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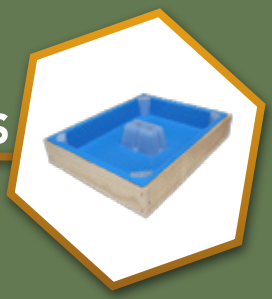

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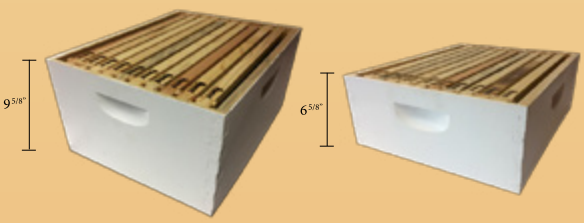

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Bee Culture

November Features . . .

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Autumn in Northeast Ohio. Photo by Kim Flottum

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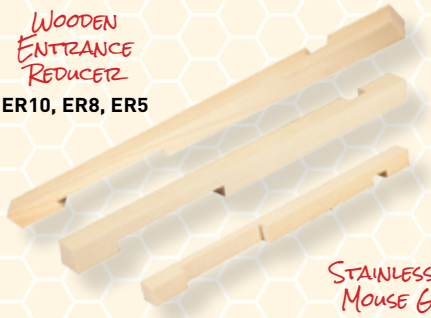

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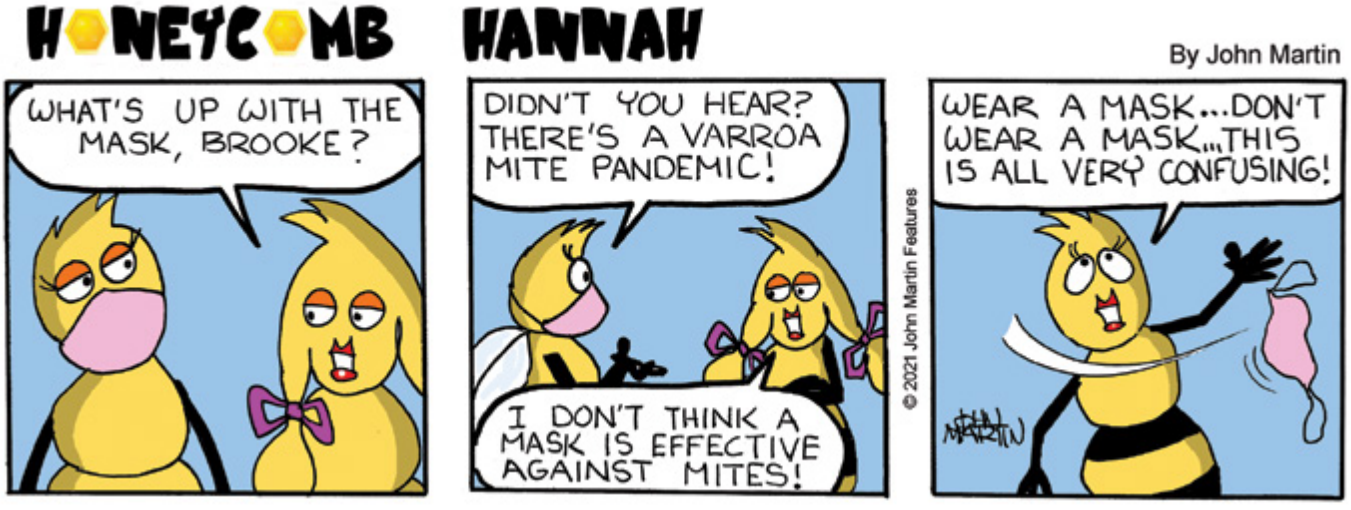
Page 40

In Every Month –



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From The New-Bee

Below is the chalk drawings that Sadie, who is nine years old, drew this on the sidewalk down the street from me a few months ago.

Her parents gave me (and you) permission to print her name and her picture. She likes bees and is very friendly for a nine-year old. Please see the picture of the text they sent me.

Barbara Bloetscher
OH State Apiary Inspector

Oxalic Acid

Oxalic acid vapor requires multiple treatments and is not feasible for outyards. Oxalic acid dribble typically is only recommended during broodless or very low brood periods. Hence, in the hot southeast it is not a viable treatment in the summer when temperatures are at 95 F +. Formic can kill queens and is not recommended for temperatures over 85F. I have killed colonies with Apiguard when the temperatures are high. Apivar is becoming ineffective to kill varroa mites.

No easy answers here. Treatment free results in heavy losses (30+ %) in the first one to two years. I would expect this since there are a lot of varroa intolerant colonies. But we are seeing 40% range losses with treating. It also depends on replacing losses with swarms from wild colonies rather than beekeeper colonies. Treatment free recommends keeping colonies in smaller hives to induce swarming; the brood break helps.

So, are we at the end of being able to treat for Varroa mites? Should we take our losses for a couple years, capture wild swarms, and propagate from there?

David MacFawn
Lexington, SC

Bee Culture
623 West Liberty St.
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STUDY HALL

I Sample, I Treat, They Die

Q — *Why do I sample consistently and treat all my colonies following label directions for Varroa and some live and look wonderful and some are mediocre and some just die. What am I doing wrong?*

Bob M.

A — There is an old saying in the beekeeping industry that 30% of your colonies will be Great, 30% Mediocre and 30% are Junk. And this was before *Varroa*. At the end of the day the really awkward and confusing thing is that we have no or little genetic consistency in managed honey bees. This is not Black Angus Cattle or Rhode Island Red Chickens that we know who Dad was and can trace genealogy back for generations. When a virgin Honey Bee Queen mates with 10-20 drones in a haphazard congregation area called a DCA that attracts Drones from 100 yards away and miles away there is NO Genetic Consistency in the stored sperm outcome that allows one to manage and have some consistency in honey bee management protocols. This is why honey bees can survive from basically Pole to Pole. They are not going for the genetic home run, they are going for just enough health and sustainable genetic diversity to swarm and spread themselves around. Do your management best and smile.

Jerry

How Do I Find A Beekeeper?

Q — *Hello, my husband and I are in the process of buying an abandoned orchard in Beloit, Wisconsin. We are hoping to find a company that will rent us bees for our orchard. If you could point me in the right direction that would be wonderful. Thank you so much!*

Britnie D.

A — I would go right to the top and contact Elizabeth Meils, the Wisconsin Apiarist and have her direct you. Might save some time. Her contact info is below.

Stay safe and well.

Jerry

Elizabeth Meils, State Apiarist, WI Department of Agriculture, Trade and Consumer Protection, Apiary Inspections, P.O. Box 8911, 2811 Agriculture Drive, Madison, WI 53708-8911, 608-224-4572; **elizabeth.meils@wisconsin.gov; https://datcp.wi.gov/Pages/Programs_Services/ApiaryProgram.aspx**

They Died and Fell Apart

Q — *I read your article on determining why an overwinter colony may die. Would love your help on figuring what happened to two of my colonies. They seem to be decapitated. I fed them in Sept. and both were still alive. Yesterday I checked them and two of four are dead. The two that died are all torn apart bees. Would love any advice or thoughts into what happened. I have two alive colonies, want to make sure this does not happen to them. Thank you! Colleen*

A — Those particular bees died many weeks ago. They just fell apart as they dried out after death. Heads do fall off. Key question is why did they die. When did you sample with an alcohol wash for *Varroa* mites and did you treat in late Summer early Fall and sample afterwards to see if the treatment worked?

https://honeybeehealthcoalition.org/varroa/

Jerry

Thank you for your response!

I did a Varroa *treatment in the fall for all four hives. The two that survived I used Hop guard and the two that perished were Apivar. I did not retest after the treatment but it would seem that Apivar was not sufficient. I'll be sure to treat earlier in the season to allow for testing and additional treatments if necessary. Thank you for reassuring it's not a crazy bug that devoured the bees!!*

Colleen

Pollination Fees

Q — *I just started receiving my new subscription to* Bee Culture. *Kudos!! The magazine has sought after information for me. I wonder if you can clarify for me how fees for pollination contracts work? T. Thomas*

A — Pollination contracts are simply based on how many 'colonies' a grower would like to rent to optimize production. There are data from USDA which recommend how many colonies are needed per acre for some pollinator dependent crops. For instance, almond growers need a minimum of two colonies per acre, watermelon growers 1.3 colonies per acre, apple growers a minimum of one colony per acre and so on. The 'fee' you would charge the grower is based on historical crop value, required strength of the colonies and competition from other commercial beekeepers who want the pollination business as well. And remember that the 'fees' in the USDA report are averages. They can be higher and lower. *Jerry*

Metarhizium

Q — *Do you recommend using metarhizium for* Varroa *control on a hobby bee hive if so how much? Thanks.*

Curt

From The Editor —

A — Short answer is no. Importantly, it has not gone through the 'Regulatory' process to allow it to be sold and used with appropriate label directions.

Longer answer is that years ago I was involved in approved research field trials using metarhizium to control *Varroa*. Picture this, you spread these fungus spores onto honey bees in a honey bee colony hoping they get on a *Varroa* mite. You have immediately introduced 'trash' into the colony and the bees hygienic behavior gets geared up to clean this stuff up and out and remove it from the colony. Let's say most of it is removed by the bees but some does get on a *Varroa* mite and it stays there. At the time the strain we were testing had temperature and humidity requirements that the interior of a honey bee colony sometimes met and sometimes didn't for the fungus to grow. Sometimes it did stay on *Varroa* and grow and its mycelium would get into the *Varroa* mite and kill, hurt, damage it. But, most of the time it didn't stay, grow and control *Varroa* consistently. Soooo, the research project was dropped.

Fast forward to 2021. Maybe there is a better metarhizium but you still have delivery and temp. and humidity issues. *Jerry*

Time to Combine

Q — *I have a hive with only two frames of bees with scattered brood. I can't find a queen, should I requeen or add frames to another hive? Thank you. C. Johnson*

A — Strangely, Winter is coming and two frames is not enough of a good start to make it through. I'd combine it with an existing colony. *Jerry*

How Do Virgin Queens Know Where to Go?

Q — *From Jerry To Dr. Jamie Ellis – In The Scottish Beekeeper magazine there is a book review of "Mating Biology of Honey Bees" written by some well know leaders in the Honey Bee world.*

In the review it notes "The queens on the other hand are programmed to search for DCAs as far from their colony as possible. This minimizes the chances of mating with brother drones and again cuts down the chances of inbreeding." I would agree with this.

My question for 40 years is how do virgin queens avoid those DCAs close to the colony they exited from that contain potentially many drones from that same colony?

A — I'm not sure we know 100%. My guess is that flight distance to DCAs may be programmed in queens (i.e. to bypass nearby ones in favor of slightly further away ones). However, I'm somewhat unconvinced. There are times, conceivably, when nearby DCAs are the only ones available. My guess is that inbreeding is suppressed more by the number of drones at DCAs rather than differential flight differences. But, both may play an important role.

The selling point (that I also use) is that both queens and drones have about 30 minutes of energy in the tank when they fuel up before flights. Queens only need five to 10 mins at a DCA. The mating process is quick. Drones, on the other hand, benefit by being at DCAs looking for queens, rather than flying to/from DCAs. So, they use more of their energy to be at a nearby DCA (rather than going to/from it). Queens in contrast use their energy to get to/from a DCA because they don't need much time there. This causes drones to stay close and queens to go further. *Jamie*

Parts and Pieces Under My Hive

Q — *Hi Jerry – a question, I always appreciate your advice. One of my three Langstroth Hives with a screened bottom board has an accumulation of dead bee Parts (Thoraxes, Legs, etc.) underneath it. NO whole bee or bee abdomens. Two weeks ago I removed about a full cup. Now I get a quarter cup every two to three days. There are some bee parts under the landing board as well, but much less.*

A — As a food item the most nutrition is found in the honey bee abdomen if the predator isn't bothered by the venom sac. I would guess that you have a mouse or a lizard or a . . . that is catching bees at the entrance and taking them further under the hive and having lunch and not eating the crunchy parts.

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It's Summers Time –

Fall, Poultry and Happy Thanksgiving –

So far here in Northeast Ohio Fall has not been very dramatic. We're still having warm days and even the nights are not very cool. The leaves are slow to turn colors – it's early October as I write this.

There is a legend here involving the Woolly (yes, two l's) Bear Caterpillars and predicting Winter. If the Woolly Bear is mostly brown/copper it will be a mild Winter and if mostly black – look out. Well about two weeks ago my son, Matt found the first Woolly of the year and it was completely black. So I guess we better get ready.

We've had a pretty good goldenrod flow and the asters are very abundant this year. Hopefully we'll get a super or two of nice Fall honey to share with friends and family.

The poultry situation on Spieth Road has been a bit disturbing. For over a month we did not have one single egg. We had to buy eggs at the store – first time in probably five or six years at least. There are 14 chickens and four ducks. Last night when I went to close them in there was finally one egg in one of the nesting boxes. We've had slow spells when they were molting and when the days start to get shorter, but nothing this dramatic.

We have two or three hens from our original bunch which means they're eight years old. The second group are about four years old and the youngest ones are two. The four ducks are about two years old. And we still have our little crippled hen. She's in the two year old group. She's a bit smaller than the others and because of her splayed leg she sleeps on the top of the nesting boxes. She can't wrap her foot around a perch. There's no way to know if she lays any eggs. But nobody picks on her and she seems happy.

We're still having difficulty with the delivery of your magazines. We apologize for that even though it's really out of our control. We're still sorry that it's happening. We know and we so appreciate how much your *Bee Culture* means to you. You are so important to us.

The folks who print our magazine are wonderful and are in the same situation that so many businesses are in right now. They simply don't have enough people that want to work. So please be patient and hopefully things will soon get back to whatever our 'new normal' is.

I'd say 90% of the places we visit here in our area have help wanted signs up. Whether it's retail, food service, medical, outside help, truck drivers – no one seems to have enough help.

So we'll keep doing our best to get each issue to the printer on time and hope that things get better for them.

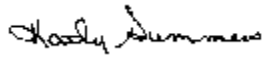
There are some things you can do to make it easier when it comes to your subscriptions. Please read your label – it will tell you how many issues you have left. We try to get renewal letters sent out in a timely manner, but for the reasons mentioned above we don't always get that done. So look at your label!

If you are renewing online please make sure that you actually type **www.beeculture.com** in that search line – make sure you're putting the **.com**. What happens often is folks just put in *Bee Culture* and do a search and you can end up on an agency site that looks remarkably like *Bee Culture*, but isn't. When you subscribe that way we don't see your money or subscription right away. We have to wait for them to send it to us. You also can't put in any kind of promo code to get the discounts that we offer. Whew! It's a lot but it's the world we live in.

The holidays are fast approaching. Can you believe it? Thanksgiving has always been a favorite at our house. Last year was so hard because we just didn't have everyone with us. I hope this year will be wonderful for all of us, that you will have all of your loved ones around you and it will be peaceful and joyful. I hope you have a houseful if that is your heart's desire. It certainly is mine and I'm so looking forward to it.

Winter is coming. Time to get ready. It's been approaching 80°F here this week. So whatever Winter looks like for you – be ready, enjoy, and look forward to Spring.

Happy Thanksgiving to all of you.



NEXT MONTH

Region 1
- Read *Bee Culture*
- Repair Equipment
- Provide Top Ventilation
- Feed Weak Colonies
- Too Late for Mite Treatments
- Wrap colonies
- Sit Inside watch Jeopardy
- Read Books on Queen Rearing
- Put Fondant on as needed
- Check Bear fence

Region 2
- Check Colony Weight
- Fix old equipment, Buy and Assemble New
- Feed If needed
- Put in Entrance Reducers
- Install Mouse Guards
- Do Last Queen Check
- Insulate Colony
- Order Honey Jars
- Combine Weak colonies

Region 3
- Check Stored Food Amount
- Replace Unfixable Equip.
- Store Empty Supers/Treat With Paramoth
- Feed
- Sample for Mites
- Feed DFM
- Put Up Wind Breaks
- Remove Mite Strips

Region 4
- Take Online Classes
- Read Books on Beekeeping
- Wrap Hives
- Provide Upper Entrance
- Feed Weather Permitting
- Ship Bees to California
- Put Up Windbreak
- Add Candy Board if Needed
- Be Sure Winter Wrap Stays On
- Go to Bee Meetings in Person if you can
- Hope for Spring Now

Region 5
- Start Building Boxes
- Put Foundation In Assembled Frames
- Check Colonies in Indoor Wintering Bldg.
- Feed
- Wrap for Winter
- Sell Honey to Buy Equip. And Break Even
- Check Colonies after Snow Strom make sure wrap is on
- Reduce Entrances

Region 6
- Sample and do last *Varroa* treatment
- Combine Hives
- Keep snow away from bottom entrance
- Too late – Nothing can be done
- Feed, Feed, Feed
- Install Top Entrance

Region 7
- Nothing – Too Cold
- Check colonies to see if Bears have visited
- Check colony weight
- Feed if Needed
- Clean Entrances
- Ramp up for Almond Pollination

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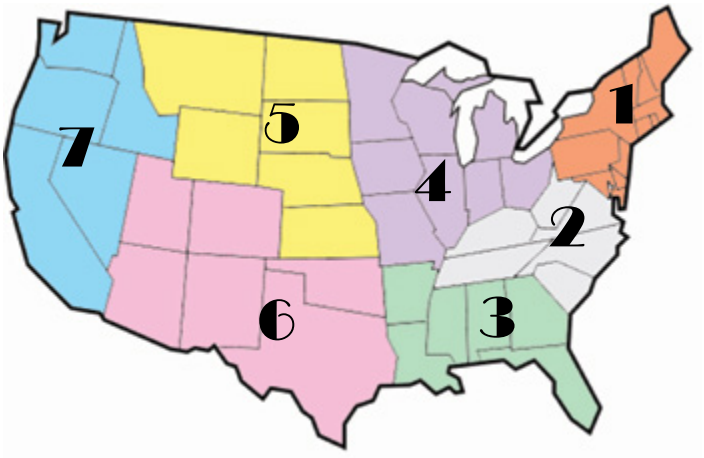

NOVEMBER – REGIONAL HONEY PRICE REPORT

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7				Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								Range	Avg.	$/lb		
55 Gal. Drum, Light	2.20	2.25	2.43	2.36	2.52	2.28	2.10	2.00-2.75	2.33	2.33	2.31	2.17
55 Gal. Drum, Ambr	2.18	2.18	2.27	2.35	2.55	2.15	1.85	1.85-2.75	2.26	2.26	2.21	2.09
60# Light (retail)	227.50	203.05	212.50	192.39	202.50	183.77	157.40	120.00-300.00	206.75	3.45	200.78	210.77
60# Amber (retail)	219.58	196.54	200.00	176.96	240.00	178.77	222.50	120.00-300.00	204.33	3.41	198.47	206.21
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	105.20	99.00	66.80	80.50	106.20	96.00	106.53	37.60-194.90	96.81	8.07	99.63	86.89
1# 24/case	157.26	166.67	121.30	112.23	171.87	83.88	144.00	48.00-300.00	141.37	5.89	143.18	131.27
2# 12/case	141.65	163.98	122.00	98.70	76.02	140.12	144.00	40.20-264.00	128.13	5.34	127.37	116.61
12.oz. Plas. 24/cs	116.20	151.08	81.80	91.25	96.72	107.76	108.00	43.60-240.00	112.10	6.23	119.43	103.70
5# 6/case	160.15	187.05	75.00	95.63	113.16	173.42	173.42	71.50-330.00	146.08	4.87	148.46	137.21
Quarts 12/case	187.36	198.55	122.50	141.20	160.36	145.94	183.00	109.20-300.00	166.62	4.63	173.15	162.63
Pints 12/case	93.98	117.48	77.50	87.00	101.33	96.00	96.00	60.00-170.00	98.71	5.48	101.62	102.43
RETAIL SHELF PRICES												
1/2#	6.39	5.95	5.04	4.45	5.08	3.95	5.77	2.89-9.00	5.60	11.19	5.50	4.89
12 oz. Plastic	7.43	7.07	6.71	5.51	5.64	4.88	4.80	2.99-11.00	6.48	8.64	6.38	6.23
1# Glass/Plastic	10.22	9.33	9.58	7.88	8.08	6.90	9.00	4.79-17.00	9.08	9.08	8.46	8.05
2# Glass/Plastic	16.52	15.55	15.56	14.50	12.59	6.89	15.50	6.89-32.00	15.14	7.57	14.17	13.92
Pint	11.63	12.61	11.00	13.61	12.63	13.67	9.80	6.65-25.00	12.38	8.25	11.39	11.38
Quart	23.37	21.54	17.08	19.98	22.32	16.33	18.80	9.25-48.00	20.56	6.85	18.83	18.23
5# Glass/Plastic	33.65	36.00	39.00	25.57	30.39	16.89	35.23	16.89-60.00	32.02	6.40	32.30	28.50
1# Cream	11.14	8.13	8.33	10.67	9.37	11.98	14.00	6.75-20.00	10.58	10.58	10.41	10.10
1# Cut Comb	14.90	11.20	11.82	12.35	11.00	12.00	14.86	8.00-25.00	13.23	13.23	13.16	13.10
Ross Round	11.39	7.33	9.00	12.25	11.61	11.61	13.75	7.00-17.00	11.22	14.96	11.07	10.57
Wholesale Wax (Lt)	7.50	6.50	5.65	6.15	6.17	5.50	8.67	3.00-12.00	6.72	-	7.17	6.32
Wholesale Wax (Dk)	5.57	5.64	4.00	5.05	6.00	4.50	5.36	3.00-8.00	5.23	-	6.33	5.31
Pollination Fee/Col.	87.78	73.00	107.50	123.00	80.00	105.10	50.00	40.00-200.00	90.21	-	93.24	89.96

Breeding Honey Bees for Adaptation to Regionalized Plants and Artificial Diets

Honey bees could be intentionally bred to thrive on plants that are already locally present or even solely on artificial diets, according to a recent U.S. Department of Agriculture Agricultural Research Service (ARS) study.

ARS researchers found individual bees respond differently to the same diet and that there is a strong genetic component involved in how they respond to nutrition. This points directly to the concept that managed bees can be intentionally bred to do better on different diets, whether you are talking about an artificial diet or a diet based on specific plants already growing in an area, explained lead researcher Vincent A. Ricigliano. He is with the ARS Honey Bee Breeding, Genetics, and Physiology Research Laboratory in Baton Rouge, Louisiana.

"Urban development, modern agricultural systems and environmental alterations due to climate change, invasive plants, and even local landscaping preferences have all had a hand in regionalizing plants that dominate available pollen. It could potentially be more beneficial to tailor honey bees to do better on what is already available instead of working hard to fit the environment to the bees," Ricigliano said.

The overall aim would be breeding to improve nutrient use by managed honey bees, like we have done for poultry and cattle breeding programs, Ricigliano explained.

"Now that we know there is room for genetic adaptation to diet, we could also look at breeding honey bees with improved nutrient efficiency or identifying genotype biomarkers that respond to various supplements to promote honey bee health," he added..

In most commercial apiaries, honey bees do not have the opportunity to naturally breed to adapt to local conditions because commercial beekeepers typically replace the queen in each colony every year. The queen in a colony is the only bee that lays eggs to produce the next generation.

Beekeepers usually purchase new queens already inseminated from a handful of queen breeders in the United States. As a result, honey bees across the country generally have the same range of genes for nutritional responses without any specialized adaptation.

Honey bees have already been successfully bred for a very few selected traits, among them *Varroa* mite resistance. *Varroa* mites are among the single largest problem afflicting honey bees in the United States today.

"It was a little surprising to find when we started this study that, despite a sizable body of research pertaining to honey bee nutrition, relatively little is known about the effects of genetic variation on nutritional response," Ricigliano said.

His next step is to refine knowledge about what genes control which nutrient and metabolic pathways and where the greatest amount of genetic variation exists so that breeding plans can be specific and scientifically guided.

The Agricultural Research Service is the U.S. Department of Agriculture's chief scientific in-house research agency. Daily, ARS focuses on solutions to agricultural problems affecting America. Each dollar invested in agricultural research results in $17 of economic impact.

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Technology Tips For Beekeepers

Malcolm T. Sanford

ANCGIS - AN OPEN SOURCE, MOBILE, AND WEB GEOGRAPHIC INFORMATION SYSTEM FOR RESOURCES MONITORING: Sylvain Galopin; University Gustave Eiffel IGN; France; sylvain.eloi.galopin@gmail.com

The apiaries placed in large cultivation areas are confronted with recurrent problems of summer food shortages, which unfortunately increase year by year due to global warming. Based on this observation, it is necessary to determine as precisely as possible the honey potential around the apiaries. The easiest answer for a beekeeper is to place automatic scales under their hives. But that only gives an annual vision that is strongly subject to the climate of the year and the colonies' strength. This first approach may be supplemented by pollen analyzes to have another picture, but this still does not allow us to have a global and precise vision of the potential that a vegetation survey can give us. This is why the AncGIS application has been created. AncGIS is the acronym of "Apinutriculture Geographic Information System." Apinutriculture means the Cultivation of nutrients (plants) for apis (bees). AncGIS is both a desktop and mobile application and aims to allow a detailed analysis of the honey resources around an apiary. The objective is to facilitate the analysis of the territory by beekeepers to give them the keys to improve their potential. 14 Minutes, https://tinyurl.com/ysu3em8v

FLIGHT AND CLUSTER HOURS MODEL: Manuel Gutierrez, Appalachian State University; Dick Rogers, Bayer Crop Science, and Appalachian State University; Joseph Cazier, Ed Hassler; Appalachian State University; USA; dick.rogers@Bayer.com

Honey bee colony development and behaviors are strongly influenced by conditions, including temperature, light quality, day length, wind, and rain. These factors even allow colonies to synchronize to the change in seasons. This makes honey bee colonies highly adaptable and able to survive in regions with very different climates. However, the species still does better if managed by beekeepers. The trick for beekeepers is to know how to adjust management to take weather and climate into consideration. To develop a tool to visualize the climate impact on honey bees, a series of algorithms for calculating flight and cluster hours (FCH) were developed. The calculations use published and observed threshold temperatures for these behaviors and readily available local, regional, and/or site-specific weather data. Tableau® was used to build a prototype interactive tool for the visualization of flight and cluster hours over time. Preliminary results show that the influence of elevation and local conditions on honey bee flight and clustering behaviors can be detected. We envision useful applications for precision pollination, determining forage utilization, monitoring conditions for cleansing flights, and investigating climate-change from the perspective of the honey bee. Initially, the focus of this research is on North Carolina. However, it should be possible to scale up to the entire US and beyond to produce heat maps and provide data for research. In this presentation, we present an open-source tool that was developed to help apiarists make climate-smart decisions that will improve the survival and productivity of honey bee colonies globally. 15 Minutes, https://tinyurl.com/3kwywcrd

OVERVIEW OF INDOOR STORAGE RESEARCH AT WSU: Brandon Hopkins, Washington State University, USA; bphopkins@wsu.edu

https://beekeep.info/vita_details/

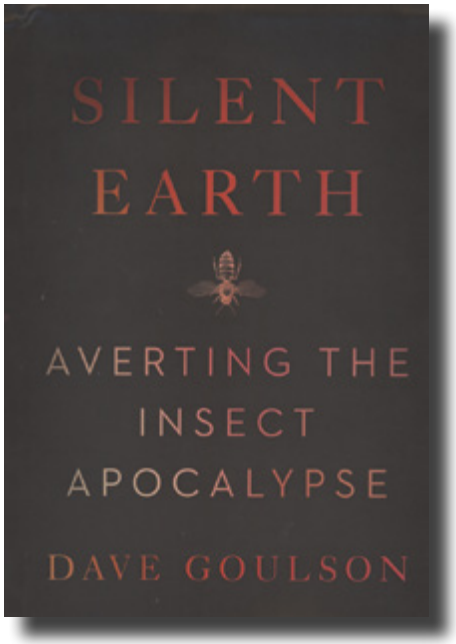
Dr. Hopkins describes some of the ongoing research at Washington State University about indoor wintering of honey bee colonies. He addresses recent research regarding (1) Components of nutrition, (2) Use of CO2 to increase varroa mite mortality during winter storage, and (3) indoor storage at times other than the winter period for studies of artificial brood breaks and queen banking. 16 Minutes, https://tinyurl.com/pyytzbmr

Winter Reading Gifts For The Beekeeper –

Silent Earth. Averting The Insect Apocalypse. By Dave Goulson. Published by Harper Collins. ISBN 978-0-06-308820-7. 328 pgs., hard cover. $28.99.

If you had to take a test to become a beekeeper, this book would be required reading. The author is an entomologist and is interested in all insects, and the information in this book applies to all insects, including the honey bee, but also to people, animals, oceans, farms, ice caps, forests, fields and all the rest of living things. The title sums it up quite well – Silent Earth. Insects are the case study of how we are rapidly destroying the planet.

He begins with a brief history of insects, and how they are disappearing at the rate that, with no changes, 75% of them will be gone in about 50 years. And then he spells out many of the reasons why this future is not a good thing. For instance, about 80% of the world's population eat insects on a routine basis. This makes more sense than you might think – insects more efficiently covert food and water to edible food, they are nutritious and very low in fat. Moreover, people share no diseases with insects, such as Mad Cow disease or the covid viruses among others. Insects don't make biological waste, they consume it and turn it into more food by making better soil, they consume pest plants without using chemicals, they eat dead animals, and from our prospective, they are excellent pollinators, producing food.



But, and you knew there was one here, the planet has arrived at the Anthropocene! This is where the earth's ecosystems and climate are being altered by human activity, represented by an accelerating rate of a decline in biodiversity. One count estimates that since the year 1500 or so, 80+ species of animals and 180 species of birds have become extinct. A 2018 study by The World Wildlife Fund estimates that between 1970 and 2014 the population of all land vertebrates had fallen 60% and the population of all freshwater vertebrates had declined by 81%.

A 26-year study in Europe found that insect biomass declined during that time by 76%, in the U.S. the Western Monarch butterfly population has declined 97% and the Eastern Monarch population by 80%. A study in the UK has measured the butterfly population down an average of 46%, with some species down 77%. There is, sadly, essentially no comparable data from the continents of Africa, South America, Oceania or Asia.

He refers to a shifting baseline in the population of people. Children today do not have experience with millions of Monarchs, for instance. It's the way it's always been for them. I compare this to the windshield effect. Remember having to stop on occasion, especially at night in the middle of summer, to clean your windshield of smashed insects? When did you last have to do that? I'll bet your children wouldn't believe you if you told them about scraping dead bugs off the windshield so you could actually see to drive.

And then he lists the causes of all this, beginning with the fact that Insects have lost their home. He sums up all of his data with a very interesting quote. "Destroying a rainforest for economic gain is like burning a Renaissance painting to cook a meal." I think he nailed it there.

He moves on to a Poisoned Land – the evolution of pesticides. He does a bit of history with the discovery of DDT and Parathion in the 40s, both neurotoxins. Paul Hermann Muller received a Nobel Prize for discovering these chemicals.

He moves on to the Neonicotinoids in the 1990s, used as systemic seed coatings, with the poison infiltering all parts of the plant, pollen and nectar included. The LD50 of the most popular brand is one 4 Billionth of a gram, but only 1 – 20% of the chemical is absorbed by the plant, the rest goes into ground water and moves everywhere water goes – streams, rivers, lakes, wells – there has been essentially a global contamination. But the pesticide company's argument is that with DDT, farmers used about 2000 g/ha, while with the neonics it's only 10 g/ha.

Fungicides harm bees by killing gut biota, and they also inhibit natural pesticide detoxification in the insects thus increasing even more their lethal effects, but you can't see that so it doesn't count. This is followed by the lethal effects of herbicides, primarily glyphosphate, by removing flowers, killing gut bacteria, affecting bees' learning and orientation capabilities when flying. Plus, iit causes cancer in people.

Fertilizers have a role here too. They change microclimates for caterpillers, destroy alge in ponds allowing toxic cyanobacteria to grow instead, increase methane release from the soils and eventually breaks down into NO2, another warming gas in the atmosphere.

Climate change has a role here too, not surprisingly. The total combined events of heatwaves, drought, wildfires, floods, landslides, avalanches, and storms have changed from about 200/year in 1980 to over 700/year in 2016. We did that, you know.

So, what can be done? Fortunately, more than you might think, if we choose to do it.

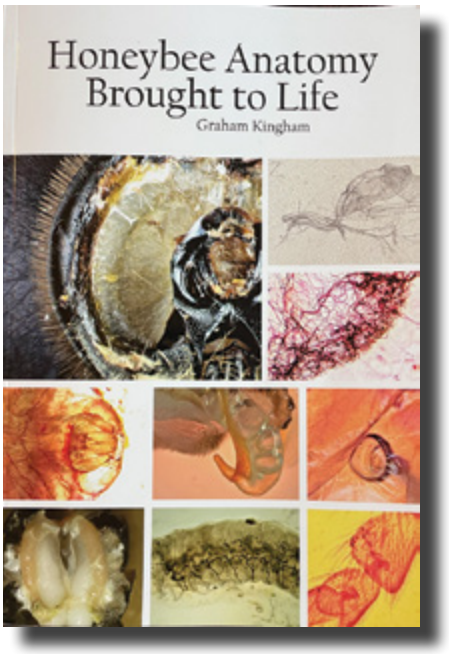
Start by raising awareness, convince those with the power to change things to begin. Change farming, become sustainable, reduce monocultures, you can reduce food waste, eat healthier, support local agriculture with community gardens, vote for the right people, use social media, and more, and don't quit.

He lists the actions that local communities can do, what local governments can do, what national gov-

ernments can do, and mostly, what farmers can do.

At the end, there is a long, long reading list of resources and supporting information, including the list of references for his data, listed by chapter so you can easily find it when needed. It's time to get started. Rachael Carson tried with Silent Spring. She started this, but now we have to finish this or it will the be time for a Silent Earth?

Kim Flottum



Honeybee Anatomy Brought To Life. By Graham Kingham. Published by and available from Northern Bee Books, UK. 186 pgs. 350 Color and black and white photos and drawing. Soft cover. 6.5" x 9.5". $44 including postage from UK.

The author started his life in honeybee anatomy by studying for the British Beekeepers Association 'Microscopy' exam, one of several exams in their program. We have covered several of these updates in books by Ann Harman and others recently.

He draws heavily on the works of Dade, Goodman, Nelson, Snodgrass and Stell using drawings and photos from some of these, and supplementing them with all of those he has taken.

The book comes in three sections. First, the larval and pupal stages, then adult bees, and finally pests of honeybees.

The line drawings, simplified for easy ID, support and enhance the color photos in each section. And there are lots of both in each section, along with excellent descriptions of what it is you are looking at, along with many arrows showing exactly what you need to see. These are mostly referred to in the text so you can compare the notes to the photos. It makes it much easier to understand what you need to see.

If you intend to do some of these yourself, he offers instructions on how to prepare the specimen so it's easy to do. For instance, for spiracles, First Shave Your Bee. Very good advice that I would have probably eventually figured out.

Every functioning part is described – glands, the brain, digestion, the fat body, the tracheal system, muscles, heart, nerves, reproduction, flight, sensory organs and all the rest, each as a chapter. And the bonus is a close up look at a varroa mite, tracheal mite, wax moth lava and the common wasp.

You will have this on the table beside you when you begin this adventure in the tiny world of the honeybee, and a few other guests.

Kim Flottum

The Bees Are Resilient – Until They're Not

Earl **Hoffman**

- I have the privilege to speak to hundreds of beekeepers each month, some are commercial, while others are sideliners, and a few are hobby beekeepers.
- I found it incredible and literally fascinating that a commercial beekeeper from Florida shared with me that last January he applied oxalic acid drench at 3% strength and at a dose of exactly 50 ml per hive and it quote "HURT MY BEES?" WHAT?
- That's not supposed to happen, oxalic acid at low doses and at low concentrations are supposed to be safe for the bees? Right? Well it depends!
- If I may remind you, the super organism called a honey bee colony is incredibly complex, nothing in beekeeping is black and white. At best, it is 256 different shades of gray that change each day. It's a complex system of thousands of inputs and thousands of outputs and we do not control most of them.
- So back to the commercial Beekeeper in Florida, I listened to his story. He exactly measured each dose with a plastic syringe. Only 50 ml and not one drop more. He followed his recipe and mixed 3% oxalic acid. The syrup was always fresh and correctly applied. He measured and measured and measured.
- Given what I was told, what I prefer to do is try to replicate the outcomes that others achieve. I like to run a trial on my apiaries using the same methods and protocols. I want to see if I can get the same results.
- Currently in Michigan we run between 60-80 beehives, most of them are on pollination contract to a local organic vegetable farm. It was decided to use these hives for a trial of 3% oxalic acid summer drench.
- After speaking to commercial beekeepers in Wisconsin, that use oxalic acid drench, it was determined to reduce the monthly dose to only 25ml per hive during the Summer trial period. 3% @ 25ml.
- Apparently, the beehives in Wisconsin were tolerating this low dose all summer long, each month.
- Back to the realities of beekeeping, having multiple yards of bees, means some yards get lots of love and attention, while others are poor and orphaned most of the time. I'm late pulling honey and I'm late getting *Varroa* mite treatments applied.
- One of the out yards pollinating 20 acres of Summer squash, has the *Varroa* mites out of control. The *Varroa* mites are vectoring viruses and the brood looks sick. We perform a Bee Informed Partnership BIP test sample and mail it to the university for analysis. The report comes back with screaming high *Varroa* mite levels and Sac Brood Virus SBV at high levels. This correlates with the spotty brood pattern and the white melted larva that have died in the open cells. The hive is dead, and it does not even know it!
- When we pulled the honey, we applied four (4) legal Apivar Amatraz plastic strips in the brood supers. Yes, the mites were out of control, but it was August and maybe I had time to recover from this calamity. The clock was ticking . . .
- Thinking of back to back *Varroa* mite treatments, brought me back to the 3% oxalic acid drench Summer trial. Why not? Why Not apply a low dose of 3% oxalic acid?
- So, in late August the oxalic acid Summer drench trial began. There was a fantastic aster and goldenrod flow of both pollen and nectar in Michigan. The hives were still bearded at the bottom board and they were still full of bees. Not 50,000 bees in a hive, but maybe 30,000 bees in each hive. About ten pounds of bees in each colony.
- The hives were all queen right and we were suppressing the *Varroa* mites for the six-week period.

- We measured and measured and measured the oxalic acid and sugar water to achieve 3% solution. What we achieved is about a three on the Ph scale and can be best described as oxalic acid lemon aid.
- Using a cattle drench gun, we measure the tiny 25 ml of dose for each hive, in each yard. Yes, only 25ml of acid solution. Looks like a tablespoon of volume.
- The other out yards have healthy brood, no indication of virus symptoms and the *Varroa* are in control.
- One week later, we return to the sick yard of 20 beehives that was dosed with the tiny 25 ml acid solution. Oh YES, we hurt the bees alright. Wow most of the hives got cut in half. The oxalic acid was the stressor that was literally, QUOTE "the straw that broke the camel's back".
- I found most of the queens in the hives, they are marked and looked fine. The brood is spotty to zero brood. The honey is still in the supers, but the bees are gone. Most hives are lucky to have a few pounds of bees in them. The plastic Apivar strips are still in the hives after six weeks and the oxalic acid was applied Oh so sparingly. I am still shocked and dismayed, this is not supposed to happen?
- So, for a comparison, we drive down the road to another pollination field, where we have 21 hives on a twenty-foot trailer. They have been in good shape all summer long. Same Queens as the other yards, the *Varroa* mites were never out of control and viruses were never evident in the brood. The hives are still full of bees and the frames of capped brood look fantastic.
- The stressor of a tiny application of 25ml of 3% oxalic acid had zero negative effect on the healthy hives.
- With the four legal Apivar strips applied for six weeks and the application of only 25 ml 3% Oxalic acid solution, the *Varroa* mite counts were all below threshold values. Mostly ones and zeros in half cup bees. The healthy hives look fantastic and are ready for fall feeding.
- The hives that are failing, will be removed from the yard. The bee equipment will be fumigated with glacier acetic acid vapors – anhydrous vinegar! They are DONE.
- There you have it, again we have observed that each beehive is different and that each colony can have a different outcome based on similar inputs. You apply 25 ml of 3% oxalic acid to a hive and it crashes within a weeks' time. You repeat the treatment of oxalic acid drench to other hives and see absolutely zero negative effects, none. The hives and bees took the stress of the acid because they were resilient.
- So, I go back to the Commercial Beekeeper in Florida, who so honestly shared with me that he used the oxalic acid drench 3% back in January. He said, "I HURT MY BEES" You know what, he was right!
- I replicated what the commercial beekeeper said, yes you can hurt bees with oxalic acid!
- The bees are resilient until . . . They are NOT! BC

FOUND IN TRANSLATION

Stress And Sickness

Jay **Evans**, USDA Beltsville Bee Lab

Honey bees are interconnected within colonies, with a crowded three-dimensional space that favors constant contact. Add shared feeding and a mite that is mobile enough to connect viruses from one bee host to another, and it is safe to say that no colony member is socially distant from the whole. Fortunately, bees have a range of defenses, from molecules to mandibles, that help them reduce the spread and impacts of disease. When this fails, beekeepers can add another layer, most importantly by reducing mite levels and being overly cautious with signs of brood disease. Thanks to these defenses, honey bees are bruised but still with us and hardworking beekeepers are still providing a great service to agriculture.

One research area that has received much attention is the ability of environmental stressors, including pesticides, to reduce the defensive posture of bees and colonies against disease. Early work by Gennaro di Prisco and colleagues suggested that chemical stress directly impacts the immune responses of bees toward viral infection, a fact that was championed to explain an apparent upswing in viral impacts on bee health ("Neonicotinoid clothianidin adversely affects insect immunity and promotes replication of a viral pathogen in honey bees". 2013. *Proceedings of the National Academy of Sciences of the United States of America, 110*(46), 18466-18471, **https://www.pnas.org/content/110/46/18466**). While mite vectors are arguably far more important for viral disease than chemical stress, determining a role for chemical stress on viral immunity has led to several important research studies. These studies are summarized in a timely review by Gyan Harwood and Adam Dolezal in the open-access journal *Insects* ("Pesticide–virus interactions in honey bees: Challenges and opportunities for understanding drivers of bee declines". 2020. *Viruses 12*, 566. **https://doi.org/10.3390/v12050566**). Alongside a plea for additional research, the authors of this review make a good case for connecting the dots between chemical insults and vulnerability to viruses. Interestingly, while they describe many laboratory studies that show an increase in viral levels when bees are exposed to chemicals, such viral outbreaks have not been confirmed in colonies in the field. Why is that?

First, field experiments are far more costly and it is hard to generate the numbers of independent control and exposed colonies needed to see subtle changes in viral infections. Second, in even the most ambitious field experiments, colonies are able to collect food sources beyond those prepped with chemicals, and it is possible they are diluting pesticide intake. Weakening these two hypotheses, bees in field colonies HAVE been shown to express behavioral and longevity effects from exposure to chemicals. An alternative explanation for survival of honey bee colonies after chemical stress is resilience (the topic of my July *Bee Culture* article). Several recent papers suggest that this resilience starts in the bee gut.

Having done numerous lab studies with live bees, it is really hard to give them adequate 'lab-based' nutrition. It is quite likely that most laboratory stress assays for bees involve suboptimal nutrition. Further, as documented abundantly by May Berenbaum and colleagues at the University of Illinois, natural chemicals found in many pollen and nectar sources can themselves trigger defenses in bees that help reduce the impacts of dangerous pesticides (for example, 'Increase in longevity and amelioration of pesticide toxicity by natural levels of dietary phytochemicals in the honey bee, *Apis mellifera.* 2020. PLoS ONE 15, e0243364; **doi:10.1371/journalpone.0243364**). The impacts of plant-based chemicals on bee health merits it's own discussion given strong evidence that these chemicals can also reduce bee disease, but the link to pesticide tolerance is especially interesting. Certain chemicals found in pollen and nectar trigger the same detoxification enzymes bees use to dampen the impacts of pesticides. If this triggering offers protection (a phenomenon called hormesis or, informally, 'hair of the dog') this might lead to practical avenues of reducing chemical stress on bees. Of course, it is also possible that plant chemicals over-tax the same enzymes and other processes that are needed to smother pesticides, in which case synergies might arise to the harm of bees. Synergies between agrochemicals that lead to unexpectedly dire results for bees are known, but so far there are no identified synergies of this sort between chemicals found in bee forage and synthetic chemicals used in farming or beekeeping.

So what is the evidence that nutrition, or these plant chemicals alone, can provide real-world protection to honey bees against pesticide stress? A recent paper by Lena Barascou and colleagues shows that supplemental pollen gives some measure of protection against the pesticide sulfoxaflor (Pollen nutrition fosters honey bee tolerance to pes-

ticides. 2020. R. Soc. Open Sci. 8: 210818. **https://doi.org/10.1098/rsos.210818**). Bees given a pollen boost had lowered mortality after both acute and chronic exposure to sulfoxaflor. After chronic exposure, bees had 2.5- and 2-fold greater survival when exposed to sulfoxaflor IF they were fed a pollen mix heavy with mustard and oak sources, or one with pollen from willow trees and other sources, respectively. Only the former pollen offered protection from an acute pesticide dose in this study. Interestingly, oak pollen is heavy with one of the plant chemicals highlighted by Berenbaum's group as being especially important for bee detox responses. Given the different chemistries of these pollens, it is also possible that pollen as a whole can provide some protection from chemicals, i.e., a 'better nutrition equals better resilience' hypothesis is not ruled out.

Bees in colonies also carry abundant microbial associates in their guts and there is evidence that these associates themselves enable greater tolerance toward pesticide stress. This is important for beekeepers both because antibiotic use in hives is known to reduce microbe numbers and change their constituencies, and because several researchers and companies are developing microbial supplements (prebiotics and probiotics) purported to improve bee health. In one recent study, Brendan Daisley and colleagues tested the abilities of a common environmental bacterium to reduce the impacts of imidacloprid on fruit flies ("Neonicotinoid-induced pathogen susceptibility is mitigated by *Lactobacillus plantarum* immune stimulation in a *Drosophila melanogaster* model". 2017. ***Scientific Reports***, 7:2703, **https://www.nature.com/articles/s41598-017-02806-w**). As with bees, low-level chemical exposure increased disease susceptibility, but that susceptibility was offset by supplementing the insects with a single bacterial species. The authors argue that this dynamic could help bees in the field survive chemical insults and they are actively pursuing this. In support of this, researchers in the laboratory of Nancy Moran (a pioneer who has made huge discoveries in the roles and makeup of bee gut bacteria) have shown that bees given a probiotic 'cocktail' after antibiotic cleansing of their guts show greater resistance to bacterial disease ("Field-realistic tylosin exposure impacts honey bee microbiota and pathogen susceptibility, which Is ameliorated by native gut probiotics" 2021. *Microbiology Spectrum*. 9(1):e0010321. **doi: 10.1128/Spectrum.00103-21**. They and others have also shown interactions between these native gut bacteria and pesticides used in agriculture.

In summary, different experimental outcomes in field versus laboratory experiments require us to push for more realistic lab setups (modeled perhaps by the Barascu paper and with a 'common' pollen source). It is also important to invest, where possible, in more costly but more realistic experiments in the world of beehives. Finally, we are learning more and more about both the subtle harms of a range of environmental stressors, including pesticides, and potential means for reducing these impacts on bees and other key pollinators. BC

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A Closer LOOK

QUEEN HEALTH

Clarence **Collison**

The reproductive quality and health of a queen are essential to ensure colony growth.

Managed honey bee colonies face multiple health risks including nutritional stress, exposure to pests and pathogens, poor queen quality, and pesticide contamination, which cause problems at the individual and colony levels. The reproductive quality (fertility and fecundity) and health of a queen are essential to ensure colony growth, survival, and productivity.

"Several factors have been identified that may ultimately affect the quality and productivity of the honey bee queen. In colonies, honey bees are normally adept at thermoregulating (Stabentheiner et al. 2010), but queens are vulnerable to heat-shock and cold-shock events during shipping (Pettis et al. 2016; McAfee et al. 2020a), where they are regularly transported long distances via ground or air cargo in poorly thermoregulated environments (Withrow et al. 2019). In a colony, worker bees can try to lessen the effects of overheating by collecting water and fanning to achieve evaporative cooling, or by heat-shielding, using their own bodies as heat-blocking insulation (Stabentheiner et al. 2010; Starks and Gilley 1999). Likewise, they can mitigate chilling by vibrating their wing muscles to generate heat (Stabentheiner et al. 2010). However, in small queen cages used for shipping, there is often limited (if any) water, poor ventilation and too few workers to effectively cool or heat the queen. Temperature loggers have been included in long distance queen shipments and have shown that both hot and cold temperature spikes regularly occur (Pettis et al. 2016; McAfee et al. 2020a) (McAfee et al. 2020b)."

"In an egg-laying queen, the ovaries occupy most of the abdominal cavity (Winston 1987). The weight of ovaries has been investigated as one of the physical criteria to assess the reproductive potential of queens (Kahya et al. 2008; Gregorc and Škerl 2015; Gilley et al. 2003). Ovaries of virgin queens are morphologically different and smaller compared to egg-laying queens (Shehata et al. 1981; Patricio and Cruz-Landim 2002) because well-developed ovaries are required for egg production, the ovaries of egg-laying queens are about eight times larger than those in virgins (Shehata et al. 1981). Ovary development occurs soon after mating and is associated with distinct gene-expression patterns in the brain and ovaries, physiological, and behavioral changes in the queen (Richard et al. 2007; Kocher et al. 2008; Niño et al. 2013). The weight of ovaries in a mature egg-laying queen not only depends on the number of ovarioles but also on the number and developmental stage of eggs in them. During winter, egg-laying activity by queens decreases or stops, which results in the queen having smaller and less-developed ovaries (Shehata et al. 1981). Ovary size and fertility are usually positively correlated (Tarpy et al. 2000). However, under certain circumstances, perhaps due to stress or disease, this relation may not hold (Kahya et al. 2008), (Amiri et al. 2017)."

"Recently, queen failure has been proposed to be a major driver of managed honey bee colony losses yet few data exist concerning effects of environmental stressors on queens. Williams et al. (2015) demonstrated for the first time that exposure to field realistic concentrations of neonicotinoid pesticides during development can severely affect queens. In pesticide-exposed queens, reproductive anatomy (ovaries) and physiology (spermathecal-stored sperm quality and quantity), rather than flight behavior, were compromised and likely corresponded to reduced queen success (alive and producing worker offspring)."

"Many factors can negatively affect honey bee health including the pervasive use of systemic neonicotinoid insecticides. Through direct consumption of contaminated nectar and pollen from treated plants, neonicotinoids can affect foraging, learning and memory in bees. Less well studied are the potential effects of neonicotinoids on queen bees, which may be exposed indirectly through trophallaxis, or food sharing. To assess effects on queen productivity, small colonies of different sizes (1500, 3000 and 7000 bees) were fed imidacloprid (0, 10, 20, 50 and 100 ppb) in syrup for three weeks. Wu-Smart and Spivak (2016) found adverse effects of imidacloprid on queens (egg-laying and locomotor activity), worker bees (foraging and hygienic activities), and colony development (brood production and pollen stores) in all treated colonies. Some effects were less evident as colony size increased,

suggesting that larger colony populations may act as a buffer to pesticide exposure. This study was the first to show adverse effects of imidacloprid on queen bee fecundity and behavior and improved our understanding of how neonicotinoids may impair short-term colony functioning. These data indicate that risk-mitigation efforts should focus on reducing neonicotinoid exposure in the early spring when colonies are smallest and queens are vulnerable to exposure."

"Colony-level neonicotinoid exposure has negative effects on reproductive fitness of honey bee queens. However, it is unclear if the observed effects are a direct outcome of neonicotinoid toxicity or result from suboptimal care of developing queens by exposed workers. Kozii et al. (2021) evaluated larval survival, reproductive fitness and histopathology of honey bee queens exposed to incremental doses (0, 5, 50 ng) of the neonicotinoid thiamethoxam (THI) applied directly to individual late larvae (7 days post-oviposition) of queens. The 5 ng dose represents a calculated high environmental level of exposure for honey bee queen larvae. Morphometric evaluation revealed that the total area of mandibular gland epithelium in queens exposed to 5 and 50 ng THI was reduced by 14% and 25%, respectively. Decreased mandibular gland size may alter pheromone production, which could in part explain previously observed negative effects of THI on the reproductive fitness of queens. They also found that late larval exposure to THI reduced larval and pupal survival and decreased sperm viability in mated queens. These changes may interfere with queen development and reproductive longevity."

"Queen failure is considered a relevant cause of colony losses, yet few data exist concerning the effects of environmental stressors on queens. Brandt et al. (2017) demonstrated that exposure to field-realistic concentrations of neonicotinoid pesticides can severely affect the immunocompetence of honey bee queens. In young queens exposed to thiacloprid (200 µg/l or 2000 µg/l) or clothianidin (10 µg/l or 50 µg/l), the total hemocyte number and the proportion of active, differentiated hemocytes was significantly reduced. Moreover, functional aspects of the immune defense namely the wound healing/melanization response, as well as the antimicrobial activity of the hemolymph were impaired. Their results demonstrate that neonicotinoid insecticides can negatively affect the immunocompetence of queens, possibly leading to an impaired disease resistance capacity."

"Stressful conditions during development can have sub-lethal consequences on organisms aside from mortality. Using previously reported in-hive residues from commercial colonies, Milone and Tarpy (2021) examined how multi-pesticide exposure can influence queen health. They reared queens in beeswax cups with or without a pesticide treatment within colonies exposed to treated or untreated pollen supplement. Following rearing, queens were open-mated and then placed into standard hive equipment in an "artificial swarm" to measure subsequent colony growth. Their treated wax had a pesticide Hazard Quotient comparable to the average in beeswax from commercial colonies, and it had no measurable effects on queen phenotype. Conversely, colonies exposed to pesticide-treated pollen had a reduced capacity for viable queen production, and among surviving queens from these colonies they observed lower sperm viability. They found no difference in queen mating number across treatments. Moreover, they measured lower brood viability in colonies later established by queens reared in treated-pollen colonies. Interestingly, royal jelly from colonies exposed to treated pollen contained negligible pesticide residues, suggesting the indirect social consequences of colony-level pesticide exposure on queen quality. These findings highlight how conditions during developmental can impact queens long into adulthood, and that colony-level pesticide exposure may do so indirectly."

"Pesticides have often been associated with queen loss and premature supersedure. Prior research has investigated the effects of indirect pesticide exposure on queens via workers, as well as direct effects on queens during development. However, as adults, queens are in constant contact with wax as they walk on comb and lay eggs; therefore, direct pesticide contact with adult queens is a relevant but seldom investigated exposure route. McAfee et al. (2021) conducted laboratory and field experiments to investigate the impacts of topical pesticide exposure on adult queens. They tested six pesticides commonly found in wax: coumaphos, tau-fluvalinate, atrazine, 2,4-DMPF, chlorpyriphos, chlorothalonil, and a cocktail of all six, each administered at 1, 4, 8, 16 and 32 times the concentrations typically found in wax. They found no effect of any treatment on queen mass, sperm viability, or fat body protein expression. In a field trial testing queen topical exposure of a pesticide cocktail, they found no impact on egg-laying pattern, queen mass, emergence mass of daughter workers, and no proteins in the spermathecal fluid were differentially expressed. These experiments consistently showed that pesticides commonly found in wax have no direct impact on queen performance, reproduction, or quality metrics at the doses tested. They suggested that previously reported associations between high levels of pesticide residues in wax and queen failure are most likely driven by indirect effects of worker exposure (either through wax or other hive products) on queen care or queen perception."

"Among many environmental stresses, viruses are a major concern to compromise the queen's health and reproductive vigor. Viruses have evolved numerous strategies to infect queens either via vertical transmission from the queens' parents or horizontally through the worker and drones with which she is in contact during development, while mating, and in the reproductive period in the colony. Over 30 viruses have been discovered from honey bees but only few studies exist on the pathogenicity

and direct impact of viruses on the queen's phenotype. Amiri et al. (2020) described a study on sublethal effects of Israeli Acute Paralysis Virus (IAPV) that led to inconclusive results." BC

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APPLICATIONS OF FORMIC ACID do and don't.

How a commercially usable, low dose continuous release dispenser and method was created.

By: Bill Ruzicka, billruzicka@mitegone.com.

Abstract:
Bill Ruzicka immigrated to Canada from the Czech Republic.
When Varroa mites arrived in North America, he contacted the head of Beekeeping Pathology at the Czech Bee Research Institute to get advice around current treatments. After researching what was available, he designed and patented a low dose, continuous release, Formic acid treatment called MiteGone which makes the varroa sick. It is not necessary eliminate 100% of varroa mites from your hives. If you can make them sick and infertile, their population will slowly die. This method will keep your varroa levels and the damage that the varroa mites can do at a threshold that will not negatively impact your hives.

In the 1960s in Europe, formic acid was the only treatment that worked on both the varroa and trachea mites. Europeans had three general treatment methods and a vast body of research regarding when and how to effectively treat hives.

The first method, the prolonged blast or short flash method, could be applied either on top or the bottom of the hive. When applied on the bottom of the hive, 30cc of acid was sprayed on the bottom board. When applied to the top of the hive, acid was added to absorbent pads like butcher meat pads (Mite Wipes) or onto Kramer Plates (MITEAWAY I & II). The principle of this method is to overdose the hives with acid and rely on the bee's ability to ventilate, reducing concentration of fumes to the level which does not kill adult bees, but kills mites. Unfortunately, these methods have many negative side effects including killing emerging brood and old queens. In addition, these methods are weather dependent and labor intensive.

The second method involves brushing a penetrating a solution of 85 % formic acid onto capped brood. This method kills mites inside capped cells but it also kills the brood. The European practice was to brush it onto drone comb only. Quick Strips and Acid Pro are based on this method. If MiteGone pads are placed close to brood, they will work in a similar fashion. As long as you use this method in the early summer your hives should recover from the treatment. As Randy Oliver in his review wrote, "losing brood is a fair exchange for reasonable mite control and hives will recover." Unfortunately, this method is climate dependent. If used in California, hives will likely recover; however, if used at the wrong time of year in a climate with a cold winter and snow, hives will die. For example, if this method is used in August or September in North, you will kill the brood that will become your winter bees. When the summer bees die in October, there will be no bees to maintain the colony through the winter.

The third method is a low dose, continuous release treatment. This type of treatment does not harm the hives, kills only the mites, and is not weather dependent. This method uses the remarkable ability of the bees to maintain brood temperature and humidity inside the hive. If you place MiteGone pads in an environment with a constant temperature and humidity, the pads will evaporate at a steady rate and will properly treat the hives against Varroa and Trachea mites.

When developing the MiteGone treatment for my own commercial operation, I decided that I did not like the side effects of blast and penetrating methods. I liked how gentle the low dose continuous release methods were on the bees, but I could not use any of the existing dispensers in my 500-hive operation
My patentable discovery was that I replaced wick suction principle, of Nasenhider, with principle of capillary tube and gravity; I knew I have to put it away from brood so I measured temperature in strong colony ready to go to pollination between last frame and wall of super. Regardless temperature and humidity outside running from below freezing to 20 C 68 F and humidity from 100 to 20% Inside was steady 24-26 C 75-78 F and 55% humidity. The challenge was how to create any apparatus into 3/8 of an inch, bee space. **USING LOW DOSE CONTINUOUSE RELEASE OF FORMIC ACID BY MITEGONE METHOD AND DISPENSER.** US 6,837,700, B2 Patent.

Fact: Formic acid on its own is not enough to treat your hives for varroa. Depending on the concentration of formic acid, and the dispensing method used, you will get either beneficial or negative side effects from your treatment.

Concentration of Formic Acid - Europeans used 85% concentration of formic acid to treat their hives; however,

Kerry Clark at the Bee Research Center in Dawson Creek Canada studied what concentration of formic acid was most effective at killing mites and least harmful to honey bees. Here is abstract of what He found:
Use 65% solution as it is a mixture of molecules of water and acid. At 72%, the molecules of water and acid evaporate at same rate. With higher concentrations, acid molecules have to evaporate first until the surface concentration reaches 72%. This high rate of acid evaporation causes harmful blasts of acid to the bees. At 65%, the molecules of water must evaporate first until the evaporating surface reaches 72%. This is gentler on the bees and does not cause harmful side effects. 85% 90% 95% acid are a common concentration to purchase. It needs to be diluted when treating honey bees to 65% **STRONGER IS NOT BETTER IN THIS CASE.**

MiteGone® pads are manufactured with millions of connected cells functioning as capillary tubes in the direction of the length of the pad. Both 4" ends are open with the tubes and evaporating surfaces exposed, so no one can put them in wrong. When soaked with acid, a four-gram 5"-pad will automatically absorb 120 grams of acid. Hung vertically, the

capillaries will keep the liquid in the pad without dripping and gravity will pull down the acid to replace acid evaporated at the bottom of the pad. If placed on wall inside of box, in a hive's controlled average conditions of 24C/75F and 55% humidity, a four-inch-wide pad will emit a total of: **6g OF ACID IN CONTINUOUS LOW FLOW PER DAY.**
This method allows for variable dosage to treat colonies of different sizes by using multiple 5" pads or by restricting the evaporation surface of one pad for baby nukes.
Website: www.mitegone.com

Apiary Inspectors of America

Apiary Inspection Tennessee

Mike **Studer**

The Tennessee Department of Agriculture Apiary Program currently has 6 part-time inspectors and one full time State Apiarist. To supplement the high need for inspections, the TN Apiary Program has a Local Area Beekeeper's Association Inspector Program that trains members of beekeeping associations to inspect and certify hives for movement within the state. All bees for sale or movement are required to be inspected and have a health certificate prior to sale or movement within, through, into, or out of the state. Any bees coming into the state are required to have an entry permit. Apiary Registration is mandatory in Tennessee and there are 6,673 registered beekeepers in the state who manage 39,733 hives. Like many other states that require registration, the primary purpose is to control regulated diseases. It is important to know where colonies are so if a regulated disease is found, beekeepers in the area can be informed quickly and all colonies within 8 miles of the disease can be easily located to control any spread of the disease and protect the industry.

The majority of beekeepers in Tennessee are hobbyist beekeepers, however there are several hundred sideliner beekeepers and around 20 commercial beekeepers. Commercial beekeepers are located in central and west Tennessee, whereas sideliner beekeepers and hobbyist beekeepers are located across the state. The primary beekeeping season in Tennessee is March through October. Cucurbits, beans, fruit trees, berries and other vegetables are the major crops in need of honey bee pollination.

The State Apiarist position is primarily regulatory but also includes some educational and consultation responsibilities. The State Apiarist assists the State Apiculturist at the University of Tennessee, and Local Extension Agents with beekeeper educational programs. The State Apiarist also sits on several oversite committees: 1) The Tennessee Agricultural Enhancement Program (TAEP) Committee that oversees Tennessee Department of Agriculture grants to beekeepers and other producers to enhance their business. 2) The Tennessee Department of Environment and Conservation/Tennessee Department of Agriculture State Parks Honey Bee Program which advises and oversees honey bee education programs currently established in 28 State Parks. 3) The Tennessee Department of Environment and Conservation/Tennessee Department of Agriculture/Tennessee Department of Transportation Pollinator Habitat Program which has created pollinator habitat and pollinator education programs in four State Parks. BC

TN Department of Agriculture

Cover Crops – Worth The Water?

Billy **Synk**

This year the entire West and Northern Midwest is experiencing drought, leaving some growers with barely enough water to keep their crops healthy. Beekeepers are also struggling in places like North Dakota, where honey bees are preparing for almond pollination in February and some beekeepers are reporting record low honey crops. When nectar dries up, bees struggle to produce the honey they need to survive Winter.

Blooming cover crops benefit both beekeepers and growers by providing better nutrition for bees, increasing the soil's water-holding capacity by adding organic matter, increasing water infiltration, reducing erosion, and providing natural weed control. Having forage available when bees arrive for pollination can help colonies build up strength after a tough year and ensure good pollination. On an exceptionally dry year, some cover crop plantings may not flourish as well as a year that sees average or above average rainfall. Even if your cover crops are not as robust as you might like them to be this year, the benefits are still valuable and are worth the effort.

What To Expect

Water is precious and promoting cover crops raises some important questions about water use. Seed blends intended to be planted in California's Central Valley should contain species that have low moisture requirements. Sowing seeds in the fall is a great way to take advantage of fall and early Winter rains. If planted early to utilize the seasonal rains, robust, well-growing cover crop stands are possible without the use of irrigation. Early planting also encourages an early bloom which provides nutrition for honey bee colonies pollinating almonds. Planting September 10 through November 10, while soil is still warm (above 55ºF) is an appropriate time to plant any cover crop in California. However, to ensure species like canola, mustard, and radish will bloom before almonds it must be sown and germinated before November 1. While not necessary for an adequate stand, irrigation can be used to ensure a more robust cover crop for some mixes.

Enrollees of Project Apis m's (PAm) Seeds for Bees® program receive seed mixes designed to be successful in harsh conditions like the non-irrigated middles of orchards. If water availability is a concern, select seed mixes that are the most efficient at growing successfully in droughts. The PAm Clover Mix, for example, requires more moisture than the PAm Brassica Mix which can perform well with average seasonal rain, no irrigation needed.

Recent trials conducted by University of California Cooperative Extension researchers Shulamit Shroder and Jessie Kanter give some insight as to what growers can expect from a cover crop that is grown in drought conditions. During the 2020/2021 season, a variety of cover crop mixes were evaluated at the Shafter (Kern County) research station. Most of the irrigated seed mixes were more successful than the non-irrigated ones by providing about twice as much biomass, with the brassica mix being the exception as seen in Table 1 (Shroder, Shulamit and Kanter, Jessie 2021). However, they conclude "all of the non-irrigated plots contributed some amount of biomass. This means that even if you cannot irrigate your cover crops, you can still reap some soil health benefits."

How Cover Crops Can Increase Water Use Efficiency

Growers who participate in Seeds for Bees receive technical advice specific to them, and our team will help you determine what mixes are most appropriate for your operation and water use goals. There is evidence to suggest that planting cover crops increases water use efficiency and water availability. Cover crops add organic matter to the soil. Organic matter is excellent at holding water; it works like a sponge that traps and retains water.

- Organic matter holds 18-20 times its weight in water (USDA NRCS 2013). One can expect the PAm Seed Mixes to provide about 3.5 tons of organic matter per acre.
- There are 1,000,000 tons of soil in six-inch deep acre plot, so growing a cover crop to about waist high will provide 0.03%-0.05% of organic matter every year. Just 1% organic matter in the top six inches holds up to 27,000 gallons of water! (USDA NRCS 2013).

Organic matter helps water stay where it's needed most, around the root systems of crops. But cover crops

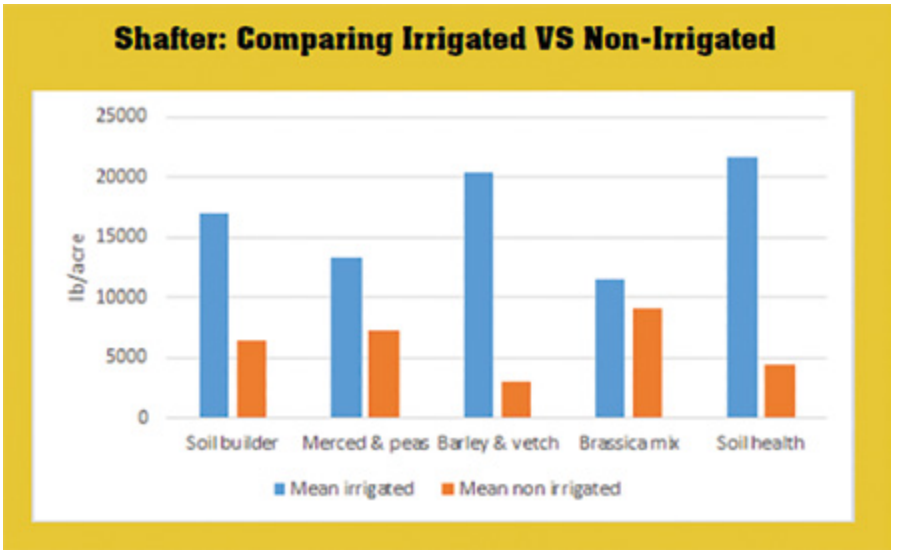

Table 1. Comparing irrigated vs. Non-Irrigated biomass collected in Shafter on March 17, 2021. (Shroder and Kanter 2021)

also use water, so let's take a closer look at how much water cover crops use in an orchard system.

How Much Water Do Cover Crops Use?

Cover crops grown in the fall and Winter months will need less water due to shorter days and cooler temperatures. More research needs to be done to determine how much water cover crops use from October to March. Typically, this is the time of the year when Seeds for Bees cover crops are growing. However, there is still something to be learned from a 1989 cover crop study that took place in an almond orchard from April to August. The results were published in California Agriculture in an article titled, "Orchard water use and soil characteristics," by Prichard, et al. The results are shown in Table 2 (below). Resident vegetation (weeds), clover, bromegrass, and herbicide (bare ground) were the four treatments that were compared in two orchards: a newly planted one (Orchard A) and a mature one with 70% soil shading (Orchard B). The herbicide (bare ground) treatment used the least amount of water. Bromegrass used from 4% less to 18% more water than bare ground. Clover used more than bromegrass, 14% to 29% more than bare ground, and the most water was used by weedy resident vegetation, from 17% to 36% more than bare ground. A clover cover crop used less water than resident weeds! If something is growing on the orchard floor, it might as well be a cover crop. It will use less water than the weeds while increasing the soil's water-holding capacity.

The 2021-2022 Seeds for Bees open enrollment period is happening now. Interested growers are encouraged to apply at **ProjectApism.org/Seeds-For-Bees**. We are currently accepting applications through November 15th, or until we run out of seed. California growers of all types can apply and first year applicants are awarded up to $2,000 of free seed. Don't forget – early planting is key to getting the most benefit as possible from your cover crop stand. Sign up today!

Feel free to contact me, Billy Synk, at **Billy@ProjectApism.org** for any questions regarding the Seeds for Bees program, cover crops, habitat, or bees/pollination. BC

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Prichard L., Terry (1989) *Orchard water sue and soil characteristics. California Agriculture.* July-August: 23-25

Treatment	Seasonal water use* Seasonal (inches)	Per-cent	Seasonal (inches)	Per-cent
	1984		1986	
ORCHARD A	4/7 - 8/18		4/29 - 7/29	
Resident vegetation	18.6 a	136	24.9 b	124
Clover	17.6 ab	129	25.9 a	129
Bromegrass	16.1 b	118	21.7 c	108
Residual herbicide	13.7 c	100	20.1 d	100
	1985		1986	
ORCHARD B	4/10 - 10/3		4/22 - 8/22	
Resident vegetation	40.8 a	123	31.9 a	117
Clover	41.0 a	123	30.8 a	114
Bromegrass	32.1 b	96	26.8 b	99
Residual herbicide	33.2 b	100	27.1 b	100
Chemical mow	33.9 b	102	27.0 b	99

NOTE: Percentage comparisons are relative to residual herbicide.
* Values within a column followed by the same letter are not significantly different at P<0.05 level using Duncan's multiple range mean separation technique.

Table 2. Seasonal water use in treatments at orchards A and B (Prichard 1989)

Epipen

The EpiPen pricing scandal: A symptom of the legalized corruption embedded within the only profit oriented health care system that still exists in any developed nation on Earth.

An adrenaline auto-injector, or epinephrine auto-injector (brand name: EpiPen) is a patent-protected medical device used to inject a measured dose of adrenaline. It is often used to prevent anaphylaxis, a severe allergic reaction that can lead to death. As the body shuts down during an episode of anaphylactic shock, the adrenaline revives the patient so they have time to get to a hospital and seek medical help.

For beekeepers that are hyper-allergic to honey bee venom, the EpiPen allows them to practice the craft of beekeeping without fear of dying from an errant sting. Some beekeepers who had never historically been hyper-allergic to bee venom, have reported becoming so after they started taking medication such as beta blockers used to control heart disease that also changed the patient's body chemistry and made them more sensitive to bee venom. Thankfully, venom hyper-sensitivity is rare and the majority of beekeepers are not deathly allergic to venom. The majority of beekeepers who keep an epinephrine auto-injector around, do so in case someone else has a severe reaction to a sting from one of their bees. As a result, beekeepers were among those who first took notice when the cost of purchasing an auto-injector, which had cost less than $100 in 2007, jumped up to over $600 by 2016.

New information on how this price increase was engineered by pharmaceutical companies has recently come to light thanks to the release of documents as part of an ongoing antitrust lawsuit in federal court. The contents of the documents reported on by journalist, Ryan Grim of the independent news outlet *The Intercept*, sheds insight on how through collusion and price-fixing EpiPen prices became artificially high.

The company Mylan owned the rights to distribute the EpiPen, the best selling auto-injector in America. As documents reveal, the former president and CEO of Mylan, Heather Bresch, approved a scheme to work with the former CEO of Pfizer, Ian Read, to force customers ensnared within the company's monopoly, to have to buy two EpiPens at once, regardless of medical need. At the time, the pharmaceutical giant Pfizer made and distributed a generic auto-injector, Adrenaclick, which at about five percent of the market was the best selling generic epinephrine auto-injector on the market.

Back in 2010, the EpiPen dominated the auto-injector market with almost 95 percent of U.S. sales. As *The Intercept* reports, the drug company Merck owned the right to market the Epipen. In 2007, Mylan acquired the rights in a deal with Merck that allowed Mylan to own the brand name and distribute the product while manufacturing part of the delivery system, but not the medication itself. The epinephrine in the EpiPen was manufactured by King Pharmaceuticals exclusively for Mylan. According to *The Intercept* story, "King in 2010 announced it would be purchased by Pfizer, which was licensed to sell Adrenaclick, an EpiPen competitor, the previous year. The deal between Pfizer and Mylan led the former to withdraw its generic competitor from the market and partner with Maylan on the EpiPen, locking down a monopoly. Following the deal with Pfizer, Mylan drove the price above $600 within five years." At the time that Adrenaclick was removed from the market it was pulling 10 percent of U.S. auto-injector sales.

When King was acquired by Pfizer, market analysts reported that Mylan was worried that the rapidly growing market share of Pfizer's generic Adrenaclick could cut the EpiPen out of the market if the company continued to push ahead with it. Emails between the two CEOs refer to a deal in which Pfizer agreed to stop making Adrenaclick. By withdrawing the main competitor of the Epipen, Pfizer helped to create a monopoly situation that allowed Mylan to continue raising prices on the EpiPen while both firms split the profits from the overpriced version. Working with Mylan allowed Pfizer to make more money than it would have if it had driven prices down by continuing to produce and market a less expensive generic version.

Once the monopoly was in place, yearly price increases started ratcheting up the cost of the Epipen to consumers. Mylan then required customers to purchase two pens at

People who purchased Epipens between August 24, 2011 and November 1, 2020 may be eligible to receive payment from the Pfizer settlement as reimbursement for being overcharged. Proof of claim must be postmarked on or before November 12, 2021."

a time. According to the documents, company executives had no medical justification for the change, but sought to generate one after the fact. Company market research concluded that since it was a matter of life and death, customers would pony up and buy two pens at a time if they were not given any other choice.

Pfizer settled a class-action suit for price fixing and is paying $345 million while denying any wrongdoing. A second federal suit against Mylan, which also denies any wrongdoing, is ongoing. For more information or to file a claim, go to **EpiPenClassAction.com** or call 877-221-7632. Meanwhile to lessen the impact of high EpiPen prices, Pfizer is offering pharmacy and on-line coupons and manufacturer discounts, and has even released its own generic autoinjector to help ward off competition from other potential generic versions of the drug. The Pfizer/Mylan generic pen is half the price of the EpiPen which sounds great until you realize how overpriced the EpiPen is now. Thankfully since the release of Mylan's authorized generic for EpiPen, much more affordable generic epinephrine auto-injectors have become available and are being marketed under the brand names Symjepi and Auvi-Q.

According to Grim, the former President and CEO of Mylan, Heather Bresch is the daughter of Senator Joe Manchin, D-W.Va. During EpiPen's dramatic price increases, Gayle Manchin, wife of Senator Manchin and Bresch's mother, "lobbied states to require schools to stock epinephrine as the head of the National Association of State Boards of Education." Bresch retired from Mylan last year with a 37.6 million dollar golden parachute.

Even if you're not from West Virginia, Manchin's name may sound familiar since it has been in the news recently. As Grim reports in *The Intercept* piece: "Manchin last week urged Democrats to take a 'strategic pause' in consideration of the party's $3.5 trillion reconciliation package, the centerpiece of the Biden agenda. A key component of the bill would lower drug prices by allowing Medicare to negotiate directly with pharmaceutical companies. That market power would save the government and patients billions over the next decade, but perhaps even more importantly, it would give the government greater insight into how pharmaceutical executives set prices. The change could reveal the type of collusion that keeps those rates high, exposing companies to risk of regulation or prosecution." A cynic would suggest that the threat of increased regulation or prosecution of pharmaceutical companies and their mega-donor political support is the real reason that Senator Manchin is stalling on the Democrats reconciliation package. BC

Ross Conrad is author of Natural Beekeeping *and* The Land of Milk and Honey: A History of Beekeeping in VT.

The World's Best Pollinator Plot

Stephen **Bishop**

Well, I've done it. I've made a contribution to beekeeping science. I would like to thank everybody who has ever doubted my scientific and observational prowess, particularly my wife who is fond of calling me the world's most unobservant person, for providing me the motivation to strive onward against all odds to reach scientific greatness. Mind you, I didn't really make my discovery on purpose – I just kind of stumbled onto it--but isn't that how most great scientific discoveries are made? I mean, Newton was just lazing about underneath a tree when an apple hit him on the noggin – and then, poof, theory of gravity. And, let's face it, Fleming was kind of a slob who let mold grow on stuff – and then, poof, discovery of penicillin. And, thus, it happened to me. I discovered the world's greatest pollinator plot completely by accident.

In fact, I was earnestly trying to avoid any discovery because the longer I live, the more anti-discovery I become. Discoveries are synonymous with bad and usually a downward trajectory in my bank account (for example, see the discovery of the leak in my roof).

Anyway, one day I was driving down the road, eyes straight ahead, diligently trying not to discover anything when I noticed something shadowy in my periphery. "Good gosh," I thought, "what now?" I tried to resist, but my willpower failed me once again: I turned my head to look. "Holy smokes," I said, "my whole field is black." If only I hadn't looked, my crop would still be green and vigorously growing like it had been days earlier.

(Disclaimer: most of what I write should be taken with a big block of red mineral salt, but you can absolutely trust the following bit of farming advice: if your crop suddenly turns black, something is wrong, bad wrong.)

I had planted a few acres of "milo," which is what southerners call grain sorghum. Now milo is not something you would generally associate with an outstanding pollinator plant. Milo is in the grass family, so it doesn't really target insect pollinators. But it does produce seed heads which can be harvested for animal feed. My plan was to harvest the milo with an old combine and run it through an even older hammer mill with oats and barley to create a complete and fulfilling ration for my pigs. Then someday in the future, I would sell sustainably-raised and overpriced pork to rich people in the city. That was the plan.

At least, that was the plan until I realized my crop was in the throes of death and I had yet again failed as a farmer. The problem was the sugarcane aphid. A few years prior, the aphid had expanded its palate from cane sorghum to grain sorghum and had become a major pest of milo in the south. As evidenced by my field, the aphid had now reached the foothills of North Carolina. The black color was from mold on the honeydew. Also feasting on the honeydew was a bazillion insects. I've never seen anything like it, and I've planted lots of pollinator/food plots over the years. Buckwheat, crimson clover, sunflowers, high-dollar wildflower mixes – nothing compared to what I saw in that ruined milo field. It was like the whole insect kingdom had descended to slurp up honeydew. Truly, I wish I had the entomological identification skills to describe what I saw. But, being the son of a Baptist preacher, all I can say is it was a giant congregation of six-legged species feasting like Baptists on homecoming Sunday.

Admittedly, it was a one-off, or what scientists would classify as an anecdotal observation. Strangely, I've never felt the need to replicate my farming failure, but if anyone else would like to try it, I will briefly summarize my scientific procedure for others to test.

Step 1: Plant milo in the southern United States.
Step 2: Spend a lot of money on fertilizer. Fertilize milo.
Step 3: Watch field grow green and healthy.
Step 4: Ride by field one day and notice field is suddenly black.
Step 5: Weep, cuss, and bemoan your luck. Second guess life choices.
Step 6: Inspect field and notice a bazillion insects feasting on honeydew.

That's it. It should be a pretty simple experiment to replicate, but if you need more specifics, feel free to contact me and I can tell you which particular cuss words to utter and in what particular order to utter them. BC

Stephen Bishop lives in Shelby, NC. You can follow more of his farming failures at ***misfitfarmer.com***

Bee Culture
The Magazine Of American Beekeeping

Christmas Booklist 2021

FIRST TIME BEEKEEPING

Kim Flottum SKU: X230 **$20.00**

This absolute beginner's guide for first-time beekeepers will teach you how to set up and care for your first colonies, from choosing a location for your new bee colonies through natural bee care and harvesting beehive products.

WORK I KNEW I MUST

Tammy Horn Potter SKU: X228 **$20.00**

Jane Cole's "Reminiscence of Forty-One Years of Factory Life" and selections from A.I. Root's "An Eyewitness Account of Early American Beekeeping."

QUEENSPOTTING

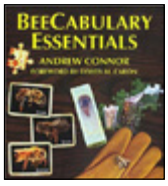
Hilary Kearney SKU: X226 **$21.95**

At the heart of every bee hive is a queen bee. In *QueenSpotting*, experienced beekeeper and professional "swarm catcher" Hilary Kearney challenges readers to "spot the queen" with 48 fold-out visual puzzles — vivid up-close photos of the queen hidden among her many subjects.

NATURAL BEEKEEPING

Ross Conrad SKU: X220 **$35.00**

Whether you are a novice looking to get started with bees, an experienced apiculturist looking for ideas to develop an integrated pest-management approach, or someone who wants to sell honey at a premium price, this is the book you've been waiting for.



BEECABULARY ESSENTIALS

Andrew Connor SKU: X225 **$36.00**

If you are curious or confused about honey bees or starting a bee hive, this book has all the special terminology about bees and beekeeping. Here is the answer to your need for short and concise definitions of the vocabulary of beekeeping.

BEEKEEPER'S LAB

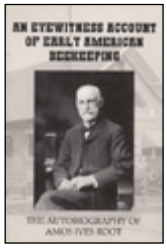
Kim Lehman SKU: X222 **$25.00**

Beekeeping's popularity as a hobby continues to skyrocket. *Beekeeper's Lab* gives you 52 bee-inspired labs to do all year long, and are accessible enough to share with the family.

IN BUSINESS WITH BEES

Kim Flottum SKU: X223 **$26.00**

This book takes serious beekeepers past the beginning stages and learning curves and offers practical, useful advice to move your passion into a part-time or full-time career with measurable results. This **beekeeping business how-to guide** offers all of the in-depth advice you need, in one place.



AN EYEWITNESS ACCOUNT OF EARLY AMERICAN BEEKEEPING: THE AUTOBIOGRAPHY OF A.I. ROOT

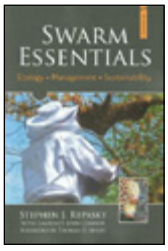
SKU: X1 **$10.00**

Explore the birth of Modern Beekeeping from the perspective of Amos Ives Root. Beekeeping, Beekeepers, and a Profound Religious Conviction are all engaged. The first of many things we still do today!

A CLOSER LOOK - BASIC HONEY BEE BIOLOGY

Clarance H. Collison SKU: X219 **$10.00**

Collison has collected much relevant biology in one place, updating our knowledge of what makes bees so interesting and distinctive organisms. Suitable for master beekeeper programs, college-level courses and general knowledge beekeeping.



SWARM ESSENTIALS

Stephen J. Repasky SKU: X213 **$25.00**

Swarming is perhaps the most powerful instinct beekeepers encounter while working with bees. Swarm Essentials outlines the ramifications of swarming behavior, the benefits of swarming, proven swarm management techniques, and how to recover and even prosper from a swarming event.

BEE-SENTIALS - A FIELD GUIDE

Lawrence John Connor SKU: X210 **$15.00**

A basic beekeeping book you have been looking for with some 'meat on it's bones' for continued study by any beekeeper. This a book focused on compassionate animal husbandry. There is a strong 'natural' focus for beekeepers who want to avoid or minimize pesticides and reduce stress on the bees.

GREAT MASTERS OF BEEKEEPING

Ron Brown SKU: X204 **$36.00**

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.

GOOD GARDEN BUGS

Mary M. Gardiner, Ph.D. SKU: X199 **$25.00**

Good Garden Bugs is an easy-to-follow reference to beneficial insects that provide pest control, allowing your garden to grow full and bountiful.

BEESWAX ALCHEMY

Petra Ahnert SKU: X197 **$25.00**

Beeswax Alchemy is your first step towards using excess beeswax to make beautiful, useful gifts for friends, family, and even yourself. It offers a basic introduction to the art of extracting and purifying beeswax, as well as countless ideas for what to make with it.

THE BEEKEEPER'S PROBLEM SOLVER

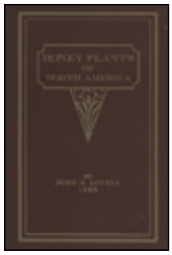
James E. Tew SKU: X198 **$20.00**

Getting the basics right is essential, and this demands a solid appreciation of important areas such as hive management, breed choice, and health requirements.

ABC AND XYZ OF BEE CULTURE

SKU: X5-42 **$64.95**

42nd Edition of ABC & XYZ of Bee Culture Since 1877 Leading the Way to Successful Beekeeping. Over 800 pages packed with information. Hundreds of color photos and illustrations . A mix of reference, the how and why things are done and a history of how beekeeping got where it is today! A MUST for every beekeeper.



1926 HONEY PLANTS OF NORTH AMERICA

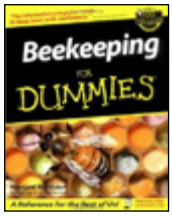
John H. Lovell SKU: X74P **$10.00**

A reprint of the original Honey Plants book, published by A.I. Root. nearly 1,000 plants, 408 pages, paperback. Measure 6" x 9". Black and white.

THE BACKYARD BEEKEEPER

Kim Flottum SKU: X141 **$25.00**

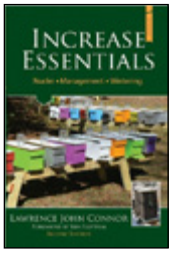
The Backyard Beekeeper, now in its 4th edition, makes the time-honored and complex tradition of beekeeping an enjoyable and accessible backyard pastime that will appeal to urban and rural beekeepers of all skill levels.



BEEKEEPING FOR DUMMIES

Howland Blackiston SKU: X98 **$25.00**

In this easy-to-follow guide, Howland Blackiston, one of the nation's most respected authorities on the subject, takes the mystery (and the sting) out of beekeeping.



INCREASE ESSENTIALS

Lawrence John Connor SKU: X163 **$25.00**

This book explains why and how beekeepers can use increase nuclei to solve problems in the beeyard and use them to winter colonies and provide a reliable source of fresh bees, locally acclimatized queens, replacement hives and colonies for operational growth or sale.

THE NEW STARTING RIGHT WITH BEES

Kim Flottum & Kathy Summers **$9.99**

This book's primary intent is a learning tool for beginning beekeepers, but it is an exceptional source of information for anyone interested in the fascinating world of honey bees. SKU: X219

WHAT DO YOU KNOW?

Clarance H. Collison SKU: X2 **$20.00**

A comprehensive study guide for every beekeeper, at any level. Test yourself to see what you already know, and what you need to know. Everything you've ever wanted to know about Honey Bees, Beekeeping, Beekeepers and the world they inhabit.

BEE SEX ESSENTIALS

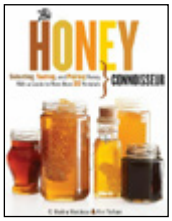
Lawrence John Connor SKU: X165 **$20.00**

This is another book in the Essential Series by Larry Connor regarding the management of honey bee production. It covers drones, queens, the mating process, colony genetics & more.

QUEEN REARING ESSENTIALS

Lawrence John Connor SKU: X177 **$22.00**

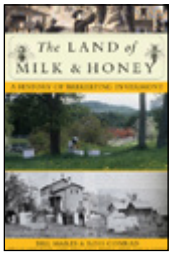
In this post-Varroa, post-Colony Collapse Syndrome era, beekeepers everywhere are developing localized, mite-resistant bee stocks. Key to this is their ability to raise queen cells and queens.



THE HONEY CONNOISSEUR

C. Marina Marchese & Kim Flottum

The Honey Connoisseur teaches consumers everything they need to know about how to taste, select, and use a diverse selection of honeys. The authors introduce the concept of terroir and the notion that soil, weather, and other natural phenomena can affect the taste of honey. **$30.00** SKU: X181



THE LAND OF MILK & HONEY

Bill Mares & Ross Conrad **$30.00**

This book is a must read for anyone interested in how bees and beekeeping got to where they are today in Vermont and the US. The Land of Milk and Honey provides a powerful testament of the state's oversized leadership to protect our nation's pollinators and challenges other states to write their own beekeeping histories. SKU: X229

Minding Your Bees And Cues

Propolis 10 Ways

Becky **Masterman &** Bridget **Mendel**

What is propolis? *Etymologically,* propolis derives from the Greek for "before the city" (pro=before, polis= city or community). *Entomologically,* propolis is derived by bees (honey bees and stingless bees) from plant resins, mixed with beeswax and enzymes (and possibly other things) and cemented around the bees' nest cavity.

Propolis has seemingly endless beneficial properties for humans and bees. A plebian might call it a magic potion and leave it at that. But for scientists, propolis is uniquely challenging to study. While propolis is antifungal, antiviral, antibacterial, antiinflammatory, antioxidant and even anticancer, it is also antistandardized. Okay we made the last word up (**Lizzo** says we can). But what we are getting at is that propolis has different properties and actions depending on the source of the plant resin. Components of propolis have numbered over 300 and standardizing propolis based on plant source would be needed to support repeatable results when harnessing the power of this natural, but complex substance (Sforcin 2016).

And propolis means different things to different beings:

If you are a honey bee...

Propolis is the substance you collect from the leaf buds of trees, plastering it into the cracks and crevices of your nest cavity. You use propolis as a form of social healthcare; this antimicrobial substance helps you and your sisters to stay healthy collectively. With propolis around the home, your immune system can rest up, ready to kick into high gear if needed (Simone *et al.* 2009, Borba *et al.* 2015).

If you are a stingless bee

If you are a stingless bee, you have many uses for plant resins in the hive. Stingless bee management, or meliponiculture, is practiced for the production of honey and hive resin products, including propolis, as well as pollination (Cortopassi-Laurino *et al.* 2006). A recent review by Shanahan and Spivak (2021) provides insight into the complexity of resin use in this diverse and populous (over 500 described species!) group.

If you are a beekeeper...

If you are a beekeeper, propolis is why you keep a little old crowbar in your back pocket. Propolis is like cement, it stains your clothes forever, gets under your fingernails, and turns your palms orange-green-yellow. Some beekeepers have allergies to certain types of propolis. Ah, the things we tolerate for the sake of our bees.

If you are a cottonwood tree...

If you are a cottonwood tree, or a poplar tree for that matter, *propolis* is just a pretentious word for *resin.* It's like how a very thin piece of ham is called *prosciutto* just because it is *cured and expertly sliced??* It's unclear if honey bees cure or otherwise tamper with the medicinal resins they collect from the leaf buds of trees, but essentially it is the same substance, give or take some enzymes. If you are a tree, you produce resin to protect yourself from insects and pathogens.

When this hive was pried open, it revealed a thick layer of propolis between the boxes. Photo credit: Judy Griesedieck

A drug developer or medicine maker...

If you are in the business of medicine making, you are acquainted with the numerous biological activities of propolis reported by researchers. Herbalists have been using propolis for wound dressing and oral health since **King Nyuserre reigned Egypt** (Hammad 2018). More clinical work needs to be done in order to understand and further harness the potential of propolis for human health (Silva-Carvalho *et al.* 2015).

If you are a food scientist...

If you study food as well as eat it, you might be intrigued by the potential of a propolis extract as a food preservative. The antiviral properties of propolis have been investigated with positive results in both fruit and vegetable juices (Nigbo *et al.* 2021).

If you are a violin maker...

If you are a maker of violins, you're all about the resin-derived products. Stringed instrumentalists rub pine resin (they call it *rosin)* onto their bow hair, to create friction across the strings when they play (bees do not collect pine resin). You also may use bee propolis in the varnish for your instruments. Furthermore, you may actually be the guy who ended up in a scientific paper describing your propolis allergy in detail (Lieberman *et al.* 2002).

If you are an ancient Egyptian undertaker....

If you are an undertaker in ancient Egypt, you use propolis all the time to embalm mummies. Your brother, a local doctor, uses propolis for the living; for treating wounds, gashes, and toothaches.

If you are a dentist...

Dentists should totally read this recent study that shows promise that propolis, used in a mouthwash, could help reduce gingivitis (inflammation and bleeding in gums) (Kiani *et al.* 2021). Propolis has been long used in toothpastes, lozenges, creams and mouthwash, but research is ongoing to understand the benefits and mechanisms of its oral health support (Khurshid *et al.* 2017).

If you are still reading this article...

You are now a proponent of propolis. Pro-propolis. A proprolite. A proprolitizer. Scientists are still catching up on what the bees have always known, namely that tree resins are definitely worth collecting. We're excited to continue following the scientists dedicated to unlocking the mysteries of this stickiness, further describing how it can be used in and out of the hive. BC

Solitary bee nest made of propolis. Photo credit: Judy Griesedieck

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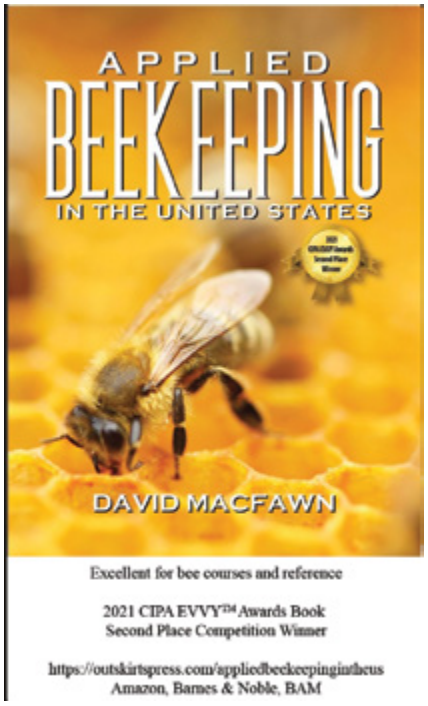
Authors

Becky Masterman led the UMN Bee Squad from 2013-2019 and currently alternates between acting as an advisor and worker bee for the program. Bridget Mendel joined the Bee Squad in 2013 and has led the program since 2020. Photos of Becky (left) and Bridget (right) looking for their respective hives.



Clubs . . . Big and Small

John **Miller**

This is for the Clubs, large and small, thriving and struggling.

Change is Constant, right? We've covered that.

Half of what we need to know to manage our bee clubs in five years – hasn't been invented yet.

What once worked; [truck-stop stops to find truckers to haul our bees] does not.

One nagging constant is How Do We Fund Our Clubs? Dues go a long way, and the raffles are a lot of fun, Zoom has relieved the expense and time [anyone going to the airport Monday morning?] of in-person talks from folks we really like hearing from.

Covid has been needlessly botched – can you imagine – if you are of a certain age – a national response to polio vaccine as this ongoing covid kerfuffle? Just get the vaccine. It works.

Save the hospitals for sick people. Stop hogging up all the hospitals because you're proudly defiant. [I'm speaking to two of my own children here.]

We've grown accustomed to in person club meeting presentations. That's changed.

What hasn't changed is financing our clubs. Clubs are often well-run operations, several come to mind. In the past five years, the number of bee clubs has increased. Five years from now?

No one knows. The big trend is home production. Gardens, Orchards, Livestock, Beekeeping: All worthy husbandry.

Lots of new beekeepers. An emerging service is providing hive-management services. I'm not speaking of in-hive techy gizmos placed in hives – I'm speaking of an in person visit from a hired professional – who may have taken and passed Master Beekeeping Program.

What has not changed is how do we keep our clubs financially strong, and in some cases, active in bee research funding. Some states, notably CA, ND, MN, ID, & WY come to mind, make significant donations to bee research.

Many of the larger groups are IRS recognized non-profits.

Clubs: Non-profit status under IRS regulations is not as daunting a task as believed.

It does take a time investment, it costs a few bucks. No lawyer necessary. A bit of patience.

The task my not be accomplished in a single year – but is possible in less than a lifetime – if you're less than 50 years old.

Rule #1: When embarking on this task: Keep a copy of all correspondence. E V E R Y T H I N G.

Rule #2: Do go to IRS.gov and ['ll save you Orland guys a lot of searching] go to IRS 1023-EZ: **https://www.irs.gov/forms-pubs/about-form-1023-ez**

Rule #3: Do open a bank account with two signature internal controls. Always.

Preparation: A Board of Directors. Pick four fellow Clubbers who will actually respond when you email an ask. Declare yourself as the OBBI Director for ease of correspondence.

Articles of Incorporation [AOI]: Out on the web are lots of examples of boiler plate non-profit AoC language.

1. Name the Corporation: Orland Bee Boosters, Inc. [OBBI].
2. Select an Address: Usually a Street Address.
3. State your purpose: 'exclusively for charitable purposes' is a nice phrase I stole.
4. State that the organization is exclusively for charitable purposes under the provisions selected, say 501c(3).
5. Names and addresses of your fellow Board of Directors [BOD]. State again who shall act as the Registered Agent and Director for the Club.
6. The functions: No earnings distributed to BOD. No propaganda, no legislation influence. No politics. Shall not carry on illegal activities [which will be a lift for Orland guys....] Shall not engage in activities not in furtherance of the Corporation. Similar language helps.
7. Exit strategy: All things Pass. State where assets will be distributed upon dissolution, and if no appropriate entity exists – say the Brad Pankratz Vacation Fund – funds shall be disposed by a Court of Competent Jurisdiction in Glenn County, CA.

In the State the Club is located, register with the Secretary of State Business Registration Unit. These entities have different names – and are usually easy to navigate. $25 fee is common.

I have learned it's a good thing to have several sets of original signatures with the AOI.

Close your AOI restating the mailing address for the Orland Bee Boosters Inc.

In time, you'll hear back from the Secretary of State with a Filing Acknowledgment and scroll happy Certificate of Incorporation, and a Secretary of State ID# 00054598411.

Wait a minute: Can you explain, Johnny, WHY go for this non-profit status mumbo jumbo?

We're a Bee Club, enjoying the art of beekeeping – we do not want to change the world.

With a 501 c (3) status, clubs can accept donations from individuals and corporations, issue acknowledgement of the donation for the benefit of charitable donation from the individual or corporations. If I write a check

to the Park Board and it is properly organized, I get an acknowledgement I can submit with my tax return as a deduction. With a 1023-EZ non-profit status, the OBBI can file a tax return on a post card. With the 1023-EZ status, club donations may not exceed $50,000 annually. Few clubs are afflicted with those kinds of donations.

The IRS 1023-EZ application can be done on-line. Instructions are provided on line. Application, Approval, and Appeal Procedures are thorough. **https://www.irs.gov/pub/irs-pdf/i1023ez.pdf & https://www.irs.gov/publications/p557#idm139736028222240**

A portal I used when filing and paying for the EIN# pay.gov worked great. My $275.00 fee processed in one day. Funny how they are really, exceptionally gifted at gathering money.

In one day I had my new EIN#.

The Streamlined Application **https://www.irs.gov/pub/irs-pdf/f1023.pdf** is filed electronically, only.

Eventually, you'll receive a letter with "Assigned Employer Identification Number".

It comes from Cincinnati.

Later, a Letter 1312 will arrive with an Information Request, First Request.

In this letter you'll have a chance to better explain the application. Here is the essence of this month's piece:

Via the USPS your letter will include:

A Human Point of Contact: A Name! A Post Office Box! A Room # in Cincinnati. And a Group #.

And! Get Ready, my Point of Contact is, A. Krickl in Cincinnati, a person – actually called me – CALLED ME!

To Ask How My Response to the Information Request Was Going? Whaaaat?

A human IRS employee called to ask if he could help!

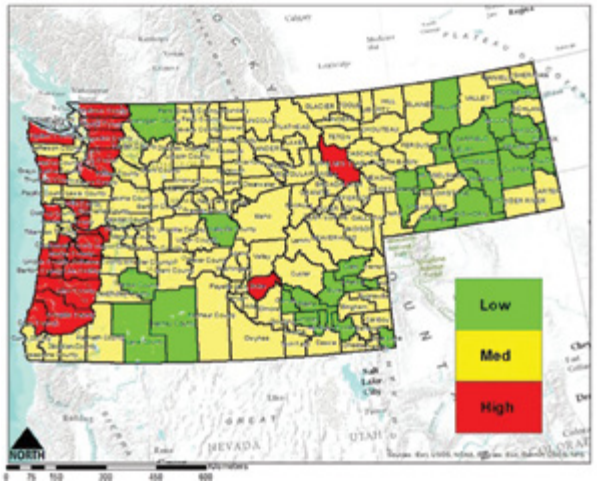
I sent the First Response for Additional Information back to my new friend A. Krickl in Cincinnati and look forward to an approved 501 c (3) application before the end of the year.

I'll let you know how this one goes. BC

John Miller is a retired beekeeper and honey packer. He can be contacted at: **jrmgkia@daktel.com**

Risk Of AGH In Far West US

Erik **Norderud &** Robert **Peterson PhD**



Summary

The recent introduction of the Asian giant hornet, *Vespa mandarinia* Smith, in the United States in late 2019 has raised concerns about its establishment in the Pacific Northwest and its potential negative effects on honey bees, *Apis* spp., and their pollination services in the region. Therefore, we conducted a risk assessment of the establishment of *V. mandarinia* in Washington, Oregon, Montana, and Idaho on a county-by-county basis. Our risk assessment relied on the biological requirements and ecological relationships of *V. mandarinia* in the environments of the Pacific Northwest. Our risk characterization was based on climate and habitat suitability estimates for *V. mandarinia* queens to overwinter and colonize nests, density and distribution of apiaries, and locations of major human-mediated introduction pathways that may increase establishment of the hornet in the counties. Our results suggest that 32 counties in the region could be at low risk, 120 at medium risk, and 23 at high risk of establishment. Many of the western counties in the region were estimated to be at the highest risk of establishment mainly because of their suitable climate for queens to overwinter, dense forest biomass for nest colonization, and proximity to major port and freight hubs in the region. By design, our risk assessment most likely overestimates the risk of establishment, but considering its negative effects, these counties should be prioritized in ongoing monitoring and eradication efforts of *V. mandarinia*.

What is risk assessment?

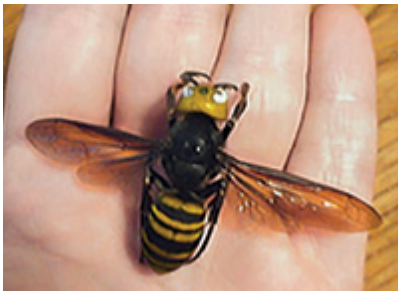
Risk assessments are a formalized process that are undertaken to objectively evaluate risk and frame the potential impacts of a particular stressor or hazard, with the ultimate goal of conferring the degree of risk that a stress or hazard imposes on health and human safety, economic sectors and industry, or ecosystems. The risk assessment process varies, but typically follows three steps. The first step is the initial problem formulation, which sets the scope, steps, and methods of the risk assessment by defining the stressor and its effects. The second step is the analysis phase, which seeks to gather and apply relevant data and information in order to ultimately aid in outlining the 'effects' and 'exposure' characterizing a particular stressor and its impacts. The final phase of a risk assessment is the risk characterization, or more simply put, the product of effect and exposure used to characterize risk of the stressor on its environment.

Problem Formulation

Invasive species risk assessments follow the same step-based framework of any other risk assessment, and focus on the negative effects that the invasive species in question tenders on its environments and ecosystems it inhabits. In the case of our risk assessment, these were the risks that the establishment of the Asian giant hornet presents to the ecosystems of the Pacific Northwest United States. Below we describe, analyze, and characterize those risks of establishment of the Asian giant hornet in the Pacific Northwest.

Stressor Description

The Asian giant hornet (*Vespa mandarinia*) is the largest known species of the hornet in the world, clocking in at approximately two inches in length. As its name would suggest, the insect is native to Asia and is found throughout China, Japan, South Korea, and even parts of Russia. The Asian giant hornet primarily feeds on various insects as a protein source such as beetles, spiders, and social wasps, but also utilizes sap sources from soft fruits. However, the Asian giant hornet is probably most well known for being an expert predator of honey bees in which mass attack by the hornets can result in the decimation of entire colonies of honey bees. This behavior has caused issues worldwide and is a direct threat to the critical pollination services that honey bees provide.

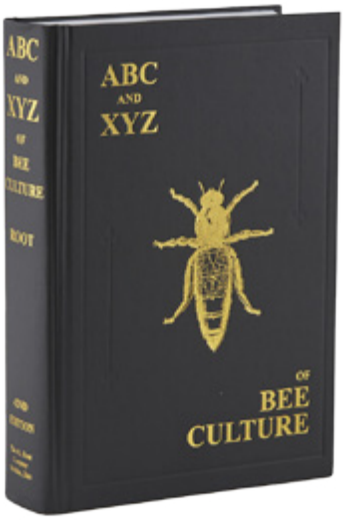


The life cycle of the Asian giant hornet typically spans a few months, and begins with a solitary mated queen initiating nest foundation in the late spring following an overwintering period. Nests are typically founded in 'green' environments such as forests, parks, and other herbaceous areas. The colony begins to take shape in the early Summer and workers begin to emerge. Mating season begins in the early Fall before the activity of the colony gradually decreases and ceases in early Winter

Christmas is Coming

Bee Culture
The Magazine Of American Beekeeping

Christmas is just around the corner! Make sure you put in all your holiday shopping orders early so they can be shipped with plenty of time to spare. Here is just a sample of our wonderful book options. Our full selection of books (and magazines) can be found at: *store.beeculture.com*!



ABC AND XYZ OF BEE CULTURE

The 42nd edition of ABC & XYZ of Bee Culture is finally here! This book has been leading the way to successful beekeeping since 1877. It contains over 800 pages packed with information as well as hundreds of color photos and illustrations. It's jam-packed with a mix of reference, how and why things are done and a history of how beekeeping got where it is today! This book is an absolute MUST for every beekeeper!

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Increase Essentials by Lawrence John Connor.....$25.00
Queen Rearing Essentials by Lawrence John Connor.....$22.00

when the newly mated queens must find a new site to overwinter in preparation for next season.

Effects and Exposure Assessment

The effects assessment in our risk assessment relied on mated queens surviving their overwintering period and establishing a new colony the following season, and the negative effects that these colonies incur upon the ecosystem during their lifecycle. The primary negative effects were the loss of pollination services provided by European honey bees and the potential resulting economic risk to agriculture sectors in the form of crop production and apiculture.

Drawing from the stressor description and effects assessment, our exposure assessment aimed to analyze the ecosystems and environments of the Pacific Northwest and compare them to the ecological requirements of the hornet. In order to accomplish this, we primarily analyzed suitable climate for the insect to survive its overwintering period, suitable habitat to foster nest foundation, apiary densities in the region to serve as a food source for the hornet, and major port and freight hubs which may serve as additional introduction pathways for the hornet on a county-by-county basis across Washington, Oregon, Montana, and Idaho.

Risk Characterization

To estimate the risk the Asian giant hornet poses to each county of the four Pacific Northwest states, we used a risk rating and scoring system to rank the risk based on the above the risk factors mentioned above. Each risk factor was scored on a basis of one to four, one being the lowest risk score and four being the highest risk score, for a total possible overall risk score of 12 across the four risk factors. Counties across the four states which received an overall risk score one to four were ranked as 'low' risk, counties with a score of five to eight were deemed 'medium' risk, and counties with a score of nine to 12 were designated as 'high' risk. The overall risk map for Asian giant hornet establishment across the four states is shown below. BC

Erik Norderud and Robert Peterson are from the Department of Land Resources & Environmental Sciences, Montana State University, Bozeman, MT 59717

BEE VET

Euthanasia

Dr. Tracy **Farone**

Euthanasia: Our Bees Deserve the Consideration

One part of my job as a veterinarian has been to provide euthanasia services. It is not an easy part of our job, but it is a part of my veterinary oath to "relieve suffering". It is a service I am glad that I can provide to clients' animals when deemed necessary. Over the years, I have received many thank you cards, flowers, and other gifts from appreciative people who trusted me to guide the passing of their beloved animal. It is time we consider euthanasia and how it may be applied to our honey bees.

I am sure some of you have had to face the difficult situation of making the decision to terminate a hive. In the field of apiculture, standard methodology for honey bee euthanasia is still in its early stages, but I will outline the major caveats here.

The Definition of Euthanasia

The term euthanasia means "good death". According to the American Veterinary Medical Association (AVMA), "The term is usually used to describe ending the life of an individual animal in a way that minimizes or eliminates pain and distress. A good death is tantamount to the humane termination of an animal's life."(1) Periodically, the AVMA publishes guidelines that outline acceptable methods of euthanasia that veterinarians should use specifically and for a wide variety of animals. This 100+ page document contains some verbiage on invertebrate euthanasia, but a section specific to honey bees does not yet exist.

The AVMA says the following regarding invertebrate species (which would include honey bees), "While there is ongoing debate about invertebrates' abilities to perceive pain or otherwise experience compromised welfare, the Guidelines assume that a conservative and humane approach to the care of any creature is warranted and expected by society. Consequently, euthanasia methods should be used that minimize the potential for pain or distress." (1) The AVMA also recommends that each euthanasia technique for any animal consider the following criteria:

"1. ability to induce loss of consciousness and death with a minimum of pain and distress
2. time required to induce loss of consciousness
3. reliability
4. safety of personnel
5. irreversibility
6. compatibility with intended animal use and purpose
7. documented emotional effect on observers or operators
8. compatibility with subsequent evaluation, examination, or use of tissue
9. drug availability and human abuse potential
10. compatibility with species, age, and health status
11. ability to maintain equipment in proper working order
12. safety for predators or scavengers should the animal's remains be consumed
13. legal requirements, and
14. environmental impacts of the method or disposition of the animal's remains." (1)

A few of the criteria above may not apply to honey bee colonies, but most do and could serve as a checklist for beekeepers and veterinarians to consider before euthanizing a honey bee colony.

How Veterinarians Use Euthanasia

In traditional veterinary practice, most veterinarians will agree to euthanize an animal for one of two major reasons: 1. A serious or terminal condition or illness that causes the animal suffering that cannot be reasonably remedied, or 2. An aggressive animal that poses a threat to people and/or the public. This is much the same for honey bee colonies.

Why We Euthanize Honey Bee Colonies

Typically, we consider euthanizing hives when they are severely ill, severely aggressive, and/or pose a public health threat. For example, in most states, hives diagnosed with American Foulbrood must be destroyed or it is highly recommended that they are destroyed, because they are most likely terminally ill themselves and can spread the disease to other hives. Severely aggressive hives may also be considered for euthanasia as they may pose a public health threat and may transfer aggressive genetic traits to future bee generations.

"Weak" hives may be a bit of a different story and a somewhat unique situation to honey bees. If the disease or condition in a "weak hive" is not severe or highly transmissible, we may be able to save a portion of a colonies' bees by combining colonies and/or requeening. "Pinching" (and replacing) a failing queen may be a physical method of euthanasia for her and her genetics, but the colony may persist.

Some Current Methods

There are several methods "out

there" used for destroying a colony. I will briefly go through each method and point out their pros and cons. When euthanizing a colony be sure to have all your supplies ready before you start the process. It is best to start the process at dusk so all the bees are present in the hive and few may escape the colony. Also close all the entrances to prevent escape as much as possible.

If you must burn the hive and colony after the euthanasia, make sure you are legally allowed to do so and you are following all local and state laws. If you must bury the burned hive remains, be sure to dig a pit big enough to accommodate the hive boxes. Typically, this is at least 18 inches in depth. Don't forget to call 811 first. Then build a fire in the pit, so it is ready to receive the euthanized hive, if burning is necessary. Remember beeswax is flammable.

1. Soapy water and/or vinegar/water solutions: These methods are fairly safe for beekeepers, but it does require opening the top of the hive to dump or spray the solution directly onto the bees through the frames. This may not be ideal for aggressive hives. It may also not kill all the bees quickly, especially if enough solution is not applied. Various mixtures have been used: ¼ dishwashing liquid to ¾ water, half and half water and vinegar with added soap, all with enough solution to soak the frames. If you must burn a hive euthanized by these methods, consider that a very wet hive may not burn as well. If you do not need to burn the hive and/or infectious disease was not the issue, the hive equipment can be cleaned and reused. Comb and honey should be discarded. The USDA mentions soapy water as a method of euthanasia for bees.

2. Isopropyl alcohol solution: If you have ever done an alcohol wash to check for mites, you will have noticed that alcohol kills bees quickly. For this reason, this method may be more humane for the bees. However, consider that isopropyl alcohol is flammable. You can dilute 70% isopropyl alcohol with water at least to a half and half solution. I have seen some claim that as low as a 5% solution will work, but I have not verified that myself. If you do not need to burn the hive and/or infectious disease was not the issue, the hive equipment can be cleaned, dried, and reused. Honey and comb should be discarded.

3. Fire: Again, if you are destroying a hive for AFB, fire is the preferred method. Dig the burning pit as close to the hive as possible to avoid moving the hive and possibly spreading spores. Be sure all entrances are closed. It is best to euthanize the bees first before burning the hive.

4. Professional chemical sprays: While utilizing pesticides is not generally recommended for killing honey bees and it will contaminate the environment and the hive equipment, if you are dealing with a particularly aggressive hive or a feral colony that has invaded a building structure, it may be time to recruit some professional extermination help. Always remember to consider your safety and the safety of those around you first.

5. Other methods that are dangerous, impractical, and/or inefficient, and therefore not recommended: Gases (CO_2, ethylene oxide). Flammables like oil, kerosene, or gasoline…just, please, no. Irradiation is rarely practical and can be costly.

The Best Ends

Because of the unique nature of our honey bees, they can present a challenge in performing a proper euthanasia. However, I believe we should take time to consider how we should best approach the situation and look to develop better methods of accomplishing a "good death" for our bees. More work should be done on this topic and it would be a good opportunity for beekeepers and veterinarians to partner in coming up with better solutions. We should also take time to acknowledge and be empathetic to the emotional toll it may take on us, as beekeepers. BC

References & Resources:

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LAYING WORKERS

Greg **Carey**

If you keep bees, sooner or later you will encounter a laying worker situation. For me it was in my second Spring. The queen died in late February, and the bees couldn't requeen themselves, and by the time I realized there was a problem they had developed into a colony with laying workers. How does this happen? How can I recognize it? What are the consequences of laying workers? What can be done once it has happened?

How does this happen? All worker bees, being female, have ovaries which are normally not developed and functional. However, some workers are genetically predisposed to develop functional ovaries under the right conditions. These are usually young nurse bees in a colony with little to no open worker brood pheromone and the absence of queen pheromone. Within a week or so of these conditions these young bees' ovaries will start to mature and produce eggs. Yes, I said bees. It's possible and even likely that more than one worker will start to lay. The laying worker is not like a queen where there is only one (there are many).

You will recognize that you have laying workers when you can't find your queen and start to see multiple eggs being placed in the cells. The multiple eggs may also result from a new queen just starting to lay, but the giveaway is that with laying workers some of the eggs will not be on the bottom of the cell but stuck to the cell walls due to the shortness of the workers' abdomens.

The sure-fire sign will be after nine days you start to see capped drones in worker size cells. This is because the laying workers do not go on mating flights and can only lay unfertilized (drone) eggs. You will notice that the brood pattern is also very spotty. That's due to other workers not recognizing the worker eggs and removing them before they hatch. A drone laying queen can have a genuinely nice drone pattern.

The obvious consequence of a colony that's only producing drones is that it will die within two months when the worker population drops below the survival threshold. The colony will act as though it is queen right and will not develop a queen from a mixed brood frame and will even tear down queen cells that are given it on a frame. The beek will usually try all these things to attempt to salvage the colony. They will get all google eyed searching and reading all the successful adventures of other beeks on that inter-web thingy.

Meanwhile those drones are starting to emerge and flood the hive and neighborhood with small, inferior drones that carry the genetic disposition for laying workers. There goes the gene pool! And, in the end, your colony dies. It's time to cut your losses and free up the equipment for new occupants.

Here's what you can do. It's what I do every time, and it works 100%. Take those frames of brood from laying workers and put them into the freezer. Leave them there until you're confident that the one with that ice age gene has succumbed. Next, and this is crucial, dump all the bees on the ground a good distance from your strong hives and store the equipment until you are ready to do another split. The dumped bees will join up with your other colonies or be killed if not accepted. By the time you read this it will most likely be too late to be starting another colony, but earlier in the season this saves you much time and resources. Just clean that equipment and store it, ready for the next split, swarm, or buy. BC

Ettamarie **Peterson**

California Beekeeping From Past To Present

Up to a century and a half ago, overland shipment of bees to California was considered impossible - travel through the Great Basin and deserts of the Southwest was too arduous. A well-known botanist Christopher A. Shelton first breached that geographical barrier by bringing bees across the Isthmus of Panama on the backs of donkeys because the railroad had not been completed from Aspinwall, Panama to the West Coast. He then put them on a North-bound ship called The Isthmus to San Francisco. The Sacramento Daily Union published an article March 18, 1853 commenting on his saying he also brought with him a lot of gold and silver fish, and a collection of seeds of different kinds." Shelton managed to get one of the colonies to the Robert F. Stockton Ranch, just north of San Jose, California, but only one colony survived. This colony had multiplied to three good ones by the end of that summer. Unfortunately, poor Mr. Shelton was killed in a horrible steamer disaster near San Francisco just a month after he put the bees on the ranch in San Jose. Two colonies of these German black bees were sold at an auction to settle his estate. One was sold for $105 and another for $110. Shelton's bees' arrival has been commemorated by a plaque at the Santa Jose Mineta International Airport outside Terminal C by the E Clampus Vitus organization (a group started during the Gold Rush to make fun of other more serious groups). The plaque states, "First Honey bees in California. Here, on the 1,939-acre Rancho Potero de Santa Clara, Christopher A. Shelton in early March 1853 introduced the honey bee to California. In Aspinwall, Panama, Shelton purchased 12 beehives from a New Yorker and transported them by rail, pack mule, and steamship to San Francisco. Only enough bees survived to fill one hive, but these quickly propagated, laying the foundation for California's modern beekeeping industry. California Registered Historical Landmark No. 945."

Other shipments followed, imported by John Harbison and others during the mid-1850s. Harbison had abandoned gold mining to start the first nursery of fruit and ornamental trees in the Sacramento Valley but soon turned to his prior skills of beekeeping on a large scale. He designed the best shipping boxes to get the bees to California in good shape from his home state of Pennsylvania. His first shipment was made in 1857 and arrived in San Francisco in November. They were then put on a river boat to the City of Sacramento. The journey was made easier by the completion of the Aspinwall Railroad's 47 miles of train track at the end of January of 1855. Harbison's brother was still in Pennsylvania and followed his instructions to prepare the hives for the journey. He also knew what time of the year was best to start the westward journey. He was not the only one to transport bees, but his methods proved to be the most successful. He became known as the "Bee King of California." (San Diego County has named a canyon after him.) He invented the "California Bee Hive" patented January 4, 1859 and published *The Beekeeper's Directory or the Theory and Practice of Bee Culture, in all its departments, The Result of Eighteen Years Personal Study of Their Habits and Instincts* in 1861 in San Francisco by H.H. Bancroft and Company.

Honey bees were dispersed throughout California. By 1860 a thousand colonies were already present in San Jose. His hive was designed to make comb honey in nice, easy-to-ship comb honey boxes. That was a very smart choice as he became at one time the largest producer of honey in the world selling his honey across the nation and across the Atlantic. The invention of the honey extractor made the Langstroth hive the more favorable hive a few years later.

The Transactions of California State Agricultural Society for the year 1859 stated:

"We would next report in reference to Mr. Harbison's Hive. This Hive is a California invention, and combines the great requisites necessary to the successful raising of Bees, namely: having perfect control of the combs, by means of the sectional frame, which is so adjusted that it is firmly held at proper fixed distances, and can be removed without the least jar; it also has the inclined bottom, and there are no useless parts to form a harbor for worms, or accumulation of filth, to facilitate their increase.

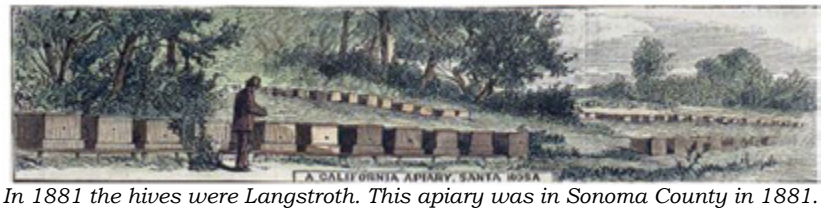
While the Hive is constructed on natural principles, giving proper depth of comb, enabling the Bees to concentrate the animal heat to the best

The photo above was taken by Ettamarie Peterson of an apiary in Sonoma County in 2020. Note the contrast between this apiary and the one in 1881. These are migratory hives and all have cans of sugar syrup as there is not nearly enough forage for this many colonies.

advantage, thereby insuring a large increase of Bees, and consequently of honey, the ventilation is on a new principle, so arranged as to admit air without light, when required, and be reduced or increased easily.

The surplus honey-box is made in sections, so that while the largest yield of honey is obtained, it is yet separated in small parcels, in a beautiful shape for the table."

In 1860 people were definitely getting the bee fever. One beekeeper wrote an article to the *Farmer* that was quoted in the Sacramento Daily Union in December 1860 declaring: *"Three years ago I began with five swarms of bees, for which I paid $500, and was my entire capital, except a team worth $400. I used the common chamber hive the first season, and my increase of stocks was less than three to one. At the beginning of the second season I introduced and practiced, in an imperfect manner, the Langstroth system, and at the close of that season I sold 103 stocks for $10,300, having fifty stocks left. During the third, which is the present season, I have practiced the same system in a more perfect manner, and the result of the fifty stocks has been about 600, which contain full forty pounds of honey each, or 24,000 pounds in the aggregate. I am selling them now at $50 a stock, and I believe that they will be worth twice that money to those who buy them. For the last two seasons I have employed one assistant, who has made most of the hives. My hives cost me less than two dollars each. From these facts and figures, it will be seen that the five swarms, with three years' labor have paid me a considerable over $30,000."*



In 1881 the hives were Langstroth. This apiary was in Sonoma County in 1881.

This was the same time the Italian bees were starting to arrive from New York. *The California Farmer and Journal of Useful Sciences* announced the Italian bees' California arrival in their December 14, 1860 edition. The first Italian bees to arrive, the article said, came from an apiary in Northern Italy. These Italian bees were highly praised, and the author of the article predicted their success. The last sentences of the article said, "Much expense has been incurred in introducing these Italian bees here. We are informed the Italian queens will be propagated as fast as possible during the coming Spring at Sacramento and Stockton and furnished to those wishing them on very reasonable terms." At this time there was some foul brood showing up in the German Black bees and the thought among beekeepers was that the Italian bees would be better survivors. The beekeeper A. J. Biglow that brought the Italian bees said he sold some to Harbison.

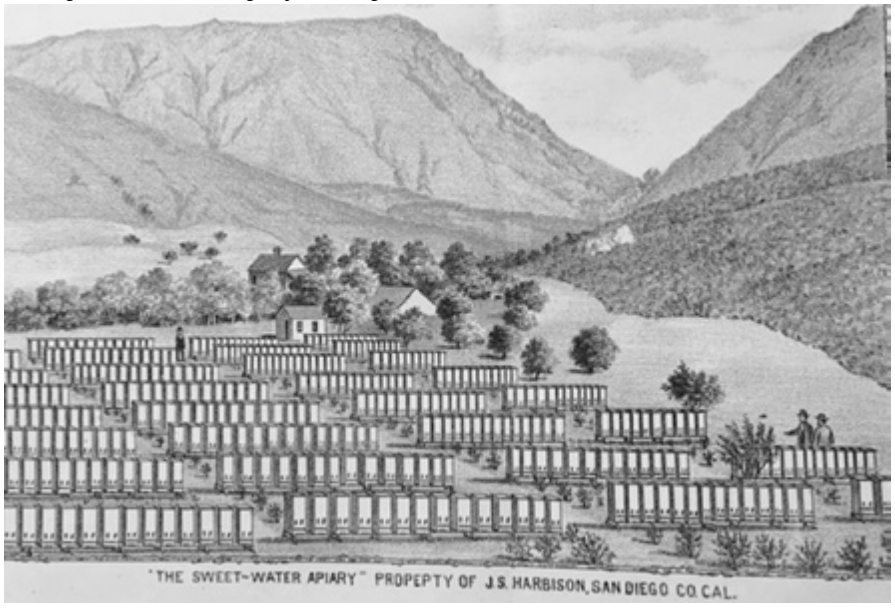
Twelve years later Harbison took 308 hives of Italian bees from his apiary just south of Sacramento to one of his five apiaries he had established in San Diego County beginning in 1869 with beehives he moved at that time by ship. The high mountains of 2,000 feet to 3,000 feet altitude near San Diego had plentiful rain which produced excellent bee forage for a long period of time.

In 1871 Harbison shipped a railroad car load of Italian hives to work in Utah. That was so successful that the following year he had an order for another car load he sent around the first of March. In 1873 Harbison shipped the first car loads of his comb honey to Chicago. Later he would ship his comb honey further East.

In 1875, the *Press Democrat* published a story about two young lady school teachers from Oakland, California that went down to Los Angeles in 1872 and formed a co-partnership in bee farming. By the time of the article, they had used their scant teacher saving to get possession of bee pasture, kept on teaching and extended their business. They had 2000 pounds of white sage honey for the market and another thousand pounds coming. The authors of the article didn't think beekeeping would be as profitable in Sonoma County as in Los Angeles so were encouraging the ladies here to make a profit in raising poultry and eggs.

By 1876 there was an organization of beekeepers that met in Los Angeles. At their June 17th meeting a paper was read ridiculing the notion of many persons about the profits to be realized in the bee business with little or no labor and expense. Another beekeeper spoke of hives melting down and the best way of preventing it. Harbison told the society the best way to obtain adequate returns for their products. He said, "The present prospect for the sale of honey was gloomy, because at this time of the year but little honey is consumed." He advised beekeepers to keep their honey until September, October and November when honey would be in better demand for actual consumption. In regard to the business in San

John Harbison moved his bees to San Diego County in the 1860's from Sacramento County to take advantage of the longer nectar season.



Diego County he said there would be little sage honey this year. The principal harvest would be from sumac and buckwheat greasewood.

In July of 1876 it was proposed to organize a State beekeepers' association. The person proposing it said such organizations exist in most of the States. The California State Beekeepers' Association came into existence in 1889.

In early 1878 a beekeepers' meeting was held in Southern California. At that meeting a resolution written and adopted stating, "Resolved, That we urge upon beekeepers throughout the State of California to petition Congress to so amend the postal laws so as to include queen bees as mailable matter. Resolved, That the Secretary be instructed to forward a copy of this resolution to our member of Congress."

Queen rearing was usually done in bee hives. J.S. Harbison published a small book called "An Improved System of Propagating the Honey Bee". He was granted patent number 26,431 dated December 13, 1859 for his use of what he called "The Vertical Queen Nursery."

It was fun for me to discover that an electric incubator made here in my town of Petaluma, California, to hatch chicks was used in 1915 to hatch queens. The people at Garden City Apiaries in Chico sent the Petaluma Electric Incubator company a letter telling them, "Last Spring we purchased a small Petaluma Electric Incubator to use in hatching embryo queens. As soon as the cells are capped, they are put into the incubator in small cages and left there until hatched. All our queens are hatched in Petaluma Electric Incubators. We were the first to use electricity for developing embryo queens. We control 5000 acres for the production of honey and the rearing of queens."

This is Christopher Shelton, a young botanist who is given credit for bringing the first bees into California in 1853. Note that he is not portrayed as a beekeeper because he was really a well known botanist when he brought the bees to California, not a beekeeper.

Dr. John E. Eckert reported in the *American Bee Journal* in November 1962 that commercial beekeeping in California was "definitely on a migratory basis which involve the use of good equipment and long hours of hard work, day and night. The growing season is long, but the blooming period of each crop is generally short so that bees have to be moved from three to five times a year in order to provide adequate pollen and nectar sources and to 'follow the crops' for pollination services." He described the use of mechanized hive loaders and the newest trend to put four to six hives on a pallet. Dr. Eckert also stated it was important for beekeepers to be able to move hives quickly "to avoid disastrous losses from the application of pesticides. California has more millions of acres devoted to an intensive type of agriculture and uses more millions of pounds of pesticides than any other state. In 1958, aircraft sprayed or dusted 5,308, 542 acres using 1,389 planes belonging to 221 firms. Other millions of acres were treated by land rigs." He said pesticides continue to be one of the greatest hazards of beekeeping in California. These concerns are still being addressed but progress has been made with pesticide application laws and the new hive registration program with the local county agricultural commissioners. For more information and details of this go to **www.cdpr.ca.gov/doc/enforce/pollinators/apiary_brochure.pdf.**

Center of the Haagen-Dazs Bee Haven at University of California Davis with true to life bee art. The lady in the photo is Christine Kurtz, member and past president of Sonoma County Beekeepers Association. Photo taken by Ettamarie Peterson

In 2018 ¾ of the nation's colonies, 1.5 million, were brought into California to pollinate the almonds grown up and down the Central valleys. California is the only state in the U.S.A. that grows them. Almonds are not a new crop to the state but in the early days all the advice given to the growers was about using various varieties to insure good cross pollination. I found no mention of using honey bees for almonds and other crops until an article in the Pacific Rural Press on May 15, 1915 mentioned an almond grower in the Sacramento area credited his bees for pollinating his trees and said they do it "with a right good hum." Later I found in the Cal Aggie paper published by the University of California at Davis on January 11, 1918 an article promoting honey bees as

The beekeeper is Mr. Wooten, a Northern California beekeeper and bee breeder, with some of his hives in the almond orchards in the central valley of California. Photo taken by Ettamarie Peterson in February 2010.

pollinators. The title of the article was "Pollination of Orchard Fruits Basis of Test Keeping Bees as Pollen Carriers in Orchard Proves Profitable to Fruit Growers" by Warren P. Tufts. In the article he gives the "common honey bee" credit for being the best carrier of pollen and states it will pay the grower to keep bees even though he might not care to go into the honey business. Interestingly, years before J. S. Harbison said in a letter from his home apiary in San Diego printed in The *American Bee Journal's* October 5, 1889 edition, "Fruit-growers generally are clamoring for the removal or destruction of all apiaries in reach of their orchards or vineyards. Their requests are generally being complied with, or the incendiary torch does the work if it is not. I have 'killed' and 'broken up' over 700 hives of bees within one year, and had about 350 hives set on fire (probably on purpose) within the same period." He went on to state, "The introduction of bee-keeping in this county in a great measure destroyed the sheep and cattle business, and now in turn the fruit and vineyard industries have destroyed bee-keeping, over a large extent of the county."

In February 1923 the Sonoma County farm advisor said that it was "evident that bees will supply what has been needed for some time. Orchardists of the county are rapidly realizing that bees are of great value in pollination and with the assistance of the farm bureau, orchardists of the Occidental-Sebastopol section have already contracted for 1,009 colonies to be shipped here from the south." He advised the fruit men to get their orders for bees in right away. He knew of only 500 more hives that could be secured. The price was $2.50 for the blooming season and the hive owner reserved the right to the honey and would be on hand to care for the colonies while they were in use in the orchards.

In 1947 Dr. Harry H. Laidlaw came to the University of California at Davis. He was a pioneer in the modern technique of artificial insemination of queens. He is considered the "father of honey bee genetics". His work is being carried on to this day in the Laidlaw facility that was founded in 1969. This bee biology laboratory was renamed in his honor in 2001. It is the largest and most comprehensive state-supported apiculture facility in North America and the only one in California. It provides leading cutting-edge research that focuses on basic bee biology and genetics, addressing international concerns of bee health and meets the needs of California's multibillion-dollar agricultural industry.

East of the facility is the Häagen-Dazs Honey Bee Haven, a half-acre bee friendly garden that was opened to the public on Oct. 16, 2009. It provides bees with a year-around food source, raising public awareness about the plight of honey bees and encouraging visitors to plant bee-friendly gardens of their own. My favorite thing about it besides the extensive plant knowledge the garden provides is all the art in the garden. The art department worked with the bee laboratory people to make all the works of art biologically accurate. For example, the huge bee in the center is many times bigger than a real bee but in perfect scale.

Research used in writing this article included several historical newspaper articles found at the website **www.cdnc.ucr.edu**, the Bee Biology website **www.beebiology.ucdavis.edu**, *The Bee-Keeper's Directory* by J. S. Harbison, and *American Bee Journal*, Nov. 1962, article "Beekeeping in California" by Dr. John E. Eckert, and *American Bee Journal,* Oct. 5, 1889 page 628 Letter to the Editor.

For a peek into California's bee forage in 1894 through the eyes of the famous naturalist John Muir go to **http://yosemite.ca.us/john_muir_writings/the_mountains_of_california/chapter_16.html.** BC

Ettamarie Peterson, a fifth generation Californian, has been keeping bees on her small farm in Petaluma for the last 29 years. She is currently, and has been for many years, the editor for the Sonoma County Beekeepers' Association monthly newsletter. She is continuing many years as the Beekeeping Project leader for Liberty 4-H and for the 2020-2021 school year had 15 young beekeepers in the project.

Ettamarie Peterson has recently put together a PowerPoint presentation with more information and is available to share it with associates with Zoom. Contact her at ***Ettamarie@petersonsfarm.com*** *to schedule one.*

Bee Driven Mid-Life Crisis, Part 5
A Place For My Honey House

James **Masucci**

Have you ever juggled? You can't just focus on one ball; you must keep an eye on the whole bunch of them. Seems like you can never spend enough time on one because the next one is always falling. Well, this seems to be my experience with putting up my honey house. I thought I'd share these experiences so you can learn from them. I am NOT saying that I know what I'm doing or going about this the right way. But, perhaps by sharing my experience and thought processes, you can have an idea of what to expect and figure out a better way.

It all starts with a location. A suitable site, however, is dependent on how I am going to use the facility. How big MAY I grow and what MAY I use this for? "May" is critical here. I don't want to make a huge investment on something I will outgrow in five years. Then again, I don't want to build something I will never come close to occupying. Things to think about: How much equipment do you plan on storing? Will there be any fleet vehicles to store? Will this need to be an inspected facility? Will you be moving things by hand, pallet jack, or forklift? Will you have a full extraction line?

Many of these questions relate to how big of a building you need. However, the site is just as important. If you are large enough, you will be getting freight shipments. Will there be room for delivery trucks? If there are fleet vehicles, are they stored in a building or will you fence in the property? Will the garage and storage sheds be part of, or separate from, the honey house? Answers to these questions tell you whether you need one acre or five acres.

For me, I want a single building that will serve as a garage, a honey house, and storage facility. The garage will be a walled off section for my bee truck. I will have a second room for a kitchen/bottling facility that will pass inspection (though I am not big enough for that, yet). It will have a bathroom/shower/laundry room to help me pass inspections as well as eliminate my wife handling bee garments in our personal laundry. Lastly, it will have plenty of space for extracting and storage. I want to park my truck indoors because it will be unattended for long periods of time. I need enough space for delivery trucks and random equipment. I don't plan on having bees on this property, because I don't want a feeding frenzy when I'm bringing in honey supers, but I still don't want to be right next to neighbors. I know from experience that bees and neighbors don't always mix. So, I went looking for a couple of rural acres, keeping in mind that I need water, sewer/septic, and electricity. Living in the suburbs of St. Louis, land is not cheap. The farther away I go, the cheaper the land gets, but the farther I need to travel to my "base camp" every day. My strategy was to be within 15 minutes of one of my yards. Then, once I have my "base camp" established, I can expand around it so that eventually, it is in the middle of all my bees rather than the outskirts.

The first place I looked at was an old gas station (from the '50s) that had the gas tanks removed and had been on the market for five to 10 years (see picture). It had water, sewer, and electricity. It also had an old cold room which I could use to store boxes (prevent wax moths). However, it was not built on a slab which would prevent me from ever using a forklift. There was no place to park my truck and no delivery access (garage door) on the building. John Miller told me, "think Walmart, open building, one floor, easy access to everything". It could work but wasn't right for me. Besides, it was 25 minutes beyond my farthest yard and not in a great area.

The second spot I looked at was seven acres smack in the middle of all my yards. Perfect location, until I went to see it. $80,000 for a steep hillside that didn't have a single place for me to build. No water, no sewer, no electricity, no deal. The third location I found while driving around. "3 acres for sale" in a perfect location. I stopped on the road and called the realtor. "…you mean the commercial property on the outage road? That's $3 a square foot". "What?" I said, "you want $120,000 an acre?". His reply…."you are obviously new to looking at commercial property". Oh yes I was. At this point, the gas station was looking better. I had a couple more of those conversations which helped me narrow down where I needed to look, the type of land I was

First look; an old gas station. Close, but not right. Floor space is not an open design, no place for deliveries (including supers) and the floor was not very solid.

Not a bad property. Relatively flat and only 5 minutes from my closest bee yard. I would need to bring in electric, dig a well, and put in a septic system. But $120,000? No way

This is it! The top is relatively flat. Ten minutes from my closest bee yard. Sewer, water, and electric on the property and a good location for someone to build a nice home when we are finished with it. AND, it comes with a tire swing.

looking for (agricultural) and what I should expect to pay. And the search continued.

One Thursday night, we had some friends over for dinner and, as usual, they asked "how are the bees?" After hearing about our land search, one of our friends told me how he constantly searches the MLS listings because he is looking for a place in the general area I'm looking and offered to pass along anything that he finds. That Sunday morning, I found an e-mail from him in my inbox. A two-acre plot that used to have a trailer on it (so it was relatively flat), that had water, sewer, and electricity on site. Water, sewer, and electricity alone are worth a lot of money. I had to visit a beeyard out there, so I stopped by….10 minutes from the yard. I immediately envisioned where I would put the building. Plenty of space for the building and for delivery trucks. I called my wife as I as going to my next yard and we agreed to see it when I got back home. As we drove into the yard around noon, we met the owners. Had a great conversation. My wife liked it. By five o'clock, the property was ours with the contingency that the county would allow for the building that I wanted to put up. They did. It's ours.

What gave us the confidence in this property to buy it the same day we saw it (besides that there were two other offers that day…)? First was location. The property is five minutes from a town that is on the edge of the urban sprawl that's happening in our area. When I retire from beekeeping in 10-15 years, we think we will more than get our money back for the property. Second is location (location, location, location, right). The property is 10 minutes from the out-yard closest to my house and 15 minutes from the next one in line. Fairly convenient from my beeyards even though it is 30 minutes from my house. Third is location. It's in a great area to expand my yards into. It will be an excellent centralized location for my bee operation. Fourth, it had all the utilities that I will need. Sewer, water, and electricity are on site. I just need to tap in. Fifth, it has sufficient space and a couple great building sites (more on that in my next article) for the building I want to put up and any extra storage that I may need in the future. Sixth, the county that it is in is Ag friendly and business friendly making code compliance relatively easy and the building department very helpful. Seventh is neighbors, or lack thereof. To the South of the building site, I own 100 feet of lawn and 200 feet of woods. Beyond my woods are more woods, then pastureland. To the west is a two acre empty plot of woods and next to that is a non-retail business. To the north is a house at least 100 yards away with a tree line in between. To the east is the only real neighbor and between the building site and them is a thick tree line.

So now I have my land. The next step is the preparation for putting up the building. Determining size, developing a floor plan , getting appropriate permits, and finding people to do the work that I don't how to do. But that's for the next article. BC

We all learn by experience but some of us have to go to Summer school.

Reading A Colony

David **MacFawn**

When examining a hive, the beekeeper can tell what is going on inside by answering a few important questions. Does the colony have swarm, supersedure, or emergency queen cells? Are there empty queen cells from which a virgin queen has emerged? How many queen cells total are there, and where are they located? The beekeeper also looks to see if there are worker brood, drone brood, and the stages of this brood (egg, larvae, pupa, emerged). Are there signs of a laying worker(s) such as drone brood raised in worker cells? How large is the brood nest? Where are the frames of pollen located, and where are the brood nest pollen bands? Is honey stored in the corners of frames of the brood nest or in the super above the brood nest? Are there signs of wax moths or small hive beetles such as debris on the bottom board? How much damage exists from wax moths or small hive beetles? Are there signs of American Foulbrood, European Foulbrood, or of *Varroa* mites ("snott" brood, *Varroa* visible on drone brood, deformed wings)?

A normal colony

The brood development of a normal colony follows the seasonal bee-year. The colony begins building its population the latter part of December, with peak brood-rearing culminating during the nectar flow. When swarming occurs, it is usually during the nectar flow and in healthy colonies that have plenty of honey and pollen available. In the spring, worker brood follows the 1/2/4 rule that means there should be twice as many larvae as eggs, and four times as many capped cells/pupae as eggs.

Figure 3 *Nice looking frame. Note the honey in the top corners. (*David MacFawn*)*

Queens

When examining a colony for queen issues, look for queen cells and other queen-related conditions. If the queen cells are toward the frame bottoms and numerous (greater than five or six), you probably have swarm cells. If the queen cells are toward the frame center and top and are less numerous (two or three), you probably have supercedure cells. If the queen cell is drawn from a worker cell and elongated, you probably have an emergency queen cell. Look to see if the bottom of the queen cell has been chewed open (raggedy edges). If so, a queen has emerged from the cell, and the workers have not yet torn the cell down.

Type	Egg	Larva	Capped Cell	Pupa	Days to Emergence	Start Laying
Queen	3 days	4.5 days	7.5 days	Day 7.5 until day 16 (emergence)	16 (avg.)	23-26 days
Worker	3 days	6 days	9 days	Day 9 until day 21 (emergence)	21 days (avg.)	
Drone	3 days	6.5 days	10 days	Day 10 until day 24 (emergence)	24 days (avg.)	

Figure 1. *Broad Development Times*

Figure 2 *Swarm Cells/cups on the Frame Bottom with Two Emergency Cells Midway up the Frame (*Kathy Carpineto*) Note the pollen between the Queen Cells and the Honey in the Upper left of the Frame.*

Figure 4. *Healthy brood.*

Other queen-related conditions also should be assessed. Look for worker brood (eggs, larvae, or capped) in the frames. If you have eggs or larvae, and the queen has not emerged from the queen cell, you know the colony recently swarmed, probably less than 16 days ago. If there are only capped worker brood, which is capped after approximately nine days, you know the colony probably swarmed nine to 21 days ago. If you have a queen cell from which the queen has emerged, together with capped worker and drone brood, you know the colony probably swarmed 16 to 21 days ago. If you have an empty queen cell, and have no capped worker brood but do have capped drone brood perhaps with some drones emerging, you know the colony probably swarmed 21 to 24 days ago, and you probably have a new queen that is getting ready to lay. After emerging, a new queen typically takes seven to 10 days to mate and start laying. Often, after swarming has occurred, the colony will backfill the brood nest with nectar/honey until the newly mated queen begins to lay.

Swarming: Diagnosing Queen Issues

	Queen cups only	Swarm Queen cells without queen emerging	Swarm Queen cells with queen emerging	Worker eggs	Worker larvae	Worker capped brood	Drone eggs	Drone larvae	Drone capped brood
		<16 days	>16 days	< 3 days	3 to 9 days Twice as many worker larvae as eggs	9 to 21 days Four times as many workers capped pupa as eggs	<3 days	3 to 10 days	10 to 24 days
No swarming	X			X	x	x	x	x	X
Queen event < 3 days		x		X			x		
Queen event < 9 days		x			x			x	
Queen event 9 to 16 days		x				x			X
Queen event 16 to 21 days			x			x			X
Queen event 21 to 24 days			x					X	

Figure 5. *Swarming: Diagnosing Queen Issues David MacFawn*

Supercedure: Diagnosing Queen Issues

	Queen cups only	Supercedure Queen cells without queen emerging	Supercedure Queen cells with queen emerging	Worker eggs	Worker larvae	Worker capped brood	Drone eggs	Drone larvae	Drone capped brood
		<16 days	>16 days	< 3 days	3 to 9 days Twice as many worker larvae as eggs	9 to 21 days Four times as many workers capped pupa as eggs	<3 days	3 to 10 days	10 to 24 days
No supercedure	X			X	x	x	x	x	X
Queen event < 3 days		x		X			x		
Queen event < 9 days		x			x			x	
Queen event 9 to 16 days		x				x			X
Queen event 16 to 21 days			x			x			X
Queen event 21 to 24 days			x						X

Figure 6. *Supercedure: Diagnosing Queen Issues David MacFawn*

Laying workers

A laying-worker bee develops when the colony's queen dies for some reason, and the colony is not successful in replacing her. This failure to replace the queen may be due to the colony having only larvae that are more than three days old when the queen dies, or the queen not returning from her mating flight. Sometimes a worker will start to lay, but her eggs are not fertilized. These eggs are known as drone eggs. The eggs are infertile since the worker has not mated with a drone and has no semen. This is the last effort for the colony to propagate the species. As brood pheromones that suppress workers from laying eggs diminish, a worker may start to lay. Laying workers usually take several weeks to develop after loss of a queen.

All workers are females with ovaries and the other egg-laying organs, but these organs are undeveloped due to suppression by the queen's pheromones. When the queen disappears and is not replaced, her pheromones also disappear and with them, suppression of the worker's ovary and egg development. As a result, a laying worker is created. The colony is still trying to pass on its genetics, but it can only do so if the laying workers produces drones that mate with a virgin queen from another colony in the Drone Congregation Area (DCA).

Figure 7 *A frame of laying worker drone cells.* (Photo courtesy: Mark Sweatman*)*

Figure 8 *Close-up of laying worker drone cells. (*Photo courtesy: Mark Sweatman*)*

The laying worker's abdomen is typically not long enough to reach the cell's bottom, so the eggs are laid on the cell sides , Multiple eggs are laid on each side of the cells. The bees enlarge the cells from worker cells to drone-size cells. Usually, worker drones are smaller than queen-laid drones. Laying workers lay more drones than a queen does, and the drones result in multiple combs/frames becoming all drone cells, effectively ruining the combs/frames for later use in producing worker bees.

Brood Nest

The pollen and honey define the brood nest boundaries, thereby defining the colony size. As a beekeeper, you should assess the brood nest by asking the following questions: Where are the outer frames of pollen and honey located in the brood nest? Where is the band of pollen above the brood nest? Where is the honey above the pollen band? Is this band of pollen in the bottom brood chamber or the super above? Is there a lack of pollen and honey in the frames? If there is a lack of pollen and honey, you may need to feed the colony.

Upon examination of the worker brood, larvae should be floating in food. If not, the colony has a nutrition issue. There is not enough honey and pollen for the nurse bees to produce the larvae food. The colony probably needs feeding.

Signs of wax moths and small hive beetles

Is there debris on the bottom boards of a hive? Are there other signs of wax moths or of small hive beetles (SHB) inside the hive? How much damage already exists from wax moths or SHB? Such conditions may suggest a hive in trouble.

If you see wax moths and cocoons when removing the hive cover(s), look further down into the equipment stack to determine if you have a weak hive. Wax moths and wax moth cocoons are usually a sign that the colony is weak. The colony is not strong enough to manage the amount of space in the hive. If you have a weak colony, you need to determine if you should re-queen the colony, combine the colony with a stronger colony, or dispose of the colony. The extent of wax moth damage to the combs will assist you in making this decision.

Wax moths are attracted to the dark comb where brood has been raised. Hence, the challenge is to maintain

Figure 9 *Super with Advanced Wax Moths: Woodford, South Carolina.* David MacFawn

Figure 10 *Frame with Advanced Wax Moth Damage. Woodford, South Carolina.* Taken by David MacFawn

your honey supers on the hive such that the queen does not lay brood in them. Wax moth eggs will not hatch at 64°F and are completely dormant below 41°F. This temperature sensitivity means that you should not have an issue with wax moths when outside temperatures fall below 64°F.

You will have issues with SHB if you feed pollen patties in large quantities early. I found it best to control SHB by placing the patty directly above the brood nest in small quantities and feeding patties more often. Also, keeping the colonies in direct sunlight helps. SHB are usually not a large issue in January/February. You can use non-scented "Swiffer" pads to help control SHB during warm months. Very few honey bees get stuck in the pad.

Figure 11. *SHB damaging comb. (*Photo courtesy Steve Seigler.*)*

Signs of American or European Foulbrood

A healthy bee has plenty of hair or/setae all over its body. Healthy brood looks "normal," without sunken or perforated caps (American Foulbrood) or dark-colored larvae before capping (European Foulbrood). Healthy brood is not hardened like chalk (Chalk Brood). There should be no signs of exterior *Varroa* mites, and no deformed or distended wings (*Varroa* or viruses). If there are many dead bees (greater than 100) in front of the colony, and they look "greasy," it may be due to pesticide poisoning.

Figure 12 *SHB in advanced stage "sliming" comb. (*Photo courtesy Steve Seigler.*)*

American Foulbrood (AFB) is caused by a spore-forming bacterium that will persist for decades. The infected worker pupa has sunken and perforated caps. When a small twig is inserted into the diseased cell, the infected pupa will "rope out" two to three inches.

European Foulbrood (EFB) usually occurs in the larvae stage. EFB is considered a stress disease that is caused by a non-spore-forming bacterium and usually clears up with a nectar flow. Adding a frame of nurse bees will often clean up EFB.

Assessing Signs of *Varroa* Mites

Are there signs of varroa mites such as "snott" brood, varroa visible on drone brood, or deformed wings? "Snott" brood is present when many larvae brood are white and flowing in the cell bottoms. Often in *Varroa* loaded colonies, you can see varroa mites on a drone pupa when it is removed. Bees with deformed wings are also a sign of heavy *Varroa* mite loads that have resulted in Deformed Wing Virus (DWV).

An alcohol wash or some other method of determining the colony's mite load should be done to determine your colony status. I refer you to Randy Oliver's **https://scientificbeekeeping.com/** website for further information on determining your colony's *Varroa* mite status.

Summary

Observation of what is going on in a colony is key to determining the colony's status. If and when the colony swarmed or superseded the queen, if the colony has wax moths or small hive beetles, if you have a laying worker situation, and if you have *Varroa* mites are all important in assessing the colony's health, and this assessment will assist you in your treatment and remedy efforts for the colony. BC

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BUILD A STAINLESS UNCAPPING TANK

Ed **Simon**

No More Plastic

Are you tired of using a plastic uncapping tank that moves whenever you bump it and then needs to be repositioned with your sticky hands? Then when you are only halfway through the uncapping process, it needs to be emptied. You can build a stainless uncapping tank that will solve this problem. By using your dumpster diving and scrounging skills the cost of a stainless-steel uncapping tank can be reduced to a minimum. Even the welding cost can be eliminated by asking a relative or friend to help. Thankfully, my grandson Logan provided the metal working skills that were needed to construct this tank.

Criteria/Discussion

- Easily cleaned.
- Inexpensive
- Easy capping/honey collection.
- This must be easily unloaded or emptied.
- All parts that touch the honey should be made of stainless steel, brass, plastic, or aluminum.
- A strainer needs to be included to allow for the initial draining of honey from the cappings.
- Usable from both sides (left or right-handed).

Parts

1. Stainless sink (1)
2. Angle iron
   a. Sink rim long side (2)
   b. Sink rim short side (2)
   c. Legs (4)
   d. Shelf support/brace long side (2)
   e. Shelf support/brace short side (2)
3. Leveling bolts and nuts ¼" (4 sets)
4. Silicone seal
5. 11" x xx" x xx" – Shelf (1) (optional)

Construction

The building of this uncapping tank is straight forward. A stainless-steel sink is suspended in a welded angle iron frame. Keeping the frame square while welding is required but not difficult. By adding the leg levelers, you can make it stable on unlevel surfaces.

Note: Dimensions in the drawings and in this text are for reference only. Actual measurements for your sink and support are based on the sink's dimensions and wax collector.

Note: All angle iron needs to be cleaned and deburred after it is cut. Welding is considerably easier and stronger if the metal is properly prepared.

Note: All welds were initially tacked in place. Before the unit was the finished the welds were finalized.

Note: All the metal for this sink stand was cut with a 4½" angle grinder. The resulting cut was cleaned and deburred with a sanding disk on the grinder.

Warning: When working with welded material, be careful. It retains the heat for a long time after the weld is complete.

Warning: Do not look at the welding process without wearing welding glasses. It will damage your vision.

Warning: When using an angle grinder, wear safety glasses. Metal particles can damage your eyes.

Step 1: Acquire the sink.

Some things to consider when selecting a sink:

1) Size
2) Depth
3) Extra faucet holes
4) Number of sections
5) Does the sink fit under the counter or set into the counter?

This is where your dumpster diving skills and your relationship with local businesses is important. Check the local kitchen remodelers in your area. When they remodel a kitchen, the old sink is scrap. I had unlimited used scrap sinks available at one remodeler. It did require me to continually check the scrap sink pile for a usable candidate. After selecting two candidates from this source, I found a better square farmhouse style sink at the local Habitat for Humanity Resale Store for $25.00. I could now eventually make three uncapping sinks.

Step 1: Acquire the angle iron.

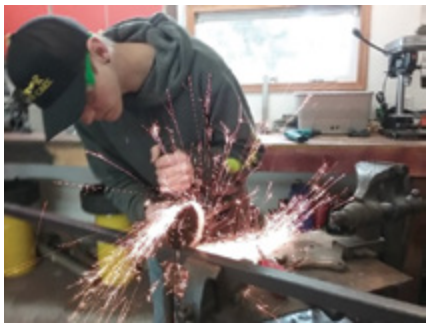
Angle iron is expensive when purchasing it new. But it can be obtained from mattress manufacturers or sales. Often when a mattress is sold a new set of support rails is needed. The old rails end up on the scrap pile at the sales location. Another source of cheap angle iron is the local Goodwill, Salvation Army or Habit for Humanity store. A Set of bed rails that can be repurposed were available at the Habit for Humanity Resale store for $15.00.

Step 2: Clean and prepare the sink.

Under rim of the sink there is accumulated dirt and possibly mounting brackets. Remove these so the sink will set flat on the frame you are building. Leave the sink drain attached to the sink.

Inside the drain there is a cross piece that is used to stop extraneous material from entering the drainage system and clogging it. Remove the cross piece and smooth the edges with a grinding drum. Removing the cross piece allows larger chunks of wax to drop through the drain and smoothing it eliminates cuts when you use your fingers to clear it.

Note: Leave the weird looking patches that are on the sides and



bottom of the tank in place. These are used to suppress noise.

Step 3: Weld the stand top.

Cut and weld the rectangle the sink will sit in. This needs to be tight so the sink won't shift while using it. After finishing the frame, add a couple spot welds to freeze the sink in place.

Step 4: Cut and weld the legs to the top frame.

The leg length in the parts section is only a suggestion. Remember you will probably be standing while using the sink so the leg length should be longer than needed for a standard table. You will also be adding adjustable feet to the legs that will increase the height of the sink.

Step 5: Add the shelf support/leg stabilizers.

Explanation: The shelf support accomplishes multiple objectives. It stabilizes the legs and holds them in alignment and at the same time it supports a wax/honey collector.

Note: We use two five-gallon pails with straining bottoms that are located under the sink drains to collect the cappings. Whatever you use, to collect the cappings, it needs to be easily removed and replaced during the uncapping process.

Reference: See "Build a Honey

Strainer" *Bee Culture* March 2020 issue.

An easy way to locate the shelf support is to place your collection device under the sink and then keep all pieces of wood under the device until it is at a height that works for you.

Tack the support rails in place and give it a try before permanently welding it to the legs.

Step 6: Add leveling bolts.

Weld a nut to the inside angle at the bottom of the legs. Then thread a bolt with a large head through this nut.

Note: Some bed support rails have feet that can be used to stabilize the bed. We were lucky and were able to weld these feet to the bottom of the sink legs.

Step 7: Permanently weld the frame and clean it up.

Finish welding the frame where you placed the tack welds. Then clean and smooth all the welded spots.

Step 8: Paint the frame.

A rust inhibiting glossy spray paint from a can is the easiest way to paint the frame.

Step 9: Seal the sink to the frame.

Use clear silicone seal to seal the cracks between the sink and your new frame. This will stop the honey and wax from getting into in these openings which will make cleanup easier.

Hint: Edge each side of the area to be caulked with masking tape. Then after applying the sealant and before the sealant dries, smooth it with a wet finger. When satisfied and before the caulk dries, remove the masking tape. This makes an excellent joint.

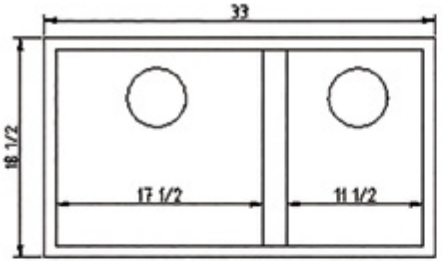
Step 10: Add Wax Shelf. (optional)

Cut the piece of plywood to fit on the leg braces added in the previous step. Then seal and paint it before it is used. This will make cleaning it a lot easier.

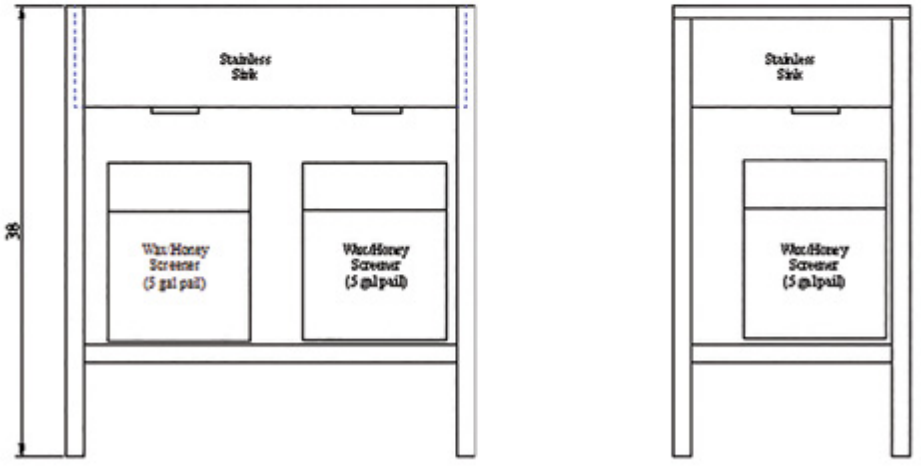
Suggestion: Get a section of old countertop to be used for this part.

The Formica covering is much easier to clean than varnished plywood.

You did it again! You now have a stainless uncapping sink that will last a long time. You will still need to attach your uncapping device to the sink. Many designs are available for these devices or you can develop your own. BC



Stainless Uncapping Sink



What Makes a Great Queen?

Patricia **Harness**

I have some great queens, three sets of sisters. Is it overly optimistic to expect their daughters to be great?

What makes a great queen?

First, I'm going to define a great queen. *Any* great queen must lay prolifically, which will only happen if she was properly reared every step of the way. As noted on page 35 of Larry Connor's book, *Increase Essentials,* a small population should not be used for starting the queen cell from a frame with eggs, because the resulting queens "are usually small, produce fewer eggs and face supersedure by the bees." I have also found that newly-laying queens which are moved too early, before they have reached three weeks of age or so, are at risk of supersedure in the new colony. Those factors are under my control, so let's call them a given.

A great queen isn't just prolific – she must produce gentle children, have a reasonable threshold before swarming is triggered, and produce lots of healthy foragers. There is a heritable component to those behaviors, which means I have a chance of continuing to have great queens if I select mothers with those traits.

I'd like to be able to select *fathers* with those traits too. However, drones fly in from the surrounding area to find my queens (Koeniger, 1986). I will be playing the numbers game – I will be trying to flood the area with my drones. I will have two colonies about 1 mile away, at each of the points of the compass, surrounding my mating apiary. It's not as effective as Instrumental Insemination, where you select drones from a known colony, but that's not part of my Five Year Plan.

Does all the work of tracking queen performance lead to a payoff?

Can you even predict what the daughter queens will be like? Will the next generation just be a total surprise?

For honey production, if you select the colonies which were the best, their daughters will also be better (Bar-Cohen et al, 1978, Calderone and Fondrk, 1991). The researchers in the 1991 study compared honey production between the *descendants* of the three lowest producers vs. those of the good honey producers. At the third generation out, they found the good honey producers were still noticeably better than the slacker colonies.

What this means for me, in my apiary? I should be able to keep my honey production where it is, by selecting from the top honey producers and eliminating the slackers. But I have no illusions that I will be creating a super-honey-collecting bee. I'm just looking to preserve the good traits that I already have.

What about defensiveness? Yes, this is heritable. It's not as simple as "Gentle like Mom" or "Fathers control defensiveness" (Guzma-Novoa et al, 2005). I don't see much variation in my colonies' defensiveness – because they are all pretty gentle. This likely means there are not many mean colonies around. To decrease the odds that drones from a distant defensive colony could influence my bees' temperament, I will flood the area with my gentle drones, and give my queens away to my neighbors.

What about swarming? Is it even possible to select for hives that, if supered appropriately, will almost always stay in the box? A lot of work has been done by Danish beekeepers to select for low-swarming queens (Holm, 2010). And it worked. *Queen Breeding and Genetics* has chronicled the Danish Beekeeper's Association's work and findings. They state clearly that swarming is worth selecting against, and that the efforts will pay off through less swarmy daughters.

Brother Adam also took meticulous notes of the many crosses made from various races in his breeding program. In the section titled "The Primary Qualities for Performance", Brother Adam included "Disinclination to Swarm" (Adam, 1987). He was quite vehement that breeding can improve the apiary's productivity by selecting against swarmy queens.

Chickabuzz Apiary does its own Swarming Selection Experiment

And I have a story of selection against swarming to share from my own apiary.

In 2018, I got eight daughters from a great queen. Her daughters were a mixed bag for making honey and swarming. They were all gentle – but five of the eight were swarmy stinkers, with some even swarming in both the Spring AND the Fall. And then the following Spring. That's a 63% swarming rate.

So along comes 2019, and I have three queens to choose from who did not swarm. I grafted from them, and raised 23 daughters as best as

I could, and then – well, then I had to check carefully for evidence of swarming in their daughters, which is a lot of work! But only two of those 23 daughter queens swarmed, which is down to a 10% swarming rate.

Alert: checking for swarming is a commitment

After a hive swarms, it still has a lot of bees in it! It's actually a challenge to detect that half of the population has departed. And seven days or so after the hive swarmed, the population will actually be close to where it was before swarming – due to the capped brood emerging. And a strong hive which swarmed will usually remove the queen cells before the new queen even starts laying eggs.

The only way I can be sure a given hive did not swarm since my last inspection is if I see brood in all stages. Eggs, larvae, and lots more capped brood than eggs or larvae. This requires inspections to be no more than 14 days apart, and diligent note taking.

So here is another tale of my adventures in queen rearing. While my apiary and pool of queens is small, I'm working to make them count. I've taken the saying "what you select for, you get more of" to heart, and it has already paid off. It's fun to work bees that are gentle, that want to store honey, and that won't swarm (unless I mismanage them). Working a hive that does not have those traits is a chore. BC

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BIGGER PICTURE

Jessica **Lawrence**

Francisco Farmfest

Our community has been holding our annual Farmfest for a few years now, but last year was modified for the pandemic. We made it the Sunflower Trail instead, which minimized interactions, reduced liability, and gave people a more personalized experience. This year, the pandemic was still here enough that people felt more comfortable with the Sunflower Trail rather than the traditional Farmfest gathering. Everyone starts at the Fire Department and picks up a map that shows all the stops and has a description on the back. While each of us that is a mark on the map want to make some money selling our products or teach people with the demonstrations, the important part of Farmfest is interacting with the community.

As I have previously mentioned, I would like to park Lucy, the 1967 F100 indoors. The few thousand pieces of bee equipment seem to keep preventing me from doing that, so I thought maybe I'd sell some at really cheap prices during Farmfest to get rid of it and make space. What I got instead was selling maybe 30 pieces of bee equipment and spending most of the day talking to beekeepers. I also sold plants, but most of the plant people knew what they wanted, paid, and went on their way. The beekeepers, however, all wanted to discuss the current bee climate and their issues and all of the things beekeepers normally talk about.

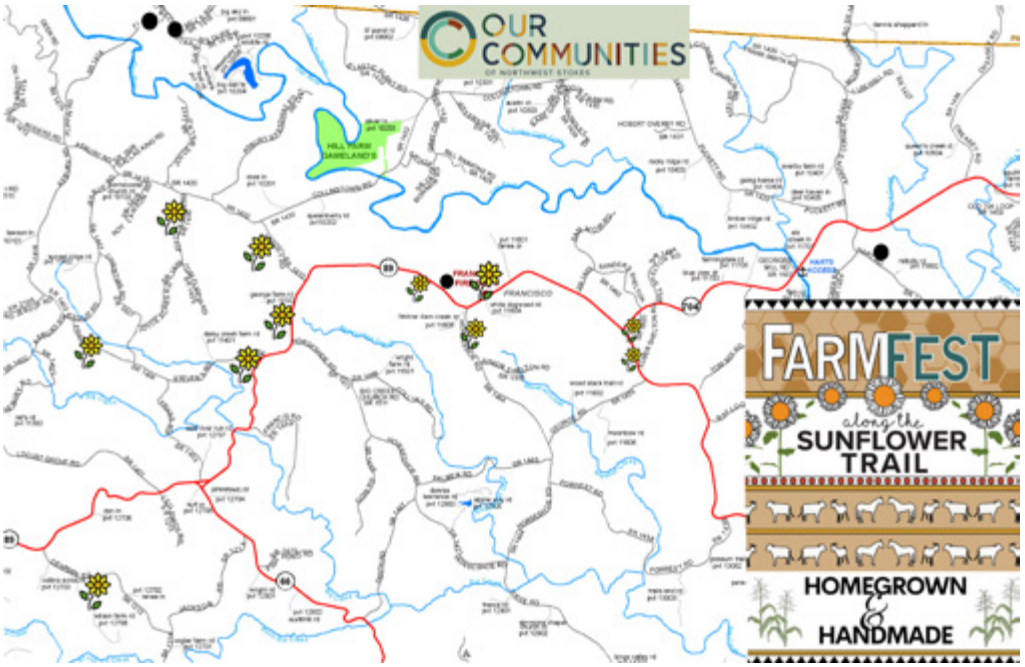
Two of my favorite beekeepers at Farmfest!

This year there was definitely some themes among all the beekeepers and what they wanted to talk about. All of the problems this year are stemming from the fact that the fall flow was really a drizzly Summer sludge that didn't do much and fizzled out in September, leaving the bees aggressive, hungry, and full of wax moths and hive beetles. I started feeding my girls pollen patties and sugar syrup in the beginning of September and they took every bit of it in a few days. Sometimes hive beetles can be a problem when feeding pollen, but that's normally only the case if it is not consumed quickly. My Varroa counts weren't too bad in August (average less than three per hive), but I treated with a round of Apiguard in mid-September, while throwing in pollen patties, sugar syrup, and doing a quick inspection. There weren't really signs of wax moths or hive beetles in my hives, but they've been babied pretty well over the past couple months and seem happy. When I spoke to my beekeeper visitors, I tried to remember to tell them to do a 1:1 ratio that means weight to weight. I can easily put a 25 pound bag of sugar into a five-gallon Coleman water carrier but I do have to heat the water up.

The wax moths are an issue that most beekeepers see as the problem when it's really a symptom. Of course, wax moths are the devil and will destroy stored frames if you don't take care of them, but in a hive of bees they normally don't move in unless the colony is already in a weakened state. Hive beetles are really underrated for the amount of damage they can do when left unchecked, but there's not a lot that can be done about them other than telling your bees to be better sentries against beetles. What's nice now is that at least for stored frames, Certan is allowed again for use after removing honey supers so at least you can prevent damage on wax for the next year. While Certan is a formulation of Bt, which is a bacteria that only attacks lepidopteran pests and is harmless to bees, it is not registered for use in a hive with bees. If I made Certan, I also wouldn't register it for in-hive use because then you get beekeepers who kill their bees and blame Certan, and then the lawsuits start and you lose your company. There are plenty of options for purchasing this product online. This is the point in my column where I fall down the rabbit hole and off into a tangent. I would like to direct your attention to Amazon for this particular product description. In the top bulleted points, where you typically find a product description, we are all gifted with this glorious note from the seller:

"NOTE: CALIFORNIA has not approved B402 for use in honey bee hives. We CANNOT ship Certan B402 to CALIFORNIA. Don't like that decision? Contact Jared Blumenfeld, Secretary for Environmental Protection at CalEPA | California Environmental Protection Agency. All other states and the District of Columbia have been approved B402 for use in honey bee hives by the EPA."

This is one of the best pieces of marketing I have ever seen and I can only find it on Amazon. For anyone who spends much time on the internet, you know there are some gems when looking through products, descriptions, and reviews on the website. The fact that they used a specific contact is description



GOLD and they clearly intend for beekeepers to be outraged by this and indeed contact Jared Blumenfeld. I could not tell you how much distress this description has caused Mr. Blumenfeld, but he has quite the biography on the CalEPA website. It appears that Mr. Blumenfeld took his position in 2019 and almost seems like a step down from his previous appointment as the EPA's Regional Administrator for the Pacific Southwest during Barack Obama's presidency. Most of his focus is on urbanization problems and does not list anything that could be an achievement or milestone with anything agricultural or rural. Surprisingly, it took me more than 10 minutes to find contact information. Some of that time was spent reading info on his personal website, on his podcast website, and on the CalEPA website. If you search it, you can get a phone number for Michelle Hutzel (916) 323-2515, but his email address, **SectyBlumenfeld@calepa.ca.gov** was a little harder to find. I will admit to more than a passing curiosity after the Amazon description just for the frustration it would take to put that at the top of a product page. It is not uncommon with pesticide product registrants to experience difficulty with California's EPA to a higher degree than the US EPA. I have tried my best to stay out of California for as long as possible after spending so much time there in the past, so my curiosity only goes so far. Please write in to *Bee Culture* if any of you happen to contact Mr. Blumenfeld but please let me know if you used information I found, or if you found another means, and if you received a response. I would definitely be curious as to his beekeeper rhetoric and the rationale for not allowing a product to be registered that would not technically be labeled as an in-hive use pesticide or come into contact with bees, and has no history of toxicity or ability to be toxic to bees.

Besides wax moths, I am trying to stress to beekeepers that while feeding sugar syrup and having honey is definitely important to honey bee success, protein is critical and often overlooked. I will not argue with anyone who doesn't want to make pollen patties because it's a long process that makes a huge mess and gets everywhere (or is that just me?) and I totally understand why you wouldn't want to do that. Pollen patties are also expensive if you buy them pre-made. I get it. With our fall flow this year, it is a pretty easy assumption that if the nectar flow is slowing down, the pollen is not likely to be pouring in either. My personal opinion is that this is the most critical time of the beekeeping cycle to ensure pollen availability in a colony. This is when your queen is going to start producing her Winter bees, who have an entirely different physiological makeup than the rest of the year. Availability of sufficient nutrients is essential to healthy production of the workers that will have to carry the colony's legacy through the Winter. Hopefully there is something available in the local environment to sustain them and your pollen patty addition will just be a supplement. If you are not sure and you just don't want to waste your time, make your pollen patties and feed them in half-doses. Check them again in a week and if there's nothing left but a strip of wax paper, you can probably feed them a whole patty with no worries of hive beetle infestation or over feeding. Patties freeze pretty well if you want to mass produce a batch while you're already destroying your kitchen or workspace. I personally prefer to make my own patties because I can add whatever I want to it, like Honey B Healthy or Brood Booster or an additional protein supplement. The danger of this is adding too much or making the wrong ratio and wasting your time because you made it repellent. Less is more with bees. Don't waste your time or money in overdoing it with an additive. The premade patties are almost always a better consistency than my personally produced ones, but they're usually thicker and I think my girls take thinner patties better. It's really a matter of personal preference for the type of protein you give them, but please give them something. It is a bit of an investment, but your girls will overwinter a lot better if you keep them happy with protein and they'll go a little faster in the Spring if you're all about some splits. BC

WRITING FOR BC

Ed **Simon**

It was cold in Minnesota! At minus four degrees, everything was canceled on this Sunday morning and my "Cabin Fever" was running rampant. I had to do something. Then an idea hit me between the eyes. The previous Friday, I received a tenative notice that another article was being reviewed for a future publication in *Bee Culture*. My writing career started with "Dumpster Diving" and "Superjig" in the September 2009 issue. After ten years and over thirty seven articles published, I should be able to write about writing.

Years ago I was taking a class on developing informational presentations when the instructor said something that still sticks with me today. She said the rules are simple when designing a presentation. First "TELL THEM what you are going to tell them". Then "TELL THEM". And finally "TELL THEM what you told them". The same basics are true when developing a written article. In this instance, I'll use writing articles for *Bee Culture* as an example of this set of rules while using a few examples from different articles to emphasize some points. The same methods, ideas or thoughts are not restricted to this publication. They are transferable to other publications or presentations for your bee club.

By writing for a publication, you can express your ideas, thoughts or methods you think would be helpful to the beekeeping community at large and help expand their knowledge. Hopefully, after reading this article, you will decide to try writing an article for *Bee Culture*. **Here we go!**

- **Tell them** what you are going to tell them. Give the audience a preview.

The preceeding paragraphs are an example of this simple rule. Basically it is a summary of the main points presented in the article. The title of the article is important. It needs to grab the attention of the reader.

In 2013 I submitted an article titled "Hints" which was never published. Then in 2014 the article was retitled to "What your mentor forgot to tell you!". It was published in May of that year. It has been republished once and now, after being been updated and expanded, is under consideration for another publication.

- **Tell them.** What do you want the reader to know?

Ideas, Knowledge, Thoughts, Methods, Wants, and even a mess-up on your part is something that you can write about. The catagories are endless. But, the premise or idea needs to be keeping with the interest of the reader of the publication. Very seldom are ideas developed from a "EUREKA" moment. But it does happen. Previously a reference was made to a "Hints" article. At one bee club meeting a new beekeeper mentioned he had a problem with ants. The speaker immediately asked the audience to respond in unison to the question with a one word answer to "What does he need?" Immediately forty seasoned beekeepers shouted "CINNAMON". From this response an article was developed. Your mentor cannot tell you everything! This article is also the result of a "EUREKA" moment.

Research – Has your idea been written about before? Is it relevant? Look into the need for an article. The internet has fantastic capabilities but you have to be careful. As Larry Conner once told me, "There is a lot of snake oil out there". Then Kim Flottum responded to the same question with "Evaluate your source." I paraphrased both but what they are saying is to be careful with your research and acceptance of ideas.

Pictures and drawings make it easy to emphasize the point of your article. Individuals have different ways of learning. Some prefer to read, some listen and some are visual. I believe that most writers perfer to learn by reading. Notice that the emphasis is on reading in this article. But additional emphasis can be placed on a relevent point with a meaningful or attention grabbing picture.

Rewrite again and again and again.

Few writers are satisified with the first draft of their writings. Missed points, reviewer criticisms

and sometimes style changes are needed to present a clearly defined idea. Unless you are one of the talanted few, revision is the name of the game.

Reviewers are needed. Usually two reviewers are used before my articles are sent for acceptance. First they are reviewed for correct english and punctuation. My wife is a retired legal secretary and knows the rules inside out. The second review is by an experienced beekeeper and woodworker who checks all the assumption, drawings and completeness.

Rules are there for a reason. Most editors are willing to help new writers but you need to remember they are under pressure to put out a publication on a schedule. This means they need to plan months in advance and they need to rely on their writers to deliver relevent articles on time. For *Bee Culture* rules look on the internet at:

https://www.beeculture.com/write-us/

- **Tell them** what you told them.

Reinforce what you just told them. The following paragraph is an example of the third rule. Summerise what you told the reader and ask them to do or try something. A salesman once told me that many sales were lost after a good presentation was complete, but the presenter didn't ask the auudiance to buy or even provide contact information.

You can do it!

Writing articles is not easy nor is it hard. It just takes time and some guts to step up to the plate and give it a try. *Bee Culture* like all monthly publications are always looking for new ideas and writers. You probably have the idea and the experience. Now tell the rest of the beekeeping community. They will be grateful!

Get a copy of Ed Simon's book *Bee Equipment Essentials* with detailed drawings, construction hints and how-to-use instructions for dozens of beekeeping tools and equipment from **www.wicwas.com.** Ed can be contacted through **SimonEdwin41@gmail.com**. BC

The great thing in this world is not so much where we are, but in what direction we are going.

BUILD A DUAL PANE INNER COVER

Leonard **Riepenhoff**

We install dual pane windows to keep our homes cooler in warm weather, and warmer in cold weather, why not do the same for your bees?

Build a wood frame 16.25" x 20" x 1" or thicker, for your 10 frame supers. **See diagram.**

Put a piece of clear plastic lens above the bottom with a space around ¼" (this keeps the bees below the lens and leaves them enough room to move under the lens), you can cut holes in the lens so you can feed the bees with a jar of Syrup. Top feeding bees lets them feed without going outside and this also helps discourage robber bees.

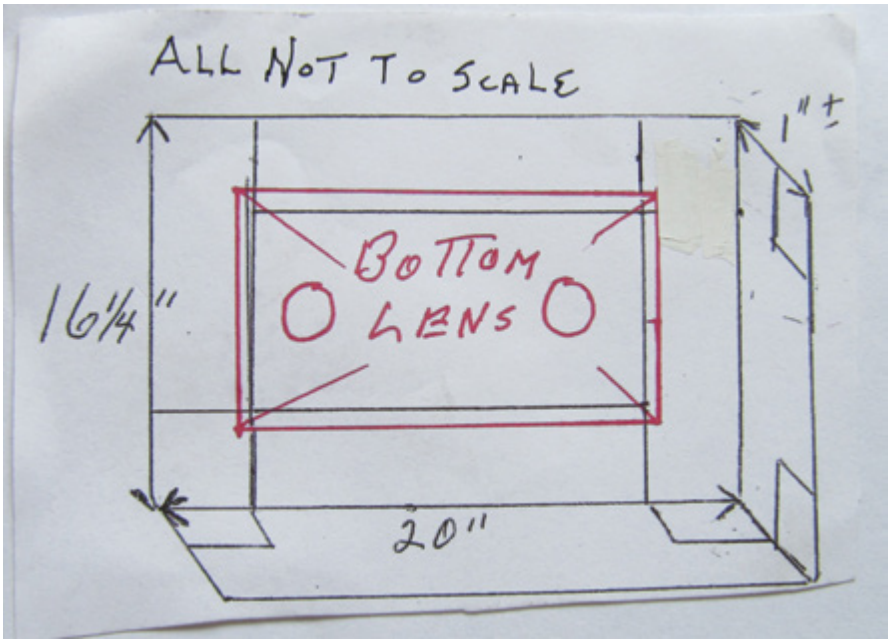
Placing a second lens on top of the frame will make it a dual pane inner cover. Cut ½" deep saw cuts for the bottom lens on the inside of each of the side boards. This provides more ventilation. Be sure width of saw cuts are wider than your lens thickness.

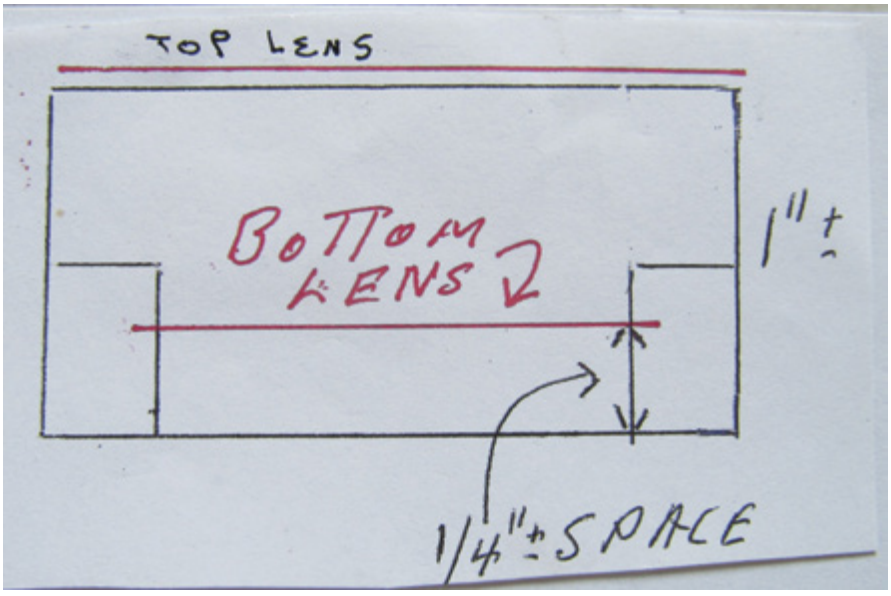
In hot weather, you can place some window screen over the feeder holes on top of the lower lens for even more ventilation and opening your top cover an inch or more so the screens will have a better chance to let the air circulate. If the bees propolis the screens shut, they probably don't need more ventilation. Lack of ventilation would be a big problem, too much is seldom a problem.

In cold weather, covering the feeder holes (with a 4" x 4" piece of plastic works fine) on the lower lens and then place the top lens on making your inner cover a dual pane inner cover. Of course, in warmer weather remove the top lens.

You and your friends can now look at your bees without disturbing them, and not be concerned about getting stung, as your bees are under the lens.

Another great feature in the spring is when the bees start putting wax on the bottom of the lower lens, this is a sign you should install a honey super. See "Craigs list" for more information.

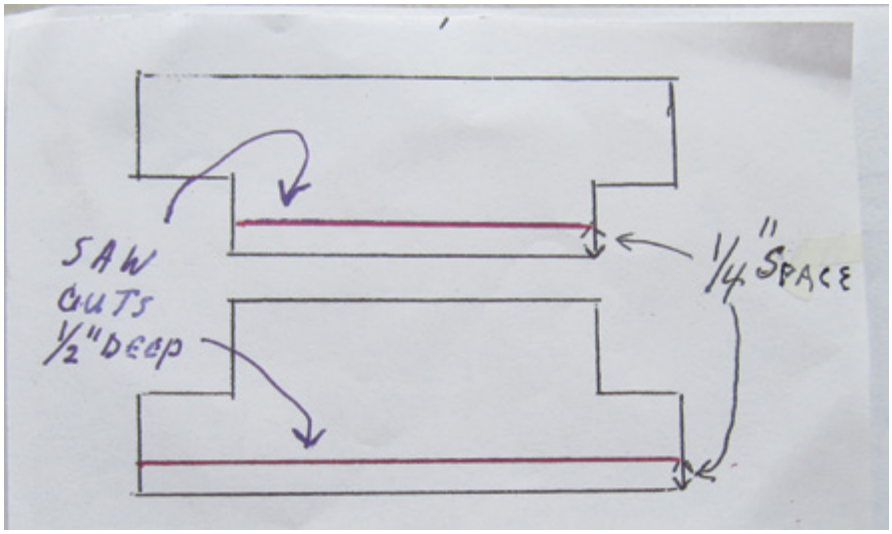




Using a single edge razor blade to clean off any wax or propolis that is on the lens helps and using some floor wax removal spray after does a good job cleaning the lens. Of course, you remove it from the colony before cleaning it. BC

Leonard Riepenhoff, Santa Rosa, CA

Any questions phone: 707 525-8424 Saturdays 10 AM -12 NOON pacific coast time



Be Sure And Check Your Mailing Label. It Will Tell You How Many Issues Of Bee Culture You Have Left! You Don't Want To Miss A Single One

Coneflower, Please

Alyssum **Flowers**

Echinacea purpurea, Purple coneflower

No garden or landscape should be without coneflower, *Echinaceae spp.* due to its cheery flowers, rugged hardiness and perennial visitation of many pollinators and songbirds. Coneflower is a favorite because, being native to the Eastern United States, they are tough, drought tolerant, and somewhat deer resistant. Their stiff 3-4' tall stems allow the flowers to rise above other flowers, giving the garden more dimension and interest. Multiple cultivars are available to blend in with any color scheme or stand out in bold colors and flower forms.

Nine species of Echinacea are known, all of which grow in North America. Native Americans of the Great Plains region used the plants as traditional medicine to prevent colds and fight infections. Echinacea is still commonly found in tea and herbal supplements and is a good source of vitamin C.

Mainly, coneflowers are grown for color and to attract bees, butterflies, hummingbirds and other pollinators. Coneflowers usually begin flowering in mid summer and will continue to flower until fall. If the seed heads are cut off after the first show, they will flourish with many more blooms. By late summer, allow some of the seed heads to remain as goldfinches and other songbirds feast on these seeds. The seeds will readily sprout to become new plants the following year.

Coneflowers can be purchased as seeds, rootstalk in early Spring or as potted plants. If planting from seed, start them two weeks before the last spring frost then transplant them outside in tilled soil, or plant them directly into the garden after all danger of frost has passed. Seedlings may take several years before they flower. The bareroot plants can be potted or planted directly into the soil. Make sure that the new plants do not dry out. Although coneflowers can grow in any soil, they perform best in rich, loamy soil and full sun. They do not flower well in the shade and become susceptible to powdery mildew in shady conditions.

Few pests bother coneflowers, although they can get some root and leaf diseases and a stem cutting weevil has been seen. An eriophyid mite can cause the ray flowers to become short and distorted. Do not spray coneflowers before or while they are flowering (so that pollinators are not harmed by the insecticide), instead, cut and discard affected stems and flower heads.

Although the purple coneflower is the most common, Echinacea can be found in many colors and unusual petal shapes which makes this perennial adaptable in any style garden. A.I. Root has several pretty cultivars, *Echinacea purpurea* PowWow White, E. PowWow Wild Berry, E. Sombrero Adobe Orange, E. Sombrero Lemon Yellow, and E. Sombrero Salsa Red. All have large, cone shaped centers and dozens of long oar-shaped petals.

Try some coneflowers in your landscape and be prepared to be amazed and impressed. Note that many pollinators and other insects love the flowers. Take pictures, instead of killing unknown insects. Most of them are beneficial. BC

E. PowWow White and Sombrero Adobe
https://www.gardenia.net/plant/malus-adams

E. Sombrero Lemon yellow
https://www.jfschmidt.com/introductions/royal-fountain/index.html

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https://plants.ces.ncsu.edu/plants/echinacea-purpurea/
https://www.almanac.com/plant/coneflowers

Echinaceae Sombrero Adobe, E. PowWow White, E. Sombrero Lemon Yellow.
https://www.englishgardens.com/weeping-madonna-flowering-crab/

E. Sombrero Wild Berry
https://www.monrovia.com/powwow-174-wild-berry-coneflower.html

E. Sombrero adobe

Wizards and Prophets

Jeremy **Barnes**

"Don't you think it would be sad if the human race suffered a catastrophe?" Charles Mann asked the late, great evolutionary biologist Lynn Margulis, No, she responded, arguing that in a million years the planet will be fine – we just won't be living on it. Then she added, "Besides, it's the fate of every successful species to wipe itself out."

One of Darwin's laws is that biological processes like evolution apply to every species, from protozoa to people. If one puts some bacteria in a petri dish filled with nutrients, they will eat and multiply until they hit the edge of the dish, and then either starve to death or drown in their own wastes. Because biological laws apply to every creature, Margulis suggested, the same will happen to us – it's inevitable. For it not to happen we would have to be special; we would have to be unlike every other creature in that the rules of nature would not apply to us.

Let's project 40 years into the future, when the earth's population may exceed 10 billion (which will include some of you reading this article) and ask what kind of world it will be. This is the essential question Charles Mann asks in his most recent book, *The Wizard and the Prophet,* which is a portrait of two little-known 20th-century scientists, Norman Borlaug and William Vogt, whose diametrically opposed views have shaped our ideas about the environment and the choices we face as to how to live in tomorrow's world.

The first view, what Mann labels the Prophets, follows William Vogt, who was in many ways the founder of the modern environmental movement, a crusade that Mann describes as 'the only enduring ideology of the twentieth century.' Vogt's fundamental contribution was to say that the planet has limits within which we have to live. According to data aggregated by the Global Footprint Network, it takes the biosphere a year to produce what humanity habitually consumes in roughly eight months – a situation that is logically unsustainable. And yet we persevere with what the British psychologist Michael Eysenck calls the 'hedonic treadmill,' holding out the hope that we can somehow purchase or will ourselves out of the crisis of diminishing returns. Rather, Vogt urges, put on your sweater. Turn down the thermostat, eat lower on the food chain, consume less rather than produce more, eliminate toxins, reduce and recycle waste, protect biodiversity, live close to the land and protect local communities. Small is beautiful, live lightly on the soil and work with nature rather than overwhelm it. Such a vision – a network of self-sufficient citizens guided by ecological precepts – conflicted with the prevailing perception of the good life and evoked epithets like 'tree-huggers.'

The Wizards are the heirs of Norman Borlaug, an agronomist and humanitarian, who exemplified the idea that science and technology, properly applied, will let us produce our way out of our problems. In 1942 he took up an agricultural research position in Mexico, where he developed semi-dwarf, high-yield, disease-resistant wheat varieties. Combined with artificial fertilizers and intense irrigation, Mexico became a net exporter of wheat by 1963. Between 1965 and 1970, using a new variety of rice developed with Borlaug's assistance, yields nearly doubled in Pakistan and India, greatly improving the food security in those nations. Thus Borlaug has been called "the father of the Green Revolution" and is credited with saving over a billion people worldwide from starvation, for which he was awarded the Nobel Peace Prize in 1970. The response of the Prophets to a technology that

Dr Tom Seeley

significantly increased the amount of calories produced per acre of agriculture, is unrelenting. Since fertilizers are essential to the Green Revolution they forever changed agricultural practices, not only in terms of never-ending streams of nitrates, potash and potassium that run off into the water system, but also the large industrial complexes that were needed to produce chemicals on a sufficient scale.

Irrigation is also essential in that rivers need to be dammed and diverted, sending water to drier areas. California is a prime example of the manipulation of water resources for the Central Valley and the crises this has caused state-wide in increasing times of drought.

In addition, the development of high yield varieties meant that only a few species of corn, wheat or rice were grown. In India for example there were about 30,000 rice varieties prior to the Green Revolution; today there are around ten, all the most productive types. By having this increased crop homogeneity there were not enough varieties to fight off disease and pests, meaning that pesticide use grew as well.

The use of Green Revolution technologies exponentially increase the amount of food production worldwide, which is advantageous for those living on the edge yet also increased the global population dramatically, thus adding to the problem that was the initial concern. Ironically such technology is denied to places like many African countries that do have the infrastructure,

governmental efficiency and security of other nations.

And let us not forget the small scale, traditional farmers who struggle with debt and crop failures in the face of large scale industrialization and corporate control. Al least 300,000 farmers across India have committed suicide since 1995 – that's almost 40 a day – often by drinking the very pesticides that are, by their price, the cause of their failure and sense of shame.

Prophets look at the world as finite and people as constrained by their environment. Wizards see possibilities as inexhaustible and humans as wily managers of the world. One views growth and development as the lot and blessing of our species; others regard stability and preservation as out future and our goal. Vogt believed that ecological research has revealed our planet's inescapable limits and how to live within them. Borlaug believed that science could show us how to surpass what would be barriers for other species.

Particularly important, the two sides have two different ideas of liberty. Wizards think that people are independent individuals who are most free when they have maximal choice – they can reinvent themselves endlessly, breaking through all barriers. Prophets think humans are by nature social and biological beings and true freedom lies in recognizing and celebrating our essential character, as creatures bound into a community, as a species in a web of other species.

What brought this to mind was the January issue of *Bee Culture* in which an article by Dr. Tom Seeley (a Prophet) on *Darwinian Beekeeping,* was sandwiched between three articles on new technologies for use in the hive (the Wizards.) After summarizing the history of the honey bee, going back to East African fossils that are 1.6 million years old, Seeley writes, "Wilk and managed (colonies) live under different conditions because we beekeepers, like all farmers, modify the environments in which our livestock live to boost their productivity. Unfortunately, these changes in the living conditions of agricultural animals often make them more prone to pests and pathogens." I would add that most of those modifications have been made for the benefit of the beekeeper rather than the long term health and survival of the bees.

Malcolm Sanford, in his article titled *Record Keeping with Smart Phone Apps,* writes, "In this technological age, the amount of data that is possible to collect is mind boggling. Thus more than ever beekeepers risk being swamped by almost infinite possibilities when it comes to making management decisions." In the same issue Engelsma et al assess the increasing number of electronic hive scales available, while Cazier et al describe the data sharing risks and rewards for commercial beekeepers.

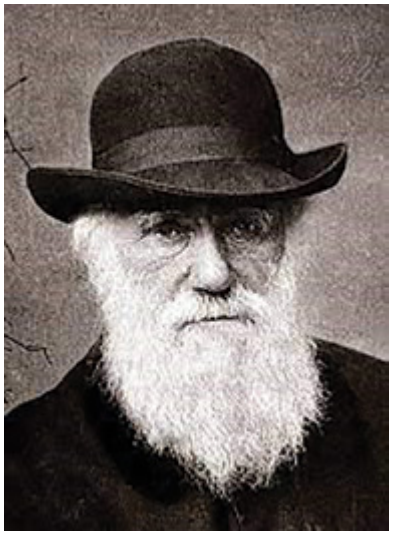
It is customary, in today's world, to give equal consideration to both sides and to come up with a compromise, in this case more environmentally friendly hives for the bees with the use of technology

Norman Borlaug

for the benefit of the beekeepers. Yet the current trend seems to be more of the latter and less of the former. I am strongly attracted by Seeley's argument and am experimenting with some major modifications to the Langstroth hive, first suggested by David Papke, that are more akin to the environment feral bees will choose for themselves. I do have scales under three of my hives as part of an experiment by Pennsylvania State University to assess the relationship between colony health and the surrounding environment; otherwise my technology consists of a hive tool and a smoker. I have to borrow my wife's smart phone to record the data from the hive scales.

In terms of the bigger question posed by Vogt and Borlaug, humankind is capable of solving this dilemma. Simply feeding 10 billion people – most of whom will be middle-class – will require prodigious social and economic changes. The issue is whether we will do it, and if so, will we do it in time. On that, the jury is out. BC

Charles Darwin



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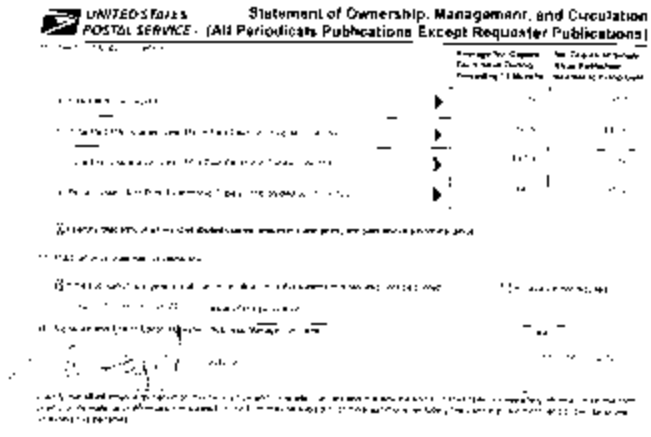
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Bee-toxic Pesticide Use In Almond Orchards During Bloom

Brittney **Goodrich**[1] **&** Jennie **Durant**[2]

Each year, the majority of U.S. commercial beekeepers truck their honey bees to California to pollinate almonds from mid-February to mid-March. Pollinating for the almond industry has benefits and challenges for beekeepers and their honey bees. Almond pollination revenues now outweigh revenues from honey production for the majority of US beekeepers (USDA Honey Report, 2021; Goodrich and Durant, 2020). However, managed colonies may also be exposed to bee-toxic agrochemicals during almond bloom that can have toxic effects on honey bees (Fisher II et al. 2018, 2017; Wade et al. 2019), affecting beekeepers' ability to meet future pollination contracts and earn income from honey production.

This study aimed to understand the types of pesticides managed colonies were exposed to during almond bloom, and if pesticide labels played a role in application rates during bloom. The Environmental Protection Agency (EPA) regulates pesticide registration and labeling in the U.S., and all pesticides must have labels outlining environmental hazards (see full article for details of federal and California pesticide regulation). Any pesticide registered for outdoor use must have information regarding the pesticide's toxicity to honey bees.

EPA separates pesticides into three categories: Group I pesticides are *highly* toxic, Group II pesticides are *toxic*, and Group III includes all other pesticides. These determinations are based on LD_{50} values (the median lethal dose that will kill 50% of an experimental population of adult honey bees through a topical application of the test substance). *Highly* toxic and *toxic* pesticides (respectively termed "highly toxic" and "moderately toxic" in our study) contain precautionary statements regarding ways to avoid the risk of exposure to honey bees, such as not applying an insecticide to blooming crops or weeds. Group III pesticides (termed "non-acutely toxic" pesticides in our study) do not have a bee-toxic precautionary statement, however independent research indicates that some pesticides in these groups can have sublethally or synergistically toxic effects on honey bees **(for list see technical appendix, table A).**

To address the use of sublethally and synergistically bee-toxic pesticides during almond bloom due to knowledge gaps in the EPA labeling system, beekeepers, extension specialists, the Almond Board, the EPA and the California Department of Pesticide Regulation (CDPR) jointly crafted and publicized a set of **Honey Bee Best Management Practices** (Bee BMPs) in 2014 (recently updated in 2018). The Bee BMPs have four core precautions: (1) maintain communication between all parties on the specifics of pesticide application; (2) only spray fungicides in the late afternoon or evening; (3) avoid tank-mixing products during bloom because some agrochemicals might have synergistic toxicities, and (4) avoid applying all insecticides during bloom. At the same time, however, growers sometimes find it necessary to use fungicides, insect growth regulators (IGRs) or other pesticides during bloom —agrochemicals that can be sublethally or synergistically toxic for bees but are not labeled with a bee-toxic precautionary statement.

Methods

To investigate grower pesticide use around the almond bloom period, we drew from CDPR's Pesticide Use Report database for eight major almond-producing counties in San Joaquin Valley from 1990 to 2016. We concentrated on agrochemical applications in almonds during almond bloom each year (February 15 to March 15), and during the months when bees would commonly be in California either before (January 1 to February 15) or after bloom (March 15 to April 1). Overall, we investigated the use of 12 pesticides with precautionary statements (mostly insecticides), and 24 pesticides with no bee-toxic precautionary statements that have evidence of being sublethally or synergistically toxic to bees (mostly fungicides and IGRs) **(for full list see technical appendix, table B).**

Results

We found that since 1990, both the bloom-time (February 15 to March 15) applications per acre and the amount per acre (pounds of active ingredient) of the pesticides have decreased. Both of these trends were statistically significant at the 1% level. The decreasing trends in applications and active ingredient per acre vary across type and toxicity of pesticides and are discussed below.

Types of agrochemicals applied

We found that fungicides and herbicides are the most commonly applied agrochemicals during almond bloom. Fungicides were the only pesticide category with a statistically significant decrease in pounds of active ingredient and applications per acre applied during al-

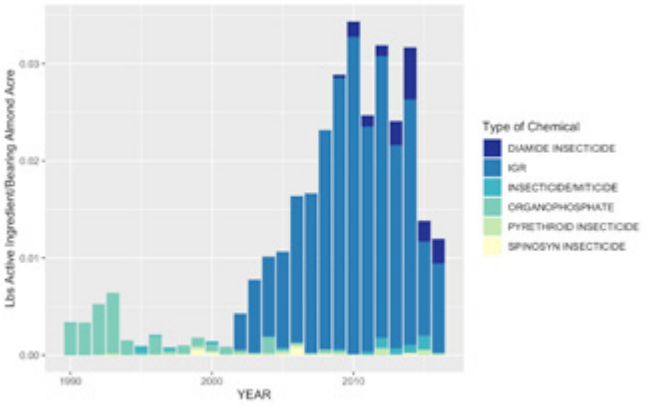

Figure 1. Pounds of active ingredient of agrochemicals in table B applied per bearing acre of almonds during bloom by type of chemical, without fungicides and herbicides, February 15 to March 15, 1990–2016. Note: Listed miticides are those applied to almond orchards, not to treat Varroa mites on honey bees.

[1] Assistant Cooperative Extension Specialist, University of California, Davis
[2] Post doctoral Scholar, University of California, Davis

mond bloom over the 1990–2016 time period. Figure 1 shows the pounds of active ingredient applied by type of chemical during almond bloom, excluding fungicides and herbicides. It is apparent that there was a switch in the late 1990s from the use of highly toxic insecticides, organophosphates and pyrethroids, to IGRs. The use of IGRs increased from 2002 to 2010, when organophosphate and pyrethroid usage began to decrease.

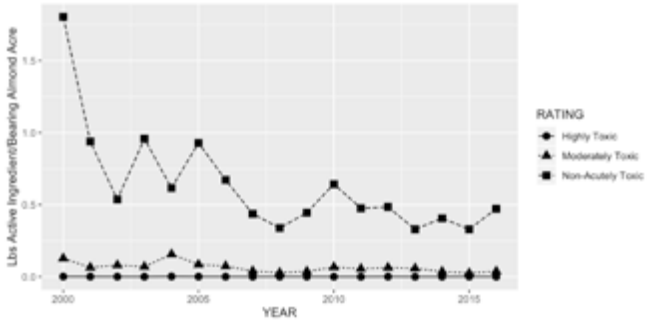

Figure 2. Pounds of active ingredient of agrochemicals in table B applied per bearing almond acre during almond bloom by bee-toxicity rating, February 15 to March 15, 2000–2016. Note: Non-acutely toxic includes sublethally and synergistically bee-toxic chemicals (table A).

Time periods and toxicity of applications

Figure 2 shows that *highly toxic* chemicals have been applied at low levels per acre during almond bloom since the year 2000, so there was little room to decrease this amount over time. *Moderately toxic* chemicals were applied at slightly higher levels per acre than *highly toxic* ones and saw a slight decrease between 2000 and 2016. *Non-acutely toxic* chemicals were applied at relatively high levels per acre beginning in 2000, but have decreased over time (fig. 2).

Table 1 shows the average number of agrochemical applications per day in the San Joaquin Valley for the years 2010 to 2016, separated by bee-toxicity rating and timing with respect to almond bloom. This table is not adjusted for almond acreage, and is meant to broadly reflect growers' decisions regarding pre-, during- and post-bloom applications. *Highly* toxic chemicals are applied infrequently when bees are in almond orchards during bloom, on average one application per day. However, there are still applications of *highly* toxic and *moderately* toxic pesticides prior to bloom. *Non-acutely* toxic chemicals without bee-toxic precautionary statements are often applied within the almond bloom time period with an average of 594 applications per day.

Figure 3 shows histograms of weekly chemical applications with and without a bee-toxic precautionary statement. The beginning and end of almond bloom each year are highlighted with two pink lines. We found that chemicals with precautionary statements were applied before bloom, but rarely during the bloom period (fig. 3a). On the other hand, chemicals without precautionary statements were frequently applied during bloom (fig. 3b).

Key Takeaways for Beekeepers

Our results suggest that growers are generally following the label during bloom, but applying unlabeled (and sometimes bee-toxic) agrochemicals while bees are pollinating almonds.

Given this finding, changing EPA labeling requirements to include sublethally and synergistically bee-toxic agrochemicals, and growers' full adoption of the Bee BMPs, may be important steps to improve bee health.

Beekeepers can also take a number of precautions to reduce the risk of their colonies' agrochemical exposure in almond orchards. The finding that many bee-toxic pesticides are applied in January, the month before almond bloom, is problematic for beekeepers, given that many beekeepers place colonies in holding yards near almond orchards over winter. The applications of *highly* and *moderately* toxic pesticides prior to bloom (fig. 3a) may impact these colonies, and beekeepers may want to consider other alternatives to bringing in colonies prior to almond bloom, or discuss application timing with growers adjacent to their beeyards. Whenever beekeepers bring colonies into California, they should register with the BeeWhere program **(https://beewhere.calagpermits.org/).** BeeWhere offers an online portal with a GIS mapping system where beekeepers can register their hives with the county, so pesticide applicators can notify them before an agrochemical spray. Beekeepers may also consider mitigating issues caused by pesticide damage through the use of clauses in their almond pollination agreements. The beekeeping and almond industries are increasingly reliant on one another for long-term economic viability, so working together to improve bee health should be of interest to parties on both sides of the pollination agreement. BC

Table 1. Mean number of total applications per day in San Joaquin Valley for agrochemicals in table B by toxicity rating and timing, 2010-–2016

Bee toxicity rating	Mean no. of total applications per day		
	Pre-bloom (Jan 1–Feb 14)	Bloom (Feb 15–Mar 15)	Post-bloom (Mar 16–Apr1)
Highly toxic	49	1	10
Moderately toxic	31	21	3
Non-acutely toxic	51	594	276

Note: Non-acutely toxic includes sublethally and synergistically bee-toxic chemicals (online appendix table A).

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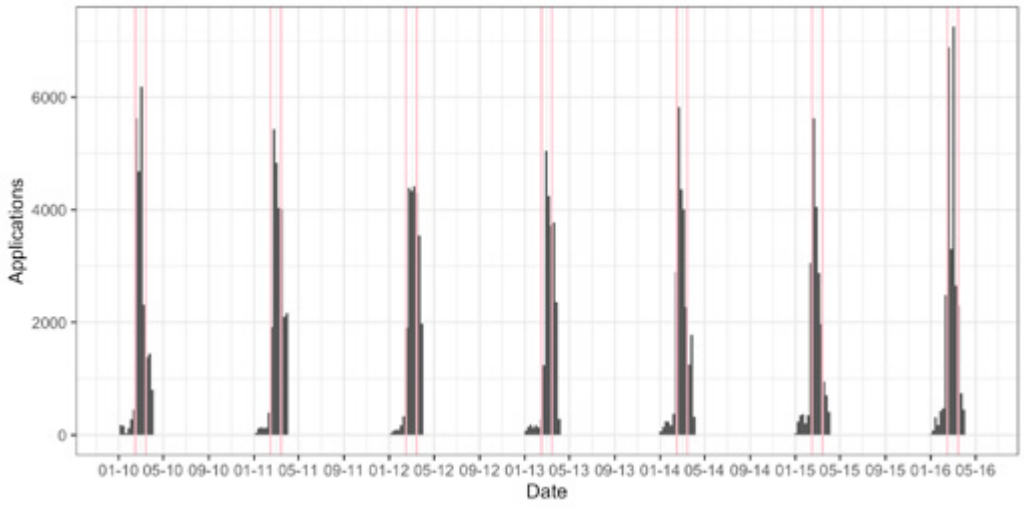
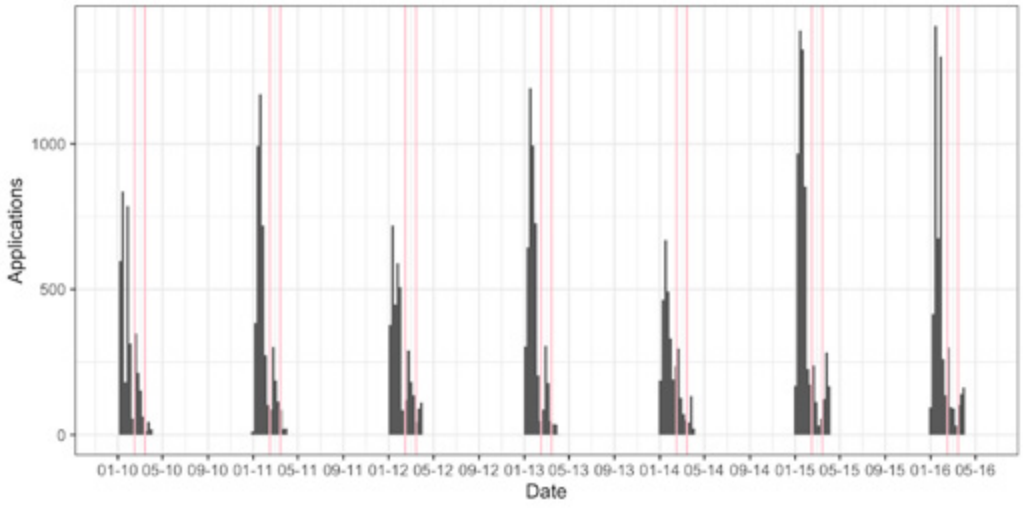
Figure 3. Histogram of weekly applications of agrochemicals in table B (almond bloom period highlighted), January 1 to April 1, 2010–2016.
a) Agrochemicals with precautionary statements



b) Agrochemicals without precautionary statements



They Are NOT My Bees!

But somehow, I am responsible.

Time stands still

Sixteen years ago, in the October 2005, *Bee Culture* magazine, I wrote an article in which I described how beekeepers unintentionally become insect pest exterminators during the Fall of the year. It's a job most *honey bee* keepers do not and should not want. The old article title still works nicely so I used it again – sixteen years later. Nothing has changed. *"They are not my bees,"* but most people are not burdened by that fact.

Guilty by association

If I were not an entomologist, I probably would not have much interest in typical stinging insects. As such, I feel your mild distaste when spending educational time on wasps and hornets. Insects like these are not our passion. *Yeah, they're interesting, but let's get back to honey bees.* But reader, one way or another – to a greater or lesser extent – you will need to know at the least the basics about stinging insects that are not our beloved honey bees. If nothing else, you will need this information to defend your honey bees when autumn yellowjackets begin to disrupt a picnic outing and honey bees are blamed.

Not because I am special

I am not unique, but I have done the honey bee thing for a long time. As have you, I have acquired many stories that involve stinging insects.

For instance, a neighbor phoned and said, *"Your bees are coming out of a hole in the ground near play equipment so my kids can't play there."* Clearly these were not honey bees. I patiently explained that honey bees did not nest in the ground and that these were yellowjackets, and as such, were not my responsibility. My neighbor responded, *"Jim, my father was a USDA forester. I know honey bees when I see them!"* Well, okay - wow… a USDA forester. (I never really knew why that mattered.)

At this point, reader, you must decide. Are you going to help neighbors with these yellowjackets or are you going to leave them feeling that my bees have threatened their children's safety? I went to the scene to find yellowjackets – not honey bees - flying from a ground burrow entrance. I sprayed the entrance with a common insect spray and very, very luckily, the colony died. I didn't try to change my neighbor's mind.

Dealing with neighbors' yellowjacket problems

On September 2, 2021, Kim Flottum, former editor of *Bee Culture* and now *Honey Bee Obscura* co-host podcaster and I did a segment entitled, *Dealing with Neighbors' Yellowjacket Problems* (segment number 37). In this segment, Kim and I were classic *Yin and Yang* components.

In **Ancient Chinese philosophy**, **yin and yang**[1] is a concept of dualism, describing how obviously opposite or contrary forces may actually be complementary, interconnected, and interdependent in the natural world, and how they may give rise to each other as they interrelate to one another. I felt that, in general, when one arose, I probably would help my neighbors and family with their stinging insect issue, but Kim was firm in that this was a job for a professional – yin and yang. Though it sounds contrary, as I got my protective gear together for a particular extermination job, I admitted to myself that I completely agreed with Kim. This was actually a job for a trained exterminator. An explanation is needed.

When family calls

Of my three daughters, Robyn, the middle one, gave me a somewhat frantic call during July just passed. Large black bees – but not Bumble bees – had invaded a climbing vine on their front porch. They were vicious bees. My son-in-law, Doug, had already been stung several times. He was in a foul mood. This was clearly an emergency and a job for *Super Bee Dad*. Honestly, I wasn't sure what my plan would be for removing this nest. It was in the balustrade around the front porch and near the front door. The nest was entangled in vine branches and twigs, and my daughter was correct. They were big "bees" that buzzed around me with an ominous hum. Need I say that the

Figure 1 A yellowjacket, good wasp in the wrong place

[1]Yin and yang. https://en.wikipedia.org/wiki/Yin_and_yang

Figure 2 A honey bee, a bald-faced hornet and a fly (upper right) enjoying a pear

bees were Bald-faced hornets and not bees at all?

It is important that you know that my daughter's house is in a new sub-division composed of modern houses positioned very near each other. No secrets in this close community. If a guy is standing in the front yard wearing strange clothes with a hood and probing around the vines, something is clearly ongoing. Kids, adults, and pets all took positions on various front porches or leaning against fence posts to watch the unfolding drama.

While I know a lot about honey bees, I don't routinely work with hornets – plus now I have an audience. I tried to look authoritative – you know – like I was trying to decide which one of several plans I would employ to save this community from pending danger. *(Actually, I was trying to be sure that I would take the fewest number of stings possible and not make a spectacle of myself while doing it.) "After dark,"* I decided. *"This has to be an after-dark task."* The hornets will all in inside the paper nest. I will gently trim branches and twigs; put the entire nest into a plastic garbage bag and then I will be off to dispose of the nest.

As dusk approached, my family and selected neighbors positioned themselves before the large living room picture window of my daughter's house where they had an unobstructed view of the playing field. I suited up but decided that a smoker would have limited value. I would frontally attack the nest and be gone.

At this point with stories like this, I should describe some hideous turn of events – some disaster – something that the community would discuss for months to come; yet all went fine. Can you believe it? There were a few anxious moments. When I ever-so-gently touched a branch, the nest immediately hummed, and a few marauders came out to attack. Annoyingly, they seemed to instinctively go for my throat where my veil ties down. I felt like a new beekeeper trying to stay right in the middle of my protective gear and nervously watching the crevice just below my chin. Would they figure out that they could squeeze in at that point? Remember, everyone is watching Robyn's Dad.

Snip, snip, snip and the nest was free of the vine. Into the bag it went and away I went. Now what? I had previously decided to put the relocated nest in my old abandoned dog house. I mean after all they are hornets – what would bother them? Having never moved a hornet nest before, I went out early the next morning to the hornet dog house only to find hornet death and destruction everywhere. I suppose the assassins were raccoons. The nest didn't make it one night before being destroyed, but never-the-less, I was still a hero with my daughter. Her porch was once again safe for human habitation. She should have called an exterminator, but I wanted to help.

It was a very personal request

But that long story just recalled was in support of my daughter. It is commonly not family but rather neighbors and friends who request help. Last month in my *Bee Culture* article, in beleaguered detail, I told you about the passing of my two nearest neighbors – one on each side of my home - two people who had tolerated my bees and me for decades. For all those years, my bees had visited their bird feeders and bird waters, I had retrieved my swarms from their property, and worst of all, my bees – at different times – had stung one of my neighbors as he mowed his lawn. And don't even go into the topic discussion of fecal spots that plastered their cars. My neighbors have been tolerant of me and my bees – for years.

After my neighbor's death, in a personal effort to be good, concerned neighbors, my wife and I offered to help the widow in any way possible. Her request was that I do something about the yellowjackets in the wall of her house. She was having frequent visitors, and due to the flight path, she could not have guests on her deck without fear of a sting.

Yes, due to litigious and safety reasons, I should have suggested she contact a pest control operator. That would have been the correct thing to do. The emotional thing to do was for me to try to eliminate the nest. I had offered to help, so help.

The perpetual problem

The predictable problem is that the nest, itself, is not near the entrance. I was just plain lucky when I sprayed the nest for my neighbor whose dad was a USDA forester. However, I was not lucky when I sprayed the nest at the widow's home. I tried five times. I used an air blower. I changed pesticides. I tried everything I knew, but clearly, I was not getting the pesticide to the nest, but only to the nest entrance. The nest was damaged but survived.

The heart of what I am trying to say

Rarely, should beekeepers be stinging insect pest exterminators, but even so, we beekeepers are frequently asked to do the job. In some instances, even exterminators do not want the work. The saddest part of this explanation is that so many times, the nest does not even need to be killed. It needs to be left alone. But we all know the public's perception of stinging insects. Even in quiet retirement, I estimate that once a week, I get notice from someone describing their insect sting allergy. Once the nest is found, much like finding a snake or a spider, something must be done. *It's urgent. I'm allergic.*

I have reluctantly killed beautiful hornet's nests that could just barely be reached from a tall ladder – stinging insects that would – most likely – have never been a problem, but the Fall leaves had dropped, and the nest

was suddenly exposed. It had to go. It's perceived danger.

The beekeeper is in a community-minded quandary. I know that some people are just a click away from complaining or being concerned about honey bee stings. Anything that I can do as a beekeeper to forestall that complaint would be a good thing. The beekeeper wants to be appreciated as a community/family asset.

So, after dark, I have fallen from ladders – twice – while trying to remove hornet nests that had not been a problem to anyone. I have been stung by bumble bees coming from the wall of a neighbor house as I tried to find their entrance. I have been stung by yellowjackets and paper wasps too many times to count. *(Oddly, I have never been stung by a carpenter bee – an insect neighbors love to hate.)* Even after all of this, it can really get complicated.

In still another extermination instance, after trying – and failing – to kill yellowjackets, I got a call from the homeowner that the insects were now ***in*** the house. The situation had escalated from annoying to urgent. The season changes and the temperature drops, the insects pull back farther into the wall cavity as they follow streams of household heat. The population is large and now deep into the house cavity. They find an entrance to the inside by following both heat and light streams. *Boom!* They are in the house and are disoriented – as are the human residents. It was not a result of me trying to kill the nest from the outside, but from the seasonal change, that caused them to move inside. But now, the stinging insects in the house have become my problem.

Once the insects are inside, the solution is simple. Turn off all lights and allow light to come in a closed window. When the insects go the window pane to escape, whack them with a flyswatter. Easy call, but time consuming. Messy.

I warned you

In the opening paragraph to this article, I said, *"…sixteen years later. Nothing has changed."* When it comes to exterminating stinging insects, as a beekeeper, you have the necessary protective gear, and you have familiarity with stinging honey bees. But now you are using insecticides and possibly you are on a ladder. You are agitating stinging insects while bystanders depend on you to finish the job safely. You want to the be good guy, but each extermination job is unique. Some are easy while some are never won.

Bluntly, when we kill these insects, we are frequently killing insects that would normally be considered beneficial. The seasonal change will naturally kill the insects. The problem will resolve itself, but – and it's a big but – the homeowner or the family member or a church associate – whomever – they want it done now. There will be pleas to help. You must decide what are you going to do? It will be your call, and you won't make the same call every time. If you keep honey bees long enough, a call will come.

Stinging insect information

There is a copious amount of information on the web concerning stinging insects – much of it from pest control companies. Even so, I came across two pretty good general sources at:

https://camp-joy.org/wp-content/uploads/2020/06/Bees-and-Wasps-of-Ohio-Guide.pdf

https://www.maine.gov/dacf/php/gotpests/bugs/factsheets/wasps-bees-col.pdf BC

Dr. James E. Tew, Emeritus Faculty, Entomology, The Ohio State University and One Tew Bee, LLC

tewbee2@gmail.com
http://www.honeybeeobscura.com

For a short video on "**They are NOT my Bees!**" and more comments on this month's article, hover your smart device QR app over this code....

https://youtu.be/GA-VI-6xOtU

Figure 3 Paper wasps. Smaller populations and easier removal

Fall Honey Recipe –

Shana **Archibald**

Apple Cider Donuts

1½ cups apple cider
1 cinnamon stick
2 Tablespoons unsalted butter, melted and cooled slightly
2 cups all purpose flour
1 teaspoon baking powder
1 teaspoon baking soda
1 teaspoon ground cinnamon
¼ teaspoon salt
⅛ teaspoon cardamon powder (or nutmeg)
1 large egg, room temperature
½ cup light brown sugar
½ cup granulated sugar (or replace with ¼C of honey)
½ cup milk, room temperature
½ teaspoon vanilla extract

Donuts:

Preheat oven to 350°F. Spray donut pan with nonstick spray and set aside.

In a small saucepan, combine cider and cinnamon stick and simmer over low heat for 15 minutes. Let simmer until you have ½ cup of reduced cider. Set aside and allow to cool.

Melt butter and set aside to cool slightly.

In a large bowl, combine flour, baking powder, baking soda, cinnamon, salt and cardamom. Set aside.

In a medium bowl, lightly beat egg with whisk. Add melted butter, brown sugar, granulated sugar, (or honey) milk, vanilla and whisk until smooth. Add reduced apple cider and whisk until well-combined.

Pour the wet mixture into the dry mixture and whisk together until combined and smooth, but don't overmix! The batter will be a light caramel color.

Pour the batter into the prepared pan, filling each about ⅔ full. The easiest way to fill them is to use a pastry bag (or a plastic bag with a hole cut into the corner). But honestly, you'd have great luck just using a spoon to fill the pan. Make sure to wipe the pan of any excess batter. Bake for 10 minutes. Remove from pan and let cool on wire racks.

Top with: Honey, sugar, cinnamon or a combination of both. Or enjoy them plain. BC

CALENDAR

♦INTERNATIONAL♦

Alberta Beekeepers Commission Conference and Trade Show will be held November 25-26 at Fantasyland Hotel, Edmonton.

For information please visit **www.albertabeekeepers.ca/about/2021-agm-conference-trade-show**.

♦ILLINOIS♦

IL State Beekeepers Association will hold its annual meeting November 13 at the Northfield Inn, Suites & Conference Center in Springfield in celebration of their 130th year.

Registration is $20/members and $30/non-members. Pre-registration will include lunch. Speakers include Jim Tew and Adam Dolezal.

For information please visit **ww.ilsba.com**.

♦IOWA♦

IA Honey Producers Association Annual Meeting will be held November 13 at West Des Moines Marriott Hotel, West Des Moines.

Speakers include Bob Binnie and Kamon Reynolds.

For information please contact **IHPAtreasurer@gmail.com**.

♦LOUISIANA♦

The LA State Beekeepers Association and the USDA Honey Bee Breeding, Genetics and Physiology Lab will hold the 25th Annual Field Day **November 6 (PLEASE NOTE CHANGE OF DATE)**. It will be held at the lab, 1157 Ben Hur Road, Baton Rouge.

Pre-registration is $35 for 12 and above. Children 11 and under must stay with their parents. Walk-in registration is $40.

For additional information please visit **www.labeekeepers.org** or contact Frank Rinkevich, **frank.rinkevich@usda.gov**.

♦NEW JERSEY♦

Bee-ginner's Beekeeping: The Basics of Apiculture November 1-15 self-paced online class.

Course content will take approximately 14 hours to move through and participants will have two weeks to complete the work at their own pace.

For information and to register visit h**ttp://www.cpe.rutgers.edu/courses/current/ae0401wa.html**.

♦OHIO♦

Ohio State Beekeepers Association will hold its Annual Meeting and Fall Conference November 4-6.

Breakout sessions Thursday and Friday evenings. Full day conference/annual meeting Saturday.

For information see **www.ohiostatebeekeepers.org**.

♦WISCONSIN♦

WI Honey Producers Fall Convention will be held November 4-6. at Hotel Mead Wisconsin Rapids.

Sue Cobey is the keynote speaker.

For information contact **Liz9120@hotmail.com**.

♦VIRTUAL♦

Honey Bee Veterinary Consoritum will be viewable On-Demand September 18 - December 31, 2021..

Online registration coming soon.

For more information see **www.HBVC.org**.

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It's early September as I write, and full-speed ahead and damn the torpedoes at Paul's honey house.

Paul casually mentioned that Salvador recently extracted 280 honey supers in an eight-hour day. That's 2,520 frames, or almost double his predecessor's output.

Salvador's a cheerful strapping six-footer who somehow pounds it out in the insufferable heat of the honey house. He laughs when I call him "El gran Mexicano." After he got in a car wreck, it barely slowed him down. I told Paul's foreman Derrick I'd help out, and lift, push and pull for a stiff-and-sore Sal, but it never came to that. Derrick did allow as he'd keep me in reserve as his "secret weapon."

I pulled my mountain honey at the end of August. I stacked medium honey supers six-high on my flatbed and used my foot to cinch down extra-hard on the truckers' hitches on my tie-down ropes. Even so, the load shifted on the bouncy 4WD track back to the main county road. Not good! I continued on to a little pullout and began re-stacking supers. I let the engine run, global warming notwithstanding. I love my one-ton '83 flatbed Ford, but like another love I once knew, she's not to be trusted.

I was wrapping it up when a car slowed down as it passed, then backed up and stopped. Gary's an old ski patrol buddy. He and Nancy were on their way down from Meadow Lake. I hadn't seen those two in a spell.

As we were catching up, my truck engine stopped. Not sputtered and stopped like it was out of gas. Just stopped. One second the beast purred. The next, nothing.

And it wouldn't re-start.

All this was unlucky, or lucky, depending on how you looked at it. I was on a lonely road in the middle of nowhere with an old broke-down truck, but I just happened to be chatting with friends eager to lend a hand. Gary and Nancy offered me a ride home, but as an afterthought, Gary gave me a hard look and popped the question: "You're vaccinated, right?"

My bee suit was filthy, but luckily I had a halfway clean pair of jeans to change into.

Back at the farm, I gave Gary and Nancy some honey and a copy of my book – *A Beekeeper's Life – Tales from the Bottom Board.* Gary initially looked a little skeptical. "Try it," I said. "There're some ski patrol stories in there!"

I did a pretty quick turnaround and headed back up the hill in my pickup. I didn't have time to fiddle around and try to get the flatbed started, but there were 48 full honey supers on the back, and I was parked close enough to the bee yard that bees were already robbing.

The truck-to-truck super transfer went pretty smoothly. I had just enough room on the pickup. Getting that honey down off the mountain was the important thing.

The next day I pondered my options. My truck problem appeared to be electrical. The engine didn't sputter. It simply stopped. Coil? Unlikely, although they do sometimes go out. Distributor? It was in pretty good shape, last time I looked. Timing chain? It better not be! But I knew there was a mini-computer called an ignition control module, bolted onto the firewall. I knew because I replaced it 17 years ago outside of Steamboat Springs, Colorado, when my truck suffered a similar fainting spell. I remember at the time the anticipation I felt when I connected the wiring, said a quick prayer, and turned the key. She started right up.

I was so impressed that I bought a spare control module and tucked it under the seat. It had been there ever since, still in the box.

I couldn't get back to the flatbed for a couple of days, which gave me cause for concern, because I have a lift gate mounted in the truck's receiver hitch that's worth more than the truck.

When I did get back, I could hear the fuel pump running when I turned the key. I never disconnected the fuel line to see if gas was making it to the carburetor. My money was on the control module. But to my chagrin, my spare had an extra set of wires coming out of it. Otherwise it looked the same. I went ahead and put it in anyway, leaving those spare wires dangling.

I had the same helpless/hopeful feeling that I had the last time I replaced the control module, in 2004. Trust me, I'm not a mechanic. All I had was a hope and a prayer. And a spare control module that might not be the right one. I didn't know what to expect. But when I pulled out the choke and turned the key, the sleeping giant roared. Praise all the saints!

I figured I needed another spare module, because who knows how long this one might last? And you never know when they might stop making them. The guy at the auto parts store said he no longer stocks them, but I found one online. It was only 40 bucks.

My gal Marilyn thinks I'm delusional, because at my age, how many more control modules am I going to need? But just between you and me, I'm only 74, so I played it safe and ordered two.

Ed **Colby**

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