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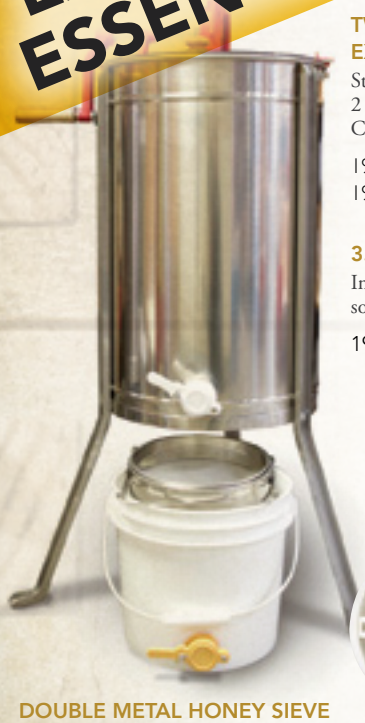

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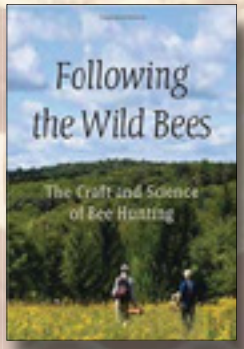
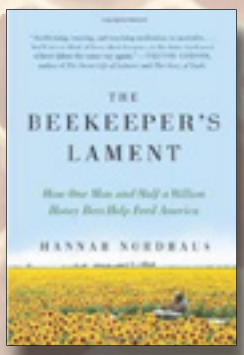


NEW!

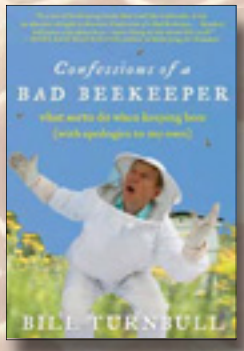
X216 Following the Wild Bees

A delightful foray into the pastime of bee hunting, an exhilarating outdoor activity that used to be practiced widely but which few people know about today. Following the Wild Bees is both a unique meditation on the pleasures of the natural world and a guide to the ingenious methods that compose the craft of the bee hunter. By Tom Seeley **$19.95**



X176 The Beekeeper's Lament

Hannah Nordhaus. The story of Miller Honey Company, migratory beekeepers from North Dakota, Idaho & California. 288 pages. Black & white. Soft Cover 5"x8" **$20**



X174 Confessions Of A Bad Beekeeper

Bill Turnbull tells all when it comes to things that can go wrong in a beeyard, honey house or anywhere in-between. Soft Cover 5"x8" **$20**

X197 Beeswax Alchemy

How to make your own candles, soap, balms, salves and home décor from the hive. By Petra Ahnert. Everything beeswax. Absolutely everything. And candles, and wicks, and lotions and potions and much, so much more. Beautiful art, extraordinary information and a long list of resources. Soft cover, 136 pages, all color. 8"x10" **$25**

X175 The Backyard Beekeeper's Honey Handbook

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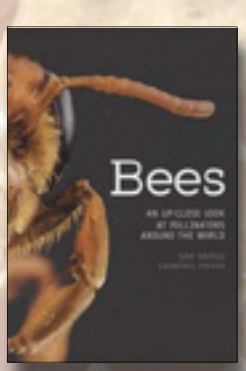

X200 Bees

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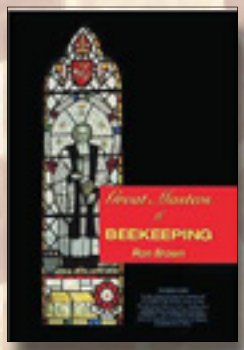

X204 Great Masters of Beekeeping

It'll appeal to beekeeping historians, journalists, biologists and book collectors as well as all beekeepers with an investigative mind who will find many answers to their queries in these pages By: Ron Brown Soft Cover 6"x9" **$18**

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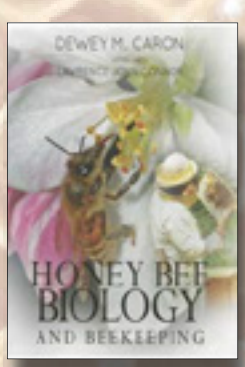

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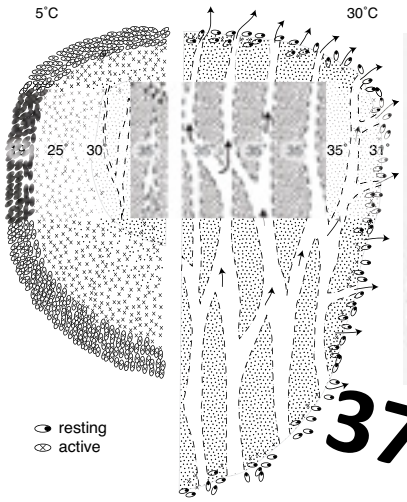

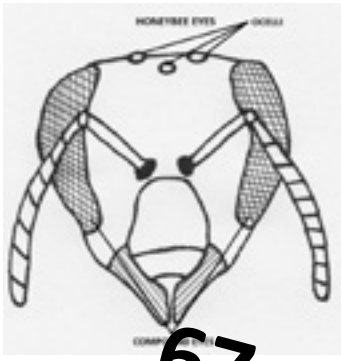

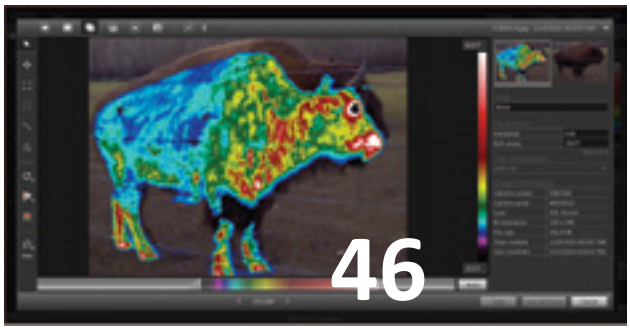

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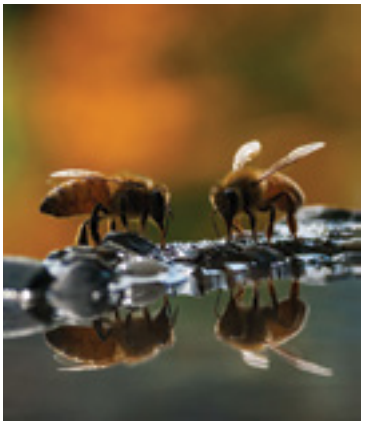

Bees on water. Photo by Dave Schiefelbein, Seattle, WA.

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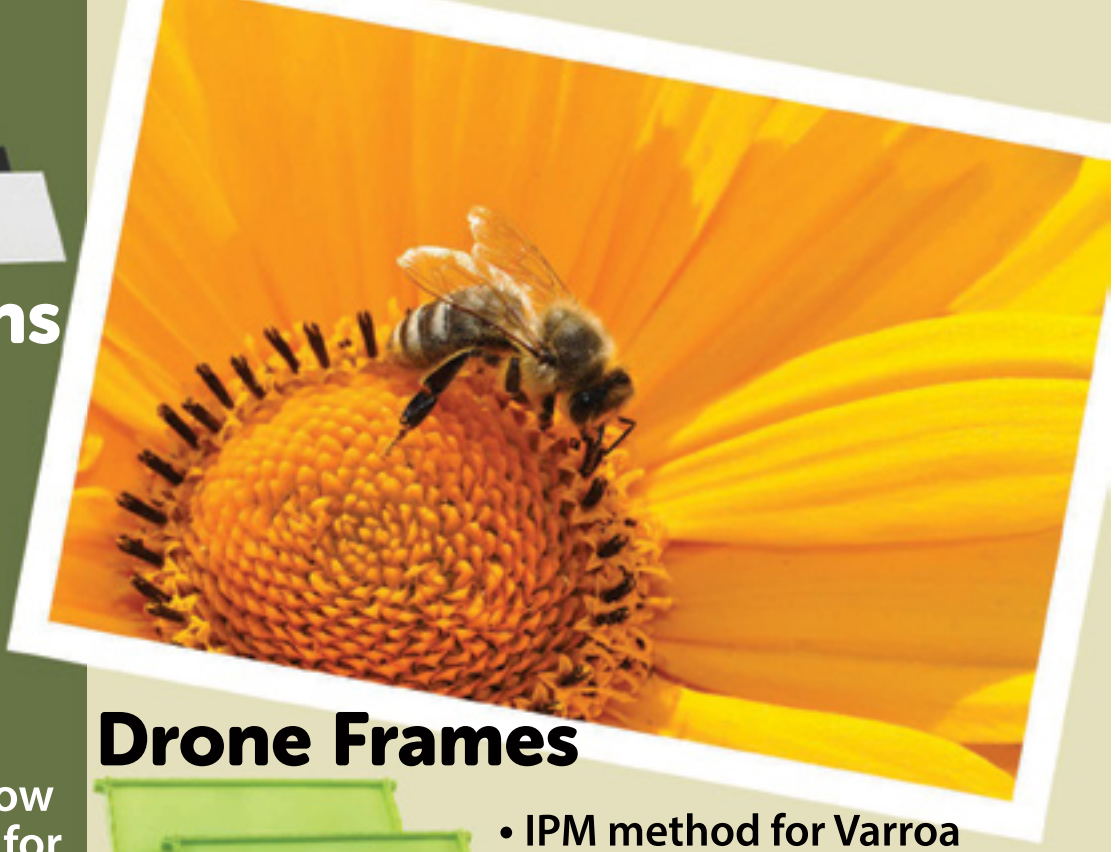

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Kudos M.E.A. McNeil

I just wanted to write a short note to thank Ms. McNeil. I've just finished her article *Vive La Honey Bee*, in the April issue and I am amazed that I understood some of the language being a second year beekeeper. I believe it was her writing that made it so a simple-minded person could understand. Don't get me wrong I do plan on rereading the story again (and maybe again).

I liked the article so much I checked out her website and read other articles like "The Story Of Z" *Bee Culture* 2012.

Thank you for your help and making it where beginners can learn and walk away entertained.

Ben Hurt

Climate Change??

As I read this article enjoying our "Western lifestyle," I remember "Global Warming," then after all of the prominent left-wing "scientist" "studies were debunked, it was called "Global Cooling," and after those studies were reviewed, it's now called "climate change." Hmm… I remember since my youth being told that humans are destroying the earth, we will have no place for garbage, the world population will increase and food and energy shortages will be rampant, etc., etc. and yet we are still here with cleaner air and water since the 70s.

As a "natural" beekeeper with 82 hives and splitting daily (0% winter losses this year), I thought about this article as just last week fueled up our trucks, tractors, and diesels, burned wood in our wood stoves, pumped and used water from our own wells, shot our own guns using some reloads, and used coal-fired electricity to power the electric motors that we use to mix up our essence of oil treatments.

Since we subscribed to *Bee Culture*, I have noticed several articles by obviously left-leaning, environmental greenie eco-wacko types that subscribe still to global warming, oops, I meant climate change. I would suggest at least to offer an opposing viewpoint for those of us that do indeed research the issues, understand statistics, and do not subscribe to man-made global warming. Since that's not likely to happen, please ask the authors of these articles to better quote their sources so we can perform some due diligence on their figures.

Everyone wants clean air, soil, and water, and we should all strive to achieve those goals, but these leftist folks use "climate change" and carbon tax efforts as a way to push their political agenda by taxing wealth and achievement, plain and simple. Not related to the article, but interesting nonetheless, I find it ironic all of the articles commenting on the negatives of chemical used in our bee hives but yet see the advertisements of chemical treatments all throughout the magazine.

Keep up the good work as we enjoy reading your magazine.

Clint Wilder
Armuchee, GA

Setting Record Straight

Ross Conrad challenged my statement that Charles Mraz, a giant of the beekeeping industry of his day, suffered arthritis to the point that it closed his beekeeping career before he died. Ross was right to do so. The obituary of Mraz in the *New York Times*, in 1999, plus related information, makes clear, instead, that Mraz suffered so badly from arthritis in his knees that he resorted to bee sting therapy, therapy which up to that point he himself, had considered an old wives tale, a recommendation with no basis in fact.

The results were so dramatic in his cure that they sent him on a mission for the rest of his life promoting bee sting therapy for others as well as for himself and became the father of the practice of apitherapy.

I apologize for my misconstrued report. It had nothing to do with my comments about smokers and did not belong in that article, or anywhere else. Have the scientific and medical professions come to terms with Mraz's innovative thinking? I wouldn't know. I have no interest in that debate.

John McKelvey
Richfield Springs, NY

Bee Culture

623 West Liberty St.
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mailbox@beeculture.com

Monster Swarm

Found seven virgin queens in this thing! Took 2½ hrs to herd them into three deep hive bodies. Started at 7pm in twilight, finished at 930pm with flashlight.

This is what happens when you don't get enough supers on before the nectar and pollen tsunami.

Terry Holcomb
CA

Photo by Sue Carlson.

Frame Spacers

In the latest magazine a reader asked about the metal frame spacers and when the last date they were available. An ordinary staple was used on the side of the end bar to space the frames side to side. Another staple was used to keep

the frame centered in the super. This type of spacing was advertised in the Root catalogs from 1903 to 1909.

The metal spacers that were asked about were advertised from 1907 to 1935.

A new style of end staple was advertised first in 1926. It would also center the frame in the supers, but was really good in cases where the top bar was short.

Jim Thompson
Smithville, OH

Fig. 215.—Thick-top Staple-spaced Frames. Price, in flat, including nails and staples, $1.50 per 100.

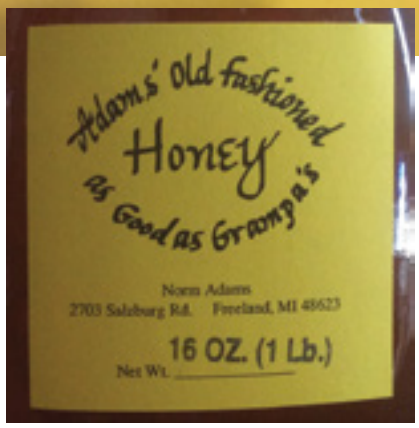
Illustration from page 14 1907 Root Catalog

Metal-Spaced Frames

Advertisement from 1935 Root Catalog page 19 Last year for the metal spaced frames in catalog.

Staple spacer that could be used for short top bars. Started in 1926.

More Honey Labels –



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Breeding Mite-Biting Bees to Control Varroa

Greg J. Hunt, J. Krispn Given, Jennifer M. Tsuruda and Gladys K. Andino

ABSTRACT

At Purdue University a breeding program was conducted for about ten years to breed bees with lower population growth of Varroa mites. Since 2007, we have been selecting for bees that have a high proportion of chewed mites on the sticky sampling sheets under the brood nest because our studies and another recent study showed that the proportion of chewed mites correlates with how well the bees groom Varroa mites from themselves. The average proportion of chewed mites in our population has increased from 3% in 2007 to nearly 50% today. In our breeding population it appears that colonies with bees that bite more mites also have fewer mites. In the last two years we worked with beekeepers to conduct a blind study comparing two Indiana mite-biter grafting sources to three commercial sources, for a total of 27 side-by-side comparisons. Beekeepers got two queens marked different colors but did not know which was which. After de-queening and splitting a hive, they introduced the queens and followed their success for a year. The IN mite biters had about as third as many mites and more than twice the survival of the commercial-source colonies (55% survival versus 22%). Beekeepers expressed a ten to one preference for IN mite-biters. We are distributing the stocks through the Indiana Queen Breeders Association and the Heartland Honey Bee Breeders Coop to make instrumentally inseminated breeder queens available, and encourage queen breeders to do their own selection.

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The Magazine Of American Beekeeping

Get Ready For Bee Culture's Next Event

A CASE FOR (LOCAL) HONEY

Fully 80% of the honey consumed in this country is imported. Vietnam and India make up half of what's sent to the U.S. How much of that is illegal Chinese honey is a matter of discussion, but we know some is, but the quality of the honeys from both of these countries no way compares to the many, many quality honeys produced right here in the U. S. This is a GOLDEN opportunity for U. S. honey producer/packers to capture a greater market share when selling LOCAL honey, and learning how to capitalize on the quality aspect of that fact. As a result of this we are beefing up the marketing aspect of our program to focus on producing the best product possible, making sure it stays that way in the processing and getting the word out on the care and quality a LOCAL honey has.

With that in mind, so far our speakers include **Dan Conlon**, Warm Colors Apiaries, Massachusetts; **Bob Binnie**, Blue Ridge Honey Company, Georgia; **Dave Shenefield**, Clover Blossom Honey, Indiana; **Steve Conlon**, ThistleDew Honey, West Virginia; **Roger Stark**, Howalt-McDowell Insurance, South Dakota, **Joann Dunlevey** RS, Food Safety Specialist, Ohio Dept. of Ag; and if possible a Representative of The FDA. Because of this new slant, other speakers are firming up travel plans and will be announced as they become known.

This well rounded group has all aspects of this topic well covered. U.S. Producers, Packers, Producer/Packers, Insurance and Risk Brokers, Marketing, and all the new Food Safety rules and regulations.

Unfortunately, missing from this discussion will be the National Honey Board, the marketing arm of the honey industry, and so far those large packers and importers who have chosen to have their annual meeting on the same weekend. The coincidence has not gone unnoticed. The focus of this event will remain on **promoting and informing ambitious U.S. Honey Producers and Packers of U.S. Honey**.

New this year will be a Friday Night Social held in Bee Culture's Conference Center, the location of the Two day Conference on Saturday and Sunday. It's a low-key, meet and greet with the speakers and attendees from 5pm to 7pm on Friday where you can pick up your folders with speaker profiles, conference agenda, and lots of information on Medina's dining and shopping opportunities. Supper afterwards is on your own but you'll have plenty of places to choose from, and lots of people to join with.

Tuition is $150 per person which includes the Friday night social and classes and an exceptional lunch on Saturday and Sunday. On line Registration opens March 1, 2016. Hotel and B&B info included here.

Friday Night Social, October 21, and classes and lunch Saturday and Sunday October 22 & 23, Bee Culture's Conference Center, 640 W. Liberty St., Medina, Ohio. Register early.

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New For The Summer –

Principles Of Bee Improvement. By Jo Widdencombe. Published by Northern Bee Books. ISBN 978-1-908904-62-1. 77 pages, 7" x 10", color, soft cover.

This book was written for British beekeepers who want to work on getting back to, and preserving the original British black bee. His goal is to 'Improve what we have got, rather than constant importation'. He wants a more uniform, but genetically diverse bee that is produced using locally-reared queens with the right traits of hardiness, ease of management, productivity and good temper.

Isn't that what we all want?

He argues that imported queens, brought in to increase colony numbers, replace lost colonies, and for new beekeepers are the problem rather than the solution. In fact, these imports produce large, robust colonies, but the downside is high food consumption, extreme inspection time and, over time – 3 or 4 generations – eventual poor performance and bad temper. Just what you might expect.

Rather, he says, using natural and some artificial selection techniques – natural meaning choosing from a colony that has survived under prevailing conditions, and artificial meaning selecting colonies that have the traits you want. In other words, control the queen side, and try and control the drone side.

He begins by assessing the first generation of choice looking at appearance (the British black bee), temper, low swarming, health and brood pattern (a good pattern is a sign of good health) and productivity. The productivity assessment was interesting. Take a whole beeyard and total the crop, and derive an average production per colony. Compare that to each colony – does a colony meet or exceed that average. Use this for all attributes you are looking for (except maybe color).

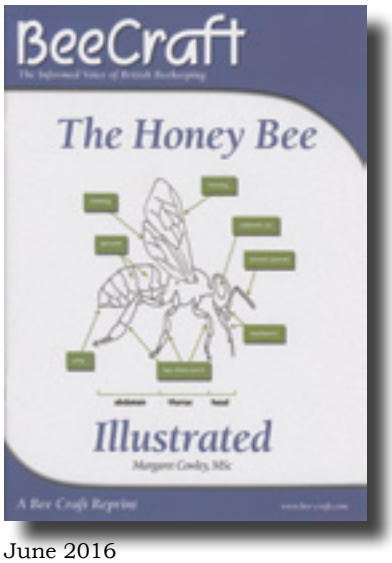
The rest of the book is a good summary of rearing methods and mating equipment. Good and reliable information. But the value of this book is the value of selecting and improving what we already got. There are already many small groups in this country trying to do just that. But we need oh, so many more. This is a good start.

Kim Flottum

The Bees, by Laline Paull, Fourth Estate, 346 pp. $9.99Euro (paper)

Spring's the best time to plant flowers, but before deciding on the red geraniums and pretty petunias, head instead to the nearest bookshop and buy the brightest book on display: The Bees by Laline Paull.

Paull is a playwright (two of her plays have been performed), living in London. The Bees, her debut novel, tells the story of life in a honey bee hive in an orchard in England. The hierarchy of a true bee colony consists of: a queen, drones (males), and infertile workers (females). Paull subdivides the workers into ladies-in-waiting, nurses, fertility police, foragers and sanitation workers. The heroine, Flora, is a member of this last group, the lowest class of bees. As a sanitation worker, her



The Honey Bee Illustrated. By Margaret Cowley, MSc. Published by Bee Craft Limited. www.bee-craft.com. 9" x 14". 48 pgs. Color. Soft cover. $18.25.

A series of annotated diagrams was published in Bee Craft magazine from 2011 to 2014 to help readers understand honey bee biology. Many who were studying for the British Beekeepers' Association assessments, especially Module 5, Honey Bee Biology, found them exceptionally useful, so they were collected into the first of the Bee Craft Reprints Series.

The diagrams have been carefully drawn to illustrate the different sections of the syllabus which are numbered from 5.1 to 5.20. They have been kept as simple as possible to allow readers to practice reproducing them for the examination. Annotations to the drawings give details of the important points to know about the structures shown.

Though US beekeepers have no comparable set of exams, the information gained from this book will go a long way in helping understand the functions of a honey bee's parts and pieces. Perhaps some organization should be offering something similar. – *Kim Flottum*

duties are to clean the hive floor, the cells, and remove dead bodies. She is not allowed to speak, to fly (except when discarding the deceased), make wax or propolis, lay eggs, or secrete royal jelly. This strict social stratification is similar to the caste system in India.

The first chapter introduces us to Flora 717, kicking and biting her way out of her pupa cell and falling onto the Landing Hall. Almost immediately, Flora begins her first task as a sanitation worker: cleaning and repairing her own cell. Suddenly she's halted and forced to undergo a physical check-up – "abnormal, obscenely ugly and excessively large" the inspector announces. This is the underdog who will quickly warm our heart with her empathy, courage and (soon-realized) intelligence.

Like a tiny camera and sensor attached to Flora's body, we share her curiosity and amazement as she roams through the hive's vast halls, hidden stairways, and secret rooms. When Flora is finally allowed to forage (thanks to her strength and courage), we fly with her miles in search of the best nectar sources: dandelions, buttercups, and thistle. Returning to the hive with pollen, she teaches us to dance the direction based on the azimuth of the sun's rays. We learn how to chew propolis, rendering its unique healing benefits. Gradually gaining her trust, we are the only beings privy to Flora's most intimate secret – she lays eggs!

Paull also does not spare the reader from tense and terrifying scenes. My heart pounded as Flora's colony is attacked by enemies: spiders trade secrets for bees' lives, a mouse intruder wreaks havoc on the hive's structure in the middle of Winter, and the most vicious – an insect cousin.

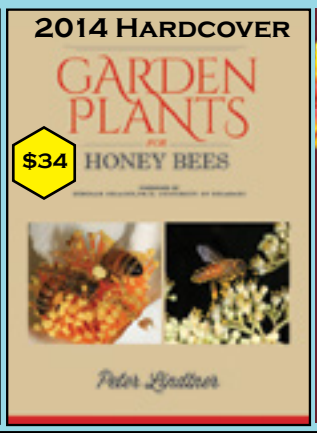
The wasp was a huge female with bands of acid yellow and glossy black. Her head was as large as three sisters' and she used her slashing claws to catch the guards one by one, killing each one with a snap of her heavy jaws. Then she flattened her long antennae, crouched down and peered inside the hive.

Spasms of fear shot through all the bees at the sight of her glittering malevolent eyes, but not one of them moved. Flora stared at the wasp and felt her dagger slide out.

Halfway through the story, Paull introduces us to the most frequent invader – the beekeeper himself. *The Bees* shout "Visitation!" warning the colony as soon as footsteps are heard. When the apiarist approaches the hive, he blows smoke, sending the bees down to the innermost part of their palace in order to protect their queen and honey (it takes 12 bees their entire lifetime to make 1 teaspoon of this liquid gold!) This human enemy not only robs The Bees of their precious food, some are actually killed, crushed when their "Treasury Halls" (honey frames) are removed.

Among so many enemies, I was surprised that Paull did not mention the parasite that has caused the greatest devastation of honey bee colonies: the *Varroa destructor*. This tiny mite feeds on brood and adult bees, weakening and killing entire colonies. Currently, varroosis is the biggest obstacle facing apiarists.

The most enthusiastic fans will likely be those who enjoy both science and literature (myself included). My book has been branded with so many notes and questions scribbled in the margins, coffee-stained pages, and dog-eared corners that it has rightfully earned its place among the "keepers." *Susan Holiday*



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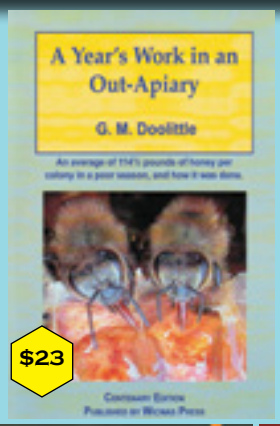

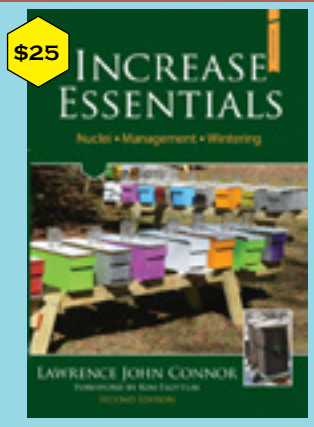

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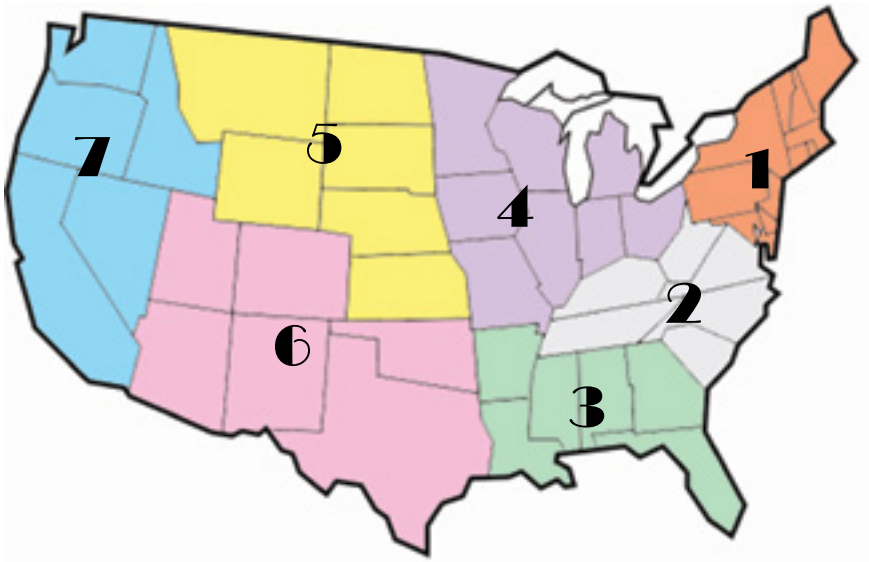

Winter Losses and Spring Time Round Up

We asked our reporters again this year about winter losses and what spring was like where they are. It's April when we do this, so in the south Spring is pretty much done, while in the north it's still active. And this year we've got last year to compare to, so let's see.

Region 1.Spring was pretty much too cold for most, and too dry for many, but just about right for over 10%, with just enough rain for almost everybody. As a result, about a quarter are a bit ahead of schedule, about half a bit behind but ok, with the rest trying to catch up. Losses ranged from 0 – 100%, but the average overall was 23%, compared to 44% last year, an improvement certainly.

Region 2. Most felt it was cooler than they would like, but not bad compared to some years, but there wasn't enough rain for the best spring forage. As a result it's a mixed bag, with about even a bit behind, right on schedule and a bit ahead of schedule now. Losses ranged from 0 – 79%, with an overall average of 27%, compared to 29% last year. About the same.

Region 3. Wet and more wet was the message, and pretty cold most places, too. Way too much rain made life difficult, with only a quarter thinking things were OK. As a result about half are behind, but still, about half are about where they want to be. Losses ranged from 3 – 35%, with overall losses at 19%, compared to last year's 15%, so up only a tad.

Region 4. Too cold said about 60% of those here, with bits looking at too wet, dry or OK. But the raid did OK, with just enough to get things going, but not slow down bee work much. As a result, about 70% are ahead of schedule this year for a change. Losses ranged from 2 - 100% with an overall average of 27%, compared to last year's 43%, so things are looking up.

Region 5. How dry it was said two thirds of our reporters here with not nearly enough rain to do the job. But this splits the work to about a third behind, a third OK, and a third ahead of schedule. Go figure. Losses ranged from 5 – 100%, with an overall average of 54%, a tough winter for sure, but just like last winter's 53%.

Region 6. Depending, it was too dry, or too wet, or just about right. Such is the southwest most years. As a result though, three quarters are behind schedule and working to catch up. Losses ranged from o – 93%, with the overall average at 21%. This compares to last year's 36%, so it's looking up.

Region 7. About half thought was too cold or wet or hot or dry, and about half thought it was just right, but over half gave it thumbs up for enough rain, a welcome change this year. So good was it that over 60% are ahead of schedule this spring. Losses ranged from 0 – 100% but the overall loss was 25%, compared to last year's 35% so it seems headed in the right direction.

When combined, reporters from all regions counted a 28% overall winter loss number. This compared to the BIP survey numbers of, yes, 28% also. Our survey does not include summer losses, and when BIP included those all losses came to 44%, and a much grimmer picture.

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7				Last	Last
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								Range	Avg.	$/lb	Month	Year
55 Gal. Drum, Light	2.00	1.98	2.35	2.60	2.10	1.90	2.78	1.45-3.50	2.31	2.31	2.21	2.29
55 Gal. Drum, Ambr	1.00	1.90	2.18	2.55	2.23	1.97	2.78	1.00-3.50	2.20	2.20	2.10	2.18
60# Light (retail)	176.00	181.00	182.50	205.17	171.00	182.88	249.29	120.00-300.00	200.46	3.34	200.91	198.38
60# Amber (retail)	189.00	179.00	183.75	199.33	205.01	183.05	248.13	116.38-300.00	201.83	3.36	197.16	195.99
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	86.00	78.90	83.00	59.33	51.84	88.30	115.20	48.00-134.40	83.00	6.92	77.67	77.53
1# 24/case	122.92	104.10	121.91	100.17	127.08	116.14	142.60	45.00-180.00	119.48	4.98	118.50	112.68
2# 12/case	112.58	100.00	107.74	96.97	97.44	118.13	117.00	72.00-180.00	108.54	4.52	105.48	99.37
12.oz. Plas. 24/cs	110.20	90.67	86.87	88.47	74.40	102.00	104.40	48.99-168.00	97.84	5.44	92.91	89.18
5# 6/case	134.94	114.50	128.91	110.83	102.30	105.00	150.00	84.00-204.00	122.75	4.09	116.61	117.89
Quarts 12/case	192.64	132.13	127.55	119.00	145.98	142.65	148.00	105.00-288.00	144.41	4.01	140.01	132.47
Pints 12/case	112.54	100.00	74.00	138.00	110.88	75.80	102.00	54.00-144.00	94.68	5.26	89.98	90.67
RETAIL SHELF PRICES												
1/2#	5.02	4.24	4.06	3.40	3.90	4.25	6.20	2.00-8.00	4.55	9.10	4.24	4.24
12 oz. Plastic	5.96	4.94	4.86	4.83	4.11	5.55	7.40	3.00-10.00	5.70	7.59	5.32	5.17
1# Glass/Plastic	7.24	6.71	7.20	5.77	5.88	7.00	10.09	4.00-15.00	7.39	7.39	6.88	6.68
2# Glass/Plastic	13.05	10.63	11.68	11.43	10.42	9.75	15.86	5.49-25.00	12.31	6.16	11.90	11.04
Pint	12.50	8.73	7.93	17.35	9.00	11.99	12.03	4.50-28.50	10.61	7.07	9.65	9.53
Quart	20.00	15.14	13.90	17.81	15.73	16.68	18.49	8.50-29.00	16.76	5.59	16.35	15.75
5# Glass/Plastic	28.37	24.69	30.75	24.54	24.26	22.56	31.25	14.98-41.00	26.88	5.38	25.92	25.21
1# Cream	8.94	7.50	9.41	6.13	10.24	6.23	9.25	5.00-16.00	8.33	8.33	7.97	7.70
1# Cut Comb	11.00	10.25	9.60	8.75	9.50	7.25	15.00	4.50-20.00	10.65	10.65	10.63	9.32
Ross Round	9.83	6.40	8.87	9.00	8.87	9.50	8.40	6.00-12.00	8.74	11.65	8.75	9.14
Wholesale Wax (Lt)	6.86	6.56	4.81	6.29	6.00	4.95	5.00	3.00-10.00	5.85	-	5.82	5.75
Wholesale Wax (Dk)	6.31	5.00	3.95	6.00	6.00	3.00	4.88	2.00-10.00	5.21	-	5.60	5.28
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INNER COVER

When I was getting my undergrad degree in Horticulture at UW Madison I wasn't smart enough for a scholarship and my folks had four other kids to support so, you work. I worked somewhere all of the time. Part time or full time work, part time or full time student. I had a family and I had to live, so you work. A year or so after I started I got a job in the Entomology Department working for a State Extension Specialist in small fruit, large fruit, trees, ornamentals and turf. Professor Kovel hired me because he needed someone who could grow the plants the bugs he was studying would eat so he could figure out the best way to get rid of them. That, and he wanted someone to put together some of the Extension Bulletins he had to produce. It was there, not the English Department that I got an education in writing. He was good and taught me a lot about being concise and about deadlines.

We had an apple orchard about 20 miles or so from Madison, cherry orchards in Door county and numerous cranberry bogs in the central part of the state we worked in, plus a huge number of varieties of birch and crabapples in Madison, a number of golf courses in both Madison and Milwaukee, and green houses in Milwaukee and on the Madison campus. And we had ornamental flower plots all over the state, growing the same varieties of ornamentals – annuals, roses, and all the rest – to see what differences there were from the very south in Milwaukee to the very north near Superior.

Our biggest plots were on the experimental farm on the west side of Madison that we shared with some corn breeders, pig and sheep researchers, some poultry people and the USDA Honey Bee Research folks who had labs and offices on campus, and lots and lots of bees, a honey house, offices and a work shop on the farm. For three summers I and my crew spent lots of time on that farm and when we were there we shared the offices of the bee dudes, ate lunch with them, stored our stuff in one of their old sheds and when something broke their fix-it guy Lester would get us up and running again.

Sometimes they helped us, and sometimes we helped them and if you had to work, this was the top of the world. But with graduation came the end of the Extension job. I'd applied at some greenhouses, nursery operations, apple orchards and even a sod growing operation, and wasn't getting very far. Pretty much the whole time I was working on this farm, the bee people, among other projects, had been studying soybean pollination and the role honey bees could play in increasing yield. They had uncovered enough questions that they needed a much larger, longer term project to find some of the answers. The USDA agreed, and the Lab leader there wrote and received a four year grant to find those answers. Funding in that grant included a post-doc position, a technician position, rental space in a high tech environmental research facility and some travel and publishing costs. The lab leader needed people for both of these positions, and, since he'd been watching me grow things for years right next door and knowing I was going to be shortly unemployed he asked if I was interested in the technician position. Two for two, he thought. He was right. I said yes.

I'd been working in the basement of the Entomology building and simply moved up to the fourth floor. I got to park closer and spend Winters inside in the Environmental building and greenhouse, and Summers outside in the field. That other job was good, but this was better. One thing though, he said. You have to learn to keep bees. It looked simple enough and I'd watched them over the years. How tough could it be I thought?

So the first week on the job he and one of his other technicians got me dressed up and took me to a beehive. We talked smoke, slow, gentle, time of day… you know the drill with beginners, and then he opened that hive. If you've been there you know what happened. Celestial hymns, blaring trumpets, a harp serenade – it all happened in an instant. I watched, listened, smelled, touched – and I never looked back to a life of horticulture. I was hooked.

Over those four years Dave Robacker, the Post-Doc researcher from NC State who had studied under Dr. John Ambrose, and I examined soybean culture from every conceivable aspect, looking at what combinations of NPK and other micro and macro nutrient levels, soil moisture and

Thanks
Eric

stress, air humidity, both soil and air temperature, light intensity and even CO_2 concentrations contributed to the attractiveness of soybean flowers to foraging honey bees. The facility we used was the Biotron, where, with practice, you could control everything in a plant's or animal's environment except gravity, and I hear they're working on that.

We grew hundreds of soybean plants in a large room under various kinds of grow lights, with all these other growing combinations and when they bloomed we first took hundreds of nectar samples for later analysis, then took plants from each treatment, plus our control plants, put them all in a room with a nuc and counted bee visitation to all the flowers on every plant. The most visits wins, we decided, and we repeated these tests again and again, filtering out those environmental factors that had little or no affect when introduced in any combination. We finally came up with the ideal growing conditions that made soybean flowers (actually soybean nectar) absolutely irresistible to foraging honey bees, and when exposed to these flowers would visit early, often and stay late. Indeed, we found soybeans that bees simply loved, visited and pollinated. We increased soybean yields in the field significantly when using honey bees.

A lot in my life changed in those four years – some good, some not, but the experience I gained, the people I met, the opportunities I had all stemmed from Dr. Eric Erickson having faith in me as a grower that could become a researcher in his world.

Soybeans weren't the only crops we studied though. Eric had a thing about sweet corn, honey bees and PennCap-M, a microencapsulated methyl parathion pesticide that when not used correctly was killing a lot of honey bees in Wisconsin. We found, if used correctly it was still a problem, but much less so and working with growers and beekeepers could mitigate most of the issues. Not all of them, and not to the satisfaction of the growers who were funding the study in the first place.

The first professional talk I gave was to a grower's group in Wisconsin, telling the results of our work. It was a hostile audience right off, and not much less hostile when I was done. But there was science here and after three year's work I was pretty confident in our findings.

I got involved in some sunflower pollination work, some honey bee plant garden work (I helped produce a bee-friendly garden 35 years ahead of the curve, just so you know) plus working with bees off and on…I wasn't the beekeeper in the bunch so didn't get called on too often. Field work, moving bees, harvesting, feeding once in a while…things like that, but not on a regular basis. I got to work with Dr. Rob Page when he was there developing his early work on a closed population breeding program, I learned to perform artificial insemination and not kill queens, and I got a good dose of how to use statistics, a specialty of Dr. Robacker's.

I had to help write research papers that were acceptable to the journals we worked with, extension bulletins for beekeepers, the same for farmers working with pesticides, and other reports and projects. It was a heady time with something new almost daily. I even got a day off once when congress voted to not pass a budget bill and we all had to go home.

My tenure in the Bee Lab wound down when the work was done and then it was time to move on. More bees? Back to horticulture or agriculture? Stay in the academic world? I'd had a lot of all three in eight years – time would tell, and opportunity would show. So I left the lab, Madison, and for a while even bees. But a series of coincidences led me here after a couple more years, and here I still am.

Not too long after I left Madison the USDA closed the Lab and Eric moved on to the Tucson Bee Lab to become the research leader there until his retirement. He stayed in Tucson, so we only got together occasionally. I invited him to my EAS meeting when I was President, and he invited me to his WAS meeting when he was in charge. We touched base on occasion on bee questions, especially small cell and Varroa, and we use his SEM photos from his book in our ABC, so he is still a part of my world.

I am where I am today in a very large part because of two men – Dr. Chuck Kovel, the Extension Professor who needed somebody who could grow things and write about it, and Dr. Eric Erickson, who needed someone who could deal with bees and had a green thumb.

Dr. Erickson passed a very short time ago from an incredibly fast moving cancer. He left, in my opinion, far too soon and far too fast. Dr. Rob Page has an appropriate piece on his passing elsewhere here, so I'll let him tell the rest of the story. This is mine. Thanks Eric.

•

The Hat. Over the last three years or so the people who publish both my books and those published by Mother Earth News, Quartous Publishing, have all worked together closely at Mother's Fairs. Part of this team has been Brushy Mountain Bee Supply, with Shane Gebauer prominent at every Fair as a Super Sponsor of the event. The bee part of the Fairs have done well, and in May this year Mother hosted a Beekeeping Institute at the 7 Springs Resort, in PA. Brushy sponsored and we helped produce this beginner's event, along with Jim Tew and Steve Repasky. So, thanks Mother for looking out for the bees, and thanks Brushy for sponsoring all of this.

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It's Summers Time –

Chickens, A Cat And A Swarm

It's been an interesting week at our house. First of all, Kim was gone all week – to England. I know – you're wondering why didn't I go. Well several reasons – deadline for this issue you're reading, chickens, cats, yard and two other May trips looming on the horizon. It just wasn't practical. So off he went with others from the Root Candle team.

So the first night he was gone I went to dinner with a friend. It was a Friday night so no rush to get home. Almost everyday the first thing we do when we get home is take a quick check of the chickens and the duck, just to see what's going on. When I got home this night and headed for the coop I heard an awful commotion, like I'd never heard before. Uh oh, something is terribly wrong, that's the first thought that went through my head. Then I wondered what I would do when I came up against whatever was causing the commotion.

I opened the door and there were three or four chickens sitting on the perches and one on top of the nesting boxes with no sign of anything else going on. I looked at the nesting boxes and saw what I thought was one of the black chickens in a box. However, it wasn't a chicken – it was a cat. Not one of my cats. It was a cat I'd never seen before actually snuggled into the nesting box. Are you kidding me? So I clapped my hands, yelled – the cat didn't move. I didn't want to try and pick this cat up because I don't know this cat and I don't want this cat to bite or scratch me. I finally managed to coax it out of the box and out of the coop, into the pen. I got all the birds in and the cat just hung around outside the coop for a couple of days.

Photo by Brandyn Weber

This cat didn't want to leave. We have a friend working on our deck and a young man, Brandyn, clearing brush and working on the property. They both tried chasing the cat away. No luck! Then I felt guilty because the cat didn't look so good, so I tried giving it some food. I know – not a good tactic when you're trying to get the cat to leave. Anyway after a few days we didn't see the cat anymore.

A day or so later Brandyn texted me at work and said there's a dead chicken just laying in the pen. If you have chickens, you probably know that they do not tolerate the sick or wounded. So when Brandyn noticed the other birds pecking at the 'dead' chicken. he went to move her and it turned out she wasn't dead. He separated her from the flock, got her some water and food and we both thought she'll be gone by the time I get home. Nope. Still there. I kept her secluded for several days and yesterday she seemed almost back to normal and clearly wanted to be outside with her friends. So far she's doing OK.

And the duck is doing OK. I think he's just going to stay with us. We haven't found him a friend or a new home, but he seems quite content. In fact last night I was actually able to pick him up and hold him. He's been very skittish up to this point. The plan is to expand the coop, so next Spring we'll get more baby ducks and possibly more chicks.

Thursday rolled around and I got a text from Brandyn that one of the hives had swarmed and what should he do – should he not go near them. They were in the general vicinity of where he was working. I told him not to worry and they'd probably be gone soon and they wouldn't bother him. The swarm landed in a very small crabapple tree and the little tree was just kind of leaning over. But Thursday night I don't get home until 9:00 p.m. so my thought was we missed this one.

Friday morning another text from Brandyn – the swarm is still there. So I said to Brandyn take some pictures.

I picked Kim up at the airport at 5:30 p.m. We stopped for supper and got home about 7:30 and the swarm was still there. We got our veils, although I don't think we really needed them. It was probably the easiest swarm we've ever had. No heights, no ladder, nothing complicated about it. So now we have 10 hives. Kim checked on them this morning and they seem quite happy in their new box.

I hope your Summer is shaping up to be a good one. Ours looks pretty busy, as usual. Next week we're off to Pennsylvania for The Mother Earth News Beekeeping Institute. The week after that off to Georgia for the Young Harris Beekeeping Institute. In June Kim is going to Texas. And somewhere in there we need to take care of the 10 hives we now have, plant a garden and get this magazine to you on time. Life is full, good and busy.

I wish you all a safe and happy Summer.

A Closer Look

STARVATION/UNDERNOURISHED COLONIES

Clarence **Collison**

Honey bee larvae are frequently inspected and, sometimes, provided with food by adult workers, but the stimuli that elicit the important task of food provisioning have not been fully investigated.

When larvae of the three honey bee castes are starved under natural or laboratory conditions, some produce dwarf adults. Jay (1964) tested the effects of larval starvation on subsequent development; larvae of various weights were removed from their food and put into gelatin capsules. The following development parameters were determined: (a) success in completing prepupal and pupal ecdyses (shedding of outer cuticle, molting), (b) weight after the pupal ecdysis, (c) time for development, and (d) type of adult reared. The longer the larval feeding period for the three castes, the more successful were the ecdyses. Developmental failure was high if worker, drone, and queen larvae were removed from their food when they were 60-65%, 85%, and 60-65% of the weights of control larvae, respectively. The developmental times of workers or drones did not vary significantly with the various larval weights but those of larvae from queen cells increased with decrease in larval weight. The various-sized adult drones reared did not appear to differ in gross external appearance but the smaller workers had proportionately longer wings than the larger ones. Adults reared from the smallest larvae from queen cells resembled workers (or intercastes) whereas those from the largest larvae resembled queens.

Honey bee larvae are frequently inspected and, sometimes, provided with food by adult workers, but the stimuli that elicit the important task of food provisioning have not been fully investigated. Larvae with their food experimentally deprived received more frequent inspection and feeding visits from nurse bees than normally fed larvae, suggesting that there could be a "hunger signal." Food-deprived larvae with artificially supplied larval food received the same rate of feeding visits from nurse bees as did normally fed larvae but still received more inspection visits. These results suggest that stimuli eliciting feeding are different from those for inspection. They also support the hypothesis that worker bees deposit food in a larval cell only when the quantity of food is below a certain minimum threshold that is perceived during larval inspections (Huang and Otis 1991).

A brood pheromone signaling the presence of larvae in a bee colony has been characterized and well studied. He et al. (2016) investigated whether honey bee larvae actively signal their food needs pheromonally to workers. They showed that starving honey bee larvae signal to workers via increased production of the volatile pheromone E-ß-ocimene. Analysis of volatile pheromones produced by food-deprived and fed larvae with gas chromatography-mass spectrometry showed that starving larvae produced more E-ß-ocimene. Behavioral analyses showed that adding E-ß-ocimene to empty cells increased the number of worker visits to those cells, and similarly adding E-ß-ocimene to larvae increased worker visitation rate to the larvae. RNA-seq and qRT-PCR analysis identified three genes in the E-ß-ocimene biosynthetic pathway that were upregulated in larvae following 30 minutes of starvation, and these genes also upregulated in two-day old larvae compared to four-day old larvae (two-day old larvae produce the most E-ß-ocimene). This identifies a pheromonal mechanism by which brood can beg for food from workers to influence the allocation of resources within the colony.

Most animals can modulate nutrient storage pathways according to changing environmental conditions, but in honey bees nutrient storage is also modulated according to changing behavioral tasks within a colony. Specifically, bees involved in brood care (nurses) have higher lipid stores in their abdominal fat bodies than forager bees. Pheromone communication

"Workers in the brood nest (house bees) have abundant stored lipids and protein while foragers are depleted of these reserves; this depletion precedes the shift from nest work to foraging."

plays an important role in regulating honey bee behavior and physiology. In particular, queen mandibular pheromone (QMP) slows the transition from nursing to foraging. Fischer and Grozinger (2008) tested the effects of Queen Mandibular Pheromone (QMP) exposure on starvation resistance, lipid storage, and gene expression in the fat bodies of worker bees. They found that GMP-treated bees survived much longer compared to control bees when starved and also had higher lipid levels. Expression of vitellogenin RNA, which encodes a yolk protein that is found at higher levels in nurses than foragers, was also higher in the fat bodies of QMP-treated bees. No differences were observed in expression of genes involved in insulin signaling pathways, which are associated with nutrient storage and metabolism in a variety of species; thus, other mechanisms may be involved in increasing the lipid stores. These studies demonstrate that pheromone exposure can modify nutrient storage pathways and fat body gene expression in honey bees and suggest that chemical communication and social interactions play an important role in altering metabolic pathways.

Schulz et al. (1998) conducted three experiments to explore the effects of severe food shortage on the control of two important and interrelated aspects of temporal division of labor in honey bee colonies: the size and distribution of a colony's foraging force. The experiments were conducted with single-cohort colonies, composed of entirely young bees, allowing them to quickly distinguish the development of new (precocious) foragers from increases in activity of bees already competent to forage. In experiment 1, colony food shortage caused an acceleration of behavioral development; a significantly greater proportion of bees from starved colonies than from fed colonies became precocious foragers, and at significantly younger ages. Temporal aspects of this starvation effect were further explored in experiment two by feeding colonies that they initially starved, and starving colonies that were initially fed. There was a significant decrease in the number of new foragers in starved colonies that were fed, detected one day after feeding. There also was a significant increase in the number of new foragers in fed colonies that were starved, but only after a two-day lag. These results suggest that colony nutritional status does affect long-term behavioral development, rather than only modulate the activity of bees already competent to forage. In experiment 3, they uncoupled the nutritional status of a colony from that of the individual colony members. The behavior of fed individuals in starved colonies was indistinguishable from that of bees in fed colonies, but significantly different from that of bees in starved colonies, in terms of both the number and age distribution of foragers. These results demonstrate that effects of starvation on temporal polyethism are not mediated by the most obvious possible worker-nest interaction: a direct interaction with colony food stores. This is consistent with previous findings suggesting the importance of worker-worker interactions in the regulation of temporal polyethism.

The age of onset of foraging in honey bee colonies is affected both by inhibitory social interactions among nestmates and starvation. Schulz et al. (2002) determined whether starvation affects worker-worker interactions by quantifying the frequencies of five social interactions (trophallaxis, begging, offering, antennating, and grooming) in colonies that either were starved or well-fed. They hypothesized that bees in starved colonies engage in fewer social interactions than bees in colonies with ample food stores. In all three trials, starved colonies had significantly greater numbers of foragers than well-fed colonies, as in a previous study. In three of three trials, starved bees showed a significantly higher frequency of begging behavior than well-fed bees. Begging in starved colonies increased exponentially with time as the starvation presumably grew more severe. Immediately following the onset of foraging in starved colonies, the frequency of begging declined dramatically. No consistent differences for other observed social behaviors were found. Their results under starvation conditions do not provide support for the hypothesis that precocious forager development must be associated with a decrease in social interactions. Perhaps factors that influence precocious foraging under starvation conditions differ from those under conditions of ample food stores. They speculate that the duration and specific nature of the social contact may be important. Furthermore, they speculate that begging itself may be a cue associated with precocious forager development.

Honey bee worker energy reserve levels are correlated with task performance in the colony. Workers in the brood nest (house bees) have abundant stored lipid and protein while foragers are depleted of these reserves; this depletion precedes the shift from nest work to foraging. Toth et al. (2005) tested the hypothesis that lipid depletion has a causal effect on the age at onset of foraging. They found that bees treated with a fatty acid synthesis inhibitor (TOFA) were more likely to forage precociously.Secondly, they set out to determined whether there is a relationship between social interactions, nutritional state and behavioral maturation. Since

older bees are known to inhibit the development of young bees into foragers, they asked whether this effect is mediated nutritionally via the passage of food from old to young bees. They found that bees reared in social isolation have low lipid stores, but social inhibition occurs in colonies in the field, whether young bees are starved or fed. These results indicate that although social interactions affect the nutritional status of young bees, social and nutritional factors act independently to influence age at onset of foraging.

Honey bee colonies, foraging predominantly on a single pollen source, may encounter nutritional deficits. Hendriksma and Shafir (2016) examined the nutritional resilience of honey bee colonies, testing whether foragers shift their foraging effort towards resources that complement a nutritional deficit. Eight honey bee colonies were kept in screened enclosures and fed for one week a pollen substitute diet deficient in a particular essential amino acid. Foragers were subsequently tested for a preference between the same diet previously fed, a different diet that was similarly deficient, or a diet that complemented the deficiency. Foragers preferred the complementary diet over the same and similar diets. Appetitive conditioning tests showed that bees were able to discriminate also between the same and similar diets. Overall, their results support the hypothesis that honey bees prefer dietary diversity, and that they do not just include novel sources but specifically target nutritionally complementary ones. While they specifically focused on deficiencies in essential amino acids, it cannot be ruled out that bees were also complementing correlated imbalances in other nutrients, most notably essential fatty acids. The ability of honey bees to counter deficient nutrition contributes to the mechanisms which social insects use to sustain homeostasis at the colony level.

Poor nutrition has major consequences for the expression of genes underlying the physiology and age-related development of nurse bees. Corby-Harris et al. (2014) aimed to further understand the transcriptional changes associated with starvation during early adult development. They assayed three

"Poor nutrition has major consequences for the expression of genes underlying the physiology and age-related development of nurse bees."

day-old and eight day-old bees kept in normally functioning hives and caged over only honey (poor diet) or honey and bee bread (rich diet) and allowed trophallaxis with the rest of their colony. Substantial changes in gene expression occurred due to starvation. Diet-induced changes in gene transcription occurring in younger bees were largely a subset of those occurring in older bees, but certain signatures of starvation were only evident in eight day-old workers. Of the 18,542 annotated transcripts in the honey bee genome, 150 transcripts exhibited differential expression due to poor diet at three days of age compared with 17,226 transcripts that differed due to poor diet at 8 days of age, and poor diet caused more frequent down-regulation of gene expression in younger bees compared to older bees. In addition, the age-related physiological changes that accompanied early adult development differed due to the diet these young adult bees were fed. More frequent down-regulation of gene expression was observed in developing bees fed a poor diet compared to those fed an adequate diet. Functional analyses also suggest that the physiological and developmental processes occurring in well-fed bees are vastly different than those occurring in pollen deprived bees. Their data support the hypothesis that poor diet causes normal age-related development to go awry. More research is needed to fully understand the consequences of starvation and the complex biology of nutrition and development in this system, but the genes identified in this study provide a starting point for understanding the consequences of poor diet and for mitigating the economic costs of colony starvation.

Corby-Harris et al. (2014) began by assessing whether bees that were fed only honey (no pollen) had reduced hypopharyngeal glands, a classic signature of starvation. Significant differences were found between three day old bees fed the rich versus poor diet, eight-day-old bees fed the rich versus poor diet, and three day old bees versus eight day old bees fed the rich diet. No differences were found between three day old and eight day old bees fed only honey.

Wang et al. (2016a) tested whether food deprivation during development can shift adult phenotypes to better cope with nutritional stress. After subjecting fifth instar worker larvae to short-term starvation, they measured nutrition-related morphology, starvation resistance, physiology, endocrinology and behavior in adults. They found that the larval starvation caused adult honey bees to become more resilient toward starvation. Moreover, the adult bees were characterized by reduced ovary size, elevated glycogen stores and juvenile hormone titers, and decreased sugar sensitivity. These changes, in general, can help adults survive and reproduce in food-poor environments. Their results suggest that this mechanism may play a role in honey bee queen-worker differentiation and worker division of labor, both of which are related to the responses to nutritional stress.

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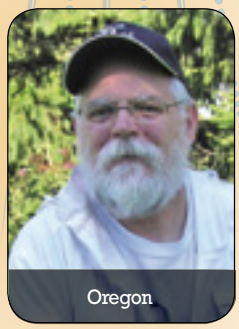

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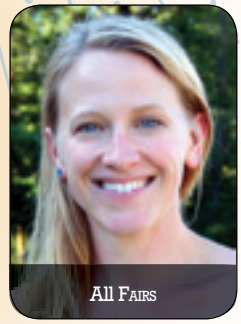

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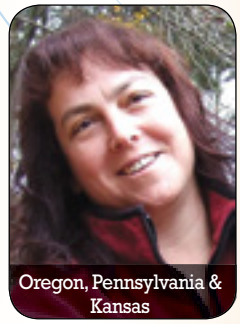

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Wang et al. (2016b) further hypothesized that developmental starvation specifically improves the metabolic response of adult bees to starvation instead of globally affecting metabolism under well-fed conditions. They produced adult honey bees that had experienced short-term fifth-instar larval starvation, then starved them for 12 hours and monitored metabolic rate, hemolymph sugar concentrations and metabolic reserves. They found that the bees that experienced larval starvation were able to shift to other fuels faster and better maintain stable hemolymph sugar levels during starvation. However, developmental nutritional stress did not change metabolic rates or hemolymph sugar levels in adult bees under normal conditions. Their study provides further evidence that early larval starvation specifically improves the metabolic responses to adult starvation. BC

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COLONY DEMOGRAPHY OR WHAT SHAPE IS YOUR COLONY IN?

Lloyd **Harris**

Every tangible object can be represented with an oval, a rectangle, a triangle, or some combination of the three basic object forms. When you think about a honey bee colony what shape do you think about? Do you think of a colony as if it were the same shape as the rectangular box that houses the colony?

What shape is your colony in? Everyone has an image in their mind that they use when they define what a honey bee colony is. For most people, the image is a geometric shape of some kind. The more familiar a person is with honey bee colonies the more complex that shape becomes. The beekeeper's mental image of a colony's shape is central to understanding what a colony is, how it normally develops, and how colony management practices affect its subsequent development. For some people, the image that they associate with a honey bee colony may be quite simple, or it may be complex, or it may be constructed as a collage of overlapping images.

For the average person with little beekeeping experience, the honey bee colony may be thought of as a triangular or semi-circular, gumdrop-shaped cluster of bees hanging from a tree branch in their backyard; no more, no less.

Those with a little more exposure to honey bees may define their honey bee colony from the physical dimension of the hive bodies surrounding the colony. They may think of the colony as being a stack of rectangular cubes of various heights. For them, the hive and the colony are interchangeable terms for the same thing, but in reality, they are not. The hive is the physical structure surrounding the colony, while the term colony refers to the bees inside the hive.

Understanding a honey bee colony begins with understanding a honey bee's life cycle and its relationship to colony development.

People who have had a casual look inside a beehive may think of the honey bee colony as being an ellipsoidal blob of bees bisected by a series of wax combs inside one or more rectangular, round, or trapezoidal hive structures.

Usually, people that have actually looked into a beehive and know something about bee biology have a much more complex image they use when they think about a honey bee colony. Their reference image acknowledges that a bee's life begins as an egg, develops through the larval and the pupal stage and then ends its life as an adult bee. These people think of the colony as being composed of four linear segments placed end to end. The first segment represents the eggs in the colony. The second segment represents the larvae in the colony. The third segment represents the sealed brood (i.e. resting/spinning larvae and pupae). The fourth and final segment represents the adult bees. They think of the colony as being a linear progression of bees progressing from one stage to another as they age. The image that they associate with a honey bee colony may be: a line, a cylindrical tube, or a rectangular tube that has been sub-divided into four sections; the length of which is defined by the duration of each stage (Figure 1).

Figure 1. *Linear representation of a honey bee colony showing the developmental progression of honey bees from the egg stage through to the adult bee stage.*

Some beekeepers use a slightly different version of the linear model. In addition to dividing the colony into four sections, they further subdivide each of the four segments (developmental stages) based on the duration of each segment (see Figure 2). The egg segment is three days long. The larval segment is about six days long. The resting larvae and pupal stage (sealed brood stage) is 12 days long. The adult bee stage is of somewhat variable length depending on the colony's health and its environment. The adult segment is divided into up to 320 daily sub-segments. However, many of these daily adult segments will be empty for much of the year. In normal colonies, the bees recruited during April, May, June, July, and the first half of August only occupy, at most, the first ninety-six adult segments. Only bees reared after mid-August and during winter are contained in the adult segments beyond the first 96 segments.

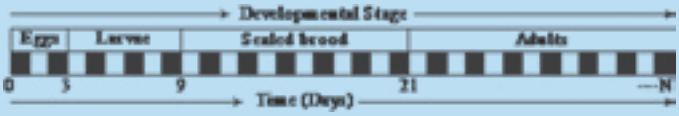

Figure 2. *Linear representation of a honey bee colony showing developmental progression of honey bees from the egg stage through to the adult bee stage and the duration of the respective stages.*

In the linear system, new bees are added to the colony as eggs. Every day, more bees are added/recruited and the previous day's eggs and immatures continue to metamorphose until they emerge as adult bees.

The adult bee segments can also be grouped into nurse bees, hive bees, and foragers based on the duties they perform. Worker bees progress through these task related sub-divisions as they age. These sub-division, may not form consecutive pathways. Some bees may perform all the hive related tasks consecutively, one after the other, until they begin foraging. Some bees may perform selected duties for prolonged periods of time before progressing on to another task. Some bees

may never perform certain tasks. These temporal related series of duties should be viewed as a series of intertwined pathways of varying lengths. The longer the path is before a bee becomes an active forager, the longer its life will be. After performing a suite of tasks, each bee ultimately exits the colony permanently and dies.

For some beekeepers, this reminds them of a cluster of bees proceeding as a lump from one end of an elastic hose down its length until it exits the other end.

The hose and lump of bees analogy is a good one. This would be what population modellers would refer to as a unidirectional "stock and flow" model. The bees are stocked into one end of the system and flow out the other. However, this analogy is a bit misleading. This hose "leaks" bees as they travel down the length of the hose. Consequently, nothing actually ever flows out of the hose. This analogy can also lead to some misconceptions if one overlooks the fact that another group of bees is added to the colony every day. In reality, a new cluster of bees proceeds down another parallel imaginary hose every day.

Beekeepers familiar with spreadsheets may prefer to view this linear colony representation as a column of cells stacked one above another or end to end. Each spreadsheet cell being a compartment designed to hold however many bees you decide to place into it. The nice thing about spreadsheets is that each compartment can also hold a mathematical formula to aid in determining what each cell contains. The older a bee or a bee cohort becomes; the further it progresses along the "hose".

The simplest version of the spreadsheet cell analogy generates an image similar to that shown in Figure 3.

If a new colony is initiated without brood, a known number of worker bees, and a mated queen; its age structure will be reminiscent of that shown in Figure 3 at Time = 0. When looking at the colony's initial age structure, it is important to realize that each newly recruited bee cohort is not derived from the age class immediately below them. They are actually derived from the bees added to the colony during some previous day in the past. Each day`s contribution of new bees in the spreadsheet moves diagonally across the spreadsheet rather than just horizontally or vertically.

When this is taken into consideration, the colony can be thought of as being composed of all the bees that were in the colony yesterday plus the bees added to the colony as eggs today. As a consequence, a new image of the colony is formed every day that recognizes that today`s colony is a product of the recent past. The colony is represented by a series of colony images, related in time; each derived from yesterday`s bees plus the bees added to the colony today.

If new bees are continuously added to a colony every day without any interruptions, a cylindrical or rectangular tube image may be an acceptable colony image. However, rather than a single image, the colony might be viewed as a family of images being something analogous to a Russian nesting doll, a musical flue pipe (think pan flute) with its array of parallel stems, or an array of nested

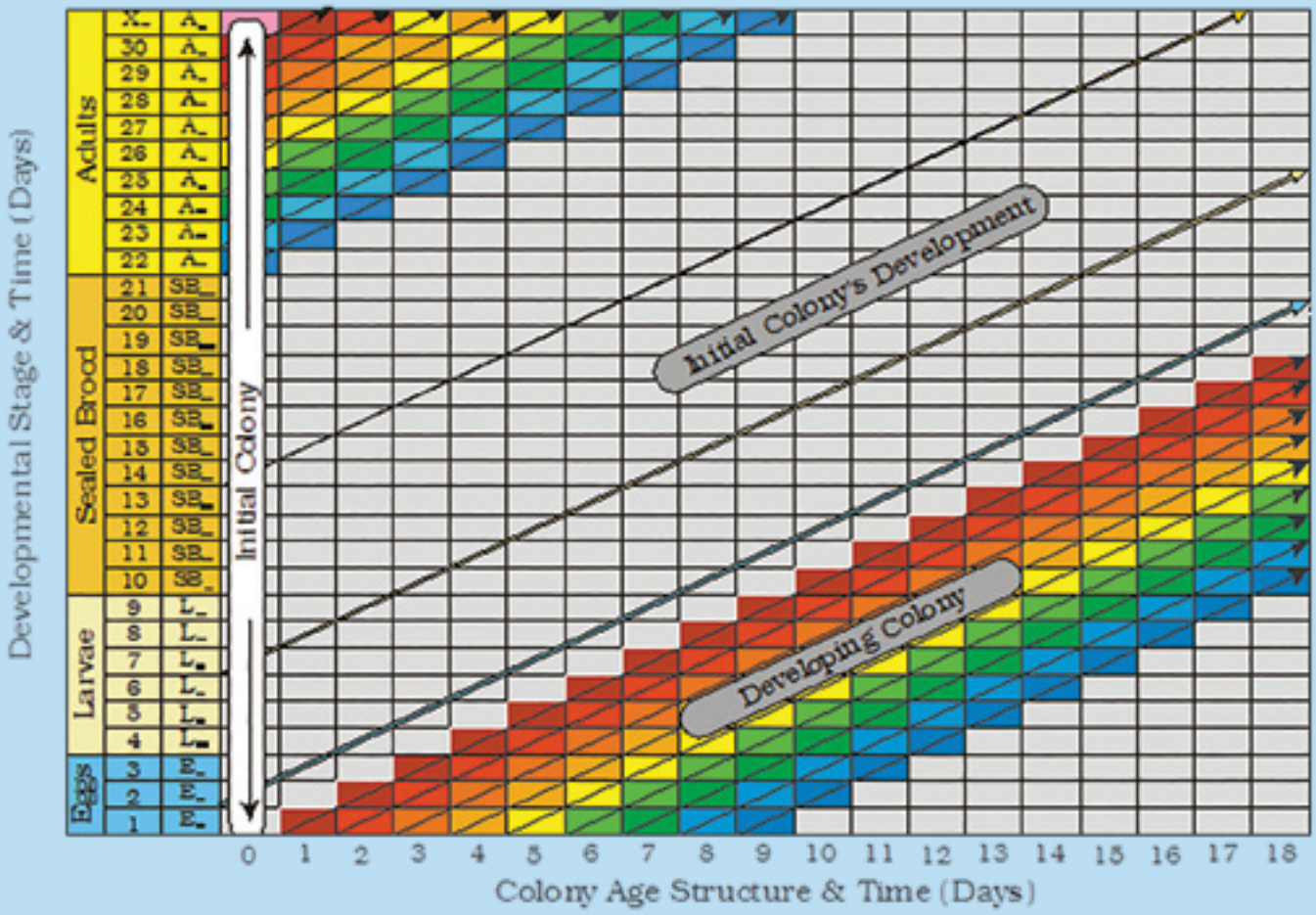

Figure 3. *A cellular spreadsheet representation of a developing honey bee colony; where the cells/rows in each column represents eggs, larvae, sealed brood and adults of various ages in the colony on a series.*

cells or overlapping daily sub-populations that can be thought of as being represented as the cross sectional view of a series of stairs arranged one above another (see Figure 3). This image is somewhat incomplete. It is only a partial representation of the colony. It only relates to the development of a hypothetical colony that forms after the first group of eggs are added to the colony at the beginning of their journey down the colony's daily "pipeline". To have a complete vision of a colony, the cell contents above the developing colony in Figure 3 also needs to be represented. If they are not accounted for, it will take at least 71 to 95 days in healthy colonies, before the first complete image of the colony would be possible. It takes that long during the Summer for each cohort/sub-population of new bees to die.

To rectify this problem, the size and age structure of the initial colony and its survival must be estimated. At the beginning of the season on some random Day 0 (see figure 3), a colony will start with some variation of the linear model. The initial colony will contain: a queen, a variable number of bees of unknown ages, sealed brood, larvae, and eggs. Typically, a colony begins the season as a package bee initiated colony, a swarm initiated colony, or a broodless wintered colony. It may also begin the season as a wintered colony with brood or as a requeened nucleus colony with brood. Once the initial colony type has been determined, the colony's initial adult bee population needs to be estimated, and its age structure and survival calculated.

To do this, the spreadsheet must be expanded to the left for at least 84 days or longer if the initial colony has been wintered in a temperate climate. These calculations can by performed by expanding the spreadsheet in Figure 3 into the past or by creating a secondary worksheet, using the same logic used to estimate the developing colony, before transferring the calculations into the main worksheet on Day 0.

The initial colony's size can be derived reasonably well by estimating the adult bee population by:

1) weighing the adult bee population and then converting the weight estimate to an adult bee population estimate based in the average weight of a bee (Nolan 1932),
2) counting the number of adult bees contained on photographs of the frames,
3) estimating the adult bee population by comparing each frame with photographs containing a known number of bees (Jeffree, 1951; Nelson & Jay, 1972), or
4) determining the cumulative percentage frame occupancy and converting these estimates to adult bee estimates based on the number of bees that a frame would be expected to contain if it were completely covered by a dense single-layer of adult bees (ie. Burgett & Burikam, 1985; Imdorf & Gerig, 1999).

The colony's initial age distribution can be approximated, but this requires an understanding of what the colony's recruitment rate/brood production and survival rates had been.

This basic linear image (figure 4a) is the rudimentary beginning of a very simple population model. It recognises that new individuals are primarily recruited to the colony through the queen's egg laying activities and that after a period of time these individuals eventually die and no longer form part of the colony. The assumptions of the initial model, although they are not explicitly stated, are that: 1) population recruitment is constant and 2) bees of the same cohort die simultaneously after a specified number of days. Both of these assumptions are not true. However, this rudimentary linear model provides a good starting point from which to build a more complex vision of the colony.

The colony is represented by a series of colony images, related in time; each derived from yesterday's bees plus the bees added to the colony today.

Perhaps, it would also be more appropriate to think of this simple linear model as being somewhat plastic. A more plastic version of the linear model would be the most preferable image to use when thinking about a honey bee colony. A plastic linear model allows your mind to reshape the colony's image to accommodate other information that you know that could potentially affect a colony's shape.

Even if the recruitment rate is constant, the brood portion of the linear image will not have parallel edges because not all the daily recruited bees are likely to survive (see figure 4b). The hose/pipeline leaks. If the adult bees in the colony cannot adequately feed and care for all of the new recruits, they will not be allowed to live. Some may be cannibalized (Fukuda and Sakagami 1968). Other bees may succumb to: American foulbrood, European foulbrood, sacbrood, chalkbrood, various viruses, or *Varroa* mites. As a consequence, a colony with a constant recruitment rate should not be represented as having parallel sides but rather tapered sides that reflect that not all the bees recruited to the colony will survive to become adults. If a colony has a constant daily recruitment rate, the sides of the first three initial linear segments will not be parallel to each other but rather tapered to reflect the death that occurred in the first 21 days of their life (see figure 4b). Most population models incorporate brood mortality rates observed by Fukuda and Sakagami (1968) because colony specific mortality rates for eggs, larvae and sealed brood are expensive and time consuming to acquire.

Likewise, the shape of the fourth segment containing the adult bees will depend on when these adult bees die. Adult bees emerging in a healthy colony between 1 April and mid-August on the Northern Great Plains of North America, should have an average adult life expectancy of between 33.3 to 36.5 days or slightly higher. Less than 0.06 percent of the spring and summer reared adult bees survive until they are between 84 and 96 days of age (Harris & Harris, unpublished).

Nolan (1932) used a hypothetical worker bee longevity to estimate a colony's adult bee population. It was based on a division of labour proposed by Rösch (1925), where: the average adult bee spend two days cleaning cells, eight days nursing young bees, nine days performing other hive duties, and the last 16 days of their adult lives as foragers

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The underlying premise for the DeGrandi-Hoffman et al. (1989) approach to worker bee longevity was based on the fact that a bee's longevity is affected by the age at which it starts foraging. The younger a bee is when it starts foraging, the shorter its life expectancy will be.

before they die. In essence, in his model, the adult bee population was assumed to contain exactly 35 daily adult bee segments. When a bee became 36 days old, it died. Bodenheimer (1937) used a similar assumption, except the adult portion of the colony contained 42 daily adult bee segments. The total life expectancy of a worker bee from the time it was deposited as an egg until it died was estimated to be exactly 63 days.

This allowed Bodenheimer (1937) to construct the first graphical representation showing the theoretical age distribution for a honey bee colony. Although the colony shapes proposed by Bodenheimer are interesting, they are not very enlightening because the assumptions used to create them were not realistic.

DeGrandi-Hoffman et al. (1989) determined the duration of the adult bee population by assuming that the bees functioned as hive bees until they were 21 days old (Free, 1965) and that they were then removed from the adult population after foraging for a fixed number of bee foraging days determined by the model's user. Bee-foraging days were defined as any day when the average temperature exceeded 12°C (Lundie, 1925), wind velocity was less than 34 km/h (Rashad, 1957) and rainfall was less than 0.5cm. The underlying premise for the DeGrandi-Hoffman et al. (1989) approach to worker bee longevity was based on the fact that a bee's longevity is affected by the age at which it starts foraging. The younger a bee is when it starts foraging, the shorter its life expectancy will be (Rueppell et al. 2007).

Any theoretical variation on the basic scheme is possible. You know that bees do not simply die in unison once they reach a certain age. Consequently, having the adult bees "leap" from the top of the colony's age structure and die in synchrony once they reach some arbitrary, magical age should be rejected. Once, this assumption is rejected as being unrealistic, it needs to be replaced with either a different assumption of when and how bees die or with real data.

Even if you know nothing about how long an average bee lives before it dies, you can still reshape your image of what a honey bee colony looks like. The easiest assumption to make is that worker bees die at a constant rate after they reach some arbitrary age. The rate you pick will determine how many days you let your oldest bee live (see figure 4b).

In a healthy colony, maximum life expectancy for bees emerging as adults during the Summer is at least 84 days but always less than 96 days (Harris & Harris, unpublished). However, adult bees infected with Nosema diseases (Hassanien, 1952) or parasitized by Varroa mite (De Jong and De Jong, 1983) will live much shorter lives.

Ideally, you would use locally derived worker bee longevity estimates from the survival of newly emerged bees that had been marked with distinctive coloured makings (Harris, 1979). However, honey bee longevity estimates from England (Free and Spencer Booth, 1959) the United States of America (El-Deeb, 1952), Japan (Sekiguchi & Sakagami, 1966; Sakagami & Fukuda, 1968) or Canada (Harris & Harris, unpublished) may be used if deemed appropriate. Regardless of what you select as an acceptable honey bee longevity estimate, the result will be that you will have reshaped what your colony looks like. Instead of having the adult bees being represented as a rectangular image (see figure 4a), it will now be triangular (Figure 4b). If you draw your mental image of your colony in three dimensions, it could also be imagined as being conical or polyhedral.

Now, consider a colony where new bees are not added to the population at a constant rate. If your colony's recruitment rate increases or decreases, this will affect the number of bees in each subsequently derived sub-population of bees as they progress through the colony's age structure. The more bees a sub-population contains, the wider its representation will be.

The colony's shape is defined by the numbers of eggs laid in a colony every day and the durations of the bees' lives. These two variables also determine the number of bees in the colony on any given day. The colony's population increases when more bees are added to the colony than exit, drift into an adjacent colony, or leave the colony as part of a departing swarm. When more bees die than are recruited, the colony becomes smaller. If you are focused on the adult bee portion of a colony's population, there will always be a 21 day lag before recruitment changes are reflected in the colony's adult bee population.

The above logic forms the basic building blocks for most colony population models. The magnitude of the daily recruitment may be defined as a function of the colony's daily adult bee population, the queen's reproductive potential, available space, ambient temperatures, or resource availability. A colony cannot produce new worker bee recruits without having a mated queen. The queen cannot produce new worker bee recruits unless the colony has enough nurse bees to feed the queen. The developing brood cannot survive if there are not enough nurse bees to feed and care for them. The nurse bees cannot sustain their activities unless there are foragers collecting the resources that the nurse bees need to rear the brood. Perhaps the most important factors regulating the addition of new recruits to the colony are all external to the colony. Favourable ambient temperature, photoperiod, rainfall, and the presence of pollen and nectar secreting plants in close proximity to a colony are essential factors that determine a colony's actual recruitment. In managed honey bee colonies, the often overlooked variable affecting colony development is the beekeeper's effect on bee recruitment and death.

The basic model has been used either as a theoretical predictive tool, or as an applied experimental tool. The two methods manipulate the data differently.

In a healthy colony, maximum life expectancy for bees emerging as adults during the Summer is at least 84 days but always less than 96 days.

The theoretical models generate colony population estimates by regulating colony development as a function of changes in the cohorts of new bees recruited every day to the colony and applying a mortality rate to the daily recruitment rate. The rate of recruitment is usually a function of: the queen's egg laying ability, the number of bees in the colony, ambient temperature, growing degree days, photoperiod, nutrient availability, etc.

The applied experimental approach uses a slightly different approach. Instead of determining how many daily recruits are added to, or subtracted from, the colony using theoretical considerations, the applied approach adds its recruits to the colony every twelfth day based on the amount of sealed brood a colony actually produces in response to a host of fluctuating environmental variables. This is the colony's actual cumulative effective recruitment rate assessed at regular repetitive 12-day intervals. Daily recruitment rates can also be derived from the 12-day interval assessments if necessary.

The applied experimental approach uses sealed brood estimates rather than measuring eggs or larvae because sealed brood is easier to measure. It is also more cost effective and ensures that the new bee recruits are not overlooked nor are they counted twice (Fukuda, 1971). Sealed brood estimates are then converted to bee estimates based on the cells per unit area measurement.

The number of eggs and larvae in the colony are then determined by multiplying the effective daily recruitment rate by the duration of the respective stages and correcting for mortality that may have occurred during each stage. The egg and larval estimates are offset by -12 days because they represent the eggs and larval rates that existed before the sealed brood was measured. The adult bee cohort emerging from the sealed brood stage is also corrected for stage related mortality. The survival of each emerging adult bee cohort/sub-population is determined from the average survival of a series of differently colour-marked newly-emerged bees. The experimental method generates population estimates and colony age distributions (Harris, 2008a, 2008b, 2009, 2010) at twelve day intervals, although daily estimates are also possible.

This method estimates the average number of bees in the egg stage, the larval stage, the sealed brood stage and the adult stage. The number of adult bees in a colony is determined from a series of 12 day age-classes/sub-populations of adult bees staggered by 12 day intervals as they progress along the hypothetical staircase in Figure 3.

The procedure allows the user to calculate eggs, larvae, sealed brood, and adult bee estimates for a colony and its demographics. Colony demography is most useful when determining the potential number of nurse bees or foragers in a colony or when determining when the bees are reared that form the Winter colony (Mattila et al., 2001; Harris, 1980, 2008a, 2008b).

A colony's demography is best represented with a "kite diagram". The kite-diagram is formed by first stacking and centering the respective bee estimates above each

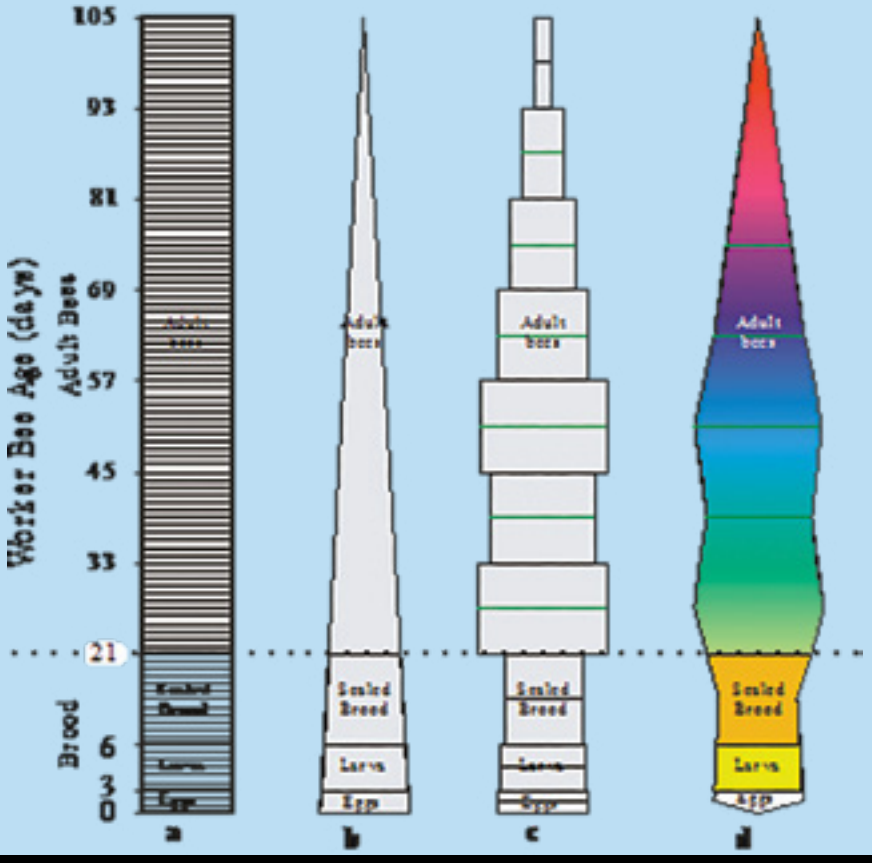

Figure 4a-d. *Honey bee colony shape as determined from – a) a colony with a constant daily worker bee recruitment rate, b) a colony with a fixed daily recruitment rate and a relatively constant mortality rate, c) mortality rate, d) item 4c redrawn as a "kite diagram."*

other; starting with the eggs in the colony and ending with the oldest bees in the colony (figure 4c). The width of each rectangular box represents the number of bees it contains. If you draw a line at the mid-point of these rectangular boxes and connect the ends of the lines, the colony will be represented as "kite diagram" (see figure 4d). The kite diagram can be transformed/splined into a three dimensional image of the colony if you have access to the appropriate drafting software (3D Studio Max®, Autocad®, SolidWorks®, etc.).

Although this applied method is intended for data processing, the basic framework can also be modified to generate limited insight into colony development by altering sealed brood data or the associated survival data.

For example, suppose you are interested in knowing how many bees an average colony needs to produce to maintain its population at its current state (see Harris, 2010). The answer will depend on what the colony's worker bee longevity is. If the average worker bee longevity is 35.52 days (Harris & Harris unpublished), the colony would need to produce 28.6 new bees per day per 1000 bees to maintain this colony at this equilibrium point. If its average worker bee longevity was 26 days (Rueppell, et al. 2007), the colony would have to produce 36 new adult bees per day. Obviously, anything that reduces worker bee longevity will also reduce colony size unless the colony is capable of compensating for the change by rearing more bees.

Similarly, suppose you want to understand the impact of brood production in September, October, or during winter on a colony's Spring population. Changing the experimental data or inserting theoretical brood production values will allow you to predict how populous a colony would be in spring. The applied methodology can also be used to verify the accuracy of the various theoretical models.

Good population models always provide the user with a list of the assumptions used by the model. A model's ability to mimic reality depends on its ability to adequately describe how all the variables affect colony development. Some variables have a direct effect on colony development. Other variables only affect colony development indirectly or in concert with other variables. Most variables only affect colony development between prescribed ranges.

If a model's assumptions are unrealistic or wrong, then it is almost certain that it will be unable to generate realistic predictions. The vernacular phrase used to summarize this situation has been, garbage in garbage out". Model complexity depends on: the number of variables considered, the relationships defined between them, and their effects on colony recruitment and bee mortality. Schmickl & Crailsheim's (2007) HoPoMo Model is a sophisticated version of the basic spreadsheet model.

The method you use to form a mental image of a colony is entirely up to you. If you understand differential calculus, one of the theoretical models may be of interest to you (Martin, 1998, 2001; Ghamdi & Hoopingarner, 2004; Ratti et al., 2012; Khoury et al., 2011, 2013; Becher et al., 2014). If you like using spreadsheets, the applied methods may be of interest. Both methods assist you with determining what shape your colony is in and whether you should change your management practices to get the shape that works best for you and your bees. BC

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You might sling the shopping in through the front door and focus on the job in hand spending ages rushing about collecting all the items needed for successful swarm collection. Even if you are a very well organised beekeeper, who needs only to collect the carefully pre-packed swarm collection kit, you might still wonder if the bees will be hanging there when you return to the tree.

If any of these responses sound familiar, then you will be delighted to learn that swarm bees give warning signals prior to takeoff, and the well informed beekeeper can easily take advantage of them to predict, and even halt, the departure of the swarm.

Bernd Heinrich, (1981) insect physiologist and pioneer of temperature control studies in insects, discovered the requirement for honey bees, in a swarm, to warm their wing muscles to at least 35°C (95°F) before takeoff, though he was not aware of the process by which all the bees in a swarm synchronously attain the optimum temperature for flight. By the way, have you ever, out of curiosity, poked a finger into the middle of a swarm and felt how amazingly warm it was in the center compared with the outside, and wondered what was happening in there? A four-pound swarm can generate enough heat to power a forty-watt light bulb, so it is pretty warm in the centre of a swarm.

Individual bees are endothermic which means that they can generate heat by themselves, and so can maintain their own thermal homeostasis. A bee generates heat by working her wing muscles, located in her thorax. A bee produces much body heat while in flight, but she can also activate these wing muscles (i.e., shiver) while not in flight, either to warm herself or to help keep her colony's broodnest toasty warm, 33-36°C (91-97°F).

A cluster of swarm bees is therefore "warm blooded" and can regulate its temperature by adjusting its heat production and by clustering more tightly when the ambient air temperature drops below about 18°C (65°F). Cluster contraction conserves heat by reducing the surface area over which heat can be lost, and by also reducing internal convection currents. When the temperature falls to 14°C (58°F) the swarm cluster develops an outer mantle of bees in a quiescent state of just hanging motionless, whereas in the core the bees have some space to move about.

Figure 1. *Tom Seeley swarm photo.*

You can see, in Figure 2, how a swarm regulates its collective temperature at different ambient air temperatures; on the left side it is only 5°C (40°F), and the bees are having to work hard to actively maintain the temperature between the core (35°C) and the mantle (19°C). A hot day of 30°C (86°F) is illustrated on the right, and bees in the mantle are mostly at rest with some active bees, most likely to be scouts. The channels between bees allows air to circulate by convection helping keep the temperature in the middle uniformly 35°C (95°F), whilst the mantle is 31°C (88°F)

But how does all this relate to swarm takeoff? Well, typically a swarm of about 10,000 honey bees hangs in a beard-like cluster from a solid object, often a tree, whilst

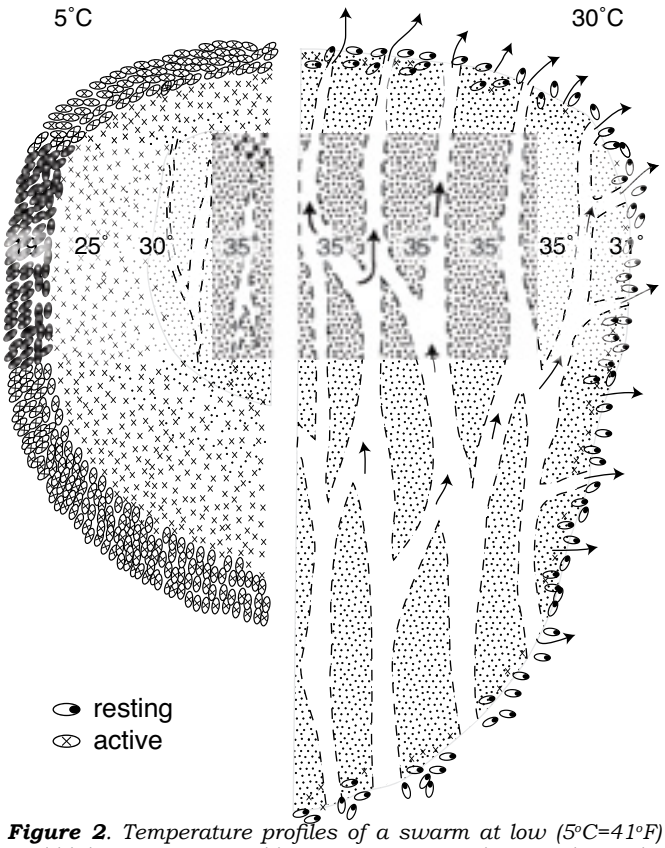

***Figure 2**. Temperature profiles of a swarm at low (5°C=41°F) and high (30°C=86°F) ambient temperatures. Diagram shows the positions of bees, channels for ventilation, losses of heat (arrows), and areas of active metabolism (crosses) and resting metabolism (dots). From* Honeybee Democracy *(Princeton University Press) and used with permission from the author.*

the 300 to 500 scout bees go and choose a new home. They may hang for a few hours, or a few days, until a quorum of scouts has built up at one of the sites, which marks the end of the scouts' decision-making process. Then it's time for all the bees in the swarm to travel to the new home site and start moving in.

Work on swarm thermoregulation by Seeley and Tautz (2001) revealed the mechanisms by which all the bees in a swarm become suitably warmed and flight-ready with their wing muscles heated to 35°C (95°F) which is close to our core body temperature. The entire swarm knows when to warm up because around 100 of the scout bees who have visited the swarm's new home site give the remaining 9,900 or so swarm-bees a clear signal to warm up their flight muscles to 35°C (95°F) to be ready to launch into flight. The signal first occurs around an hour before takeoff and comes in the form of piping which is easy for the beekeeper to hear by listening with an ear close to the swarm. This is usually possible as most swarms are extremely calm and settled, unless the bees are starving, or have been hanging in the open for a long period during poor weather. The piping noise is generated by a worker bee pressing her thorax, with wings pulled tightly together over the abdomen, onto another bee. While she presses against another bee, the scout bee activates her wing muscles and produces a sound resembling a Formula One car revving up at Le Mans. These piping scout bees are highly excited and run all over the swarm burrowing into it, and pausing frequently to pipe. At first, the beekeeper will hear sporadic weak piping sounds, but they will increase in intensity and build to a climax just before the swarm's takeoff.

Some of the scout bees communicate imminent departure by shaking or vibrating the quiescent mantle bees. A shaker bee grasps her sister and shakes her body for one to two seconds at 16-18 Hz but this shaking signal is not as significant as another important signal, the buzz run. This third signal really gets the bees going and, if observed in conjunction with piping bees, is a clear sign that the swarm will usually takeoff in the next one or two minutes.

The buzz runners are also the pipers and are most noticeable on the swarm cluster just prior to takeoff. You can see above in the diagram how the buzz runner runs towards the small group of torpid bees, and a second later she spreads her wings and buzzes them as she makes contact with the cluster. She pushes through them still buzzing her wings when contact is broken, and she may fly round before landing to repeat the procedure. She may sense the temperature of the bees whom she presses against, and research informs us that takeoff begins only a few seconds after 100% of the bees have their wing muscles warmed to 35°C. And they're off!

So how does this knowledge benefit beekeeping? Acquiring a deeper understanding of this amazing behavior of the scout bees on a swarm enables the beekeeper to watch some of nature's most wonderful displays as a partner in a unique relationship with bees.

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Figure 3. *Panel 1: The buzz-runner runs towards the quiet bees. Panel 2: One second later, the buzz-runner makes contact with the cluster, spreads her wings, and buzzes the other bees. Panel 3: One second after making contact, the buzz-runner continues pushing through the cluster, still buzzing her wings. Panel 4: Bee is still buzzing her wings as she runs off. Drawing by Barrett Klein, from* Honeybee Democracy *(Princeton University Press) and used with permission from the author.*

for signals. If no piping is heard and no buzz runners are seen, then there is time for assembling the necessary equipment, and to think carefully about the best action to take in a relaxed manner. How many times do beekeepers get so excited by swarms that they react rather than think things through quietly and carefully?

If, however, piping is heard, and maybe buzz running is also seen, then still all is not lost! The swarm can be lightly sprayed with cool water using a spray bottle. This will lower the bees' body temperatures and will stop their departure cold, at least temporarily. Now the beekeeper has an extra 10 minutes or so to capture the swarm and so keep the girls at home. BC

To see videos that show the sights and sounds of scout bees producing their piping signals and buzz runs, check out the following website: **https://www.youtube.com/watch?v=yJcoFUvTihc**

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Beeyard Thoughts

Setback beekeeping – dealing with discouragement.
Bee diarrhea may not always bee diarrhea – apparently.
Growing old with your extractor.
Odds and Ends – Balancing an extractor with canoe footing.
A wheeled extractor base.

Setback Beekeeping

In much of the country, it was a trying Spring season. Things did not go perfectly for many colonies in the Midwest and Northeast parts of the United States. Most of my personal colonies came through a mild Winter, and bees began bringing in pollen and nectar, bluebirds began nest construction, and lawns started greening up – only to have Winter cold and snow return for two weeks. Can I just say, this was frustrating?

Inches of snow on several occasions, temperatures back to the low 20s, frequent cold rain, and heavy cloudy days resulted in soggy, soggy ground. Just try walking in that apiary without Muck Boots. I have named these periods *"setback beekeeping."* You will not find that term anywhere but here. This is such a frustrating period that I needed to name it something besides the name I was calling it.

How many times have I told beekeepers or written articles and factsheets reporting that Winter is not over until it is truly over. Time and again, fruit tree blossoms will be at "tight pink" or even open, and a late season frost or cold snap will set things back – even far back. Orchards are misted; and in some cases, heaters and large fans are used to keep the cold air moving within the orchard. It is during these times that I communicate with beekeepers telling them that bees are not completely out of cold weather's grip until Winter is truly finished (based on historical Winter records).

Classic cold weather setback beekeeping does not often occur in warm climates, but sometimes during hot weather, colonies will have to shut down – especially if rainfall is scant. Even warm climates can experience something of a setback, just not in the springtime. But know this – no matter when or where the setback occurs, it is frustrating or even outright discouraging to live through these periods. I wonder if the bees are as worked up as their keeper during these annoying cold, wet periods.

In cold weather setbacks, there is little that can be done to help the colonies. Checking honey stores, offering pollen substitutes, or reversing deeps causes too much colony intrusion. Clusters are broken. Bees fly all about – most will never return. Brood may be chilled. All the antsy beekeeper can do is wait it out. During that waiting period, feeling of management guilt will probably arise. *If I had not gone to that weekend Spring bee meeting, I could have used that warm weekend to work my colonies.* Nope. For me, I was off giving talks telling others what they should be doing when my own bees were being ignored. *Well, I have to work to earn enough money to buy replacement bees!"* Tell that to my bees as they freeze and die during springtime.

I did get to use my stethoscope again and it worked – again. A couple of years ago, I included a goofy photo of me in a *BC* article with a stethoscope stuck to the side of a wintering colony. *(I did this when the neighbors were not around.)* In my hours of frustration this past Spring, I once again returned to my colonies with my scope. I could confirm that they were all roaring away within the hive. That provided a small glimmer of hope and enjoyment in a discouraging time.

This was the year that I have talked about so many times. In fact, it is not too late for yet another spate of Winter weather again this year. All of us in cold zones should remember that we need to prepare for this setback beekeeping experience in the Fall. Once the cold is underway during late Winter and early Spring, other than worry, little can be done.

A robin taking it all in stride.

Cold Daffodils. Could it be that the blooms hand downward to restrict frost damage?

I made a note to myself below. It may apply to others of you.

Note to Jim Tew for next Fall

Jim, you really should:

(1) Treat for mites all season long.

(2) Monitor the queen's performance. Going into Winter, she should be at least an average queen.

(3) Leave plenty of honey in the correct position, and have the brood nest in the bottom deep.

(4) Use the pollen supplement that is taking space in the freezer, and put some on the colonies. Remember to take any unused supplement off hives before Winter begins. Do this – even though it is better to add pollen supplement in the very early Spring. Do it in spring, too.

(5) Put the colonies on decent hive stands.

(6) Remove any un-needed equipment. Doing this task will keep the wintering colony compact and stable.

(7) Put the metal sheet in place on screen bottom boards. In solid bottom boards, reduce the bottom entrance to 3/8", and flip the inner cover to the deep side allowing for upward ventilation so frost will not accumulate. (In warm climates, water will sometimes accumulate.)

Jim, you really need to do these minimal tasks and stop procrastinating. You really should have learned your lesson by now.

Are there different types of bee diarrhea?

One of my hives that survived this past season had spotted the front of the hive with diarrhea spots. Yet the colony in the hive is (presently) alive. I find it interesting that this same colony streaked the hive front last year – even streaked it more. Yet, it survived last Winter, too. So here it is – a streaked colony for two years and the colony still survives. (No, I did not replace the queen. That should happen later this season – if it ever warms up.)

Please note that I have not a single shred of scientific backing, but it would appear that diarrhea is not always the end of a colony's world. At other times, this gastrointestinal disruption can cause a colony kill. *(Again, I am making these comments on very limited observations.)* Like so many other bee diseases, I guess that I am postulating that all diarrheas are not the same ailments.

The spotting on the hive front in the colony that has survived for the past two seasons, is much more solid and formed. In colonies that have died from the malady (to the right in the photo), there is a greater water content. *(I have to say this again; this is only a small observation on a few examples. This is not science. My comments are guesswork and no, I have no plans for becoming an insect pathologist during this lifetime.)* But I must admit that I will be more observant of the appearance of a case of bee-upset stomach. I will harbor some hope that some sick colonies will survive. Additionally, I will wonder if something is wrong with the remaining honey stores in the ailing colony. Finally, I will try to clean this mess up *(again)*, disinfect as much as possible, and simply toss a lot of the dirty frames.

Growing old with your extractor

Your honey extractor has absolutely nothing to do with cold weather and sick bees that I have been discussing; but I stumbled into the realizations that I have not avidly kept up with honey extractor manufacturers and design advances as the years have passed.

I need to confess that the last new extractor that I purchased was for The Ohio State University probably 25 years ago. It is still in the bee lab and is still remarkably current. For the most part, metal extractors have

Is this the same disease? They do not look the same, but they sure do have an odor.

been bulletproof since the earliest days; ergo, they can last forever.

Last February, at the annual Alabama Cooperative Extension System Beekeeping Symposium, I boldly assigned myself the project of producing a short video on the evolution and design of the honey extractor. I initially planned to simply review the big bee equipment producers and highlight their extracting equipment. Man, was I wrong!

When I last purchased an extractor, there were probably about 20-25 different models and sizes. The only ones available to me all were USA made. As I keyed my search into the web (primarily looking for video footage of extractors for my movie), I was swamped with links to companies that built honey-extracting devices, and was surprised that they came from all over the world.

Here's the rub – some of them looked as though they were insightful and well made. All of them did not appear to be lightweight or poorly constructed. Even more un-nerving was that many of these unfamiliar bee supply companies ***did*** have video and still shots that were available for subsequent use. I don't know why but U.S. manufacturers had posted very little video on their extracting equipment. I have posted the 36-minute video at the URL presented below[1]. The original URL is a secure link for those who prefer to use those.

Sturdy stainless steel, advanced welding methods, and variable speed DC motors are fairly standard on all metal extractors. Extractor sizes ranged from small to ridiculous. It is easy to marvel at these devices, but I had to realize that the international freight charges would be prohibitive. Then I noticed . . . (hmm) . . . that some of the units seemed to be available within our normal bee supply outlets. If not the same, it surely looks the same. This equipment may be much more available than I thought. With so many other international products sold here now, the availability of some international honey extractors should not be surprising. Extractors are still the same in fundamental design, but the suppliers and quirks of some models are interesting and new. These units continue to be something with which you grow old and pass down to your future beekeepers.

[1]An overview of the evolution of the honey extractor (36 minutes)

From the Standard Churn Company. I had one like this for my first extractor.

Speaking of which . . .

If you inherited one of the old, incredibly heavy-duty units somewhere along the way – especially the smaller units – the galvanized tank and basket along with the solder-sealed joint should be coated with a clear epoxy finish. It has been postulated that all those years ago, solder containing lead could have been used. There is no easy way for you to tell. Epoxy-coat these vintage machines and keep them coated.

For the Beginner

If you do get a honey crop during your first or second year, and you do not yet own or have access to an extractor, you may be tempted to uncap the honeycombs and lay them across a shallow pan, and allow them "drain." In theory, that would work, but in reality, it is a dismal process. It takes a long time – days or even weeks. Unless you cover the draining frame, bees and other insects will love the food resource. Stickiness and messiness will be common. No harm in trying, but *"I told you so."*

I have not mentioned cheaper plastic extractors or devices like the Reel Easy Extractor[2] (**www.reeleasyextractor.com/index.html**). There are cheaper ways to extract a few frames, but once your bees have produced several supers, you will grow to the next level of extractor needs.

[2]This is not a personal endorsement. Apparently, others have had similar ideas. Explore the Internet and form your own opinion.

Odds and Ends

Remember that in an article a few months ago, I asked if any of you had a good system for restraining a small to mid-sized extractor. Obviously, I can't use everything that all of you send, but I did select a couple.

Dave P. uses foam canoe blocks (see: **http://www.nrs.com/product/31211/nrs-universal-**

Canoe pads being used to restrict extractor vibration.

A wheeled extractor platform. Much of the vibration is absorbed.

canoe-blocks) to restrict his wandering extractor.

"Initially I thought the blocks would simply work well to prevent marring the kitchen floor. It was a surprise that the extractor stayed balanced even when an imbalanced load was put in the extractor and the speed turned up. The extractor resists walking pretty well - depending on the severity of imbalance, of course. The foam absorbs the wobble. It's not perfect but it does work."

In my youth, (yes, it was a long time ago), I worked in my Dad's paint and wall covering supply business. Our old model *Red Devil* paint shakers, when in use, were notorious for walking all over the warehouse. We found that using four small pneumatic tires on a simple flat platform that held the shaker base essentially kept the racket and vibration in one place. I found it interesting that Beekeeper Patrick D. has been using a similar setup for his wandering extractor.

Patrick said, *"We used to have one person cling to our motorized radial extractor for the first 10 minutes of extraction but now that we installed caster wheels on the legs, the extractor innocently wiggles around just a bit, and all of the energy seems to be absorbed by this movement. No bouncing, banging, or washing machine meltdowns. You might also notice the light placed beneath the extractor to let the honey run smoothly – this is the only form of "heat" we use in the processing of our honey."*

You might also notice that Mr. D. is using his kitchen as his extracting room. Additional photos and videos, either related or not related to this particular article are posted at: **https://onetewbee.smugmug.com/May-2016-Bee-Culture/n-ctXc7Q/i-3VwHrV3**
http://tinyurl.com/May-2016-BC

From you...

You have sent quite a few pictures of hive stands and a few novel extractor stands – plus most of you included a description. I am trying to post these at the URL above. As you think of it, keep sending them along. At some point, I will be requesting that those of you who have interesting honey extracting facilities – any size – to send photos along also. An occasional short video could be interesting, too.

Good-bye and good beekeeping. We will talk again next month. BC

Dr. James E. Tew, State Specialist, Beekeeping, The Alabama Cooperative Extension System, Auburn University; Emeritus Faculty, The Ohio State University. ***Tewbee2@gmail.com; http://www.onetew.com; One Tew Bee*** *RSS Feed (**www.onetew.com/feed/**);* ***http://www.facebook.com/tewbee2; @onetewbee*** *Youtube:* ***https://www.youtube.com/user/onetewbee/videos***

Professional IR Cameras

Jerry **Bromenshenk**

Getting The Most Out Of An IR Camera.

Lesson Learned

Last month, I wrote about using infrared (IR) cameras to image colonies before loading trucks and shipping bees. After arrival in California, Bill Fluke, the owner of Arlee Apiaries, called me to report that some of the colonies were not as strong as they had appeared from the front-of-the-hive IR images from the wintering shed; the bees had bunched up near the front of the hive. These colonies were queen-right and alive and looked good, but the actual cluster was smaller than expected.

This was a lesson learned. It's best to image each hive from at least two vantage points, either from the front and top or from the front and back of the hive. Side views can be misleading, especially if there are one or more honey frames between the side of the box and the cluster, or if there's a hanging feeder on the outside of the box.

IR Imaging

When using any IR camera, you are imaging the heat of the outside surface of the hive. IR is not a true through-the-wall imaging method. Anything that separates the cluster from the outside of the box will interfere with accuracy; a pillow wrapping for wintering, an inner hive cover, frames of honey and feeders, an extra deep cover, or a reflective surface such as silver paint or an aluminum covered lid.

Some materials thwart the camera. IR images through most clear and opaque plastics; for example, if I hold my hand behind a sheet of clear plastic, you'll see both it as a visible image and the camera will pick up the IR image. Switch out the plastic for glass, you'll still see my hand, but the IR camera won't see it. A sheet of black plastic will block your ability to see my hand, but black is an ideal color for IR imaging.

Qualitative (visual) and Quantitative (software) Image Assessments

In previous articles, both Wyatt Magnum and I have presented a variety of applications for IR cameras based on visual or qualitative evaluation and interpretation of IR images. However, my team is attempting to go to the next step, whereby the camera can be used as a quantitative tool. Ideally, one could image a hive and a software app would instantly display some form of assessment category: dead, weak, suspect, strong, or even assign a grade.

Regardless of how you intend to use these cameras, both camera resolution and camera accuracy are important. I've discussed the resolution issue in some detail in previous articles. Here I'm going to address camera accuracy, image manipulation, analysis, and reporting software available for FLIR cameras. Other manufacturers have comparable software. We're most familiar with the free FLIR Tools that comes with FLIR cameras, as well as FLIR's ResearchIR camera control and analysis software, marketed primarily for research and science applications.

Should you buy ResearchIR? Absolutely not unless you are into research; it's a superb tool, but expensive, and still won't automatically produce a quantitative grading system for bee colonies. We use it for our research and development work, but it's beyond the needs of most beekeepers.

Camera Accuracy

Some years ago, Dr. Joseph Shaw and Paul Nugent at our sister institution, Montana State University, in Bozeman, compared our basic FLIR i7 camera to their high end research grade cameras. At that time, the FLIR i7's 19,600 pixels were considered to be as low a resolution as one could go and still obtain accurate, quantitative images of bee populations in hives.

We and the MSU team had two concerns, one was that the FLIR camera was specified to operate accurately at temperatures between 0°C and 50°C. The other was calibration stability at different environmental temperatures.

The 0°C (32°F) limit was a concern since outside temperatures are likely to fall near or below freezing during early spring and fall. During actual use this January where the wintering shed temperatures were around 38°F and outside temperatures at 14°F, our i7, E40, and E60 all functioned well. We may have lost some accuracy of calibration, but we did not see any obvious differences between cool-temperature, indoor IR images of hives, and those of hives taken outdoors in freezing cold.

During their testing, MSU found that for the accuracy, of our i7 was best when the camera was kept

YouTube video: https://youtu.be/udfD1TlyBV4

in a stable temperature environment well before and during measurements. Rapid temperature changes in the ambient environment around the camera, or in the camera itself should be avoided. Since then, we have tested many FLIR cameras and have verified many of the recommendations from MSU. For maximum accuracy, it's best to turn on the camera at least 20 minutes before using. Grabbing a camera from a heated vehicle, powering it on, and immediately imaging hives at near or below freezing temperatures can result in significant camera calibration drift.

It's obvious to us that camera angle and distance are important to accuracy. New camera users often attempt to image hives at a distance and at odd angles. For maximum accuracy, it's best to image hives from a distance of six feet (two meters) or less, looking straight on from the camera to the hive surface to minimize reflections of thermal signatures. On better cameras, manually setting the camera to bracket the expected temperatures of the hive itself will further discriminate the hive IR thermal image from background IR sources.

MSU also found that for painted wooden hives, camera emissivity should be set at "0.95 if the ambient air temperature is properly input into the camera; otherwise, use an emissivity of 1 to minimize biasing of the data." We've since discovered that painted versus unpainted hives, and some colors of paint like silver may require changes in emissivity settings. Unfortunately, even changing the camera's emissivity setting may not adequately compensate for reflective surfaces like silver paint or metal hive covers.

Colony Cluster

Accuracy also depends on colony and hive conditions. Bees will cluster more tightly at colder temperatures. Cluster size increases with warmer temperatures. Colonies lacking brood or a laying queen won't cluster, unless it's cold enough to threaten the life of the adult bee population. A queen-less colony usually produces a diffuse heat signature, without the typical hot spot near the center. In warm weather, the best time to image colonies is in early morning, before sunrise. As soon as sunlight hits the hives, reflected heat may mask the cluster image. After a sunny afternoon, hives retain surface heat from the sun, and it may be difficult to image the cluster until well after dark. Wind and rain also affect hive surface temperature. Colonies can usually be imaged on overcast days, but if it's warm enough for the bees to fly, the colony may not cluster.

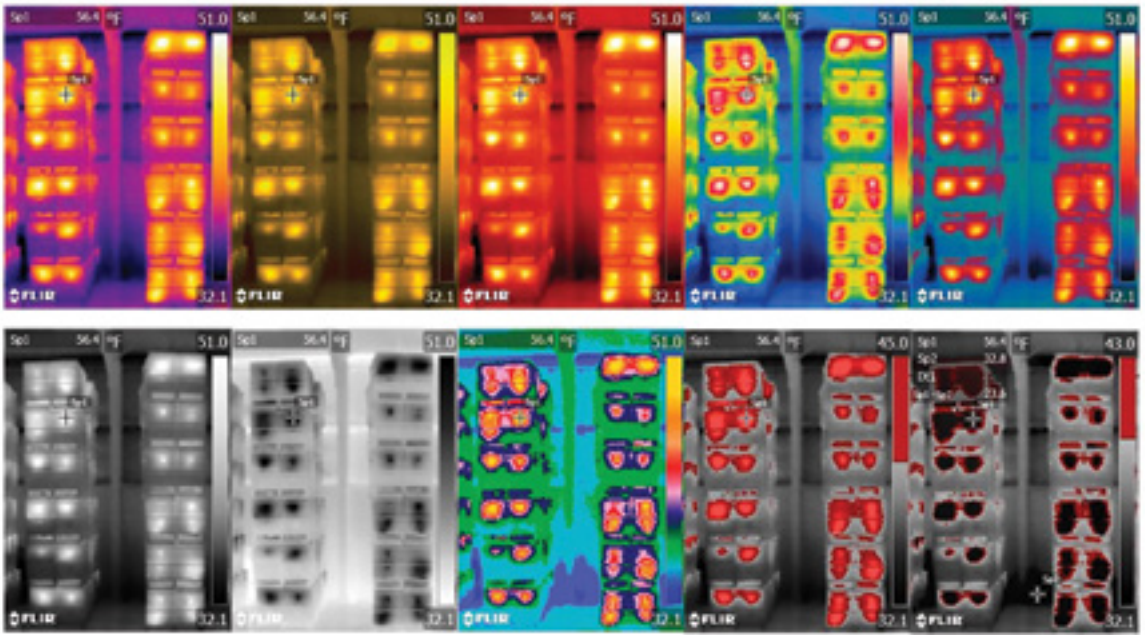
Software

FLIR Tools is free-software bundled with FLIR cameras, and FLIR Tools+ is a purchasable upgrade. These are tools for controlling cameras, transferring and emailing images, manipulating color pallets, managing images, extracting quantitative data and measurements, analyzing temperature data, and generating reports. Aimed primarily at contractors such as electricians, plumbers, and energy auditors, these tools provide a means of analyzing images and reporting to customers. With FLIR's recent marketing of inexpensive, entry-level IR cameras, the company has rapidly added a proliferation of variations to this software. Originally available for Mac and PC desktop computers, FLIR Tools is now available as an app for iPhones, iPods, and Android phones and tablets.

For the mobile apps, since FLIR's professional grade FLIR cameras generate their own Wi-Fi signal, an Apple device will directly connect. Unfortunately Android does not offer this type of pairing. To wirelessly connect the camera to an Android device, like my phone shown in the picture, you must connect the camera to a Wi-Fi signal (your home or office) and then connect the Android device to that same signal before they will pair.

Why pair a camera with a phone? I've found two major uses: (1) camera images can be emailed directly from the apiary, assuming you have a cell phone signal, and (2) many of FLIR's cameras can be remotely controlled via a phone app. This can be useful for getting images from tight spaces such as between stacks of hives in a wintering shed; although the camera may have to be mounted on a very long stick. Walk along the top of the stacks, lower the camera, and use the phone to control the camera.

These cable, wireless, Bluetooth, Mac, PC, and Android communication issues can be a bit confusing and frustrating, especially if you assume that the camera-to-remote device communication will be the same across different platforms. We've found that this can be especially problematic on older Android phones and tablets. Most of FLIR's cameras will communicate with most other



devices via a USB cable; but wireless and Bluetooth capabilities vary considerably. Furthermore, I found that documentation for FLIR TOOLS ranges from sketchy or almost non-existent for some of the newer mobile apps, and there's a rather long learning curve for the PC and Mac versions. ResearchIR is even more complicated.

Once I learned how to use each of the versions of the FLIR TOOLS software, it seemed easy in retrospect. The fault, in my opinion, lies in the instructions provided by FLIR rather than shortcomings of the software. Many FLIR TOOLS functions are hidden until one discovers where on the screen to click to open menus. In fact, I found hidden menus that even some of FLIR's technical support didn't know existed.

None of this should put you off from accessing and using FLIR TOOLS. It can be useful, informative, and a lot of fun. The best that I can do is try to make the experience less onerous. However, none of FLIR's software packages, including ResearchIR, will provide an easy to generate hive strength category or grade; that's something we are working to develop.

For FLIR Tools, I think it is far easier to show you how to use it, and what it can do, than to try to describe it in detail. Working with the University of Montana's School of Extended and Lifelong Learning, I developed a short video tutorial regarding image manipulation and basic image analysis that should make this much easier to understand.

FLIR Tools has three main components. The first is the ability to manipulate images such as changing color pallets, altering contrast, bracketing temperature ranges; all of which can alter the appearance of the image. This can be very useful for visual inspection and interpretation of IR images. The second is the ability to pull out actual temperature measurements. By moving the cursor, the temperature of any part of an image can be displayed. Choose a rectangle or ellipse to mark out and obtain the average temperature of any portion of an image; and FLIR Tools can determine differences in temperature from one part of an image to another. I highly recommend exploring these tools; you'll learn a lot about the IR images that you take.

The third part of FLIR Tools is report generation; whether for your own use, communication with a work crew, or to a grower about the condition of the colonies delivered for pollination. Basically, it's a set of pre-formatted templates where one can insert logos, company information, and some boiler plate text, select types of data to display, and then tag images for automatic insertion. It's designed for a contractor to quickly and easily provide a report to customers; wherein the company, basic information, and data analysis can be standardized into a report that can be edited as needed and printed. Unfortunately, the included templates are designed for the trades that most commonly use these cameras. There's no template for bee colony applications. The options are to work within the constraints of FLIR's supplied templates, which I found to be cumbersome, or purchase FLIR Tools+. For $295, FLIR TOOLS+ adds imaging options such as being able to stitch images together for a panoramic view, record and play IR videos, and the ability produce custom templates and advanced reports using Microsoft Word.

Finally and most importantly, practice! Purchasing a camera will not automatically make you an expert in thermography. You have to learn how to use an IR camera and its tools. Image colonies before smoking, open to inspect, and learn what the camera can and can't do. BC

APPRECIATING YOUR VOLUNTEERS

Growth Of The Organization Is Key To Volunteers Volunteering.

Michele **Colopy**

The majority of beekeeping associations are managed by volunteer Boards of Directors. A continual refrain heard around any group or club is "it is so hard to get anyone to volunteer."

People volunteer because they want to contribute their time, energy, and skills to helping an organization grow. Volunteers want to know and feel they are appreciated. When one volunteer recruits another person to volunteer, it is because they had common interests in supporting the growth of the organization. "Growth" of the organization is key to volunteers volunteering. If leadership in a bee club is unable to get members to join the leadership ranks it is often due to:

1 – the same people have been leaders for far too long
2 – new ideas are ignored or discounted
3 – the current club leadership does not know the talents and skills of its membership
4 – the current leaders are not asking individuals directly to volunteer recognizing a member's skills.
5 – the current leadership does not want the bee club to change

I addressed some of these concerns in the last article in the many ways to break a bee club.

A bee club is about the group, so leaders must be willing to work with others, and recruit the next leaders. No one should serve as a Board member "forever." Each Board member, besides their committee or officer duties, should make "getting to know the membership" one of their "duties" as well. Beekeeping Associations are becoming more and more diverse. With this diversity comes a depth of skills and talents that can benefit beekeeping associations. Bee Clubs have to plan, manage, and implement their Facebook page, website, newsletter, refreshments at meetings, meeting planning, fundraisers for the bee club, legislative activities at the local and state levels, and have knowledgeable members for the By Laws, club accounting, honey judging, and county fair booth. to name a few. Appreciating the skills and energy of current and prospective volunteers is key to maintaining them, and securing new volunteers.

How Do You Identify Volunteers?

A University of Arkansas, Division of Agriculture, Cooperative Extension Service has a 4-H Volunteer Leaders Series for recruiting volunteers. It is easily "adjusted" for a bee club recruiting volunteers from within its membership.

Before identifying potential volunteers, you will need to know:

- *Why volunteers are needed.*
- *What will be expected of the volunteer.*
- *What skills the volunteer needs.*
- *What help will be available to the volunteer.*
- *How long the volunteer needs to serve.*

You should develop a job description containing this information. These job descriptions need not be elaborate. Much more information would need to be provided to someone being recruited as an organizational leader than to someone being recruited to be a resource person for only one club meeting.

Occasionally a volunteer will think they would be good for a task or project, when in reality they have no skill-set for it at all. The key with volunteer management is finding the best task for the volunteer. An outgoing person who enjoys getting to know others and is a good listener, would be great as the greeter each meeting, directing members to pay their dues, pick-up handouts, where the refreshments are located, etc. That type of person would not work well collecting the dues or "selling" supplies before the meeting. Collecting dues and selling supplies is about fast customer service, and keeping the line moving. You know why you need a sticky board, a 10 minute discussion is not necessary. The volunteer who is easily distracted by questions, and is taken off task easily should not be a person collecting dues or other club income; money will get lost simply due to their high distract-ability.

Appreciating volunteers is important if you truly want volunteers. An announcement at the front of the room expressing a need for volunteers is just that an announcement. Now club leadership needs to personally interact with members for the volunteer activity. An email is not a personal interaction; neither is a phone call; those are follow-up communication methods. Once club leaders announce they need volunteers for a task(s), go talk with a prospective volunteer. However, do not ignore the member who truly volunteers. Just because you did not originally think of that person as a good volunteer, they just might surprise you.

The University of Arkansas Leadership Series continues, *"Now that you know what is expected of the volunteer you seek, you will have an idea of the type of person you need. Once you have a specific job to fill, you should use every possible means of identifying potential volunteers. Some approaches you might consider include the following:*

- *Use yourself as a resource. List people with whom you are familiar that have skills and interests related to the job.*
- *A key way to identify volunteers is to ask others for recommendations. Members, other volunteer leaders and key club leaders are good sources of leads for identifying volunteers.*
- *Search for individuals with skills*

and interests related to the job and approach them directly.

- *Keep your eyes open for clues. A notebook or card file of club members and their interests as demonstrated through participation in various aspects of community affairs can be an asset.*
- *Don't forget that family members of your members would be a good source of potential volunteers.*

Once volunteer prospects have been identified, the next step is the actual recruiting.

You should approach your potential volunteer confident that the job you have in mind is a worthy one and one that the potential volunteer is capable of doing. One of the first things the prospect will want to know is what you want done and when. With your job description in hand (or at least in mind), you should have no problem providing this information. You should also be prepared to discuss the benefits volunteering will have for the volunteer, and the bee club. For example, benefits to the volunteer may include:

- *A chance to learn or improve skills .*
- *Opportunities to meet and work with other club members.*
- *An opportunity to promote topics of interest to the volunteer.*
- *An opportunity to really contribute to the club's development.*
- *It can be fun.*

Everyone wants to be appreciated. Everyone wants to feel their contributions are valued. So, appreciate and value your volunteers. Beekeepers join bee clubs to be with others with the same interests, and to learn. Leadership must express a welcoming attitude toward all of their members, especially the new members. Beekeeping Association stories are plentiful with beekeepers going outside of their county or even across state lines to join a bee club. People will travel to a bee club if the leadership is "better," the speakers are better, and most importantly, they feel welcome, and have developed friends in the bee club.

Cristopher Bautista suggests *7 ways to Appreciate Your Volunteers* in a blog on Volunteer Match:

While they are volunteering
Give them the bigger picture.

One way to thank volunteers is to give them perspective about what they're doing. No matter what they're doing, let your volunteer know the larger context — not just what they're doing, but why they're doing it – and you'll show that you respect them and appreciate their work.

Provide food for your volunteers when they work.

Be sure to provide food for them as they work. It keeps them energized and shows that you care.

Check in with your volunteers.

Be sure to check in with your volunteers regularly, especially if your volunteers are located in some back room or storage area where people don't usually go. If they're looking tired, give them a break. If they're looking bored, offer to give them a different task.

After they volunteer
Feature volunteer stories on your blog/website.

Take time to interact with your volunteers, not just to thank them for their work, but also to get to know them personally.

Give your volunteers awards.

Are there any volunteers who have gone above and beyond? Nominate them for awards such as "Volunteer of the Year," or have multiple categories, such as "Most Inspirational," "Most Enthusiastic," etc.

Give your volunteers small tokens of gratitude.

Give volunteers a thank you gift, even something as small as a gift card.

Send your volunteers a simple, handwritten thank you card.

Sometimes the best way to show you appreciate your volunteers is the old fashioned way – sending them a thank you card. In the age of email and social media, the handwritten letter is a novelty. Bonus points for personalizing the message, such as thanking them for a specific task they did during their time volunteering.

As beekeeping clubs gain diverse members, these members will demand (and rightly so) quality speakers, diverse educational topics on the many facets of beekeeping and hive products, and suggest new programs relevant for new beekeepers. These new programs may utilize the skills of the new members. The club leadership needs to promote and practice a culture welcoming new members, new ideas, and new volunteers.

A growing club is a successful club. A growing club is dependent upon the interactions of the membership – all of it, not just a select few year after year. Appreciate your current volunteers, other members will see that, and want to become volunteers: you simply need to ask them. BC

Resources

Reprinted for use in Arkansas from material prepared by Iohn A. Rutledge, Jr., Extension 4_H Youth Specialist, Cooperative Extension Service, University of Florida. Mike Klumpp, associate professor, 4-H youth development, University of Arkansas, Division of Agriculture, 4-H Volunteer Leaders' Series. "Recruiting Volunteers for Your Club," 4HCE5-PD-10-05R, **https://www.uaex.edu/publications/PDF/4HCE5.pdf**

Bautista, Cristopher, *7 ways to Appreciate Your Volunteers*, April 5, 2012, Volunteer Match, **http://blogs.volunteermatch.org/**

All The Buzzz in...

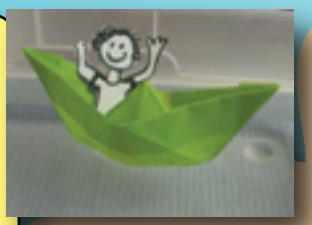
Hello Friends,

Summertime! Say hello to all of my bee friends the next time you are outside.

Bee B.Queen

Bee B. Queen Challenge

Send me your bee artwork!



Beeswax Boat Float

Summer is here! The heat is on. Why not make something you can play with in the water to cool down? How about a paper boat that will float and not get wet? Let's get started. You will need an adult to help you with this project.

Materials

- paper
- crayons or markers
- beeswax
- double boiler or crock pot

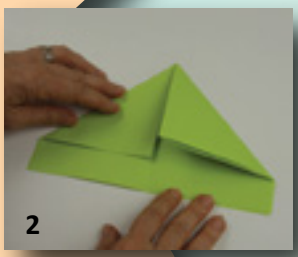
Directions

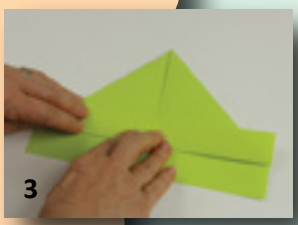
Fold the Boat

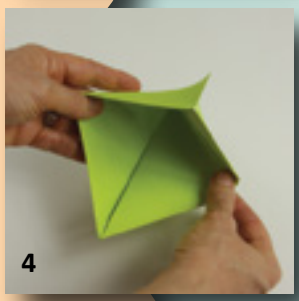
1. Fold a piece of copy paper in half with the short edges together. Find the center by folding the paper in half again.
2. Fold the top two corners of the folded side to the center line to form triangles.
3. Fold the bottom flap up on one side, turn over and do the same on the other. If you stop here you will have a little hat!
4. Pull the sides of the open end and fold to make a square. Fold the flaps under.
5. Fold each of the bottom corners up to meet the top corner on each side. Now you have a triangle.
6. Pull the sides of the open end and fold to make a square. Sound familiar? It's the triangle to square trick again.
7. Now for the magical grand finale. Pull the sides out and carefully flatten to create your boat. To help your boat float, pull apart the bottom so it will sit on the table.
8. Decorate using crayons or markers.

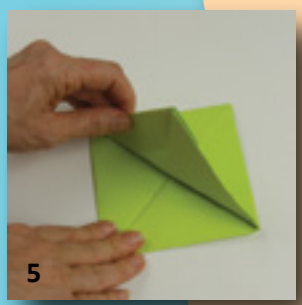
Coat Your Boat

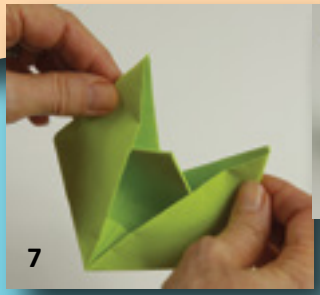
9. Melt the beeswax in a double boiler or crock pot. Beeswax is flammable so keep away from direct flames.
10. Dip the boat half way into the wax. Cool. Repeat on the other side. The paper will absorb the wax.
11. Head to the bathtub, wading pool, or pond to float your boat!









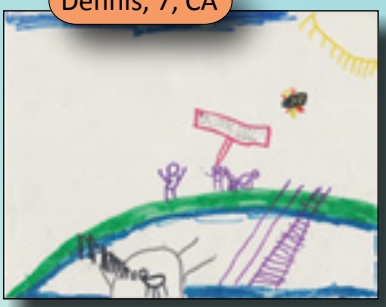


Across: 1. cream, 2. candles, 4. soap, 6. lap balm. Down: 1. crayons, 3. batik, 5. polishes

... Bee kid's corner

Produced by Kim Lehman -www.kim.lehman.com
www.beeculture.com
June 2016

Dennis, 7, CA



Jessica, 8, FL

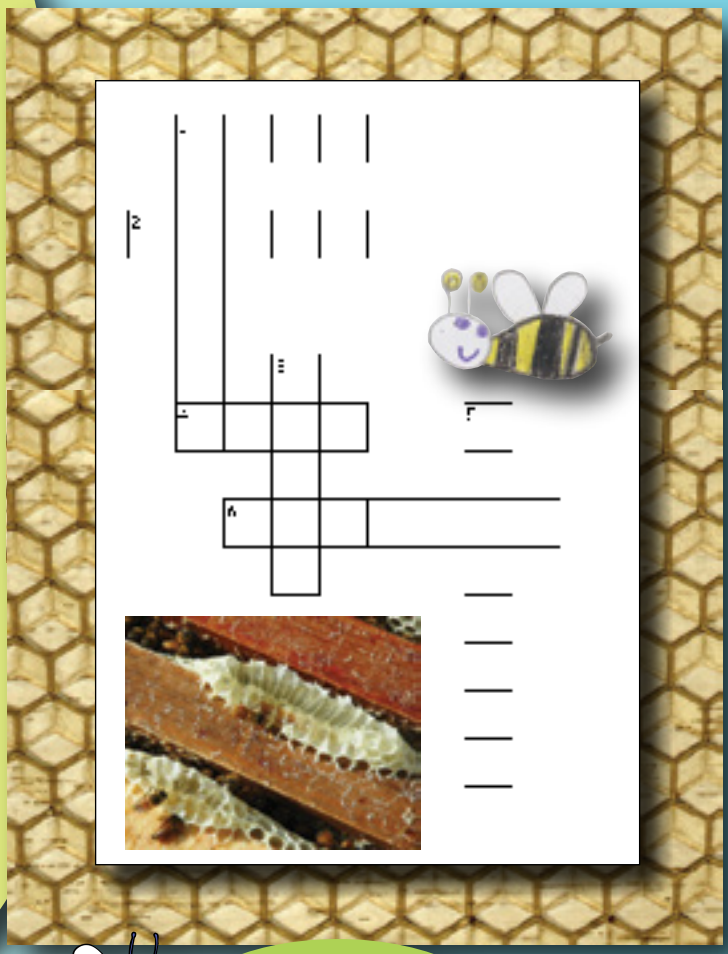
Kaleigh, 7, MA

Waxy Crosswords

All of these clues are made with beeswax. Can you finish this puzzle?

Across
1. Used to moisturize skin
2. Lights up a dark room
4. Something you use in the bathtub to get clean.
6. Helps protect chapped lips

Down
1. Comes in many different colors used to create art
3. Wax resist technique with dyed fabric
5. Protects wood and furniture



What do you get if you cross two bees with a water pistol?

A bee-bee gun.

Bee Buddies

Joseph (age 5) and Jeremiah (age 3) Mautz are nature loving brothers living in Ohio. Spending time with their beekeeping grandma, Terry Mautz, is always full of fun and surprises. At first the boys were afraid of the bees but time and experience have produced two honey bee supporters. Actually, Joseph and Jeremiah are protectors of all insects. Of course honey makes the bees extra special. Last year Joseph was very excited to share some honey with his classmates to celebrate National Honey Month.

Beecome a Bee Buddy

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

Name
Address
Age
Birthday Month
E-mail (optional)

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

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

Retired professor Norm Gary happened to stop by the day the author was visiting. He continues with his music, playing with several groups. He is here with Elina Niño the new extension bee specialist at Davis.

Dr. Elina Niño California's New Extension Specialist

Larry **Connor**

The University of California, Department of Entomology at Davis, has a new entomologist on staff covering extension and research in apiculture. In February I had an opportunity to visit the Harry Laidlaw Jr. Bee Research Laboratory in Davis and meet Elina L. Niño, her husband, Bernardo Niño, and others at the lab. There have not been many changes to the building, although the primary classroom and some technical rooms have been renovated.

It was a busy day, and Elina and I did not have as much free time as we thought to do the interview, in part because of a surprise visit by Dr. Norman Gary, who has been retired from the lab for a number of years and coincidently visited the lab that day to meet Elina. Dr. Robin Thorpe, the non-*Apis* specialist at the lab, is retired but continues to be very active in his work, having just co-authored a book with **Gordon W. Frankie** on the *California Bees and Blooms: A Guide for Gardeners and Naturalists*.

As a result I sent Elina a set of questions for her to answer. She had done that and here is our Interview with Elina L. Niño, University of California, Davis:

Larry: Elina, you've been at the Laidlaw Bee Research Lab for a year and a half now, and you seem to have had time to settle into this new role. I'd like to ask a few questions so readers will be able to get to know you better and see how they might support your various programs.

Let me start with some personal history. Where were your born? Where did you grow up? How did you become interested in science and more specifically in biology?

Elina*:* If you are a California beekeeper you most likely heard me say that I was born in Bosnia and Herzegovina, the capital city of Sarajevo to be exact. My parents still live in Bosnia and I hope to visit them again soon. Seventeen years ago I came to the U.S. to visit my aunt and uncle in New York for the Summer. At the end of the Summer they generously offered to support my college education so I stayed. I'm very grateful to them, as well as my parents for not flying over to drag me back home as I remained in the U.S. for 14 years before going back for a visit.

Larry: Tell us about your Master's project on dung beetles at the North Carolina State University:

Elina*:* First off, I have to say I have been extremely lucky to have the most wonderful advisor for my Master's program. Dr. Wes Watson and a super supportive research specialist Steve Denning. The main question of my master's thesis was whether if the growth regulator methoprene used for control of pestiferous flies has a negative effect on dung beetle populations on dairy farms. Dung beetles are beneficial insects and are an important member of a healthy ecosystem. They use manure to feed and to reproduce and thereby they compete for resources with filth flies on cattle leading to their control. Basically, they're the good guys and girls and we wanted to make sure they could be used as a part of a successful integrated pest management program without compromising their survival and health. And we found that indeed, in doses normally used for control of pest flies, methoprene was not harmful to many dung beetle species found on the North Carolina dairy farms.

Larry: How did that lead to a Ph.D. at Penn. State University? What was your thesis topic? Explain what you learned in this research.

Elina*:* I actually started my Ph.D. in North Carolina in the Lab of Dr. Christina Grozinger and was co-advised by Dr. David Tarpy. It seemed like a natural transition since I've already been working on beneficial insects, and as we all know, honey bees are fascinating and we are not even close to being done with learning about them. In my dissertation work I characterized how drone seminal contributions modulate post-mating changes in queens. My studies revealed a complex interplay of seminal fluid volume and seminal fluid components in triggering and maintaining queen post-mating changes including ovary activation, transcriptional changes in fat body tissue (the site of synthesis of the egg-yolk protein vitellogenin as well as many antimicrobial peptides) and pheromone production. I have since expanded on these findings and the ultimate goal is to identify specific seminal fluid components that are regulating specific post-mating changes. Understanding these complex processes will help us support the honey bee breeding efforts.

Larry: You met your husband, Bernardo, at NCSU, and you now share a passion for honey bee and pollinator research. What has been the advantage of working with

Two retired bee researchers and two new books. Robin Thorp with Bees of California *and Norm Gary with* Honey Bee Hobbyist.

a husband who shares your interests? What story(s) can you share about this?

Elina*:* Bernardo and I have been working together for a long time and long before we started working on bees. People do have an interesting reaction when they hear we work together and you can tell that they're thinking: "Poor Bernardo and Elina have to work together." In fact, we're a great team and we complement each other very well. Plus there is nobody else who is more invested in our success so we really try to support each other the best that we can. We also work well together at home; we both share in the responsibility of raising our two very active boys. Bernardo has been great about me traveling a lot in the evenings for the extension talks and I'm very grateful to have a supportive husband.

Larry: California has a long history of honey bee research and extension. What programs have you started that will continue to make a contribution to California beekeepers and beekeepers everywhere?

Elina*:* In the past year and a half my lab has developed and offered several beginner beekeeping courses, as well as advanced classes including the Queen Rearing Techniques Short Course and Basics of Bee Breeding course. Considering the steady increase in interest in beekeeping, certainly intensified with the invention of the Flow Hive, I think it is crucial to ensure that novice beekeepers understand the issues facing honey bees and are ready to deal with them appropriately. We are also developing a children's Pollinator Education Program which will take place at our beautiful Häagen-Dazs Honey Bee Haven. I love working with kids and I do think they're the most awesome audience.

We, of course, also have a very active research program. I currently have two Ph.D. students, Cameron Jasper and Patricia Bohls and both are working on furthering our understanding of queen reproductive processes and what factors might be regulating queen health. My lab is also actively working on several applied projects one of which is testing several novel bio pesticides for *Varroa* mite management.

Larry: I know you added a new person in December of last year. Can you tell me about him?

Elina*: We are very happy to have Charlie Nye join us as our new Staff Research Associate and the Laidlaw facility manager. Charley comes from Illinois where for the past five years he was a technician in the laboratory of Dr. Gene Robinson. He has also assisted with honey bee projects coming from the laboratory of Dr. May Berenbaum. As president of the Central Eastern Illinois Beekeeping Association, he helped in community outreach and was instrumental in creating plantings at the University of Illinois Bee Research Facility supported by a $60,000 grant.*

Larry: Among other programs, you have announced a California Master Beekeeping program to start in the Fall of 2016. What are the key elements of this program that have been developed? How many beekeepers do you expect to train and certify as master beekeepers during the first five years of the program?

Elina*:* In a sense all of the educational programming that we've developed has been in the expectation of offering the California Master Beekeeper Program. We are also developing additional educational resources to be used as part of the program. The program, as is common, will be done in several levels and we would expect to have approximately 50-75 students enrolled in the first year. We are very excited about this program, especially that there will be a large emphasis on educational contributions by participants in their communities.

Larry: What is something few beekeepers know about you? Anything in the arts, athletics, or other areas that readers may find interesting?

Elina*:* I'm not very artistic; in fact, I was kicked out of a choir when I was only eleven so you know it's pretty bad. I was getting into running and even completed a half-marathon, until I injured myself in preparation for an evening race. Then the kids came along and the move to California, well, as you can imagine the running is not very high on my priority list these days.

Larry: Any final thoughts?

Elina*:* I can't believe it has been almost a year and a half since I started as the extension apiculturist at UC Davis. I think it has been great 18 months and I'm very glad I had an opportunity to meet a great deal of beekeepers in the state of California. Ours is a small lab and we hope that we can make valuable contributions to the industry through both our research and extension efforts. BC

For further information about the research, extension and outreach programs at the Davis Bee Lab, contact **http://elninobeelab.ucdavis.edu**

The month of June puts Dr. Connor speaking and vending at the anniversary field day of the Connecticut Beekeepers, a field day at the Eastern Connecticut Beekeepers Association, a Three-Day Queen Rearing Class and a two-day Beekeeping 102 program at Mann Lake in PA, and the weekend Summer meeting of the Virginia State Beekeepers in Smithfield, VA. For details, check the ***www.wicwas.com*** *or the respective organization's website.*

Got A Question?

Ask Phil

Phil **Craft**

He Knows!

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

A beekeeper in North Carolina writes:

This will be my 3rd season as a beekeeper. Each year I like to learn new skills and this year I would like to trap some swarms. I've read about trap types, lures, and preferred locations and have placed three traps within 1/2 mile of my apiary. My question is if I should be fortunate enough to catch a swarm and hive them will the foragers return to the trap location and if so how can I prevent that. I can check the traps daily so would most likely take them home the same day near dark.

Thanks in advance for your help and the many interesting articles on your web site.

Phil replies:

It's true that, if you were trying to relocate an established hive, a move of half a mile would probably not be enough to prompt foragers to reorient upon making their first flights from the new site. They would be likely to try to return to the original location. However, if you check the bait hives daily, and move any swarm you catch before the foragers have a chance to orient themselves to the environs of the bait hive, you should not have a problem. Even if some should return there, your losses would be small. Because they need to build comb as quickly as possible, swarms are comprised of a large percentage of young, wax producing bees. By the time those bees are ready to make their first foraging flights, they will imprint on the site of their new home.

Though haven't used bait hives in a number of years, I frequently hive swarms I catch in the vicinity of my house. I transfer them to a hive body, which I leave at the swarm location until near dusk in order to collect as many bees as possible, then move it to a new location in my bee yard nearby. I never have a problem with bees wanting to return to the original swarm site. Be aware though, that just because they don't return to the trap location doesn't mean that they will accept the hive you put them in. Placing a frame of brood or a few frames of drawn comb in the box will improve the chances that they will settle in. If they do abscond, they will most likely just move to a nearby tree or branch – not go back to where the swarm trap was originally located.

Beekeepers have long used traps or bait hives, both to recover swarms from their own hives and to capture feral colonies. I have a friend who ALWAYS leaves a bait hive in each of his out yards (bee yards that are not near his house), since he can't visit all these locations every day during swarm season. A bait hive, an artificial potential nesting site designed to attract swarms, can be as simple as an empty hive body. Frames with wax foundation or old comb make it more enticing, though the problem with old comb is that it can also attract wax moths. Some beekeepers use specially constructed boxes or commercially produced swarm traps designed to mimic the characteristics of the natural nesting sites preferred by honey bees: cavity size, height above ground, and entrance size. Others go even further and use a chemical lure, a synthetic form of nasonov pheromone, which is used by bees for orientation and to mark entrances, foraging sites, swarm gathering sites, etc. (*Bee Culture* readers: I wrote more extensively about the use of bait hives in my May 2013 column. Contact me if you would like a copy.)

Since you have obviously been doing some research, you might be interested in the work of Dr. Tom Seeley, author of *Honeybee Democracy* – a very informative book about the decision making process during swarming. He also wrote a nice article about bait hives, though it doesn't

address your specific question. It can be downloaded from the Cornell University webpage: **https://ecommons.cornell.edu/handle/1813/2653**. In this helpful handout Dr. Seeley offers tips about bait hives, such as the best distance from the ground to place them (about 15 feet), the ideal box size (about 1.5 cubic feet), pheromone attractants, and other useful information.

A beekeeper in Kentucky writes:

I'm a beekeeper here in Kentucky for the past five years. Last year I raised some queens and wintered one of those queens in a five frame nuc with a second nuc box on top with three more frames and a feeder inside (eight frames total plus a feeder). The colony made it through winter and yesterday (3-29-16) when I checked on it, there was some capped worker brood, open brood, and a patch of eggs a bit larger than a tin can. The odd thing about the eggs is that there were two to three eggs in most of the cells. At first I thought I had lost the queen and had a laying worker (I saw the eggs on a frame before I saw the brood and larvae on the next frame) but the queen was present on the next frame. All of the eggs were at the bottom of the cells, not up on the side like laying workers usually do. Is this common? Or is the queen just having some start up issues laying? Or is the queen wanting to lay but the workers haven't cleaned up enough cells for the queen to lay as much as she wants too? (there are plenty of open cells, but the colony is quite small – maybe they just can't cover the brood and eggs she wants to lay – I was really surprised they made it through winter as small as they were last fall.)

Thank for you time and thoughts . . .

Phil replies:

No matter how long we work with these little creatures, they can always manage to surprise us with something we haven't seen before. As long as you continue to see healthy worker brood, I would not be overly concerned. There are a few of possible explanations – none of them anything to worry about. New queens do sometimes lay multiple eggs in a cell; this one is not new, but she is young. I have also heard, though rarely, of more mature queens laying a few cells with multiple eggs. One of those occurrences was also in the early spring, so your suggestion of an over-eager queen is plausible. Another possibility is that you do have one or more egg laying workers. Under normal circumstances, a worker's urge to lay is suppressed by the presence of queen and brood pheromones, but aberrations

Photo by Mark Kay Parnell.

can occur. It is only in a queenless hive, when all the usual constraints are removed, that laying workers get out of hand and become a BIG problem. Your small colony has both a queen and brood.

Your suggestion that a small colony may not be able to utilize all the comb available to it is also accurate. I always say that it takes bees to raise bees, and a colony cannot make use of more comb than it can cover. The bees must not only clean out cells prior to the queen's depositing eggs in them, but they must also maintain a cluster around the eggs and developing brood in order to sustain a temperature of about 90°F. Thus no egg laying or brood production is possible outside the area of the cluster. This is one reasons that we strive for strong colonies going into Winter – not only to increase Winter survivability, but also to allow rapid growth in the Spring.

Just keep an eye on this hive as the season continues. If you continue to see worker brood, especially increasing amounts of it, you have nothing to worry about.

A beekeeper in Wisconsin writes:

The last couple of years, we been treating our hives for mites with vaporized oxalic acid. Since it works best with minimal capped brood cells, would it be best to vaporize the hives immediately when I receive our bee packages. Would vaporizing the bees immediately interfere with the pheromones and acceptance of the queen or would I be better off waiting a week or so.

Phil replies:

I have had the same idea myself. The use of oxalic acid as a quick and inexpensive control for *Varroa* mites in package bees has long been discussed. It can be vaporized, sprayed, or drizzled, but however applied, it is a "flash treatment" the effects of which have a very short duration. As you obviously know, it kills only the mites on adult bees, leaving those inside capped brood cells untouched. Since a large percentage of the mites present in a hive is usually to be found in the brood cells where they reproduce, this is a serious drawback. After a treatment, mites which were sheltered in cells emerge, already mated, replete from feasting on pupae, and ready to continue their reproductive cycle. As a result, any reduction in the level of *Varroa* infestation is quickly compensated by the mites. The obvious way for beekeepers to overcome this problem is by treating during times of the year when there is very little or no brood present, such as in early Winter. (By using the vaporization method of application, treatment can be accomplished without ever opening a hive.) Because hives with newly installed packages contain no brood, they would seem to offer ideal conditions for the use of oxalic acid – if mite levels warrant treatment.

I have had concerns for some time about mites in package bees. Bee producers work hard to control *Varroa* and provide healthy bees to their customers, but mites are impossible to eradicate and difficult to keep in check. A relatively small number early in the year can proliferate rapidly during the spring build up because they breed while bees raise brood. Mite infestations can get out of hand quickly. Over the years, I have talked to so many new beekeepers, enthusiastic about starting their first

Package installation.

package, who lost the entire colony to mites within the first year. I have become convinced that it is a good idea to monitor new packages for mites, and it's fairly easy to do since the queen is caged and there is no risk of harming her during the process. I have some packages ordered myself, and I plan to conduct an alcohol wash on each one as I install them. (*Bee Culture* readers: I wrote about alcohol washes, and other methods of varroa monitoring in an earlier column. Contact me if you would like a copy of that Q&A.)

That said, I think you're wise to be cautious about treating packages too soon – with oxalic acid or any fumigant miticide. Every Spring I hear about a certain percentage of package bees absconding within a few days of installation, and no one can explain exactly why. Treating immediately might not cause a problem, but to be on the safe side, I would give the bees a week or so to get established first. Allow them to draw some comb, and the queen to leave the queen cage and begin laying. Mites do not move into the brood cells until late in the larval stage, so until the eggs begin to hatch, what *Varroa* is present will still be on the bees and highly susceptible to oxalic acid.

Good luck. Let me know how it goes. BC

Beekeeping In LATVIA

Sarah **Gabric**

The Latvian people are passionate about honey bees and beekeeping.

Latvia sits nestled between Estonia to the north, Lithuania to the south, Russia to the east, Belarus to the southeast and the Baltic Sea to the west. About half the geographic size of Ohio, Latvia has a current population of approximately two million people, about 25% of whom are Russian.

My husband and I traveled to Latvia early this year to visit friends and while there did some exploring of local apiculture. We stayed in the capitol city Riga, which is, latitudinally speaking, about as far north as Juno, Alaska. While there we visited three shops dedicated solely to the sale of bee related products. We encountered, at every market stand, pharmacy, souvenir shop, and corner store, bee-inspired toys, decorations, and images, as well as honey and products that utilize honey, pollen, propolis, etc. in their ingredients.

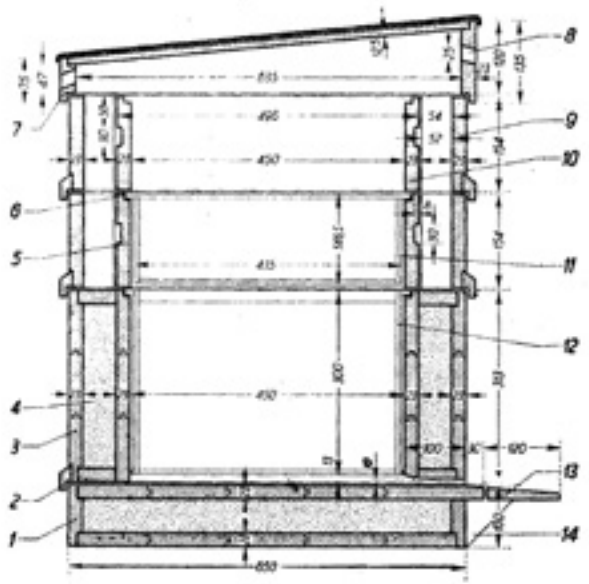
The Latvian people prize the honey bee and seem deeply invested in the health and medicinal benefits derived from apiculture. They consume honey, pollen, propolis (good for toothaches), bee bread (helps the body heal after illnesses), and royal jelly directly as well as using the above in both food products and creams, suppositories, balms, cosmetics, and tinctures. Additionally, some Latvians practice apitherapy (also known as bee venom therapy or sting therapy).

A month or two prior to our visit, we began communicating with Juris Steiselis, Chairman of the Latvian Beekeepers' Association, and beekeeping ambassador extraordinaire. We met-up with him on our second day in Riga at Medus Veikals, a local beekeeping emporium. Who knew one could fit so many honey bee-related items into a room no bigger than 20ft x 30ft? Medus Veikals (medus means honey), is owned and operated by Janis Malcenieks a third generation beekeeper, and supplies its customers with everything from the practical; smokers, hive tools, wax foundation and colorful jackets and veils, to the whimsical; candles in every imaginable shape and size. Medus Veikals did a brisk and steady business during the 30 minutes we were there. Most customers did not browse but seemed to be coming in for the specific reason of purchasing a product they were familiar with but maybe had run out of, as though their stop at the honey shop were merely an errand tucked in among a list of others.

After spending half an hour talking with Juris, Janis (the proprietor), and Janis Snikvalds (a beekeeper and export manager of the Latvian Beekeepers' Association) we headed for the countryside in Juris' car. Janis, pronounced Yan-ees, is a very popular name in Latvia, meaning God is Gracious. We encountered the name, which translates to John in English, countless times. In the remainder of this article when I mention Janis I am referring to Janis Snikvalds.

As we left downtown Riga, the oldest section of which dates back over 1,000 years, a city of grand, palatial architecture, magnificent, ancient cathedrals, and countless cafes, bakeries, and restaurants we jostled over cobblestone streets inlaid with tram tracks and pavement. Our car wove in and out of traffic patterns either too complex or erratic for me to follow in a jolting but unhurried fashion. From the city proper we passed through more modest neighborhoods and on into an area of monotonous, hulking, concrete apartment buildings, one after the other, in a seemingly endless succession. These structures are remnants of the Soviet era and are said to be as identical on the interior as they are without.

As we continue on the landscape begins to soften, less manmade geometry and more of the natural world with its gentle curves and tangle. The colors here are familiar to me, as they are similar to the colors of Maine, the neutral nivian colors



29. att. Stāvstropa vertikālais griezums:
1 — grīdas siena; 2 — apmales līstīte; 3 — peru telpas ārējā siena; 4 — starptelpa izolācijas materiālam; 5 — pirmās medus telpas iekšējā siena; 6 — grope apkāru aizbalstam; 7 — jumts; 8 — vēdināšanas aperaugs; 9 — otrās medus telpas ārējā siena; 10 — otrās medus telpas iekšējā siena; 11 — medus telpas apkāre; 12 — peru telpas apkāre; 13 — skrejlaipiņa, 14 — skrejlaipiņas balsts.

Dimensions of Latvian standard hive.

of winter; lichen-grey, aspen-silver, dusty-dun, amber-rust, deep spruce-green, the stunning white of snow and birch bark set against the dark black of soil. The air is heavy and thick with moisture. The temperature a steady 33°F.

At this time of year, early Spring, the Latvian people tap the maple and birch trees and drink the sap. The saps, berzu sulas and klavu sulas respectively, are sold in the grocery stores and as well as being refreshing with the slightest hint of sweetness are considered a spring tonic, cleansing and invigorating.

After about 40 minutes of driving through forests and fields interspersed with small villages we arrived at the home of Lolita Rudzite in the town of Lielvarde. In her front yard, in a neat row stand 18 colorful hives. Latvian hives are larger versions of the more familiar (to Americans) Langstroth hive.

Latvian hives came into being in the late 1920s as a result of the work of the man known today as both the Latvian Langstroth and/or The Father of Latvian Beekeeping, Professor Peteris Rizga (1883-1955). In 1908 Rizga emigrated to America and worked in quarries with his brother to earn enough money to purchase two farms. This they succeeded in doing. On one farm they raised poultry, on the other bees. During this time Rizga earned both a bachelor's and master's degree from Boston University. Rizga returned to Latvia in 1922 (Latvia had won sovereign independence from Russia in 1918) and began working at the University of Agriculture. At that time there were no national standard hives and most hives were bulky and unwieldy. In response to this situation and after having kept honey bees in Langstroth hives in America, Rizga created three new types of hives, the surviving hive design, described below, remains today as the national Latvian standard.

The Latvijas stavstrops or Latvian standing hives (referring to the fact that the hive stands vertically as opposed to laying horizontally as traditional log hive sometimes did), the standardized hive created by Prof. Rizga is composed of one brood box measuring 25 inches in length X 25 inches in width X 12 inches in height. The interior volume of the brood box, which holds 15 frames (17-1/8 inches in length by 11¾ inches in height), is equal in capacity to two deep 10 frame Langstroth hive boxes. The brood box is double walled in the front and back. The foundation used in both the brood boxes and honey supers are almost exclusively wax (as opposed to plastic). The honey supers are almost exactly half the size of the brood box. Over a strong season most beekeepers hope and expect their colonies will fill three or more honey supers, each super containing up to 55 lbs. of honey

As it was still early Spring when we visited, Lolita's hives were condensed, her colonies occupying eight to 12 frames within the brood boxes. The bees were covered with newspaper and cloth and topped with a pillow which served both to insulate and ventilate the hive. Additional insulation was provided by newspaper covered frames filling the spaces just beyond the brood frames facing the side hive walls. Topping the stack was the familiar (though dimensionally larger) telescoping cover.

Lolita keeps Buckfast (*Apis mellifera linguistica*) and Carniolan (*Apis mellifera carnica*) honey bees. Both are dark colored bees, originating from cooler climates, and seem well suited to Latvia's climate. This partially evidenced, by the fact that Lolita, like most other Latvian beekeepers, experiences less than 10% winter loss. This year she has only lost 2.5 % of her colonies!

I am told that the honey bee races most favored in Latvia are Buckfast, Carniolan, what they call Finnish Italians (owing to the fact that these particular *Apis mellifera linguistica* are imported from Finnland and are thus adapted to the Nordic climate). The German black bee also called European dark bee, Norwegian brown bee and Russian black bee, (*Apis mellifera mellifera*) was considered, 20 years ago, Latvia's aboriginal bee. This race of bees is not currently popular in Latvia owing to its aggressiveness.

Lolita demonstrates the gentleness of her bees by lifting the insulating cloth beneath the pillow and lightly tapping the backs of the hundreds of bees who have come to the surface of the hive, into the brisk air and have struck the intimidating posture of heads down, abdomen raised, sting out, wings fanning. Janis breathes deeply as we peer into the hive exalting in the smell of venom. I try but can't catch a whiff of what to him is a sweet, distinctive and familiar odor. Lolita, of course does not get stung, (none of us do) and the bees, though full of apparent sound and fury, are mostly disinterested in our doings.

Lolita has been keeping honey bees for 41 years. She, at this point, keeps 200 hives, though before her husband (also a beekeeper) passed away they had as many as 300

Interior of Medus Veikols.

Bee jackets at Medus Veikols.

colonies. She keeps perhaps 10 in her front yard, the rest are in out-yards, apiaries whose location is, if not secret, information closely kept.

Lolita says that her bees rarely swarm as a result of preventative practices. She, as is customary here, feeds only in the Fall. Additionally, she treats for mites only in Autumn. *Varroa* mites first arrived in Latvia in 1977. Initially beekeepers were required by law to burn hives infested with *Varroa*. Today they are mainly treated using formic and oxalic acid. There are no tracheal mites reported to exist in Latvia nor has the small hive beetle made its way that far north, though the beekeepers we spoke with were well aware of their existence and the potential encroachment. Juris said that the percentage of hives affected by American and/or European Foulbrood was around 4%.

The Latvian people appreciate varietal honeys. When we visited honey shops there were a few amalgam honeys; Spring, Wildflower, and Forest Blossom. The rest were specifically labeled and every honey vendor practically insisted you sample the array of varieties. These included Canola, Heather, Linden, Hogweed and Wild Raspberry.

The bees are said to generally take their first cleansing flights March 23-25, weather permitting. The major nectar flows in Latvia begin in April with tree blossoms, maple, willow and orchard trees. This time of year can be tricky for bees and beekeepers alike in that April and the first half of May tend to rainy and cold. The next major flow commences with the blooming of the rape or canola seed (*Brassica napus*). At this time of year, late spring, some people take their hives to the forests to capture the flowering of wild raspberry canes (*Rubus sp.*). Some bee keepers also encourage their bees to forage on Hogweed (*Heracleum sosnoskyi*) which was introduced during the Soviet Era, has become invasive and produces a honey with a distinctive odor and flavor similar to daffodils. Linden, also known as Basswood and Lime (*Tilia sp.*) bloom in mid-June. The next major flow comes in July with buckwheat (*Fagopyrum asculentum*). Some beekeepers take their hives to heather (*Calluna vulgaris*) fields from July 25- September 10th. Around the year 2000 goldenrod (*Solidago canadensis.*) which had been kept as a decorative garden plant since the 1950s 'escaped' and its true nature, that of an invasive, opportunistic propagator began to flourish. It has now taken hold, filling fallow fields and waste areas such as ditches and wind breaks, providing the honey bees with an addition floral source for nectar and pollen from July through September.

In Latvia the honey bees begin to go into the Winter cluster in October and November. However, the weather is highly variable in this geographically diverse region. As Juris explains it, "The cold comes down from Siberia. The warm comes in from the Baltic Sea. These airs fight." Two regions separated by 150 miles may experience bloom differentials of up to two weeks. Additionally, Latvia is experiencing the same dramatic shifts in weather patterns as the rest of the planet, "The winters used to be colder, longer, more snow".

After visiting on of Lolita's out-yards we return to her home, tour her processing rooms, and enjoy a delicious, gracious lunch. Lolita's honey house is immaculate, not a sticky surface or propolis stained instrument in sight. Here is where she extracts honey and bee bread and where she bottles and labels honey, propolis, pollen and bee bread. Bee bread, a relative rarity in the United States is ubiquitous in Latvia and is consumed for its purported health benefits. Being fermented, it is rather sour tasting as compared with the chalky sweetness of pollen. Lolita also

Hives in Lolita's front yard.

Buckfast bee with sting out.

Interior of one of Lolita's hives.

melts honey and makes candles as well as fermenting propolis to make tinctures. Lolita and her business are, as they say, the complete package, and her operation appears, at least to this outsider, to run as smoothly as silk on a sunny day.

Though honey sales within Latvia seem brisk, the ability to export honey is limited. I am told that when Latvia was under Soviet rule and much of the honey and honey-relate dproducts produced were consumed by Russia, a beekeeper could earn a good living and then some. Juris tells us, "I bought my first car with [the money earned from] 30 beehives". Janis seconds this, saying, "My father built our house on [money earned by collecting and selling] pollen".

Latvia is a country whose epic history is dominated by occupation. Just in the last 100 years Latvia was occupied by the Russians, from whom it won independence in 1918. This independence was then interrupted in 1940 when WWII broke out and Latvia was forcibly reincorporated into the Soviet Union. It was invaded and occupied by the Nazis in 1941 and retaken by the Soviets in 1944-5. Latvia again reclaimed its independence in 1991 and was officially invited to join the European Union in 2004.

I am told that though life was much different, and in some ways more difficult, for instance there were regular scarcities of common goods, under Soviet rule, keeping bees was a profitable undertaking. At present, Latvians cannot sell to Russia because of the EU boycott resulting from Russia's recent aggressions toward Ukraine. This boycott is difficult for honey sales and export agencies. Entrepreneurs, agencies and associations are actively looking to expand their markets abroad.

Despite the decline in export opportunities of late the popularity of beekeeping in Latvia appears to be on the rise. Juris shared the following statistics gathered by the Latvian Beekeepers Association in 2016. At present there are approximately 4,000 active beekeepers and 2,945 officially register apiaries in Latvia. Of these 2,945 apiaries 40% keep 1-14 hives, 25% 15-29 hives, 20% 30-49 hives, 10% 50-99 hives, 2% 100-149 hives and 3% 150 + hives. From these statistics it is clear that the majority of beekeepers are running relatively small operations, with 85% keeping 50 hives or less.

Of these beekeepers 32% are women. In aggregate, the ages of Latvian beekeepers likely mirror those in the United States. Nearly half of the beekeepers are between 40-60 years old. I am told that there has been, in just the last three years, 800 new beekeepers added to the Latvian ranks and that beekeeping classes are very successful. This renewed interest may in part be linked to the financial crisis which hit hard in Latvia in 2008-9. During this recession many people lost their jobs and began looking to more traditional ways of earning money.

When our comfortable modern ways of life become threatened and disrupted by financial, social, and/or environmental crisis we often revert to more fundamental, time-tested, and traditional ways of life. These, often more holistic, ways of interacting with our world generally bring us closer to that world. We learn again to rely on our intuitive, inventive resourcefulness, our penchant for working with – with our hands, with our land, with the creatures with whom we share the land. I can think of few practices more perfectly aligned with supporting these oft underappreciated gifts of human ingenuity and even fewer whose reward is as sweet and satisfying as beekeeping. The Latvian people know this, honor this, celebrate this, and in this we can only applaud and hopefully follow suit. BC

How Bees See And Why It Matters

Sharla **Riddle**

Here's an "eye-popping" fact: The USDA estimates that 80% of insect crop pollination is accomplished by bees. Scientists consider bees to be a keystone species. They are so important to an ecosystem that it will collapse without them. At least 90 commercially grown crops depend upon bee pollination for survival. How important is the pollination by bees? Ask an almond grower. Without bees, there would be no almonds. Apples, blueberries, cherries, avocados, cucumbers, onions, grapefruit, oranges and pumpkins would also disappear. Bees are the undisputed champions of the pollination world. And their secret weapon? Sight.

The remarkable eyesight of bees has long been a source of fascination in the scientific community. A hundred years ago, Nobel Prize-winning scientist Karl von Frisch proved that bees can see color. The color we see is based upon how a pigment absorbs and reflects light. When light hits an object, some is absorbed and some is reflected. Our eyes perceive the reflected portion as color. The brilliant color in flowers is a way of attracting pollinators, such as bees. The colors of flowers help target the areas of nectar. That's the reason why petals are usually a different color than leaves. Even though humans can see more colors, bees have a much broader range of color vision. Their ability to see ultraviolet light gives them an advantage when seeking nectar. Many patterns on flowers are invisible to humans. These nectar "bulls-eyes" are visible only to animals, such as bees, that have the ability to see ultra-violet light. This "bee vision" makes finding nectar much easier. In fact, some flowers such as sunflowers, primroses and pansies have nectar guides that can only be seen in ultra-violet light.

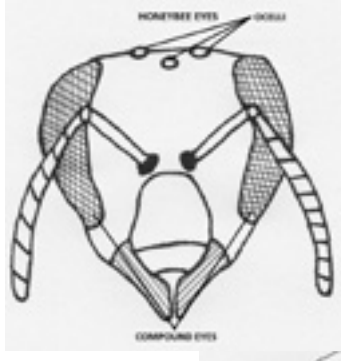
Like us, bees are trichromatic. That means they have three photoreceptors within the eye and base their color combinations on those three colors. Humans base their color combinations on red, blue and green, while bees base their colors on ultraviolet light, blue and green. This is the reason why bees can't see the color red. They don't have a photoreceptor for it. They can, however, see reddish wavelengths, such as yellow and orange. They can also see blue-green, blue, violet, and "bee's purple." Bee's purple is a combination of yellow and ultraviolet light. That's why humans can't see it. The most likely colors to attract bees, according to scientists, are purple, violet and blue.

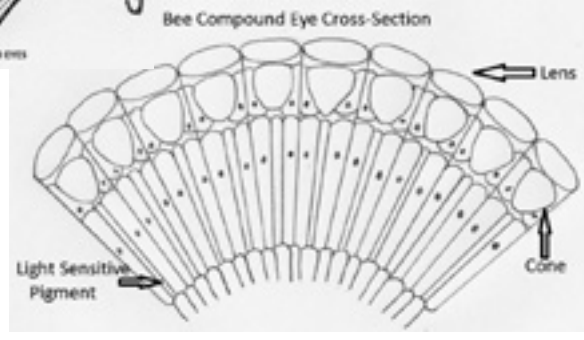
Bees also have the ability to see color much faster than humans. Their color vision is the fastest in the animal world-five times faster than humans. So while we may have trouble distinguishing one flower in a group from another, bees don't. They see each individual flower. Some flower petals appear to change color, depending upon the angle. This is known as iridescence. It's often in the UV spectrum, so we can't see it. But, bees can. They see these shiny petals and associate them with sugar. Thus, the flower becomes more attractive to the bee and gets pollinated.

When we drive on a highway and look out the window at the flowers by the roadside, we usually can't distinguish one flower from another. The car is moving so fast that the flowers blend in to one another and we see a blur of color. Bees have a far higher "flicker" threshold. They can see individual flowers while traveling at a high rate of speed. Because of this, they actually respond better to moving objects than stationary ones. That's why honey bees have no trouble pollinating moving flowers. That's also why it's rather useless to try swatting a bee-it has no trouble avoiding moving objects.

Flying helps bees see better. They can see depth and they can see three dimensionally. They can also judge distance. They communicate these distances and directions of good foraging sites to the hive through their waggle dance. However, scientists have found that it is possible to trick bees into misjudging distances. In one study, a tunnel was painted in a semi-checkered pattern. When the bees passed through it, they became confused regarding the distance of the tunnel. The checkered pattern caused them to think the tunnel was longer, because they thought they were passing by a lot of objects. When the scientists painted horizontal stripes in the tunnel, the bees flew too short. Because of the lines, they couldn't judge that they were passing by any objects. Thus, scientists realized that bees use the objects they fly by to judge distances, which they later communicate to the hive.

Bees have two different types of eyes-each with separate functions. The three smaller eyes in the center-top of a bee's head are called ocelli. Ocelli comes from the Latin word "ocellus" which means little eye. These little bee eyes have single lenses and help the bee maintain stability and navigate. They enable the bee to judge light intensity and stay oriented. Using these ocelli, bees can gather light and see ultra-violet light, helping them to detect UV flower colors.





2016 Price List

Gardner's Apiaries
Spell Bee Co. LLC

510 Patterson Road • Baxley, GA 31513
Ph: (912) 367-9352 • Fax: (912) 367-7047

ITALIAN QUEENS

100+	$16.00
25 -99	$17.00
10 - 24	$19.00
1 - 9	$21.00

Pick-up Queens	$20.00	Cells	$4.00
Clipping	$4.00	Marking	$4.00

Terms: 10% down. Balance due two weeks prior to shipping.

MasterCard VISA

If a bee were a superhero, its sight would be its super power. Every bee has two large compound eyes. These eyes are amazing examples of nature's engineering. A compound eye is made up of thousands of tiny lenses called facets. Each of these facets takes in one small part of the insect's vision. The bee's brain then converts these signals into a mosaic-like picture made of each image. Worker bees have 6,900 facets in each eye, and drones have 8,600 facets. Every facet is connected to a tiny tube. Each of these units, called an ommatidium, contains a lens (facet), a cone of visual cells and pigment cells that help separate it from its neighbor cells.

A bee is able to see color, because each of these tiny tubes contains eight cells that respond to light. Four of these cells respond to yellow-green light, two respond to blue light, and one responds to ultraviolet light. But a bee's super sight powers go much farther than seeing mere colors. A bee can also detect polarized light. Polarized light moves in one direction. It's caused when air molecules from the atmosphere scatter the photons to create a "super highway" of light. A bee's amazing eye can scan and match the polarization patterns in the sky. It's a bee version of GPS. They are able to use this polarized light as a navigating system. What makes this such a super power is that bees can use polarized light to locate direction even when the sun isn't shining. They then communicate these directions to the colony. Basically, it's a bee road-map. Bees can find their way back home by checking the pattern of polarized light in the sky.

Every super hero has at least one side-kick and a bee's pal is light. Light is defined as the electromagnetic energy we can see. Humans generally see in the 700 to 400 nanometer range of the spectrum, while bees can see from the 600 to 300 nm range. The 400 to 300 nm section of the spectrum includes ultraviolet light Studies have shown that if deprived of ultraviolet light, bees lose interest in foraging and will remain in the hive until they are forced out by starvation and severe food shortages. UV light, which can penetrate cloud cover, is critical in a bee's ability to find nectar. Bees don't see the same flower color that we do. The UV patterns on the petals of a flower can be compared to the landing deck of an aircraft carrier. Those patterns guide the bee to land at the nectar source. It also explains how bees are able to select a particular species of flower from a field of white flowers. Bees aren't just seeing white flowers. They're seeing flowers with distinct UV markers. In fact, bees will head to the UV-absorbing area of a flower first. It is their bullseye. And, just because a flower is ugly to us, doesn't mean that it's ugly to a bee. Recent studies have shown that weeds are more successful than other plants because they're more attractive to the pollinators. Beauty is in the eye of the "bee-holder."

In very rare instances, people can see into the ultra-violet range. Usually, it's after a lens injury or cataract surgery. This condition is called aphakia. People with aphakia see a "near" UV light. It is perceived as a whitish-blue or whitish-violet color. The French impressionist painter Claude Monet had this condition after cataract surgery. Before the surgery, his cataracts were so bad that his color range was limited to red and orange. After the surgery his paintings included deep purple and blue hues.

Because of the bee's extraordinary ability to see and navigate its world, researchers have made many attempts to create models that mimic a bee's sight. The first "bee eye" cameras weren't successful. They contained more than one camera, which caused them to be too heavy to use. Then, in 2010, German scientists were finally able to create a camera with a "bee's eye view." The key to this camera's success was in using a combination of lenses and mirrors to create a bee's 280 degree field of vision. The camera is tiny, with a diameter of only 23 millimeters. This "bee camera" will allow drone aircraft to "see" more of the world around them. It's a small step in trying to mimic the bee's very complex vision system.

The contribution by bees to world economies is staggering. Researchers at the University of Reading calculated that bees contribute more to the UK economy each year than does the Royal family from tourism. In the U.S., these super-pollinators are worth 14.6 billion dollars in crop production. With its incredible vision, a bee can pollinate plants with pinpoint accuracy. Windy weather and overcast skies are no match for its incredible sight. It can see what we can't and because of that ability, it's the ultimate pollinator. A bee's sight is its super power. Why does it matter? Because bees matter. BC

Sharla Riddle is a retired educator and freelance author. She has been named a Huddleston Scholar, Tandy Scholar and RadioShack Science Chair.

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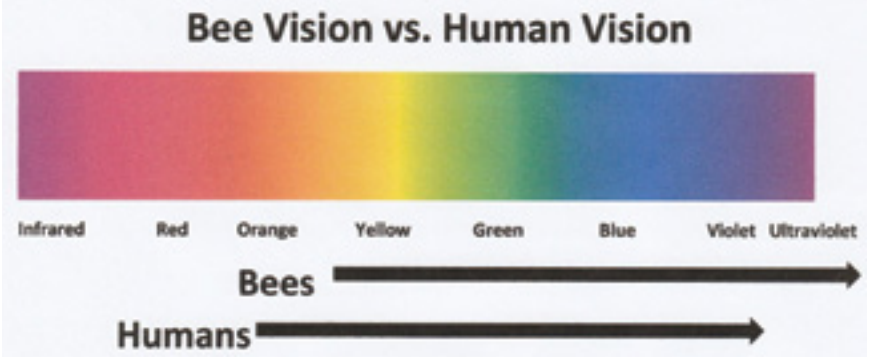

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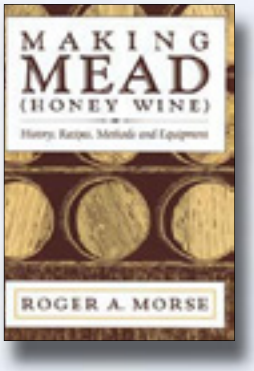

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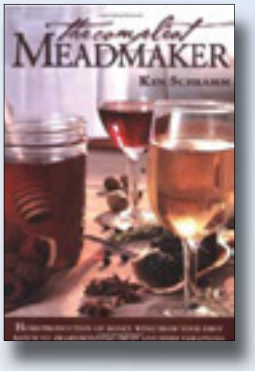

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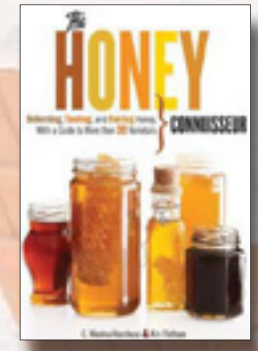

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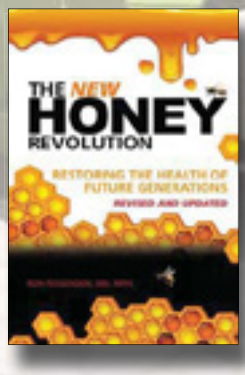

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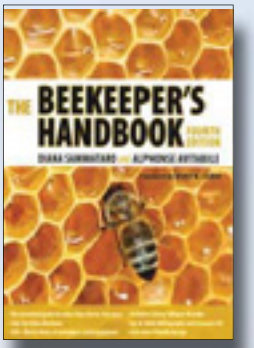

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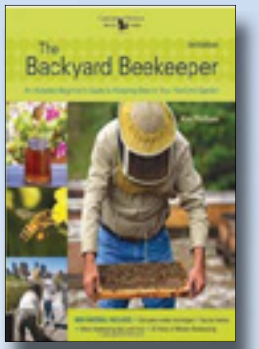

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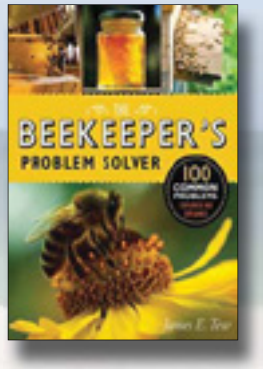

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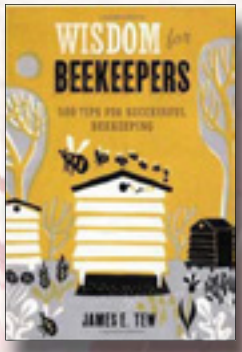

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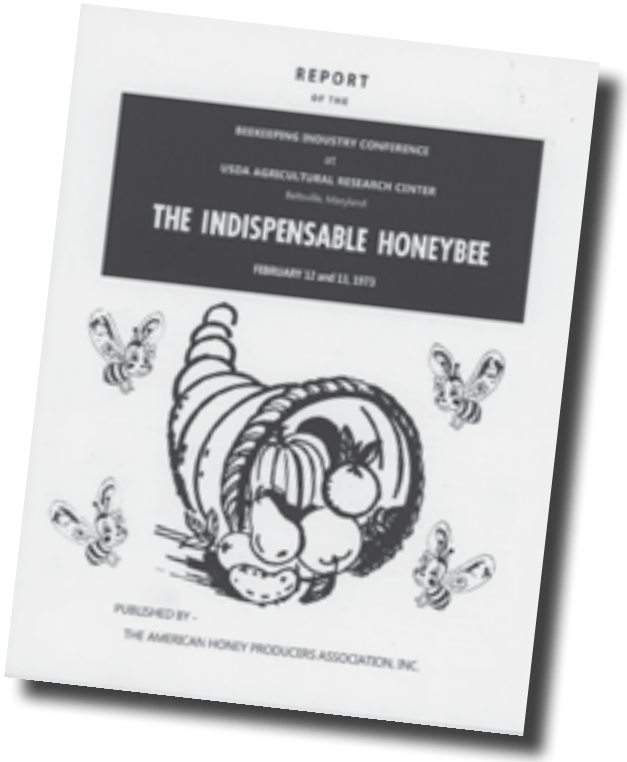

1973 vs. 2015: The Financial Situation

G. **Splevin**

In previous issues of *Bee Culture* magazine I have written of the 1973 report, "The Indispensable Honey Bee."

Then, as now, beekeepers' costs comprise bees, beekeeping supplies and equipment, transportation, honey house, and labor. Land is a small cost. Inputs for beekeepers continue to be pollination fees, honey, and beeswax. In the 1973 report "All of the cost figures we examined placed a major emphasis on the costs of hives and accessories, with transportation equipment as the second most costly item purchased."[1] In 1973 the Farmers Home Administration stated per colony investments of $40. To secure a loan they would review "four basic areas of concern:"

1. The soundness of the proposed operation.
2. The volume of business.
3. The degree of management skill and experience of the applicant.
4. The possibility of his making adjustments in farming enterprise in the event the market and price conditions necessitate such adjustments."[2]

The Assistant Administrator of the Farmer Program in 1973 predicted the "beekeeper's financial position should be in a reasonably favorable climate provided: current prices are maintained; proper pesticide control is established; we have increased emphasis on marketing; new managers are encouraged to become apiculturists and you have favorable weather." PG 46

Pollination services were valued at $1B in 1973; today pollination services are valued close to $30B. Today's business model in beekeeping is 75% reliant upon the revenue from pollination services, with honey, wax and sales of bees comprising the balance. It is difficult to make honey even when pollinating a crop if your honey bees are killed due to pesticide exposure in the very crop being pollinated. My neighboring farmers know about my bees, and work with me to protect them from the agricultural chemicals they apply. Not all of my fellow beekeepers experience the same cooperation. Agricultural chemicals applied during bloom wreak havoc upon their honey bees. This past Fall too many friends had beeyards full of honey, and just a handful of bees in the hive. Pollinating a number of crops across the Summer those hives came home filled with a mix of chemical residues which slowly killed the hive. The *Varroa* counts were low because there were so few bees in the hive. Even relative to the number of bees, there were no mites because there was no brood. Certainly costs change with inflation across 43 years, but costs cannot rise enough to make up for 60% losses of bee hives in a year. I have run my small farm, sometimes "robbing Peter to pay Paul," but I have never had Peter beaten to a pulp, and then told him to get up and go rob Paul anyway, and then get a beating from Paul!" This is the experience of my fellow beekeepers today as they try to make a living, and keep their bees healthy.

Returning to the topic of the costs of beekeeping in 1973 compared to 2016; my daughter found this easy website to calculate the value of a dollar then and now. The dollartimes.com website (**http://www.dollartimes.com/inflation/inflation.php?amount=1&year=1932**). According to this calculator spending $1.00 in 1973 costs $5.56 today. Beekeeping however, has not adjusted its pricing for services to inflation. The *expenses* for beekeeping reflect real costs, that 4.07% annual inflation, but income has not. Indemnity programs and insurance provide a cushion, at one-third to half the actual cost, but it cannot provide enough funding to rebuild a business every year. A beekeeper who loses 60% or more of their honey bees, their honey crop (dead bees do not make honey), and land on which bees can forage to make honey would not qualify as a "sound business." Examining the Farmers Home Administration guidelines for providing a loan to a beekeeper in 1973, the bank would be hard-pressed to provide funds today.

"The soundness of the proposed operation." I do not know of any business plan that finds a 60% or higher loss of inventory annually to represent "soundness of the proposed operation." Certainly, the *income* side of a beekeeper's business plan will look sound. However, when you apply 10-20% losses of honey bees with each crop

pollinated, and 10-20% loss of honey produced due to the loss of bees, and the additional travel cost and down time if bees are taken to a native, pesticide-free area to recover (if that area can be found), beekeeping is not a sound operation from a banker's perspective.

"The volume of business." A number of articles have been written in recent years explaining the need for migratory beekeeping to pollinate within our monoculture. A beekeeper can be quite busy pollinating nuts, fruits, and row crops from February to August. The question is will that beekeeper have enough honey bees remaining by July and August to provide pollination services?

"The degree of management skill and experience of the applicant." Beekeepers today have not just depth of experience, but the opportunities from honey bee research, educational programs at the local, state, and national level, as well as access to the experience and knowledge from beekeepers around the world. The management skill and experience which is difficult to explain to a loan officer is "beekeeper math." If I have 100 hives for pollination services for one year how do I keep those hives healthy and productive?

100 hives (two deeps, 10 frame, four to a pallet) available for pollination
100 hives pollinate almonds
-8 hives lost to pesticide exposure from neighboring field to almond orchard
-2 hives lost to *Varroa*
90 hives travel to apples
-6 hives lost to weather and pesticide exposure
84 hives remaining
+16 splits are made from among the 84 hives
100 hives travel to cranberries
-30 hives lost due to fungicide applications on the crop
70 hives travel to pasture land for four weeks
+ 20 splits made from among the 70 hives
90 hives travel to pollinate row crops in the south staying for the balance of the Summer
-54 hives lost while pollinating row crops
36 hives remain to go into Winter

I began with 100 colonies, I ended the season with 36 colonies. I suffered an overall 65% loss of honey bees. While I can make splits from strong hives early in the season, I still lost a total of 100 hives. It is only through the "degree of management skill and experience" of a beekeeper that we make the business model work. But on paper, it should not work. Beekeepers make it work by renting other beekeepers' hives, by splitting hives that possibly are not ready to be split. The combinations of reduced bee pasture, the soup of agricultural, garden, and lawn chemicals, the effects of *Varroa*, and bee diseases even tax the beekeeper's skill and experience.

"The possibility of his making adjustments in farming enterprise in the event the market and price conditions necessitate such adjustments." Sixty-five percent losses have not been sustainable for nearly a decade. In order for "beekeeper math" to correlate with banker math, beekeeper's need to work in 2016 dollars, not 1973 dollars. If the cost of pollination increases, it is due to the loss of native bees providing "free" pollination. The costs of monoculture only offering a food source while the one crop is in bloom also adds costs. A provided service has costs. If part of that cost is loss of workforce, then the recipient of the service needs to pay for the loss. Pollination for apples in 1973 was $10 per hive, adjusted with inflation, that cost should be $60 per hive. This does not include losses while providing the pollination service. If a beekeeper averages 65% losses annually should beekeepers be adding that to their fees? Adding a 65% loss fee to a $60 pollination fee would increase that pollination fee $39 for a total pollination fee (which would cover losses of honey bees) of $99 per hive.

The costs of beekeeping are many, and the math is not simple. The financial situation in 1973 and today though has not changed. We continue to battle the same issues in 1973 as we do today, 43 years later. Where will we be in 2059, forty-three years from now?

I hope this "curious guy" is inspiring contemplation and discussion, as beekeepers lead our state beekeeping associations, and national beekeeping organizations to willingly take simple and effective action for our bees and our industry. BC

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[1]"The Indispensable Honey Bee," published by The American Honey Producers Association, Inc, 1973; page 43, (re-print available from *Bee Culture*)
[2]Ibid, page 45

"The Indispensable Honeybee, A Report of the Beekeeping Industry Conference at USDA Agricultural Research Center, Beltsville, Maryland, Feb. 12-13, 1973" is available from *Bee Culture* magazine.

Education Is Not The Learning Of Facts, But Rather, Training The Mind To Think

Albert Einstein

The Apicultural Coverup

Ross **Conrad**

Begins In Your Backyard

I am surprised at the number of highly regarded and experienced beekeepers who blame the dramatically high honey bee colony losses being experienced these days on *Varroa*. I'm not saying that *Varroa* mites are not a major problem. They are, especially among the large number of beekeepers who do nothing to control mites in the hope that they are going to help the bees get stronger through the evolutionary process. Everybody has to deal with the mite issue, and *Varroa* were present in large numbers and were a major problem for more than a decade before the recent increased level of annual colony losses kicked in. If *Varroa* mites were the driving force behind the 25-35 percent yearly average losses experienced by the beekeeping industry since 2006, these same symptoms known as CCD would have shown up in the early 1990s, not the mid 2000s. Why so many knowledgeable and well respected beekeepers fail to consider this when claiming that *Varroa* is the primary issue that beekeepers face today is hard to understand.

Consistently Rising Colony Losses

Varroa came on the scene in the U.S. just when the industry was recovering from the introduction of the tracheal mite. Winter losses that were typically well below five percent jumped up to roughly five to 10 percent following the tracheal mite's introduction, although initially losses were much greater. Then *Varroa* mites were identified in the U.S. in 1987 and spread around the country. After the initial damage was done by the *Varroa* mites inflicting dramatically high losses, a situation developed where losses of between 15-20 percent, or so, were common by 1996 after the industry found its equilibrium. However, something changed around 2005-2006 that caused average yearly honey bee colony losses to jump yet again to the now all-to-common 25-35 percent mark (though losses are mitigated somewhat in years when mild Winter weather conditions prevail in northern areas).

The usual suspects

One early suspect as to the cause of this new level of loss was the newly discovered and reportedly more virulent form of nosema, called *Nosema ceranae*. Unlike its cousin, *Nosema apis*, *Nosema ceranae* impacts hives primarily during the summer and is generally without symptoms causing the older bees to simply "disappear." Surveys done of operations that were losing large numbers of bees to CCD, were highly likely to find that the majority, if not all of the CCD colonies were infected with *Nosema ceranae* which generally seems to have displaced *Nosema apis,* as well as with the Isreali acute paralysis Virus (IAPV). (Bromenshenk 2010, Cox-Foster 2007) *Nosema ceranae* has been found to weaken bees nutritionally by interfering with digestion (Molonea 1998) and to suppress the honey bee's immune function (Antúnez 2009).

Beekeepers with *Nosema ceranae* infected colonies would complain of a lack of population build up. This may be a result of either bees that are infected and perhaps sensing that they are going to die, flying off to die outside the hive in order to prevent the spread of the disease to nestmates (Kralj 2006). Another possibility was that nosema caused foragers to engage in risky behavior that would result in death, such as by flying during cool weather when temperatures are marginal (Woyciechowski 1998).

In an effort to restore colony health in the face of nosema, many beekeepers would turn to the approved treat Fumagilin B, an antimicrobial which was originally isolated from the mold *Aspergillus fumigatu*. (Hanson 1949, Eble 1951) Unfortunately results were often patchy. (Huang 2013) Sometimes treatment would work, sometimes it didn't and just to confuse things, Dr. Jeff Pettis found that in large-scale field trials that *N. ceranae* would sometimes clear up on its own in control colonies. (Oliver) Meanwhile, IAPV issues seem to have subsided and we don't hear much about it anymore.

Essential Oil Update

Back in 2010 I reported on an essential oil treatment that appeared to be helping bees deal with the symptoms of CCD. (*Bee Culture*, March 2010) At the time ARS scientists at USDA's Weslaco bee lab found indications that sugar syrup containing the emulsified feed stimulant mixture of spearmint and lemongrass essential oils had the potential to help bees suffering from nosema. (Hackett 2009) These essential oils have powerful antiviral, antibacterial and antifungal properties. (Nikos 2007, de Bona da Salva 2008, Minami 2003) Since then additional research has been completed that supports the idea that drenching with essential oils such as Honey-B-Health or Pro Health, from Mann Lake Beekeeping supply in Minnesota can indeed help bees survive nosema infection about as well as the approved treatment Fumagilin B. (Rhoades 2011) Follow up interviews with some of the beekeepers that I spoke to for the original 2010 article indicate that not only are beekeepers still regularly drenching their bees with these essential oils, they are relying on the essential oils more today than ever before to keep their bees alive and healthy.

The (multi) million dollar question

So if *Varroa* is not the culprit behind the dramatic increase in colony losses since the era of CCD began and *N. ceranae* and IAPV, whose presence correlated with CCD symptoms in

colonies, are more or less under control; why are U.S. beekeepers still regularly experiencing abnormally high colony losses when compared to the relatively stable losses of 15-20 percent experienced in late 1990s through approximately 2004? There is only one major change that impacted U.S. agriculture around 2005 when this new level of yearly honey bee colony loss took its latest jump, and that is the remarkable increase in the use of neonicotinoid pesticides that corresponds with this time frame. (Douglas 2015)

But you may say, the U.S. Environmental Protection Agency closely regulates pesticides based on science. If seed coatings such as imidicloprid were really a problem, the pesticide registration process would have revealed this and the agency would have taken appropriate action. Oh, how I wish this was the case.

Regulatory failure or corruption?

Read through the pollinator assessment that EPA is using to support registration review of imidicloprid and you discover that there are large gaps in our understanding and knowledge regarding just how these pesticides interact with the environment and what their effect on honey bees actually are. The EPA itself admits to not having a lot (or in some cases any) data that they would need to evaluate many areas including synergistic effects (final pesticide formulations and tank mixes), impacts on bees at all their various stages of development, colony-wide impacts over several generations of worker bees, sub-lethal impacts of minute amounts of exposure, and exposure through water sources. (EPA 2016)

To make matters worse, EPA administrators have a tendency to either ignore or over-rule staff scientists who express concern over a pesticide's safety, or the legitimacy of studies submitted by applicants as proof the chemicals are safe. (Theobald 2010) They then go on to muzzle those same scientists by requiring them, in Orwellian fashion, to go through the EPA communications department if they want to speak publicly about their work. (Philpott 2010)

Is CCD history?

Today we are no longer bombarded with media reports filled with heart-wrenching stories of beekeepers who find hives where all the bees have 'disappeared.' In fact, USDA/ARS reports that colony numbers in the U.S. have actually gone up a bit from 2.44 million colonies in 2008 to 2.74 million colonies in 2015. (Kaplan 2008, 2015) Does this mean CCD is history? A phenomenon to be simply relegated to one of those mysterious 'disappearing' diseases that has struck beekeepers around the globe so many times in the past? Given that annual colony losses have not dropped back down to pre-2005 levels, I don't think this is the case.

The apicultural cover up

As mentioned above, beekeepers are covering up for the damage that normally inflicts hives by feeding or drenching bees with essential oil products like Honey-B-Healthy or Pro Health. In addition, they have gotten really good at splitting hives and making nucleus colonies in order to replace the high yearly losses that are so often experienced by today's beekeepers and expand their colony numbers. Historically high honey prices (until recently) and pollination fees are certainly helping to provide incentives for beekeepers to do so. While these actions are serving to maintain, and even increase colony numbers in the U.S., they are taking a huge toll on profitability. Essential oils are costly and there is significant labor involved in having to treat hives, especially in operations that are not used to feeding sugar syrup on a regular basis. In addition when a hive is split to form a nuc, the ability of that hive to produce a honey harvest is greatly diminished and any harvest that is obtained is unlikely to be anything like the harvest that would have resulted if the worker population was allowed to increase naturally without interruption. As a result the beekeeping industry is taking a big hit financially.

Obviously we beekeepers are a bunch of really nice and generous people. Most of us seem perfectly satisfied to take financial losses so the pesticide industry can continue to peddle their toxic products. The question now is, how bad do things have to get before more of us stop blaming *Varroa* mites, and everything else under the sun for our colony losses, and quit making excuses for our pesticide problems? BC

A five-frame nucleus colony awaiting additional empty frames. Many beekeepers have turned to splitting hives and making nucs in an effort to make up for record colony losses.

Ross Conrad is author of Natural Beekeeping: Organic Approaches to Modern Apiculture 2nd Edition. Ross will be the featured guest speaker at the Texas Beekeepers Association Summer Clinic June 18th in Conroe, Texas.

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Knowledge Speaks
But Wisdom Listens

Saving Native Bees and Honey Bees

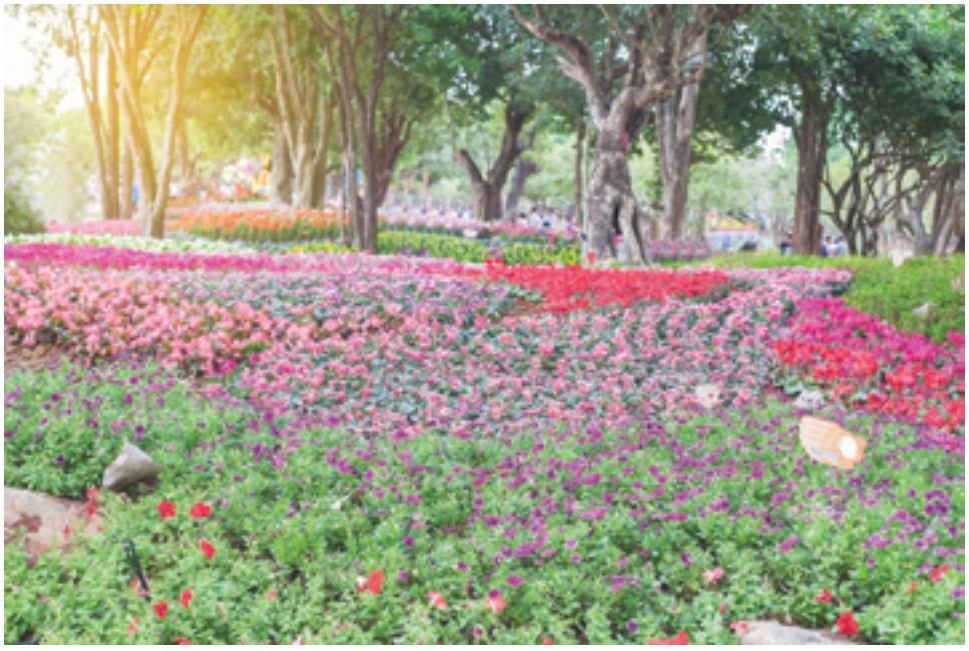
What You Can Do.

Jenny **Flores**

We have all heard about the disappearance of honey bees and there is certainly cause for concern. With honey bees as our most important food pollinators, responsible for the pollination of 71% of the world's most widely consumed crops, according to the U.N. Food and Agriculture Organization, the disappearance of honey bees will have a tremendous effect on us all.

The unprecedented rate at which honey bees are dying has prompted the U.S. Department of Agriculture to issue a warning that it is no longer confident in our ability to "meet the pollination demands of United States agricultural crops." Bees act as our canary in the coal mine and they are dying. As apocalyptic as this sounds, we cannot afford to fall prey to learned helplessness. There is hope and you can help.

Whether you are a land owner or an apartment dweller, beekeeper or not, there are actions you can take that will have a significant impact on the health of our pollinators. Let's start with our gardens. From market and kitchen gardens to container gardens on your balcony, your plant choices are important.



- **Buy organic seeds and plants.** When buying plant starts, make sure they have not been treated with neonicotinoids. Neonicotinoids are a class of pesticides that are applied to seeds and remain in the plant as it grows. Neonicotinoids may not kill bees immediately, but they have sub-lethal effects. They suppress the immune and detoxification systems, as well as attack the bees' nervous system, leaving them confused, unable to find and gather food.

The Pesticide Action Network of North America reports that seeds for 94% of the 92 million acres of corn planted in the United States are treated with neonicotinoids. This is bad enough, but it gets worse. Only a small amount of the pesticide used is absorbed by the plant. The rest of the pesticide blows into neighboring habitats, where 90% of it is absorbed by the soil. Neonicotinoids can remain in the soil for years.

- **Rethink your lawn and container gardens.** Replace a portion of your lawn with flowering plants. Choose single flower tops instead of double flower tops when planting for bees. Although the double flower tops are showier, they produce less nectar and make it difficult for bees to access pollen.
- **Plan for season-round blooms.** Good plants for spring are crocus, hyacinth, borage, calendula, and wild lilac. Summer blooms include bee balm, cosmos, echinacea, snapdragons, and hostas. For fall, plant zinnias, seedum, asters and goldenrod.
- **Research organic alternatives to neonicotinoids and other toxins.** Use only natural pesticides and fertilizers. Two simple natural pest controls that are available to anyone are putting up bird houses and removing aphids by spraying them with water. Remember, most insects are beneficial or harmless. In addition to refusing to use neonicotinoids, boycott Syngenta, Bayer, and Dow, the companies that make them.
- **Create a "bee bath".** Sources of water and mud are crucial to native bees. Fill a shallow container of water with pebbles and twigs.

- **Embrace diversity.** In every size garden, maintain a diversity of plants. Agricultural specialization has hit our wild bee population hard. Studies have linked the size and duration of a monoculture with the disappearance of native bees. Honey bees cannot be expected to bear the load alone. They need native bees and we need to maintain the spaces and food choices these wild bees require.

Moving out of the garden and into the kitchen will provide us with even more opportunities to make a difference. The only tool you need is a willingness to investigate options and make meaningful choices regarding where you spend your money. You can make a difference with your ethical food choices.

- **Shop your local farmer's market.** Support the local farmers who are farming organically. Your farmer's market is an excellent place to find and support local beekeepers.
- **Buy honey.** Look for honey that is local, raw, pure, or organic. Pure honey is what we expect to get when we buy honey – honey without any other sweeteners or chemicals in it. Unfortunately, this is not always the case. It is important to be willing to cast a vote with your cash. Buy from a local beekeeper. Ask questions. A good beekeeper is proud of their bees and willing to answer any question.
- **Read labels.** Over 70% of packaged food in North America contains genetically modified ingredients. The five GMO crops you will most likely find are corn, soy, canola, cotton, and sugar beets. These can be used in corn syrup, oil, as flavoring agents or sweeteners, and as thickeners. Reading the labels on packaged foods is important, but don't stop there. Chicken, beef, and pork can be fed GMO corn, soy, and canola.

To avoid purchasing GMO products, look for a USDA Organic seal. The USDA National Organic Standards prohibits the use of GMOs. You can also look for a seal of approval from a third party, such as the Non-GMO Project, verifying the product is GMO free. Organic or Non-GMO verified chicken, beef, and pork is also available. If you cannot find it in your area, ask for it. Market demand is ultimately the reason companies change their practices.

Political involvement is another way to focus attention on the plight of our pollinators.

- **Be aware.** Stay abreast of new pesticides, practices, and policies that affect bees. Your local Department of Agriculture is a terrific resource.
- **Sign petitions.** The Environmental Protection Agency has sided with DowAgroSciences and approved a new, highly toxic pesticide called sulfoxaflor. They are not working on expanding the number of crops this pesticide can be sprayed on to include corn, alfalfa, and oats. This pesticide has proven to be extremely detrimental to bees. A petition to stop the spraying of sulfoxaflor is just one of the bee-friendly petitions available online.
- **Support policies.** The Obama administration has recently enacted the National Strategy to Promote the Health of Honeybees and Other Pollinators. Some of what this entails involves managing the way forests burned by wildfires are replanted, the way offices are landscaped, and the way roadside habitats where bees feed are preserved.
- **Write a letter.** Write a letter to your local council member or representative urging them to save the bees. They can be influential in decisions regarding pesticide use in public places, as well as making spaces available for wildflowers and other bee-friendly plants.
- **Speak up.** Take any available opportunity to educate others on pollinator-friendly actions. Whether you are buying plants or reading food labels, most people are interested in positive actions they can take as well. Before you can educate others, educate yourself. Your local Department of Agriculture will be able to direct you to beekeeper workshops and meetings.

The ultimate action you can take, of course, is to become an independent beekeeper. The choices available to you range from commercial to tabletop hives. Researching what it takes to become a beekeeper can be frustrating because the advice runs the gamut from "foolproof" to "don't even try it". Jewell Butler, a Mississippi beekeeper, offers practical advice that falls somewhere in the middle. According to Jewell, anyone can be successful at beekeeping as long as they are willing to make a commitment of time and resources.

Although beekeeping may appear to be a solitary pursuit, Jewell encourages beekeepers of all experience levels to be active in local beekeeper meetings. These meetings are invaluable for the education and support they provide. A mentor is also a valuable resource for all beekeepers, but those new to

beekeeping will find having a mentor especially beneficial. The best way to find a mentor is to attend your local beekeeper meetings. You will have no trouble finding someone who is interested in sharing their knowledge and skills with you. Every state has one or more beekeeper associations. You can find out what is available in your area by doing an online search or by contacting your local Department of Agriculture.

There are other questions you should ask about independent beekeeping before you get started that will help to ensure your success.

- **What are the local regulations?** This question will be easy to answer with one call to your local Department of Agriculture.
- **How will my neighbors react?** A little thoughtfulness and education can go a long way towards alleviating the concerns of your neighbors.
- **Do I have a suitable spot?** With the increasing interest in beekeeping, there are options available to everyone. Make certain you have chosen the best spot possible for you and your bees so you don't have to disrupt them later.
- **Do I have the time?** Keeping bees does require work, and not just the actual physical labor of hive upkeep. As Jewell pointed out, a beekeeper is constantly seeking out new information about bees in general, and about their personal hives in particular.

The plight of our pollinators is disconcerting, but it is not hopeless. By actively researching, reaching out, and changing some simple habits, you can help. BC

Resources

www.offices.usda.gov/ Use this website to locate your local Department of Agriculture. They can assist you with information on organic gardening, as well as locating your closest beekeeping association.

What's For Lunch

Ann **Harman**

Over the many centuries of man's association with bees, including throughout beekeeping husbandry, one fact was well-known – if there is not enough honey in the hive for survival then feed the bees. Even Aristotle (384-322 B.C.E.) wrote that if a bee colony ran out of food, the bees died. Today we buy or craft feeders for our hives but in earlier centuries pieces of honey-filled comb were cut from hives with enough honey to give to the starving colonies. Beekeepers were cautioned against being greedy and removing too much honey from the hive thus allowing the colony to die.

When sugar became plentiful worldwide, beekeepers were able to easily feed their bees to maintain strong, healthy colonies. Their survival meant that the beekeepers could produce surplus honey for sale and provide colonies for pollination of crops. Today it is necessary for beekeepers to monitor the honey stores in the hives and feed sugar when necessary. So let's find out the source of sugar, how the bees use it, and what is best for our bees.

The actual name for our familiar table sugar is **sucrose**. Many other 'sugars' exist, related chemically but each with its own name. The one we are familiar with, sucrose, we call white granulated sugar or table sugar. Other table sugars are available but these are not suitable for feeding bees. You can purchase 'raw sugar,' 'brown sugar,' Turbinado, Demarara and even flavored sugars but these are actually toxic for bees and should never be fed to them. Neither should sugar substitutes, used to sweeten coffee and tea, be fed to bees. In addition bees cannot tolerate sweet syrups such as molasses, sorghum syrup, light or dark corn syrup, even if diluted with water. The honey bee's digestive system is quite different from ours.

Sucrose is produced by plants. Green plants contain chlorophyll. The complicated chemical reaction known as photosynthesis produces glucose, known as a simple sugar. The plant then converts this to sucrose, the principal sugar of green plants. This weak solution of sucrose in water is transported throughout the plant to the leaves and blossoms. Therefore the sweet liquid called nectar contains sucrose as the principal sugar. The amount of nectar and its quantity of sucrose varies with the type of plant and with the weather. Commercial sources of sucrose are sugar cane, found in warm temperate and tropical climates, and sugar beet, grown in cool temperate climates. Virtually all beet sugar is GMO, while virtually all cane sugar isn't.

Sugar Beet.

Sucrose is useless. In order to be used by bees, our bodies and also by those that eat green plants (cows, horses) sucrose must be broken down to the simple sugars, glucose and fructose. This process is done by an enzyme. If a **plant** is converting sucrose the enzyme is called **invertase**. If an **animal** is converting the sucrose, the enzyme is called **sucrase**. The honey bee is an animal. So are we and the cows and horses. Unfortunately many books about honey bees will be using the wrong term.

In bees the enzyme is found in the ventriculus, the actual stomach of the bee. It is probably also found in the salivary glands. In bees of foraging age the enzyme is found in the hypopharyngeal glands, in the head. The foraging bees can add the enzyme to the nectar as they are removing it from the plant. Thus the conversion from sucrose to glucose and fructose, the sugars found in honey, has begun. If the bee needs energy for the flight back to home, nectar can be passed into the true stomach where the sucrase there can convert the sucrose to the useable glucose and fructose.

Glucose can be used. Brains – of bees, humans, cows and horses – cannot function without glucose. It does supply energy to muscle cells. Glucose also aids body cell functions. Fructose is also used but in a different way. It is metabolized by the liver but the brain does not use it. Fructose is an energy source.

Now it is time to meet something else that is involved not only with feeding bees but also with processing honey. Since its full name is long and complicated, hydroxymethylfurfural, it is referred to as HMF. This substance is not found in fresh vegetables (remember, they are from plants). However it is found naturally in cooked vegetables, but in very small quantities. HMF is formed from fructose. Cooking generally means applying heat and it is heat that causes fructose to decompose, forming HMF.

Is HMF a problem? Yes! It is toxic to honey bees. And it is not good for people either. What about the cooked vegetables? There is such a very small amount in cooked vegetables that it is of no concern.

The sugars, separately or combined, available for feeding our

Sugar Cane.

bees are: Invert Sugar that is a commercially available mixture of glucose and fructose, high fructose corn syrup (HFCS) and sucrose (white granulated sugar). Let us look at each of these individually.

Invert Sugar, used commercially by bakeries, is made from sucrose by one of two different processes. One is called acid hydrolysis. This process involves heat so the fructose being produced can decompose to HMF. If the enzymatic process is used, no heat is used therefore no HMF is formed. This process is not used in Europe. When beekeepers buy Invert Sugar for feeding bees it may be impossible to know the process used to make it. Therefore the HMF content is unknown.

Beekeepers do make Invert Sugar but it is called fondant, a smooth-textured solid that can be formed as a patty to be placed in the hive. Fondant is made by boiling a solution of sugar and water. Most of the recipes found in beekeeping books call for the addition of an acid, such as vinegar, lemon juice or cream of tartar (acts as an acid). The acid prevents crystallization. However HMF is formed with the combination of acid and heat.

It is possible to make a safe, uncooked solid slab of sucrose for winter bee food. The minimal amount of water is ideal for Winter supplementary or emergency feeding since the bees will not have to evaporate water. No cooking or acid – no HMF!

10 pounds of white granulated sugar
8 fluid ounces (1 measuring cup) water

Mix well.
Shape into slabs on waxed paper or plastic wrap.
Allow to harden overnight.
Remove plastic wrap to place in hive.

Another popular food for bees is High Fructose Corn Syrup, HFCS, a cheaper sweetener than sugar in the U.S. HFCS starts out as corn. Cornstarch is hydrolyzed to glucose. Then the glucose is enzymatically changed to fructose. This mixture is 90% fructose and 10% glucose. That mixture is then diluted with glucose to give 55% fructose, 42% glucose. The rest is water. There are other proportions but beekeepers use the HFCS 55.

As manufactured, ready to leave the processing plant, HFCS 55 does not contain any HMF. However at temperatures above 113°F fructose will decompose. HMF will be formed. The higher the heat, the more HMF. The longer time exposed to heat, the more HMF. The syrup leaves the processing plant in tanker trucks.

Do you know anything about its journey to your beehive? No. On a hot summer day the syrup in the metal tank can easily be heated up so decomposition of fructose can occur, yielding HMF. The syrup can them be sold in large quantities to a beekeeping equipment supplier. It may be stored in 55-gallon drums. Are those drums sitting in hot sun or are they in a building? Does the syrup contain HMF? If so, how much? Analysis is not economical. Therefore it is the beekeeper's decision whether to use HFCS or not.

What about honey, the natural food for bees? Honey is a plant product. The bee only adds sucrase and evaporates water. So honey contains glucose and fructose and a few percent of sucrose. Since honey contains fructose can it also contain HMF? Honey can after storage for a very long time. If exposed to heat it can contain HMF but usually a very small amount. However, if scorched, indicating excessive heat, it would not be a suitable food for bees.

Do not store honey in a warm place for a long period of time. For daily use at home, store honey at room temperature. For long-term storage, keep it in a freezer. Crystallization will be significantly delayed. Remember, the ideal temperature for crystallization is 57°F so a cool cellar can hasten crystallization.

So many choices! What should I feed my bees when they need more stores?

Sucrose is safe. It contains only one substance – sucrose. It is incredibly clean and pure. Kept dry it will last for years and years and – forever. Sucrose is completely digested by the bees. It leaves no residue in the gut. If they store it as glucose and fructose there is no residue in the gut. Therefore it makes excellent Winter food for bees.

What about cane sugar or beet sugar? Basically there is no difference. Both are 99.95% sucrose. The differences are in the 0.05% (a very small amount). There are slight differences in the processing of cane and beet sugars. The compounds in the 0.05% are ordinary simple ones, found in many foods and water. They are completely harmless to us and to the bees.

What about honey? New research has shown that bees do need the variety found in the various plants bees visit. Bees do obtain some vitamins, some minerals and other nutrients from honey. The quantities in honey may seem small to us but the bee is small, very small. On a diet of only honey, humans would have to eat 40 pounds of honey a day to have sufficient nutrition.

Research today is being done on the structure of the honey stomach and on the beneficial gut bacteria of the bee's digestive system. Keep up with new research findings so you can keep your bees healthy.

Weather is unpredictable. Plants depend on the weather. Bees depend on plants. If your bees need to be fed, keep the centuries-old beekeeping tradition – feed your bees when they need to be fed. BC

Ann Harman keeps her bees and feeds them well at her home in Flint Hill, Virginia.

Inch By Inch,
Row By Row,
I'm Gonna Watch
My Garden Grow

BIGGER PICTURE

Jessica **Louque**

It's A Farmer's Life For Me

Bobby and I were on our way to drop off some bees in a pollination contract and check out a blueberry farm when we went by a Case International Harvester dealership in eastern NC. As I like to take a lot of time to plan out decisions, I decided immediately that we needed a tractor. Both our hand tillers are broken at the moment, and neither my back or Bobby's is really up to the challenge of cultivating about an acre by hand. I also don't like using the zero turn mower on the hay field front yard, and we (by "we" I mean Bobby) spent about seven hours the week before digging holes to plant nine honey berry plants. Bobby shakes his head and says we should take some time to think about it, so of course I call my mother to tell her I need to buy a tractor right NOW. Since my impatience is clearly not inherited, she responds with "I'm surprised you waited this long. Let me call Daddy (my grandpa) and see if he'd let you have his" which would be totally fine with me. Anything that's his makes it ten times better, even if it's not new. In this particular case, the difference in "not new" and "maybe a bad idea" was the part where the brakes didn't exactly work unless you knew how to finagle it . . . and sometimes even that wasn't enough to placate it. Now it's on to find a new tractor.

Most farmer families have some pretty strong alliances to certain brands. You either won't buy anything but a Ford, or you buy anything *but* a Ford. John Deere green coats the landscape as far as the eye can see, or you'd only have one on your property if a neighbor was driving it and it happened to break down there (and even then, only for as long as it took to get it away). In my particular case, I've never paid for a vehicle that wasn't on a Ford dealership, and I'd have a Ford tractor if they had made it through the economic crash before selling out to New Holland. My family runs on Case IH tractors. At this point in time, New Holland and Case Corp merged, but they still sell the two brands as individuals. I think they realized some people like to keep their reds and blues from becoming purple. One year for Christmas, my present from my grandpa was a red Case IH hoodie. Two of my uncles tricked out their Case IH tractors with flames and chrome for tractor pulls just to get to the point of having so many trophies that you couldn't give them away. Uncle Tony is the exception with a barn full of green, but he just finished his last year of tobacco production and is selling out, so he will no longer have to sit in the corner at holidays.

Bobby tilling with the new tractor.

As I start researching the tractor of choice, I start negotiations with mom, which usually starts with me calling to say "I love you" and her reply of "how much is that going to cost me" and then discussions begin. I explain to her that her contributions to my fund for the needy (those who need a tractor) would go to a good cause, namely a long list of equipment to use with said tractor. We come to a loose agreement, and the search is on for real. The next week, we had to go talk to a landowner in Siler City about some rental for bees, and he was going to be about an hour late. It just so happens that there was a tractor store in Siler City that sells Case IH. We sort of explained what we wanted and where we lived, and he explained that he also lived in an area with soil that grew rocks better than potatoes. Within the hour, we had signed a purchase agreement for a Farmall 50A with a loader, a Bush Hog, an auger, a tiller, and a subsoiler.

We were headed to Oregon the next week for work, and told him we'd be back after that weekend to pick everything up. This is a pretty taxing time because on one hand, you now have a tractor, but on the other hand, you don't have the tractor *yet*. The obvious way to satisfy this is to order ridiculous amounts of flower seeds to appease the farmer gods. This isn't to say that the "ridiculous amounts" haven't been happening all winter, but it just amped up from a piercing shriek to a jet engine roar. I think we have 15 different sunflower varieties, three types of clover, a 50 pound bag of buckwheat, chicory, bachelor's button, some 100+ bulbs of whatever looked pretty, and then a random assortment of other flowers

that could possibly be bee attractive. This was enough to keep me occupied during the wait. At the end of the week, we weren't sure we were going to make it back in time to pick it up because the store was only open until 12 on Saturdays, and it's not close by any means to our house, and our flight was supposed to arrive back in NC late on Friday. Excitement won.

We went to pick everything up, and it turns out that some of the equipment didn't fit quite right. At the time, this was incredibly frustrating, but it turned out to work in our favor because I had badly underestimated the size/weight of the tractor we were getting and there was no way we were going to be able to get everything on our little trailer. Since nothing but the tractor was ready to go, we took that home and they delivered the equipment for free after it had been fitted for our tractor size (on a different 50A that was on the lot).

Since we brought the tractor home without the "toys" coming too, we made the best of it by using the bucket for literally anything we could even pretend might be a good idea. There was an odd hill of gravel left by the last load from the driveway (right about the time that the guy left the dump bed up and ripped out our power lines and destroyed the transformer) and now that hill is magically flat. A pile of broken cedar branches that was left over from the Great Storm of 2013 was pushed into the woods and out of the way of the lawnmower. Hive equipment was cleaned up and we learned that the loader would hold exactly four hive bodies side by side. It was amazing to see that the tasks that had been previously avoided were suddenly completed in minutes.

My first goal after getting the equipment was going to my grandpa's house and tilling up his garden with the new tractor, just because I could. Unfortunately, sometimes stories don't always have a happy ending. The Monday before we left for Oregon (about 24 hours before, actually), he had a stroke and ended up in the hospital. We went to see him, and I told him when I got home, I'd go till his garden so he could get going on my meat trees (when I was little I thought my grandpa could do anything, and I asked for trees that grew ham and bacon, and he tied packs of meat on all these little "trees" that he'd planted so I could "harvest" them and make supper). He was going to need a stay at home nurse from now on, but after rehab, he'd be able to go home. We came home, picked up the tractor, and were waiting on the equipment delivery

Pa Harvey with the bees.

on Monday afternoon. On Monday morning, he died in the rehabilitation center. I had planned on writing about buying a tractor since it was in the works, but it was supposed to end with a picture of us with Pa Harvey and the tractor in his garden. I guess sometimes things don't work out the way you plan. Instead, this goes out in loving memory to my grandpa, who read *Bee Culture* every month from the time I started writing until the April 2016 edition, who fed my bees and wore NC State ties to church on Sundays because I went there, and who taught me how to point out the big rocks in the field to my cousins who were picking them up as I sat on the fender of his Case IH 584 while he drove. My Granny Ruby was a UNC fan (hey, everybody makes mistakes) and they lost the NCAA tournament on the same day Pa Harvey died. I like to think that she finally got to see him again and told him that he was her consolation prize for the tournament loss.

In my grandpa's life with my grandma, he has created a family of (by my account) 57 offspring, plus their significant others, step-children, and ex-spouses that are biological parents of grandchildren or great-grandchildren, or the great-great-grandchildren. That's quite a legacy to leave behind. Before he died, he was able to meet five great-great-grandchildren, and has at least a sixth one on the way (there may be a seventh, but it's hard to keep up with everyone with a family that big). That newest addition to the generation will never be able to meet the man that the rest of us loved and lost, but it's up to us to make sure that Pa Harvey is never forgotten. BC

Jessica Louque and her family are keeping bees, farming, gardening and living off the land in North Carolina.

ERIC H. ERICKSON JR.

1940 - 2016

Dr. Eric Erickson died April 13, 2016, 13 days shy of his 76th birthday. He is survived by his loving wife Lucille and sons Eric and Jeffrey Erickson, and William Schad. He and Lucille combined have 5 grandchildren, the center of Eric's post retirement life.

Eric was born in Lakewood, Colorado, where he grew up on a poultry farm and developed his interests in agriculture and biology. He attended Colorado State University where he received his bachelors and masters degrees in entomology. In 1965, following the completion of his masters, he entered the U.S. Army as a 2nd lieutenant in the Medical Service Corp and served as a Medical Entomologist in Vietnam (1966-1967) where he earned an Army Commendation Medal.

He left the army 1967 and entered the University of Arizona where in 1970 he completed a Ph.D. in entomology. Armed with his new Ph.D., Eric began working for the United States Department of Agriculture – Agricultural Research Service as a Research Entomologist in the North-Central Honey Bee Research Laboratory, Madison Wisconsin. He became Research Leader in 1981 and provided oversight until the lab was closed in 1986. He then moved to Tucson to become the new Laboratory Director of the USDA-ARS Carl Hayden Honey Bee Research Center. Eric directed the center until his retirement in January 2002.

Eric's research and leadership career was marked with high productivity and many successes demonstrated by publication of more than 140 scientific articles and research papers, one book, and numerous book chapters and review articles. He also was awarded two patents. Adjunct professor appointments at the University of Wisconsin and the University of Arizona provided Eric opportunities to mentor students. Combined, he mentored eight Masters/Ph.D. students and three postdoctoral fellows. His research was always innovative, looking at fundamental questions of biology with an eye to how they could be used to address the problems of beekeeping and pollination. He was awarded the James I. Hambleton Award for Outstanding Research (1986), the Western Apicultural Society Award for Outstanding Service to Beekeeping (1995), USDA Award for Public Service (1996), USDA-ARS Outstanding Senior Scientist of the Year (1998), and numerous USDA Certificates of Merit.

Bolo tie and corduroy jacket – this is how we remember him.

Eric Erickson the person, was a decisive leader, caring supervisor, and untiring mentor. He had the ability to take a 10,000 foot perspective on any problem or issue and find the clear path to resolution. He guided his students and those he supervised with a personal warmth and genuine interest. Eric is one of the most important people in my life, as I told him many times. He "rescued" me from failure twice and provided me a template for administrative leadership that I used successfully throughout my career. I will miss him. Rest in peace Eric.

Robert Page
University Provost Emeritus
Regents Professor
Foundation Professor of Life Sciences
School of Life Sciences
Arizona State University
Professor and Chair Emeritus
Department of Entomology and Nematology
University of California Davis

CALENDAR

♦INTERNATIONAL♦

The 6th Cuban Congress will be held in Havanna July 17-22.

Learn about their technology, productive handling, pollination, bee selection and breeding.

For more information visit www.cubabeekeeping.com/home.html. Transeair Travel has arranged a congress Travel Package. For trip information call them at 202.362.6100 or **blubic@transeairtavel.com**.

♦CONNECTICUT♦

The CT Beekeepers Association will celebrate their 125th anniversary June 4 at the CT Ag Experiment Station in Hamden.

Larry Connor and Diana Sammataro will be the featured speakers.

For more information visit **www.ctbees.com**.

Back Yard Beekeepers Association 2016 Speaker Schedule – May 24: James Wilkes, Hive Tracks – using technology for record keeping; June 28: Dinner & Silent Auction Meeting; September 27: Brenna Traver, Penn State, Honey Bee Pathogens; October 27: Anne Frey, TBD; November 17: Jennifer Tsuruda, Clemson TBD.

Each month we have timely weekend hands on inspection workshops, bee school, mentor program and more. For dates and locations and more information please visit **www.backyardbeekeepers.com**.

♦GEORGIA♦

Two-Day Queen Rearing Course taught by Jennifer Berry at her farm in Comer Georgia, June 3-4 and again Jun3 10-11.

No experience necessary.

For more information visit **www.honeypondfarm.com**.

♦ILLINOIS♦

The IL State Beekeepers Association will hold their Summer meeting June 11 at the Northern IL Univ Hoffman Estates Conference Center. Registration is $70/members and $85/non-members.

Registration starts at 7:30 a.m. Jerry Hayes is the keynote speaker. Phil Craft and Dick Rogers will also be speaking.

For more information and to register visit **www.ilsba.com**.

♦INDIANA♦

Queen Rearing Short Course June 16-18 at the Purdue Honey Be Lab. Registration is $150 which includes Queen Rearing Manual and DVD. Limited to 30 students.

Instructors are Greg Hunt and Krispn Given.

To register send email to **kgiven@purdue.edu**.

♦IOWA♦

IA Honey Producers Association will hold their Summer Field Day June 11 at Goodell Community Center. Registration is $35/members and $40/non-members.

Speakers include Gregg McMahen and Andy Joseph.

For information contact Mary Wiltgen, **tmwiltgen@gmail.com** or 563.920.9628.

♦KANSAS♦

Northeast KS Beekeepers Funday "Jamie-Bee-Ree" June 4 at the Douglas County Fairgrounds in Lawrence.

Jamie Ellis will be the featured speaker. Other speakers include Judy Wu-Smart, Marion Ellis, Petra Ahnert and Chip Taylor.

For more information visit NEKBA.org or call Becky Tipton, 785.484.3710 or **bstbees@embarqmail.com**.

♦MASSACHUSETTS♦

MA Beekeepers Association, Univ of MA and Franklin County Beekeeper are hosting a Field Day June 18 open to all beekeepers. No cost.

Bring protective clothing. Most of the day will be live bee demonstrations.

For more information visit **www.massbee.org**.

♦MONTANA♦

Master Beekeeping Certificate endorsed by MT State Beekeepers Association; The American Honey Producers Association and Project Apis m.

For more information visit **www.UMT.EDU/BEE**.

♦NEW YORK♦

NY Bee Wellness Workshop will be held August 5-7 at Dyce Lab, Ithaca..

Randy Oliver will be the speaker..

For information contact Pat Bono, **info@nybeewellness,org**, 585.820.6619.

♦OHIO♦

Medina County Beekeepers Association will host Steve Repasky May 16 at the Root Candle Company in Medina, OH. The meeting starts at 7:00 p.m. Steve is president of Burg Bees and author of *Swarm Essentials*.

For more information visit **www.medinabeekeepers.com**.

♦PENNSYLVANIA♦

The Capital Area Beekeepers' Association will hold their Annual Short Course, May 7 & 14 at the Dauphin County Ag & Natural Resources Center.

The cost is $50.

For additional information visit **cabapa.org** or contact 717.365.3215 or **jdnovinger@epix.net**.

Queen Rearing Course at DE Valley College, Main Campus, May 7-8 and 17.

The fee is $199. Bring your veil and a three-ring binder. Gloves are not allowed in the beeyard.

For information and to register visit **http://vincemasterbeekeeper.com/courses/**.

♦TEXAS♦

TX Beekeepers Association will hold their annual Summer Clinic June 18 at the Lone Star Convention & Expo Center, Conroe.

Ross Conrad will be the keynote speaker. Cost is $50/person, $90/couple which includes lunch.

To register go to **www.texasbeekeepers.org**.

♦VIRGINIA♦

Summer 2016 – Floyd, VA - One-Week Intensive Biodynamic Beekeeping Program - For those who are prepared for the most in-depth and comprehensive training in beekeeping that we offer at Spikenard! With Gunther Hauk & Alex Tuchman. 540-745-2153 – **www.spikenardfarm.org**

Summer 2016 & 2017 – Floyd, VA - Sustainable Biodynamic Beekeeper 2-Year Training: SBBT New Class Begins June 2-4, 2016 - For those who are prepared for the most in-depth and comprehensive training in beekeeping that we offer at Spikenard! With Gunther Hauk & Alex Tuchman. 540-745-2153 – **www.spikenardfarm.org**

September 3 – Floyd, VA – Winter Preparation - We will not only look at what needs to be done in the fall in order to let the colonies go into the winter as strong and healthy as possible, but we will also take a look at the winter and early spring months, probably the most difficult and treacherous time of the year for the bees. With Gunther Hauk & Alex Tuchman. 540-745-2153 – **www.spikenardfarm.org**

September 23-25 - Floyd, VA - Biodynamic Principles and Practices - This workshop will offer practical advice for those who want to have bees and for those who had bees and want to start again. With Gunther Hauk & Alex Tuchman. 540-745-2153 – **www.spikenardfarm.org**

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Last Day On The Job

Ed **Colby**

My Aspen Mountain ski patrol boss Bud gave me my best job evaluation ever, maybe because this is my last season. I got to write comments of my own at the end of the appraisal form. I have old-man handwriting. When Bud tried to read my chicken scratches, he looked bemused. "Does this say, 'Thanks for loving me?'" he asked.

"No, Bud, I wrote, 'Thanks for *hiring* me!'"

Then once I had him laughing, I went for the kill. "My bees are back from California," I said. "I need the rest of the season off. I'll be back for the end-of-season party."

I had him on the ropes. What could he say? I was retiring, and the season was about over anyway. "I guess," he muttered. "When would be your last day?"

"Today," I said.

The California almonds were early this year, and my bees came back to Colorado before March 20. Oh, my! Top and bottom brood boxes mostly full of bees, honey, pollen and brood. Of the 59 colonies I sent, 57 came back alive.

I tested for *Varroa* mites and found a few, but no chalkbrood or American or European foulbrood.

I got the supers reversed, and I was mulling over just splitting hives and letting the bees make their own new queens. I didn't want to go begging and borrowing queens from Paul. My two California suppliers had me scheduled for late April shipments. Then out of the blue Julie from Koehnen called to say they got a little ahead, and she could ship me 40 queens the week of April 5. Praise all the saints!

When I make splits, I just shake the bees from the top brood super into the bottom super, put on a queen excluder, and then replace the top super. The bees re-occupy the top super in short order, but of course the queen remains trapped in the bottom super. Now I can simply remove the top super and take it to a different location to introduce a new queen. A new location, because I don't want foragers from both splits returning to only one.

To introduce a queen**,** I let the receiving hive go queenless for 24 hours. Then I put a caged new queen into the brood nest, with the candy plug in the cage exposed, so the worker bees can get at it. Then I walk away and stay away for a week or 10 days. I get 90 percent queen acceptance. There are more complicated ways to introduce queens, but this is my way.

The ski hill is a great place to meet folks, especially if you wear a name tag. The other day as I walked out of one of the mountain restaurants, an unfamiliar woman approached me. "You're the beekeeper!" she exclaimed. She and I have a mutual friend, and he told her to look me up. She wants a top bar hive. She read a book about them. To me a top bar hive makes as much sense as driving a horse and buggy, but who am I to rain on her parade? I told her to sign up for Derrick's Saturday beekeeping classes in Silt. And I told her Paul might sell her some bees. I suggested she get two hives, just in case. I tried to be encouraging, even though I knew she had no idea what she was getting into. I said, "Call me 24/7."

When we talked on the phone, she told me she'd just ordered two top bar hives and signed up for a class in Steamboat taught by a "bee whistler." I said, "I whistle all the time when I'm out there with my little darlings." The woman didn't say anything to that. Later my gal Marilyn explained that my new friend obviously said "bee *whisperer*," because whisperers are all the rage. The woman fretted about all the things that beekeeping newcomers obsess over. Like hive location. She wanted me to walk her property and pick the perfect spot for her, like a dowser divining for water. She lives in a canyon with not a lot of sunlight. I said, "Find your sunniest spot and put your hives there. Just do it! You don't need me."

This poor child intends to buy a couple of nucs, shake the bees off brood, pollen and honey-filled comb, into an empty top bar hive. Now what? I gently suggested that in order to succeed at beekeeping, she might first have to fail, because it's not all in books. I'm not sure she grasped that.

When I get a queen shipment, I generally pick them up at the UPS depot. Cheryl works there and acts like getting to hold honey bee queens for me is about the biggest honor anyone could bestow. She always reminds me that she waters the little darlings by sprinkling droplets of water on the ventilation screens. Bless her heart.

The UPS depot stays open late, so I stopped by after work to pick up my queens. That was last Wednesday, the day I got my patrol evaluation and finally retired.

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