COOPERATIVE EXTENSION UNIVERSITY OF CALIFORNIA

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Extension Apiculturist Recruitment

The University of California has announced an opening for an Assistant Specialist in Cooperative Extension in Apiculture. "The position of Specialist in Cooperative Extension is one of statewide leadership towards University colleagues, agricultural industries, consumers, youth, policy makers, environmental agencies, and other public agencies. The Specialist is generally expected to keep campus and county-based UC Cooperative Extension (UCCE) colleagues and clientele appraised of emerging issues and research findings and directions, work with them to conduct applied research and develop applications of research knowledge to specific problems, and provide educational leadership and technical information support for county-

based CE advisors and clientele. A Specialist in CE is a primary liaison with university research units. The specialist is expected to provide leadership, facilitate teamwork, develop collaborative relationships with colleagues, and ensure appropriate external input into the planning of research and educational programs by the Agricultural Experiment Station (AES) and CE. The Specialist will be expected to provide leadership and participation in ANR Program Teams, workgroups and Strategic Initiative Programs, work closely with CE Advisors toward the resolution of issues of regional and statewide importance, and coordinate statewide programming with UCCE and AES colleagues throughout California. The Specialist also identifies and considers the needs of all relevant major clientele groups in the planning, development and execution of applied research and education programs. The Specialist is evaluated for merit and promotion using four basic criteria: 1) Extension Teaching, 2) Applied Research, 3) Professional Competence and Activity, and 4) University and Public Service. Because the Specialist's role is unique, in comparison to faculty and Experiment Station academic appointees, activity within some of the components of the four criteria used in assessing a CE Specialist's performance, therefore, should be based on the specific responsibilities listed for that position. To apply, use https://recruit.ucdavis.edu , click on "Applicants" and scroll down to the first position (as of 6/21/2013) and fill in the information. A PhD in Entomology or animal biology with experience, training or coursework related to management of honey bees for pollination, knowledge of Africanized honey bees, a Curriculum Vitae, publication list, research interests, contact information and at least four potential references are required.

Monsanto Ready to Go

I attended the recent Honey Bee Health Summit held at the U.S. Monsanto, Chesterfield, MO, Research and Development facility. The pre-meeting tour of the facility was a bit like visiting an elaborate movie set, but with more security. Each substantial-sized laboratory was devoted to a single function that was one in a series of steps through which each product proceeds during development. The labs are equipped with state-of-the-art instrumentation and labor-saving gadgets. However, the gadgets are specifically designed to complete their tasks error-free (robotics). The laboratory personnel stated that analyses that used to take months can be completed in a day.

As might be anticipated, a great deal of time and effort is devoted to quick-time selection of the next generation of corn or soybeans for marketing. This work is accelerated immensely by genetically analyzing a crumb from each seed. If the proper genes are identified, the seeds are grown in one of the 2.5 acres of roof-top greenhouses. Final selections are made in the "fields" on the roofs.

Having heard a lot about toxic dust from corn planters, I pressed the issue about seed coatings while in the laboratory devoted to those studies. Very cognizant of the real-world problems, Monsanto formulated a coating that attaches firmly to the seeds and is slippery. However, down-stream companies coat the seeds with their own additional products that can make the seeds sticky, again. Then the talc is required to allow the seeds to pass successfully through the planter and the toxic dust problem returns.

What about Monsanto's new interest in bee health? Currently, they have decided to help the founders of Beeologics, now Monsanto employees, to pursue their dreams. A couple years ago I wrote about Remebee®, the double-stranded RNA

(dsRNA) product designed to protect bees against infections with Israeli Acute Paralysis Virus (IAPV). Remebee is fed to adult bees in sugar syrup. The dsRNA "vaccinates" the cells of the bee so that they can attack that specific dsRNA if it shows up as a real virus. Double-stranded RNA is an essential component in viral replication, so the bees became immune to IAPV. More recently, continuing studies revealed that the dsRNA passed through the bees, into the larvae and pupae, then appeared in the emerging adults. Varroa mites feeding on the emerged adults had the dsRNA in their bodies. This demonstrated that dsRNA could be delivered to *Varroa* through the honey bee lifecycle chain. The tedious work now is to unscramble the genome of the varroa mite and find one or more biochemical pathways susceptible to being destroyed if a specific RNA is prevented from forming in the mite. Obviously, that pathway cannot be shared with honey bees. Once found, lab test, field tests, registration steps, and marketing need to be worked out before the product can become available to the beekeeping industry.

I am sure that the company executives already know that the beekeeping industry is not large enough for them to ever recover the costs of their research and development on this project. Like the old days, when each year Pfizer Inc. fermented up a batch or two of Fumidil-B at a loss for the sake of the beekeeping industry, Monsanto likely will be helping us at its continuing expense.

After contemplating the potential of having all that technology and creative power available to us, I thought that Monsanto could really help us by genetically assessing honey bees, worldwide, that tended to have uniquely low virus titers in their bodies. The specific genes involved in this resistance to viral infection could be elucidated by their molecular genetics experts. Next, the geneticists could share that information (and perhaps diagnostic services) so that individuals breeding bees could use those identified genes to build bee stocks minimally affected by virus diseases. It might be a nice change of pace for the company geneticists to chase animal genes instead of plant genes.

I guess we eventually can determine how dedicated to honey bees the company actually is by how quickly they complete steps toward getting the new Remebee (structured to cover all bee viruses with dsRNA for each major virus family) and *Varroa* products on the market. It won't happen overnight. If it does look promising, they might also target *Nosema ceranae* using a similar technique.

Talking with other researchers is always interesting. One Monsanto chemist, who hap-pens to be a beekeeper, told us that glucose oxidase is very toxic to a number of insects, as well as to bacteria. While studying the enzyme, he determined that hydrogen peroxide was not necessarily the antibacterial compound in some cases. Instead, there was a blocking mechanism (reductase preventer) that did not allow long-chain carbohydrates to grow. Without those chains, the bacteria cannot construct their cell walls. That is a potent, non-hydrogen peroxide, antibacterial effect. I also talked to a researcher who was trying to determine how the dsRNA could be delivered to *Varroa* without running it through a bee. That kind of thinking is why is will be critical to have Jerry Hayes on the staff to speak to honey bee biology and behavior.

Summit sponsors, Monsanto and Project Apis m, also took this opportunity to invite a significant portion of the country's researchers and extension folks to provide a bit of information on what they are doing and what they are finding. Each speaker had 15 minutes. Information flew and taking

notes was just about ompossible. However, I did capture some tidbits that I feel are worth sharing.

USDA and EPA are holding another three-day honey bee/pesticide meeting in Virginia beginning Oct. 15, 2013. All attendees at the Summit were invited to attend. This is really good news. It demonstrates that beekeepers, and now the general public, are being taken seriously about their concerns over the health of honey bees and the possible contributions pesticides and pesticide residues may be playing in excessive honey bee colony losses. Those concerned with broader environmental issues also should consider this a step in the right direction.

Also of interest is that the U.S. Geological Survey National Water-Quality Assessment Program has posted county-level pesticide use maps covering the years 1992-2009 (http://water.usgs.gov/nawqa/pnsp/usage/maps/ . The second page at the site asks to select the chemical of interest. When you do, the 2009 map pops up with darker colors indicating more use. Beneath the map is a table revealing what crops were treated most with that chemical. Above the map is the button to move back to the previous year. Note how the change in imidacloprid use from 2003 to 2004 was followed by our first winter of unexpectedly high winter losses. In 2005 we were short on bees for almond pollination. Then use tapered off for a few years, picking up again in 2008 and becoming quite prevalent in 2009. It will be interesting to see the last few years when the information becomes available.

Two economists were asked to take a look at the bee industry. The first speaker was a minimalist. He determined the value of each individual bee, from varying points of view. For almond pollination, it appeared that each bee was worth 13 cents. But, since so many of them got out and worked, the colony produced about $2,650 per acre in almonds. He questioned the appropriateness of charging only $150 to rent that colony. The comment was made that ascribing the total crop production to the bees failed to recognize all the other essential operational inputs of growers. The economist also developed some projections for the future. He warned that if our colony numbers fall to half of what we currently have, we will be out of business. He did not specify if that was for individual beekeepers, or for the nation's industry.

The second economist did not paint a very rosy picture, either. He noted that when beekeepers divide their colonies to make splits, following a 30 percent loss the year before, they often manage to recover only about 80 percent of their original colony numbers. At a loss level of 35 percent, the beekeeper would have to split more than 50 percent of the remaining colonies, and that is not sustainable.

Pesticide/Bee Damage –U.S./Canada

Both the U.S. EPA and the Canadian PMRA (Pest Management Regulatory Agency) have become more proactive recently as beekeepers in both countries are encountering annual levels of colony losses that are not acceptable if commercial beekeeping and a large portion of commercial agriculture are to remain in business. Concern about pesticide poisoning of bees pollinating commercial crops has been omnipresent for decades. However, in the good old days, unless the colonies were killed outright, they often managed to shake it off and come back into production.

Currently, additional stresses, such as varroa mite and the viral diseases it vectors, *Nosema ceranae*, poor nutrition, exposure to many pesticides and pesticide residues (insecticides, acaricides, fungicides,

herbicides, insect growth regulators, adjuvants, etc. in seemingly "subacute" levels), are found to be having much more negatively significant impacts on the bees than was anticipated.

In Canada, the national Canadian Honey Council (it always has more political persuasion than our U.S. organizations do in the U.S.) made a number of recommendations to PMRA for improving procedures for reporting and investigating pesticide incidents. The full text of this article ("Recommendations concerning the reporting and investigation of pesticide incidents"), as well as another well-written article on the topic ("The Importance of Reporting Bee Kills" by Doug McRory), can be found in the May 2013, Vol. 26, #2 issue of "Hivelights," the monthly magazine published by the Canadian Honey Council.

Briefly, the 12 recommendations under "Reporting" were:
1. The national toll-free reporting telephone number should be more actively promoted and publicized. After a call, everyone in the loop should be notified.
2. With beekeeper permission, the chemical registrant should be notified of the incident.
3. That Health Canada budget adequate funding for this program, well into the future.
4. PMRA alerts the Canadian Honey Council (CHC) when informed of an incident.
5. A verification investigation is conducted before listing the incident on the public website.
6. All interest groups meet periodically to address gaps in printed guidelines about bee incidents.
7. Discontinue use of the current AG Field Questionnaire until further discussions with landowners and beekeepers.
8. PMRA incorporates comments from the Canadian Association of Professional Apiculturists into the Bee Yard Questionnaire.
9. Incident form should have a question pertaining to the last time the apiary was visited.
10. Report form should have a check box that would prevent further investigation.
11. Report form should have a check box permitting PMRA to share information with registrant.
12. CHC, Provincial Associations, and Provincial Apiarists provide information to beekeepers on what to look for in the event of a pesticide incident.

On May 9, 2013, the EPA Office of Enforcement and Compliance Assurance issued a guidance document to FIFRA Compliance and Enforcement Managers (Regions 1-10). The title of the 31-page document is "Guidance for Inspecting Alleged Cases of Pesticide-Related Bee Incidents." The first eight pages deal with the following topics:
1. Purpose

"To identify unique considerations that federal, state, and tribal inspectors should take into account when they are conducting … inspections as a result of the heath of honey bees or other social insects." "The data gathered in these types of inspections will help determine if the death of the bees was associated with the legal or illegal use of a pesticide."
2. Bee-Related Inspections

Requests response to incident and an inspection that "focuses on the circumstances of the incident as well as the collection of evidence …" Included are: "… Notices of Use inspection, creating and maintaining chains of custody for any samples collected for analysis, and issuing Receipts of Samples, …" "Bee-related inspections must focus on the immediate location of the incident as well as any surrounding areas in which pesticide applications may have occurred which may have influenced the incident." [Editor's note: We have encountered situations where honey bees were getting into Penncap-M four-and-a-half

miles from the almond orchard which was going out of bloom. That is more than 50 square miles that might have to be considered "any surrounding areas in which pesticide applications may have occurred which may have influenced the incident."] This section defines three "phases of determining the role of illegal pesticide use in an incident:" a) collect any additional information about the incident and plan for inspections; b) inspect the hives to collect observations and evidence; and c) identify and inspect sites of possible pesticide use in the areas surrounding or adjacent to the site. [Editor's note: This may be easier in California because most of the applications of restricted materials require a notice of intent 48 hours before the application. Thus, a pre-application record already exists.]

3. Collection of Preliminary Information and Planning

When possible, the complainant is supposed to supply the following information, but it is most likely that the beekeeper would have to be involved: a) nature of incident, b) where it occurred, c) when it occurred, d) identities of any persons who may have been involved, e) why the complainant believes it happened, f) why the complainant believes a pesticide was involved. Obviously, the complainant's contact information must be collected, but it can be kept confidential if the complainant fears retaliation. At the apiary, or wherever the dead bees are noticed, the GPS coordinates are recorded. And, if they can be determined, all the particulars about the incident are requested: chemical name, product name, registration number, application rate, time of application, method of application, and target crop or site.

4. Pre-Inspection Planning

Location: Use Google assistance to try to determine what might have been transpiring in area around reported site of loss.

Weather Data: Try to find data from three area weather stations to determine which way the wind was blowing and how fast.

Incident Reports: Registrants are required to file incident reports if they become aware of an incident with their product. Non-registrants do not have to report ecological incident data, but if they feel so inclined they can report via the Ecological Pesticide Incident Reporting web portal at the National Pesticide Information Center. All those reports are sent to EPA headquarters on a regular basis. This section also includes a reminder to the inspectors to have intact personal protective equipment (PPE) on hand. In this case, it is the typical suit, gloves, veil, etc. and an EpiPen or similar epinephrine delivery system. Finally, there is a reminder to prepare the collecting equipment in advance.

5. On-Site Hive Investigation

Before inspecting, the inspector should ascertain whether or the colonies are dead. When was the last time the beekeeper inspected the colonies and what was written on the beekeeper's inspection report? Have the colonies been fed and watered? If so, what was fed and when? Next the inspector should obtain from the beekeeper "all information on pesticide applications to the hives in question made by the beekeeper or other person(s) in the last year, documenting the date, time and nature (if known) of pesticide applications to the hives (e.g., chemical name, product name, application rate, time of application, name of applicator, and if a restricted use pesticide (RUP) the name of the certified applicator)." "The inspector should also collect labels or copies of labels for all products used by the beekeeper for pest control within the last three (3) months at minimum, ideally including labels for pesticides applied within the last year." It gets more detailed, but you can read it if you are interested. The inspector should always have permission from the beekeeper before the inspection is conducted. If the beekeeper refuses, then

the inspector should leave the bees and seek advice from supervisors.

6. Inspecting the Hive and Site of Bee Deaths

Inspectors should put on protective gear and should not manipulate the hives, unless they have adequate prior experience. Frequently, the beekeeper will be there and should assist with inspections. Adult bee samples should be limited to dying or freshly dead bees. They can be picked up in or near the hive, or farther away, if they can be found. If bee bodies in various stages of decay are noted, photos should be taken and the beekeeper asked how long ago the bees may have been killed. Swabs can be taken from the outside of the hive to see if toxic residues can be detected. If perceived to possibly be useful, samples of honey, stored pollens, and beeswax may be collected from the hives. Photos should be taken as the hive samples are collected. In some cases, samples may have been collected other than at the time of the inspection. Those samples will be processed, but will have a weak "chain of custody."

7. Identifying and Inspecting Potential Pesticide Sources

Beginning closest to the apiary, inspectors are expected to try to determine where a pesticide application may have been made that might affect the colonies. Examples of where such contact could occur include: a) sites where crops are frequently sprayed or have been known to have received a recent application, b) sites where pesticide-treated seeds have recently been planted, c) areas or sites with flowering plants (crops, weeds, ornamentals) or other plants which bees might consider desirable for foraging, and d) rights-of-ways such as utility lines or roadside drainage ditches. The following really caught my attention: "Note: Treated seed (and any resulting dust-off from treated seed) may be exempted from registration under FIFRA as a treated article and as such its planting is not considered a *pesticide use*." Finally, if the inspector cannot locate nearby potential sources of contamination, then the search expands more broadly, and has to consider such things as mosquito abatement, etc.

8. Conducting Pesticide Inspections of Possible Sources

Environmental sampling should be based on knowledge of pesticide use practices in the area. For commonly used chemicals, all the registration, application, etc. data should be known. Drift and direct overspray should be fairly easy to determine. If a chemical residue shows up for which there is no registration, then more effort should be made to find the source.

Pages 9 through 31 contain a series of attachments that provide specific details of how all those general things noted on the previous pages ought to be done. The detail is overwhelming. Attachment III provides information on "Bee Basics." There is information on CCD; a description of the stages of dead bee decay (hair loss, wing loss, putrid odor, darkening color, body becomes amorphous (desiccated or dismembered); how bees come into contact with toxic materials and what effects the toxins can have outside and inside the hives; and problems with trying to estimate how far honey bees might go to get into trouble. Attachment IV contains photographs of hives, bees on combs, and a varroa mite on a bee. Some of the explanations with the photos are unique. Attachment V contains all the blank forms that must be filled to complete an inspection.

Bee Schools

Two events, at opposite ends of the country, are scheduled for the same dates. Kat Nesbit is organizing an event called the "Pacific Northwest Treatment-Free Beekeeping Conference: Where Science and Earth-Friendly Beekeeping Meet!" The meeting will be held just outside Portland, Ore, from July 26 to 28, 2013. Among the featured invitees are: Dr. Tom Seeley, Kirk

Webster, and concert musician Timothy Sellers. For further information and to register for the event, please contact Kat at www.blisshoneybees.org/events.html .

The second event does not even require that you leaving home. Dr. David Tarpy, of North Carolina State University, is offering a two-day, online short course titled "Advanced Bee Breeding." This course is focused on general concepts of how to improve queen rearing and implement selection of genetic stock, not on how to rear queens. For that type of course, note the mini-course on the BEES network (http://www.cals.ncsu.edu/entomology/apiculture/BEES.html). Specific areas of attention will be: Friday, July 26, 2013 – 1 to 5 pm EDT – History of queen production, basic honey bee genetics, selection theory, and molecular markers and other tools. On Saturday, July 27, 2013 – 9 am to 5 pm EDT – Controlled mating designs, instrumental insemination, stocks and stock selection, record keeping, rearing queens (lightly), quantifying queen quality, discussion and Q&A. The two-day course requires a $150 donation to the bee program as NC State. The official announcement and description of the course can be found at: http://www.cals.ncsu.edu/entomology/apiculture/BeeBreedingShortCourse2013.html . The registration form can be downloaded from a link at that site.

Sincerely,

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