



Kelley Beekeeping

SERVING THE BEEKEEPER SINCE 1924

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From the Queen's Court by Melanie Kirby

Time is starting to speed up. Or at least it seems that way. The bee season has already started for a lot of beekeepers in the warmer states. No doubt the beekeepers from Florida through the southern states are getting into full swing. The west coaster beekeepers in California, and those from other states who migrate to the almond blooms are also in full swing. The rainy weather on the west coast has sogged out plenty of orchards so beekeepers are having to move their hives to higher ground and slurp around in the mud.



I truly hope that the blessed water will ease the drought in California. Yet, somehow it seems to be more than enough in any one instant. Water can be a blessing and a curse. In states where water is critically low, we see water as a valuable resource. In states where there is too much water, it perhaps comes across as more of a nuisance. But no doubt everyone appreciates having fresh food, clean water to drink, and the ability to keep them, their clothes, and their belongings clean.

The waters runneth from high to low and the landscape alters itself to accommodate that. In some places, natural water ways and channels are tended to keep water flowing freely. In other areas, water is stored and held behind man-made barriers to curb flooding. It truly is quite magnificent to see how each area learns to deal with water or the lack thereof. It is even more interesting to learn how each can capture water. Growing food, flowers and trees are one way to "bank" the water into the existing ecosystem. We need more of that as creating healthy habitat can nurture healthy organisms such as our bees.

Right now, I'm on one of the areas of the country that is surrounded by water. I'll be spending the next month and a half visiting beekeepers around the Big Island of Hawaii. This area is where I got my running start in the beekeeping arena. It has been 13 years since I last visited



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Queen's Court *cont'd*

this gorgeous state and it does rekindle feelings of nostalgia.

I'll be visiting beekeepers around the island and cataloging the different perspectives and practices. When I was living here, there were not many hobbyist beekeepers. And like other states, the hobbyist scene has exploded. Hawaii is also home to some of the world's largest queen rearing operations. Due to the rather constant weather patterns here

(though there is a dry season and a wet season), the temperatures stay in a nice buffer zone and so many of the plants are able to have multiple flowering phases throughout the year.

This allows for virtually constant floral forage from diverse plants. These blooms range from rainforest tropical flowers to macadamia nuts, avocados, and coffee. The diversity of blooms and the multiple flowering phases provide a plethora of nectars and pollens for bees, birds, butterflies and other critters.

Back in the day, I was an even bigger thrill seeker than I am today. I was addicted to boogie boarding and all things packed with adrenaline. This trip, I'm having to reacquaint myself with the landscape and the more "safer" locations for enjoying the water where my family can safely play in the sand and surf.

We've already seen several different kinds of native bees, as well. Here's a couple of photos of carpenter bees in Hawaii (xylocopa). I only recently learned that the males are golden. The females are black. In this place of extremes, from the ocean to the top of Mauna Kea (where there is snow), there is such rich biodiversity that it reminds me to appreciate the volcano's life force, and the dramatic landscapes that once formed North America.

Our continent has a history that goes way before our times. It has taken millennia to become what it is today. May we remember to cherish it, and embrace it, like children who love their mother.

**Aloha (With love and affection),
Melanie Kirby, Editor**



Bee on yellow hibiscus.

Melanie Kirby is a professional apiculturist and queen breeder in the southern Rocky Mountains. Over the past 20 years, she has learned from bees and their keepers around the globe; and continues to do so. She is humbled by the bees' refined elegance for learning to live and promote life on our beautifully diverse planet. She is ecstatic to write about bees and beekeeping; and enjoys having a big cup of Earl Grey tea with a heaping spoon of pure, raw honey during the cold months. She can be reached at Editor@KelleyBees.com

Cover Photo: Anne Money sent in this picture of her and her first swarm. It was her first encounter with a swarm. She was early in her second year and though she brushed it into a box three times, it sadly was unsuccessful. What a beautiful swarm it was. Better to have loved and lost than not to have loved at all.

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If you have a question you would like to share, email it to Editor@KelleyBees.com

A•Bee•Cs

Beginning Beekeeping

by **Phill Remick**

**Editor's Note: Our beloved Phill suffered a stroke a few weeks ago and is learning to walk again. Let us keep him in our prayers for a speedy recovery. Readers can send an email to him and his wife at his email address listed at the end of this article.*



BUY ONCE

It's a recurring theme; people who want to initiate beekeeping pursuing only the least expensive mode to do so. I often receive correspondence stating, "I don't want to spend too much money", or "Does it really cost that much to get a decent hive?" IF you are serious, it's akin to any other purchase; you go for what you can afford, but usually, don't go for rock bottom cheap, usually.

The wanna-bee thinks if he/she purchases/builds the cheapest structure available they are ahead of the game because it makes no difference to the honey bees they will house inside. Hmmm. Does it make a difference?

HOW SILLY IS THAT?

Being part of an apiary inspection team in central California's San Joaquin Valley, I witnessed the cheapest of cheap approaches to beekeeping equipment. As a point of reference, I was once employed by a highly-knowledgeable, veteran beekeeper whose supers and hive bodies were riddled with holes, protruding nails and covered with non-existent paint. Lids fell apart. I mean falling on the ground, falling apart! Bees would appear on rotting, splitting bottom boards and unsecured dove tailed joints as mice, lizards or snakes scattered beneath.

More than once prior to feeding liquid sugar, we'd take Silly Putty and head for the bee yards (owner had a total of 6,000 colonies) and begin 'plugging' holes to prevent the liquid sugar from running onto the ground, this was usually right before or after moving into the almonds for pollination in late February.

Picture this: We used a two inch hose with facet style turn- off fronting a 200 gallon tank filled with sugar syrup. With the flatbed truck, we'd roll into each yard where there were 120 colonies per yard. We would insert the nozzle directly into the entrance of the hive and let it rip! Sometimes it didn't leak too much, but usually it did. Hence the Silly Putty solution.

Obviously, there were minimal solid surfaces on which to rely. Being a migratory operation, I had to move these dilapidated hives using an electric loader which clamped down on the top and bottom of the hive and kept it together while hoisting them via a metal cable toward its slot on the truck load.

ABCs *continued*

Do this with 119 additional colonies and you can see the difficulty sub-par equipment can cause, to man and bee. In addition, success using a smoker on these unmaintained hives was erratic; you would watch smoke blown in the entrance and rapidly exit all over the hive! It looked like a five alarm fire.

WHY INVEST?

Once you decide to try your hand (or glove) at keeping bees, you will be presented with many options in regard to your colony housing choices. Yes, you can save some money by building your own hives, but specifications are crucial (especially the 3/8 bee way) to avoid heavy burr comb, cross-combing and excessive buildup of propolis as the bees seek to seal off uneven surfaces or gaps inside the hive. In case you were wondering, bees normally won't build comb in 3/8" passageways, however in a space larger than 3/8", honey bees do construct comb! Less than 1/4" propolis will be affixed. So, builder-beware that inaccurate construction can 'cost' you.

YOU GET WHAT YOU PAY FOR

There are low quality gloves which can fall apart at the most unwanted times, suits or veils that will sprout holes that the bees WILL find, smokers that won't stay lit, and foundation that no respecting bee would want to claim – all available on line or locally, too. To me it is counterproductive to purchase inferior equipment and to assume there is no difference. You do get what you pay for! Honey bees can be protected and secure - or open to the ravages of nature and other insects/predators if they lack decent housing. They are your charge. It takes your bees more time to secure and protect their dwelling when it is riddled with holes.

Better quality equals greater longevity, which will provide several years with minimal maintenance. Buy cheap and purchase over and over. My wife's mother used to say "Buy once." Yes, you can buy a cheap couch for \$200 and then a year later purchase another cheap couch for \$200 after the springs are sprung and upholstery shot. You can do this year after year, or you can 'buy once' by purchasing quality that will last and last. You can invest in quality bee equipment once - and have it serve you and the bees for many years. Good quality beekeeping equipment is a solid investment and often a source of pride.

Moral of this story? **BUY ONCE!**

Bee seeing you,
Phill Remick
phill@newbeerescue.com

*Phill Remick is a former commercial beekeeper teaching beekeeping and providing year round apiary consultation near Grand Junction, Co.
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Just the FAQs

Questions & Answers

by Dennis Brown

Hi Dennis,

We are getting an order ready for some more hive bodies, frames and bottoms to set out some swarm boxes. We were wondering if we should get some swarm lure. Does that work? If you like it or what do you recommend? Caroline P.

Hello Caroline,

That's a great question. First, let's talk about swarm box size. When bees swarm, they not only look for a place large enough to house their current population, but they take into consideration their future needs. So, when you make up a swarm box, it would be best for you to use a standard brood box instead of a standard nuc box like so many beekeepers do. When doing so, your chances of capturing a nice size swarm is much greater. Unless of course you live in the south and are trying to capture an African swarm which is typically much smaller in size than their European counter part.

The best swarm box to use is one that has already had bees in it. When using a liquid lure, I've found the odor to be too strong for the bees if left inside the swarm box. If you only have a new box, place the lure inside it a month ahead of time. (March, here in Texas.) Make sure the box is completely sealed. The lure will permeate the inside of the box. Remove the lure when you are ready to place the swarm box outside. Thanks Caroline for your question. I hope this helps you.

Enjoy your bees!

Dennis Brown

Dennis Brown is the author of "Beekeeping: A Personal Journey" and "Beekeeping: Questions and Answers." Contact Dennis at www.lonestarfarms.net.



X•Y•Zzz

Advanced Beekeeping

by Melanie Kirby

Queen Breeding 101

Over the course of this 2017 year, we'll be flipping back and forth between the past and the future of bee breeding. As with any endeavor, reviewing the past in preparation for the future is essential as we can only figure out where to go from where we've been. For those who are unfamiliar with what bee breeding is and how one can participate in the process, we'll cover the basics and also begin discussing what is realistic and pertinent for promoting and nurturing healthy stock lines for all experience levels. For this third installment, I will share the second part of an article I wrote back in 2011 for The American Bee Journal on establishing a survivor bee breeding program in today's circumstances. Also check out Texas A&M Rangel Bee Lab PhD student Liz Walsh's article, "Micro to Macro," on how DNA relates to honey bee breeding in the Bee Sciences segment of this month's newsletter.



IN HER MAJESTY'S SECRET SERVICE, Part II

First published in the June 2011 American Bee Journal

The Nature vs. Nurture¹ concept affects bees' immediate and long-term behavior hand in hand. The bees' diet affects their DNA and determines whether they will express certain genes in reaction to an environmental stimulus. This includes their hygienic genes, their gentleness genes, their pest/disease resistance and their productivity/behavioral genes. Professor Maleszka² from The Australian National University, conducted some profound research on the integration of environmental and genomic³ signals in honeybees and the critical interplay of nutritional, brain and reproductive networks. His work is routinely cited by others who are also cited in conjunction with this current discussion of longevity, and its effects.

Maleszka said, "This study represents a giant step towards answering one of the big questions in the nature-nurture debate, because it shows how the outside world is linked to DNA via diet, and how environmental inputs can transiently modify our genetic hardware"⁴.

If diet affects DNA so profoundly, then what our bees are eating significantly determines what genes are passed on and expressed in subsequent generations. It affects how they manifest and exist. Long-lived queens have shown enhanced Vg expression—Vitellogenin⁵ and juvenile hormone, which help dictate caste behavior along with essential fat bodies formations⁶, overwintering ability and insulin production and regulation. Our bees, especially in order to promote their heartiness, need some pressures, including varroa, in order to express their hygienic genes, and some exposure to illness, to express their ability to combat antigens and to demonstrate their immunocompetence.

If we compromise their diet, then their quality genes may not be passed to each generation and in the end, we may end up with bees that cannot function properly nor appropriately deal in a variety of situations and circumstances. Heavily medicated bees on a routine regiment never have the full potential nor opportunity to demonstrate their true genetics. And as we are learning about some of the medications, they can toxify the hive and have negative impacts on everything from food stores, to brood development and the list goes on.

All the food which the foragers collect, natural pollens and nectars, supplemental feed and “randoms” or isolated incidences of forage (i.e. soda pop factory, sugar cane processing plant, etc) in turn feed all the bees within a hive organism- including other workers, developing larvae, drones AND Her Majesty. This includes the royal jelly that determines the queen caste and their ability to metamorphosize successfully,

...“royal jelly provides the external information interpreted by the developing larva to create and maintain the epigenetic state necessary to generate a queen. In addition to vitamins, lipids, and amino acids, royal jelly also contains a family of proteins called Major Royal Jelly Proteins, which are thought to be crucial in reproductive maturation⁷.”

This inferior jelly and bee bread that is fed to bees are reflected in compromised interactions- including stressed egg laying, stressed larval development AND drone virility and semen viability. This obviously affects the mating and thus, the procreation of hives and their ability to sustain themselves within an ever changing reactionary environment. If the food is inferior, then any performance expected of the hives and their individual castes has to be adjusted.

“Honeybees are unique, as different life forms can be entirely induced by diet. The availability of their genome⁸ sequence also makes them a unique system to study how environmental stimuli regulate gene expression.”⁹

This statement and the following, come from recently published research about Epigenetics and Royalty which shares astounding news of the link between diet, physiological and behavioral metamorphosis,

“While caste differentiation into queens and workers is largely mediated by nutrition in honeybees, there appears to be a genetic influence as well.¹⁰ Because of the promiscuous habits of the queen, a honeybee hive typically contains multiple subfamilies of workers each fathered by a different drone, and some subfamilies can be substantially overrepresented in queen production, presumably mediated by preferential treatment of certain larvae and selective abortion of others. This adds a level of complexity to the interplay between genomic and environmental factors: the provisioning of epigenetic factors via larval nutrition might in turn be controlled by genetic factors that control provisioning behaviour.”

So which came first, the diet or DNA; the bee or the queen; their behavior or their genes? As far as

I have been able to interpret, they manifest hand in hand—Nature Nurtures. Instead of adjusting expectations to having poor hives, let us try to reverse the inferiority and look to enhance our bees' nutrition and our rearing protocols. In reality, the bees' available nutrition is part of their environment or more specifically—is based on the area which they travel foraging. This area is part of a larger agroecosystem¹¹.

"An agroecosystem is.... defined as a spatially and functionally coherent unit of agricultural activity, and includes the living and nonliving components involved in that unit as well as their interactions.¹² An agroecosystem can be viewed as a subset of a conventional ecosystem. As the name implies, at the core of an agroecosystem lies the human activity of agriculture. However, an agroecosystem is not restricted to the immediate site of agricultural activity (e.g. the farm), but rather includes the region that is impacted by this activity, usually by changes to the complexity of species assemblages and energy flows, as well as to the net nutrient balance. Traditionally an agroecosystem, particularly one managed intensively, is characterized as having a simpler species composition and simpler energy and nutrient flows than "natural" ecosystem.¹³ Likewise, agroecosystems are often associated with elevated nutrient input,¹⁴ much of which exits the farm leading to eutrophication¹⁵ of connected ecosystems not directly engaged in agriculture.

One of the major efforts of disciplines such as agroecology is to promote management styles that blur the distinction between agroecosystems and "natural" ecosystems, both by decreasing the impact of agriculture (increasing the biological and trophic complexity of the agricultural system as well as decreasing the nutrient inputs/outflow) and by increasing awareness that "downstream" effects extend agroecosystems beyond the boundaries of the farm..."

This agroecosystem will choose to support or not support various organisms, bees included. And like seeds, the bees and their individual hives, contain stores of memory, genetic memory which, under prime and conducive conditions, will root itself and grow from a seedling into a sapling and eventually yield the most exquisite fruit bearing queen; one whose genes have been nurtured, not solely by man, but refined by Mother Nature. Depending on where keepers keep their bees, the agroecosystem can lack diversity (such as in monoculture crop farmlands) or it can be complex with rural melding into urban and "manicured" fields into wild lands. We should look to develop more varied agroecosystems, similar to what Mother Nature naturally provides, that include a diverse plant index for the benefit of our bees' genetic memories to unfold.¹⁶ This is a form of biomimicry¹⁷ and it has its significance not only in assessing and establishing a positive agroecosystem but it also serves well when we switch gears to talk about production.

Stay tuned for Part III in next month's newsletter...

Melanie Kirby is a longevity based bee breeder at 8300' in the southern Rocky Mountains of northern New Mexico: www.ziaqueenbees.com. Along with partner Mark Spitzig, their small operation offers Enchanted Empress Breeder Companions for interested queen rearers and breeders. As dedicated honeybee stewards knowing that their efforts are but a drop in a very large bucket, they look to share and swap quality stock. For more info email: ziaqueenbees@hotmail.com

¹Royal Jelly Makes Bee Queens, Boosts Nurture Case <http://www.sciencedaily.com/releases/2008/03/080317152324.htm>

²Epigenetic integration of environmental and genomic signals in honey bees: the critical interplay of nutritional, brain and reproductive networks. <http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=Search&doptcmdl=Citation&defaultField=Title%20Word&term=Maleszka%5Bauthor%5D%20AND%20Epigenetic%20integration%20of%20environmental%20and%20genomic%20signals%20in%20honey%20bees>.

³A genome is the sum total of all an individual organism's genes

⁴Bees Reveal Nature-Nurture Secrets: Extensive Molecular Differences in Brains of Workers and Queen <http://www.sciencedaily.com/releases/2010/11/101102171606.htm>

⁵Vitellogenin, juvenile hormone, insulin signaling, and queen honey bee longevity Miguel Corona*, Rodrigo A. Velarde*, Silvia Remolina†, Adrienne Moran-Lauter‡, Ying Wang§, Kimberly A. Hughes†¶, and Gene E.

Robinson*Departments of *Entomology, †Animal Biology, and §Cell and Developmental Biology, and ‡Neuroscience Program, and ¶Institute for Genomic Biology, University of Illinois at Urbana–Champaign, 320 Morrill Hall, 505 South Goodwin Avenue, Urbana, IL 61801 <http://www.pnas.org/content/104/17/7128.full.pdf+html>

⁶Randy Oliver www.scientificbeekeeping.com and *The American Bee Journal*

⁷Maleszka R (2008) Epigenetic integration of environmental and genomic signals in honey bees. *Epigenetics* 3: 188–192.

⁸Insights into social insects from the genome of the honeybee *Apis mellifera*. Weinstock G. M, Robinson G. E, Gibbs R. A, Worley K. C, Evans J. D, et al. (2006) *Nature* 443: 931–949.

⁹Epigenetics of Royalty Chittka A, Chittka L (2010) *PLoS Biol* 8(11): e1000532. doi:10.1371/journal.pbio.1000532

Wolfson Institute for Biomedical Research, University College London, London, United Kingdom, 2 Queen Mary University of London, Research Centre for Psychology, School of Biological and Chemical Sciences, London, United Kingdom <http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1000532>

¹⁰Nature versus nurture in social insect caste differentiation. Schwander T, Lo N, Beekman M, Oldroyd B. P, Keller L (2010) *Trends Ecol Evol* 25: 275–282.

¹¹<http://en.wikipedia.org/wiki/Agroecosystem> "Emergence of Research on Agro-Ecosystems". Loucks, Orie (November 1977). *Annual Review of Ecology and Systematics* 8: 173–192. doi:10.1146/annurev.es.08.110177.001133. <http://arjournals.annualreviews.org/doi/pdf/10.1146/annurev.es.08.110177.001133?cookieSet=1>. Retrieved December 7, 2004.

¹²^ Agro-ecosystem Health Project. 1996. *Agroecosystem health*. University of Guelph, Guelph, Canada.

¹³Elske van de Fliert and Ann R. Braun. 1999. *Farmer Field School for Integrated Crop Management of Sweetpotato. Field guides and Technical Manual*. Bogor, Indonesia: International Potato Center. ISBN: 92-9060-216-3. <http://www.eseap.cipotato.org/MF-ESEAP/Abstract/FFS-ICM-SP-Ind.htm>

¹⁴^ Agro-ecosystem Health Project. 1996. *Agroecosystem health*. University of Guelph, Guelph, Canada.

¹⁴Elske van de Fliert and Ann R. Braun. 1999. *Farmer Field School for Integrated Crop Management of Sweetpotato. Field guides and Technical Manual*. Bogor, Indonesia: International Potato Center. ISBN: 92-9060-216-3. <http://www.eseap.cipotato.org/MF-ESEAP/Abstract/FFS-ICM-SP-Ind.htm>

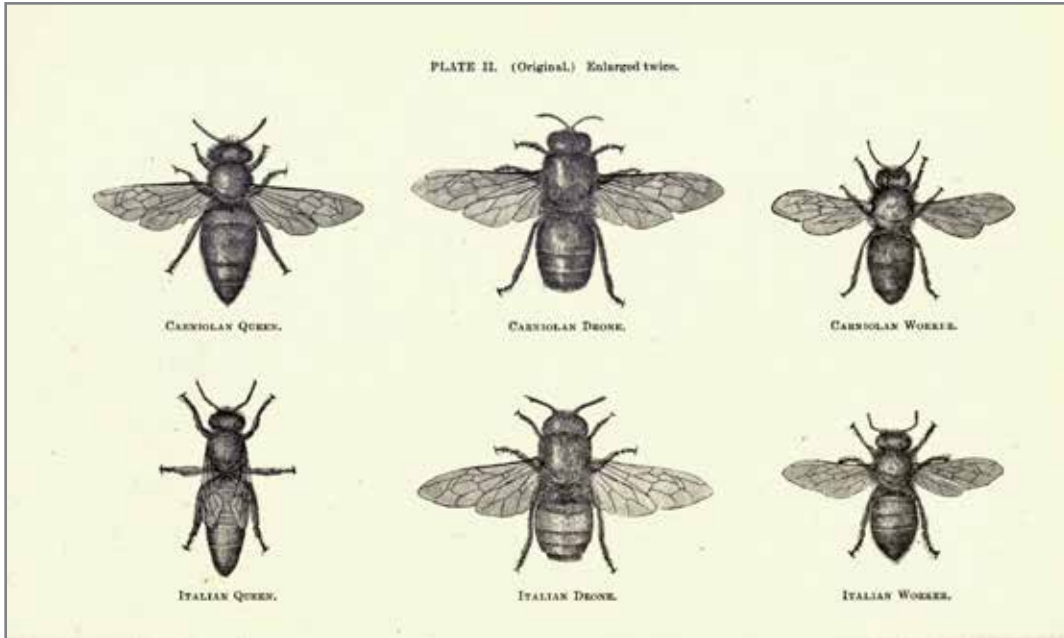
¹⁵^ *Agroecosystem Management for Improved Human Health: Applying principles of integrated pest management to people*. D. G. Peden. Published in *New Directions in Animal Production Systems. Proceedings of the Annual Meeting of the Canadian Society of Animal Science, July 5-8, 1998, Vancouver, British Columbia, Canada*. Edited by R. Blair, R. Rajamahendran, L.S. Stephens, M.Y. Yang. http://www.idrc.ca/en/ev-3443-201-1-DO_TOPIC.html

Eutrophication (Greek: eutrophia - healthy, adequate nutrition, development) is the addition of artificial or non-artificial substances, such as nitrates and phosphates, through fertilisers or sewage, to a fresh water system.

Definition taken from www.Wikipedia.org

¹⁶Bee Pastures May Help Pollinators Prosper <http://www.sciencedaily.com/releases/2010/08/100804110904.htm>

¹⁷<http://en.wikipedia.org/wiki/Biomimicry> Biomimicry or biomimetics is the examination of nature, its models, systems, processes, and elements to emulate or take inspiration from in order to solve human problems. The term biomimicry and biomimetics come from the Greek words bios, meaning life, and mimesis, meaning to imitate



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Diversified Pollinators

Beginning the Pivot to Do What's Natural...



As I listen to, read from, and discuss with native bee experts, I have learned a lesson that I hope you find intriguing as well. "Life is easier when you work with nature rather than try to control it."

Here are two concepts that steer how we look at our bees.

1. Humans need nutrient-dense food that is pollinated by bees.
2. Most of our crops are grown in an artificial way as monoculture. Monoculture crops force us to manipulate honeybees into pollinators.

The world is full of many different kinds of landscapes, climates, and ecosystems. Each place is home to a huge variety of bees and we shouldn't rely on one bee for all crops and all places.

North America is home to about 1,000 species of hole-nesting bees. These bees thrive in their natural ecologies. Their regions are just right for them: weather patterns, plentiful nearby nest-building material (mud, resin, leaf, etc.), flower variety, and nesting sites.

We want to learn what bees work best in each region, for each season, and for each yard and crop. The best bees are already around you, just unknown and not well understood yet.

Crown Bees will begin pivoting now. Soon, we will launch the Native Bee Network, a citizen science project that will involve many gardeners over the next few years. We'll be working with researchers and sharing what we learn with them.

Search for bees in your backyard >> Find and gather data >> Share data with Others

Our goal is to find the right bees that thrive best in your backyard, learn how best to raise them, repopulate and rehabilitate, and share bees regionally for more backyard and farm food.

Join us.

Dave Hunter
www.crownbees.com



Bee Health

Rocky Mountain Seed Alliance

Our Mission

The Rocky Mountain Seed Alliance is a nonprofit organization working to assure an abundant and diverse supply of seeds for the Rocky Mountain region through education, networking, and establishing community-based models of seed stewardship.

Locally produced seeds yield hardier, more delicious crops. When seeds are grown, saved, and replanted in a particular location year after year, remarkable adaptations develop. Growers can select and save seeds from standout specimens with traits like resistances to pests and diseases, brighter colors, and tastier flavors. In essence, they are carrying the best from one growing season into the next. This is how our ancestors farmed sustainably for over 10,000 years—and it's the only way to recreate such a system today.

Fortunately, people everywhere are waking up to the vital importance of seeds for our future. A seed saving movement is growing around the world and reviving this ancient practice in our modern lives. But this global phenomenon requires local action. Each region must rise to the challenge and collect, preserve, and share its own unique collection of seeds.

Here in the Rocky Mountain West, we have heard the call and we are banding together. We envision a resilient Rocky Mountain region where the health of our communities and environments are supported by diverse and abundant supplies of locally grown seeds. The Rocky Mountain Seed Alliance is working to create a network of seed growers, distributors, educators, and resources in our region. Our goal is to inventory the seed diversity we have, find out what we need, identify growers and stewards to conserve this diversity, and then save a backup copy of everything we find.

This is where you come in. Whether you are an expert seed saver or just a passionate believer, we need your help to create this network. Please join us as an Alliance member. Thank you!

Seed Stewards

Help Save Seed Diversity—Become a Seed Steward!

The Rocky Mountain Seed Alliance is seeking gardeners and farmers to become Seed Stewards in their communities. Seed Stewards are individuals who are committed to preserving and sharing seed diversity. They may already be skillful seed savers or just beginning to learn about this ancient art and practice. Seed saving is essential for ensuring that diverse and abundant supplies of regionally adapted seeds are securely maintained for the benefit of current and future generations.

Seed Stewards are a vital force in the burgeoning seed sovereignty movement. From starting community seed libraries to preserving precious heirlooms in backyard gardens, the efforts of these grassroots leaders are laying the foundation for community-based seed systems that can replace the unsustainable paradigm of industrial agriculture. The Rocky Mountain Seed Alliance (RMSA) recognizes the fundamental role Seed Stewards play in accelerating this crucial shift. We have created the Seed Stewards program to support and expand the efforts of seed savers in the Rocky Mountain West

Bee Health *cont'd*

by providing them with resources, technical assistance, education, and networking opportunities.

Duties and Benefits

To participate in this program, Seed Stewards will commit to grow (or wildcraft), save, and share seeds within their community from at least one plant variety, including herbs, flowers, edible crops, ceremonial plants, wild natives, trees, and shrubs. Seed Stewards will ensure their seeds are carefully grown, skillfully selected for saving,

and securely stored. As community seed leaders, Seed Stewards are also encouraged to be involved with the distribution or sharing of seeds through seed libraries or exchanges. They should strive to learn as much as they can about seed saving and share their knowledge with others.



Seed Stewards are a vital force.

In exchange, the Rocky Mountain Seed Alliance will support Seed Stewards with the following benefits:

- a digital download of Basic Seed Saving written by RMSA Director Bill McDorman
- a subscription to our eNewsletter and Seed Steward updates;
- technical support for your seed saving efforts via email and online resources; and
- free and secure long-term seed storage backup** at our Rocky Mountain Regional Seed Vault proposed for the Sawtooth Botanical Garden.

***In order to store seeds in the Rocky Mountain Regional Seed Vault, some basic protocols must be followed. Read more about this here. RMSA promises to never sell, trade, or otherwise distribute your stored seeds and will not attempt to grow them out without your written consent.*

At RMSA, it is our goal to inspire all farmers and gardeners to join in the ancient tradition of seed stewardship. We have seen firsthand the incredible impact that passionate individuals of all backgrounds and skill levels can have in creating more resilient, healthy, and sustainable communities through seed saving. There are four different Seed Steward levels to choose from according to your experience and proficiency, from first-year beginners to seasoned experts. If you feel called to do this work, regardless of your experience level, we encourage you to join us as a RMSA Seed Steward.

How to Sign Up

To become a RMSA Seed Steward, please begin by visiting <https://rockymountainseeds.org> This automatically makes you a RMSA member if you are not one already, so you can stay up to date with the latest seed news about our burgeoning movement.

Applicants will be asked to agree to the four-point Seed Steward Pledge:

1. I agree to become knowledgeable about all aspects of seed saving, with an emphasis on the seed varieties that I steward within my community.
2. I agree to follow, to the best of my abilities, organic principles and seed quality best practices for the

Bee Health *cont'd*

varieties that I grow.

3. I agree to include accurate and detailed labeling information with all the seeds that I grow, harvest, and share.

4. I agree to not knowingly buy, grow, or share genetically engineered (GMO) seeds or plants.

If you have any questions, concerns, or comments regarding this program—or if you experience technical issues with the application process—please contact Lee-Ann@rockymountainseeds.org. Thank you!

Mountain West Seed Summit: March 2017

Join Seed Stewards from the Mountain West and beyond for three days of seed knowledge and networking in beautiful Santa Fe.

The Rocky Mountain Seed Alliance, in partnership with the Rocky Mountain Farmers Union and the McCune Foundation, presents a two-day summit and one-day field trip focused on training and inspiring seed producers across the Rocky Mountain region. The Mountain West Seed Summit will include presentations, demonstrations, hands-on activities, lively discussions, seed exchanges, art, music, and more!

Additional local partners include SeedBroadcast which will be capturing and sharing seed stories and hosting a seed poetry slam, and Squash Blossom which will be providing incredible local food and cuisine.

Mountain West Seed Summit "Honoring Origins and Seeding the Future" March 3 – 4, 2017 Santa Fe, New Mexico – Hotel Santa Fe

Featuring an all-star lineup of visionary seed leaders:

Emigdio Ballón – Tesuque Agricultural Initiative
Clayton Brascoupe – Traditional Native American Farmers Assoc.
Micaela Colley – Organic Seed Alliance
Jacob Cowgill – Prairie Heritage Farm
Benjamin Fahrer – Top Leaf Farms
Flordemayo – The Path
Lois Ellen Frank – Author, Foods of the Southwest Indian Nations
Jeanette Hart-Mann – Seed Broadcast
Dan Hobbs – Farm Direct Seed
Kristina (Kiki) Hubbard – Organic Seed Alliance
Andrew Kimbrell – Center For Food Safety
Joseph Lofthouse – Landrace Gardens
Sherry Manning – Friends of Enca Farm
Bill McDorman – Rocky Mountain Seed Alliance
Dr. Nanna Meyer – Grain School, University of Colorado, Colorado Springs

Bee Health *cont'd*

Casey O'Leary – Snake River Seed Cooperative
Chrissie Orr – Seed Broadcast
David Salman – High Country Gardens
Bettina Sandoval – Indian Pueblo Cultural Center
Loretta Sandoval – Zulu's Petals Organic Farm
Miguel Santistevan – Sol Feliz Farm, AIRE
Greg Schoen – Glass Gem Corn Steward
Rebecca Spector – Center For Food Safety
Don Tipping – Siskiyou Seeds
Dr. Tim Voss – New Mexico Landrace Corn Project
Rowen White – Sierra Seeds
Bevan Williams – Rocky Mountain Seed Source
And more to be announced!

Proposed workshops to include:

- Honoring a New Seed Conservation
- Seed Elders Panel
- Bioregionalism and Seed Adaptation
- Seed Vaults
- Rocky Mountain Grain Trials
- Population and Isolation for Seed Saving Success
- Accounting and Bookkeeping for Small Scale Seed Companies
- Perspectives on Seed Patents
- GMOs and Seeds
- Starting a Seed Internship
- Incorporating Seed Production into Market Farming Operations
- Corn Genetics and Breeding Principles
- Starting a Seed Company
- Seed Stories
- Creating and Sustaining the Seed Movement
- Social Justice and Seed Justice

Registration fee: \$195

**Discount Registration: \$150

Sponsored by: La Montanita COOP, McCune Charitable Foundation, Santa Fe Farmers Institute, Edible Southwest Colorado, Edible Santa Fe, Albuquerque, Taos, High Country News, Green Fire Times, National Young Farmers Coalition, Rocky Mountain Farmers Union and Squash Blossom.



Bee Health

Micro to Macro Bee Breeding

by Liz Walsh

One can think of DNA as the code for all living things. DNA is the abbreviation for deoxyribonucleic acid. By having a code comprising for four different characters (A,T,C,G) in different sequences and read in different ways, proteins are made within the body according to these coded specifications and the various proteins acting in various ways then differentiate living things into the recognizable forms we know as honey bees, dogs, aloe plants, and humans.



Different species, populations, and individuals all have different patterns in their DNA that describe where they come from. Sometimes these historical DNA patterns are visible to the human eye, like when you examine a darkly colored honey bee or a golden colored honey bee and you know they are of different lineages. When a genetic pattern is visible, like the coloration example of honey bees, then this is called an organism's "phenotype."

Most breeding programs are built around phenotypes. In the apicultural sense, a phenotype could even be something discernable such as temperament or capabilities rather than strictly physical characteristics. A phenotype consistently gets into a group by consistently being in parents. This means, for apicultural purposes, that queen breeders need to carefully choose mother colonies to take graftable (young larvae in the first or second instar) larvae from. The drone side of the equation is more difficult for beekeepers to control. However, drones contribute half of the genetic equation (Fig. 1) in fertilized offspring. If you only control for the maternal genetic contribution to the offspring, then you aren't running a breeding program--although you could still have a queen rearing operation.

This is the same in breeding programs for all sorts of animals. For example, someone who shows Arabian horses wants horses that have the phenotypes associated with the breed; they might buy an Arabian-mixed horse for fun, but they want purebred horses for showing. That means that they need purebred horses, so the mother and father must both be Arabian. An Arabian mother and a Quarterhorse father is not going to yield offspring that have all the Arabian traits the owner wants. Indeed, the offspring might have Quarterhorse traits that the owner does not desire. It's the same in beekeeping. If you run a breeding program, then you need to have some control over both the maternal and paternal contributions to the offspring.

In honey bees, we have a haplo-diploid reproductive system. This means that one of the parents has one ("haploid") set of chromosomes and the other ("diploid") has two. Chromosomes are essentially just DNA that is really, really tightly wound up onto itself. The haploid parent still produces a gamete, a sperm or egg, which contains one set of chromosomes. They have contributed all the genetic information that they have. The diploid parent produces a gamete which also contains one set of chromosomes, half the genetic information that the parent has. The two gametes join together and form a fertilized zygote, which is an offspring individual once it reaches maturity. This is also described in Fig. 1.

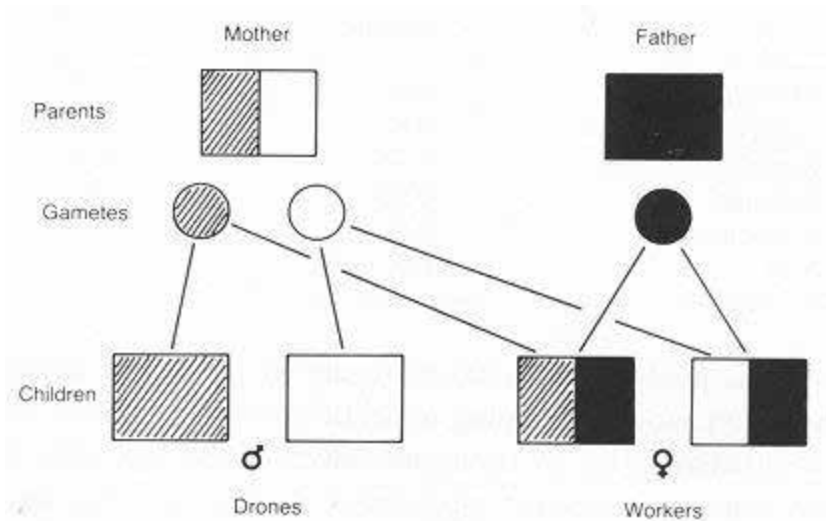
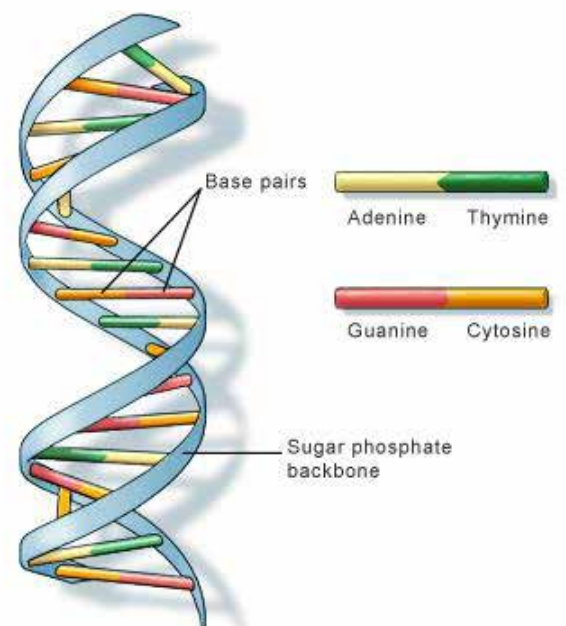


Figure 1. The haplo-diploid reproductive system (simplified). The mother contributes one of two sets of chromosomes while the male contributes his sole set of chromosomes to fertilized offspring. While the schematic above is correct, it is also simplified, as it assumes that the mother only mates with a single father. Work in the David Tarpy lab at North Carolina State indicates that queens in the USA mate with an average of 15 drones. This allows for lots of genetic diversity in a single colony. (Anonymous source—please send me the author’s information if you recognize the figure!)

While breeding individuals are selected for their displayed phenotypes, phenotypes are something coded for in DNA. This means that even though I haven’t seen a queen or colony of workers in the field, I can still find out the phenotype of an individual by determining its genotype, or the genetically heritable traits that describe it. This is how scientists can definitely say something about a population, also known as a group of individuals who interbreed with each other, or an individual’s lineage. We can also say that different populations are distinct from each other, meaning (in this case) that they have different phenotypes that are coded by their genotype.

Some things you need to know about DNA to continue reading are: DNA has a slight negative charge to it from the molecules that make up the sides of the DNA ladder (Fig. 2).

Fig. 2. This is a rendition of a strand of DNA. The four different characters are more often called “base pairs” and are A(denine), T(hymine), G(uanine), and C(ytosine). The Sugar phosphate backbone which forms the sides of the DNA ladder make it negatively charged. (US National Library of Medicine)

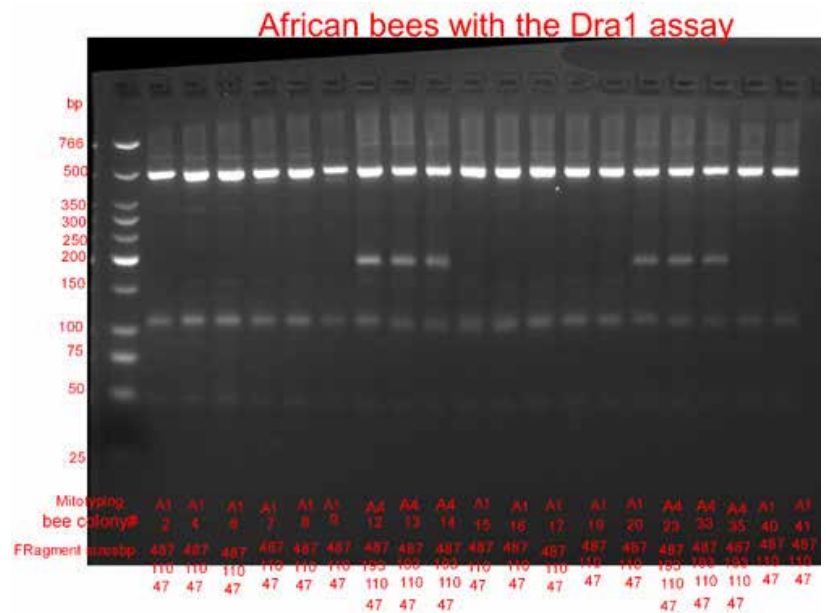


U.S. National Library of Medicine

Scientists can discover the genotype of an individual in many different ways, but it is most commonly done by taking some sort of tissue sample and breaking it down to extract the DNA. Then, one can add specific proteins that recognize a specific sequence in the DNA. A specific sequence is chosen based on prior knowledge of what a location of the DNA phenotypically codes for. If I have a hypothetical gene that is AATTGCGGCATATCCCCAAAA and I know that this sequence means that individuals are originally from Africa, then I can add a protein that recognizes CCCCCAAAA and cuts the DNA strand after 4 A's (scientists—please remember this is a hypothetical example for communicating rather than reality).

After the DNA is fragmented into pieces, the pieces are all of different sizes. There are short, long, medium, etc. fragments depending on where the DNA was cut. This means that the DNA pieces can then be run through a gel that has smaller and smaller openings for the DNA pieces to travel through. This is accomplished by running a charge to the gel so that the negatively charged DNA pieces go as far through the gel as they can. However, eventually various DNA pieces are just too big to go further. They get stuck in the gel. The different pieces are stuck at different levels, so you end up able to see bands of DNA pieces in the gel (Fig. 3).

Fig. 3. This is a picture of the gel with bands of DNA fragments in it. The numbers on the left side correspond to the number of base pairs in the fragment (length of fragment). You can see that these samples (one column is one individual) have several different fragments and that Individuals 8,9,10,16,17 and 18 are genetically different than the rest of the individuals because they have a band of DNA fragments the rest don't have that is around 200 base pairs long. (Picture and DNA work done by Alejandra N. González of the Rangel Honey Bee Lab at Texas A&M University, 2014)



If I have pieces of DNA forming a band at a specific size, then I know that the cutting protein that I put into the DNA found the sequence of the gene that indicates the hypothetical individual is from Italy. If the DNA fragments form bands indicating they are different sizes, then that means that my cutting protein never found the sequence I was looking for. The individual isn't of African origin then. I should try different cutting proteins and see what else I can find out.

I hope this helps aid in understanding genetics and I can't wait to share more about how it applies to bee breeding in future issues.

Liz Walsh is a graduate student at the Rangel Honey Bee Lab, Department of Entomology, Texas A&M University. She can be reached at walshe@tamu.edu

Meet the Beekeeper

Judy Wu-Smart, University of Nebraska

1. Name: Judy Wu-Smart

2. Occupation: Assistant Professor & Extension Specialist

3. Location/Institution: University of Nebraska-Lincoln

4. How did you get your start in beekeeping and what inspired you to seek to study them?

In 2005, I was working in Fort Lauderdale, FL as an intern with the USDA Invasive Plant Laboratory through the Student Conservation Association program and was introduced to a South American native bee, *Euglossa viridissima*, the green orchid bee. This bee was becoming naturalized without their mutualistic orchid partner from which males collect perfume oils to attract female counterparts. The scientist I was working for discovered that this ingenious little bee was collecting compounds from various other natural and man-made sources from herbs to solvents to mix a cocktail chemically similar to the oils they would have obtained from their absent orchid partners. From that point on I was hooked into learning more about bees and all kinds of bees. At the same time, Florida seemed to be ground zero for colony collapse disorder and I became acutely aware of the importance and need to protect honey bees. That's when I began searching for ways to dedicate my career to helping the bees. I began beekeeping when I started my graduate MS program at Washington State University in 2007.

5. What is some past research or programs that you worked with?

2007-2010 MS Program
Washington State University;
Pesticide Residues in Honey Bee
Brood Comb, Research advisor: Dr.
Walter Sheppard

2010-2015 Ph.D. Program
University of Minnesota;
Neonicotinoid Insecticides and
Bees, Research advisor: Dr. Marla
Spivak

6. What are you currently working on?

Projects examining the use
of landscape enhancements



Judy Wu-Smart

to reduce non-target pesticide drift into marginal pollinator habitats and integrated pesticide management for beekeepers.

7. Where do you see the next few years of research or beekeeping management leading?

My focus the next few years will be on finding ways to reduce and or eliminate pesticide residue accumulation in brood comb and how to mitigate the impacts of agrochemical exposure on bees.

8. What message about bee health and management would you like to share with readers?

Agrochemical exposure can have various direct and indirect effects on individual bee health as well as on normal colony functions (brood production, foraging, hygienic behavior) that can lead to a colony becoming more susceptible to pests, diseases, and even in-hive miticides. The first line of defense is to provide bees with abundant and diverse flora resources and adequate nutrition which will help bees detoxify harmful compounds and or minimize risk of agrochemical exposure.

9. Where can we find information about your research/organization?

University of Nebraska-Lincoln Entomology Website

10. Anything on or off topic that you find interesting about yourself/organization to share with readers?

The University of Nebraska-Lincoln Extension is a nationally respected educational and research leader providing services to 93 counties throughout the state. To improve demand-driven programming among stakeholders, in 2015 NE Extension conducted a statewide survey to identify topics of greatest concern to Nebraskans. Among the top issues identified was the protection of beneficial insects, including pollinators. As a result, a Beneficial Insect Ecosystems Issue Team made up of extension employees (assistants, educators and specialists) with a wide range of expertise (horticulture, entomology, crop IPM, apiculture, and conservation ecology) came together to address this topic. This team is developing a comprehensive Beneficial Insect Protection Plan (BIPP) for the State of Nebraska that focuses on educating Nebraskans on the importance of beneficial insects and the ecosystem services that they provide. This includes pollinating bees and butterflies, natural enemies important for biological pest control, dung/carrion beetles and other soil dwellers for nutrient cycling, and aquatic insects for biological monitoring of soil and water. We have 20+ partners including government and non-government organizations, industry, small businesses, and citizens to participate and collaborate on the BIPP. This state-wide movement will help organize conservation efforts, reduce redundancy, and maximize resources and cost-effectiveness. Beyond the environmental benefits that will come from the BIPP, we are building strong linkages between extension, research, teaching, and the community across multiple disciplines and with many partners.

11. How can readers contact you and get more info on your organization?

<http://entomology.unl.edu/faculty/dr-judy-wu-smart>

E-Mail: jwu-smart@unl.edu

Bee Thinking About **Wyoming Bee College Conference**

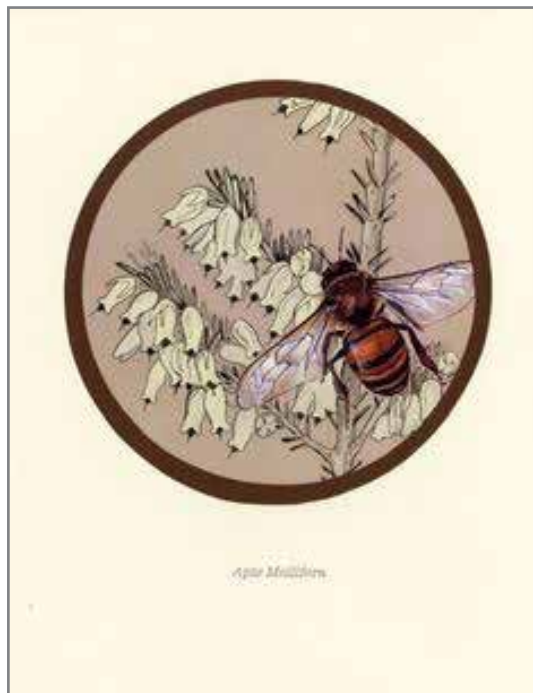
The University of Wyoming Laramie County Extension Office is hosting the Wyoming Bee College Conference at Laramie County Community College in Cheyenne, March 18-19, 2017.

The 2017 conference offers 5 tracks on day one; and 4 tracks on the second day. The conference is open to everyone interested in the health, welfare and conservation of pollinator insects.

The Bee College covers Beginning Beekeeping 101 (taught by a licensed Veterinarian) and Beekeeping 102, journeymen beekeeping methods, native bees, and ways to help them all.

We are pleased to bring in beekeeping authors James E. Tew and Les Crowder along with the Denver Butterfly Pavilion, University of Wyoming's Bio-Diversity Institute, and Rayah Carlson with her program on the Hive as the Medicine Chest plus much more.

For more information and a schedule: <http://www.wyomingbeecollege.org> or www.eventbrite.com or call Catherine at Tel: 307-633-4383.



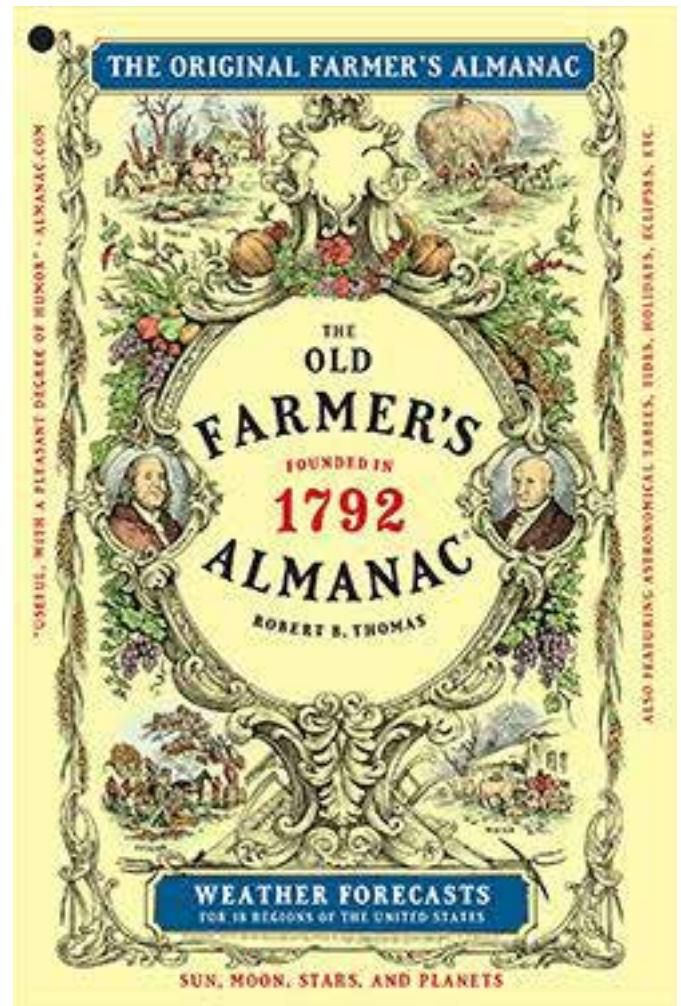
Bee Thinking About *cont'd*

Dear loyal Almanac Companion readers,

Drum roll. This year, your “little yellow book” celebrates 225 years! We’ve just released The 2017 Old Farmer’s Almanac—and have created an extra-special anniversary edition—featuring famous friends, behind-the-scenes history, and helpful tips!

It was in 1792 that The Old Farmer’s Almanac released its first edition. Thanks to your loyal support—and that of generations before you—this handy reference guide is North America’s oldest continuously published periodical!

How has it endured? “The mission of the Almanac set forth by its founder, Robert B. Thomas, is to be ‘useful, with a pleasant degree of humor,’” says our editor Janice Stillman. “This virtually ensures its appeal to folks from all walks of life and diverse interests.”



In the 2017 edition, we’ll celebrate its unprecedented legacy, with . . .

Tributes from the U.S. President and Canadian Prime Minister.

Founder Robert B. Thomas’s story, with reproduced pages from the first edition.

Almanac moments in history: the snow-in-summer forecast, the Lincoln defense, the weather omission, the German spy plot, the JFK assassination hint, and more!

Famous names from business, media, politics, arts, and more (former governor Bill Richardson, author Jodi Picoult, and National Black Farmers Association president John W. Boyd Jr., among them) share what they like most (and least) in the Almanac and divulge their personal weather forecasting methods.

Speaking of the weather: The 2017 Old Farmer’s Almanac releases its famous long-range predictions for the year!

In the U.S., get ready for a shift from last winter, with colder temperatures in most parts of the country but less snowfall overall. The snowy exception will be most of the northern tier of the U.S., which can expect to be blanketed in white.

In Canada, brace for more snow and colder-than-average temperatures throughout most parts of the country. The exceptions to the winter of white will be Manitoba, portions of Saskatchewan, and northern sections across the land. While snowfall will generally be below normal in these areas, temperatures will remain chilly.

Sweet As Honey

Honey Chocolate-Covered Strawberries

by **Beatrix Royale**

Ingredients

1. 1/3 cup Sue Bee® Honey
2. 1 cup virgin coconut oil
3. 3/4 cup cocoa powder
4. 1 teaspoon vanilla extract
5. 1/4 teaspoon chocolate extract, optional
6. Dash of sea salt
7. 20 fresh strawberries

Instructions

1. Wash strawberries using cold water; dry and set aside.
2. Measure honey into a small bowl and warm it by placing the bottom of the bowl in warm water. Do not microwave or overheat.
3. Use the same process to warm the coconut oil.
4. Mix the warm honey, coconut oil, cocoa powder, vanilla extract, chocolate extract and sea salt in a bowl.
5. Individually dip strawberries in melted chocolate mixture and place on baking sheet lined with parchment paper.
6. Cover and place the baking sheet in the freezer for 20 minutes or until chocolate has hardened.
7. Remove from freezer and repeat dipping if necessary.
8. Enjoy!

Visit www.suebee.com
for more honey recipes.



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Or Call: 800-233-2899 ex. 213



UPCOMING EVENTS

February 2017

Indiana: Beekeepers of IN present 15th Annual Bee School with Sue Cobey, Greg Hunt, Tim Tucker...
February 25, 2017
Decatur Central High School
5251 Kentucky Avenue
Indianapolis, Indiana 46221
Info: <http://indianabeekeeper.com>

New York: HoneyBeeLives' Organic Beekeeping Workshop
February 25-26, 2017
Sustainable Living Resource Center
Hudson Valley, NY
Info: www.HoneybeeLives.org
or call 845-255-6113

March 2017

Vermont: Bennington County Beekeepers Club 2017 Beginners Workshop
March 2, 2017
VT Veteran's Home
325 North Street, Bennington VT
Info: Contact Jeanne Davis
Email: jdavisbwheat@comcast.net
Tel: 802-823-7955

Tennessee: Northeastern TN Beekeepers Association Honey Convention-All About Honey & the Honeybees
March 3-4, 2017
Walters State Community College
1325 Claiborne St., Tazewell, TN
Info: www.facebook.com/easttnhoney
Email: HONEY.convention@gmail.com
Tel: 423-944-3230

OK State Beekeepers Association Spring Conference
March 4, 2017
First Baptist Church
901 W. Ash Ave, Duncan, OK.
Info: Pat Tickel at patokbees@gmail.com
Tel: 580-795-4619 www.okbees.org.

Arkansas: Spring Meeting featuring Ann Harmon
March 10th & 11th, 2017
Hope Community College
2500 S Main S, Hope, AR 71801
Info: www.arbeekeepers.org

North Carolina: Craven Pamlico Beekeepers Association (CPBA) spring bee school
March 11th & 25th, 2017
Craven County Cooperative Extension Building
300 Industrial Rd., New Bern, NC.
Info: Will Johnson
Email: newbernwillsusanevin@yahoo.com
Tel: 252-474-4564

Illinois: Mettawa Bee Seminar- Bee Nutrition: The Next Step
March 18, 2017
W.W. Grainger Corporate Headquarters
100 Grainger Pkwy
Lake Forest, IL
Info: <http://www.mettawabeeSeminar.com>

Wyoming: WY Bee College
March 18-19, 2017
Laramie County Community College
Info: www.wyomingbeecollege.org,
or call Catherine at 307-633-4383

Indiana: Rutger's Bee-giner's Beekeeping: The Basics
March 23-25, 2017
Rutgers Eco Complex
1200 Florence-Columbus Rd
Bordentown, IN
Info: <http://www.cpe.rutgers.edu/courses/current/ae0401cb.html>



We'd love to share news of your upcoming events. Please send the event name, date, website and/or contact information by the 10th of each month for inclusion in the following month's issue. Editor@KelleyBees.com