COOPERATIVE EXTENSION UNIVERSITY OF CALIFORNIA

from the U. C. APIARIES University of California

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Newsletter Emailed to You

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Colony Loss Survey (2013-2014)

If you have been in the business of beekeeping even for a short time you are likely familiar with the US National Survey of Managed Honey Bees conducted by the Bee Informed Partnership (http://beeinformed.org/) team comprised of researchers from several universities and the United States Department of Agriculture. The first survey was conducted in the 2006-2007 season and has been published yearly ever since. And by the time you read this newsletter they will have collected the data for the 2014-2015 season.

I am very curious to find out how this past year has treated us, especially considering the particular weather patterns

we've been experiencing across the country. But in the meantime let's see what's been happening with our nation's colonies April 1, 2013 – April 1, 2014?

This was the second year that the survey recorded both winter and summer losses allowing for an overall assessment of the yearly losses. At a first glance (http://beeinformed.org/wp-content/uploads/2014/05/ColonyLossWinterup2014-v2.png), the overwintering losses appear to be less severe than the previous year (2012-2013). Interestingly, there seems to be a pattern of one poor year followed by a better year (I'm not saying there is anything to it, but I am hoping that doesn't mean that this past year will turn out to be worse).

Also worth noting is that there seems to be a higher acceptable percent loss by the beekeepers possibly because we have unfortunately grown accustomed to high losses and are more likely to expect them and accept them. Although, 66% still had losses higher than what they thought was acceptable.

A total of 7425 beekeepers managing approximately 500,000 colonies, responded to the survey. The analysis of losses was then further broken down by the time (winter, summer, yearly losses), operation size (backyard: <50; sideline: 50-500; commercial: >500), and the state. Beekeepers also reported what they thought were the main causes of their overwintering loss.

Lee and colleagues (2015) state that the total percent loss is more appropriate for comparing seasonal and regional losses while the average losses are more appropriate when we're talking about differences between different operation types so that is what we will do here.

The total winter (October 1, 2013-April 1, 2014) losses reported were 23.7%, total summer (April 1, 2013-October 1, 2013) losses were 19.8%, and total annual (April 1, 2013-April 1, 2014) losses were 34.1%. Do not worry that the numbers don't add up – responses used were from different groups of beekeepers. These numbers are definitely more reassuring than the ones from the year before. However, the average annual losses were similar to previous year.

Now, which states seem to have suffered the most? Well, there was a quite a range for total losses for different time periods. Total summer losses ranged from 2.5% (Massachusetts) -70.3% (Connecticut). (Surprising isn't it – two neighboring states with the highest and the lowest summer loss.) Winter losses ranged from 11.2% (Alabama) – 70.7% (D.C.), while the total annual losses were highest for D. C. (85.7%) and lowest for Wyoming and South Carolina (20.1%). So it looks like the climate might not be driving these differences although it would be interesting to compare more local losses too.

As far as the state of California, the beekeepers seemingly fared better than the previous year and that includes summer, winter and annual tally. Granted we can't be sure if the same beekeepers replied to the survey so it is a bit difficult to say that this indeed was the true state of affairs, but it was looking promising. In my many communications with California beekeepers this year, I have attempted to get a sense of how they did in the 2014-2015 season. I got a range of responses from "I had no loss" to

"I lost almost 50% of my colonies" making it difficult to really gauge the situation. I almost considered holding off on publishing this newsletter so I can include some of the preliminary data for 2014-2015, but I guess you'll have to go to the BIP website and find out for yourself. Based on the reports from previous years, the BIP team is quite good at getting out the preliminary results sometime in the month of May so we hopefully won't have to wait too long.

Similarly to the previous season, the highest average winter and annual colony losses were in those beekeepers identifying themselves as backyard beekeepers. However, while the summer losses for 2012-2013 survey were the lowest in the backyard beekeepers, 2013-2014 was similarly devastating for all, regardless of the operation type. Maybe different individuals responded to the survey or it could be that whatever was ailing the bees finally caught up with them.

When the beekeepers were asked to identify what they thought caused the overwintering colony losses, the answers were quite similar to the previous year. Queen failure and varroa mites were reported as the top causes by the commercial beekeepers (followed by pesticides and CCD). Poor wintering conditions, starvation and weak colonies were reported as the top causes by the backyard and sideline beekeepers. These differences between operation types are most likely due to differences in colony use and management.

Overall, looking at the maps of the losses throughout the country nothing jumps at me to be able to say, for example: "Well, it is obvious – the Northern states have suffered a much greater winter loss." One thing that varied quite a bit between the states was the number of operations and therefore the number of colonies that were included in the survey. Plus there was a lot of movement of these colonies between the states.

And speaking of movement, I often get asked if the migratory nature of the pollination business is what's killing the bees. While it is likely stressful for the bees to travel very large distances (let's face it we get stressed out too when traveling a lot) it is very much worth noting that, when the migratory and pollination colonies from commercial operations were compared to those that were stationary or not used for pollination, there was no significant difference in colony losses. Interestingly, when the sideliner operations were compared, there were actually fewer losses in those that were migratory. These results echo findings from the previous season. Now, I'm not saying throw your colonies on a truck and move them around, but it is a good reminder that it is indeed a number of factors that play a role in loss of colonies and we should try to stay away from simplifying things. Honey bees are complex and so are the factors affecting them.

Article: Lee, K. V. et al. 2015 Apidologie DOI: 10.1007/s13592-015-0356-z.
http://link.springer.com/article/10.1007/s13592-015-0356-z

Oxalic Acid

The US beekeepers finally have yet another weapon in their fight against varroa mites. Every beekeeper knows that *Varroa* is a serious problem for honey bees and high infestation has been correlated with high

colony losses in the US, Canada and Europe (if you want more information on this take a look at these articles: Genersch et al. 2010; Guzman-Novoa et al. 2010; Lee et al. 2015). Other than feeding on bee hemolymph (insect blood) these little suckers also suppress the immune response of a bee and can transmit viruses between colony members. Bad news all around!

Beekeepers have limited options for *Varroa* control and this has been particularly true since varroa mite resistance to certain, miticides has been recorded (for example, coumpahos and fluvalinate). These have also been shown to sometimes have a negative effect on honey bees themselves.

So what's left? If you have only a few colonies you might be able to apply mechanical (e.g., drone comb removal) or cultural (e.g., re-queening with hygienic stock) approaches. Miticide application, however, still remains a more feasible option for many. In addition to conventional miticides, beekeepers can employ what we call "biorational" miticides which includes formic acid and now oxalic acid. Which ever specific methods you decide to use, make sure you incorporate them into an integrated pest management plan – that is, make sure to utilize more than one approach especially when it comes to pesticides in order to avoid development of resistance.

But I digress so let's get back to the topic at hand. The use of oxalic acid for *Varroa* control is really nothing new as it has long been registered for use in Canada and Europe. Oxalic acid has also been commercially available in the US for uses other than pest management. The Environmental Protection Agency, based on the documentation provided by our Canadian neighbors, has deemed the compound sufficiently safe for the environment and humans. "Therefore, EPA is granting the unconditional registration of oxalic acid under section 3(c)(5) of FIFRA."

As mentioned, oxalic acid, when handled properly, doesn't seem to present an increased risk for human health. However, oxalic acid is NOT TO BE USED WHEN HONEY SUPERS are on the hives. Oxalic acid is corrosive to skin, eyes and respiratory organs if inhaled. To protect yourself when applying it, you need to wear a respirator and goggles in addition to your bee protective gear. And if you normally don't wear gloves when beekeeping (I certainly find gloves to be restricting) you better get a pair to wear for oxalic acid application. As always, read the label instructions prior to any application of a pesticide. Speaking of label, oxalic acid will be registered for use as a spray solution for bee packages or in hives, and as a vapor treatment in the hives.

So we just talked about humans and the environment, but how might oxalic acid be affecting the honey bees? I perused the available literature and found a nice review on oxalic acid published by Rademacher and Harz in 2006. The results of the reviewed studies were mixed, but overall it appears that honey bees will do ok with a single application of a solution of up to 4.6% oxalic acid while multiple applications seem to do more harm to the bees. BUT (there is always a BUT, isn't there), it seems that the tolerance levels varied between climactic regions, with South European bees being more tolerant of higher oxalic acid concentration and multiple applications as compared to their North European counterparts. Similar results were recorded

when evaluating evaporation and spraying of colonies with 3% oxalic acid. Again, multiple sprays seemed to cause more harm than good. Please note that the US draft label recommendation is 2.8% oxalic acid for the solution and spray methods.

A couple of other things of note. Oxalic acid has been reported to have a negative effect on brood so the recommendation is to use it during a broodless period in the fall or spring. Reed Johnson and colleagues (2010) also noted that oxalic acid had an agonistic effect with several other miticides possibly because the oxalic acid crystals are abrasive and might have damaged the bee cuticle.

Still, the use of oxalic acid for management of what is considered to be the number one parasite on honey bees, seems to outweigh the negative effects on honey bees. As with any pesticide, please read the label carefully and use oxalic acid judiciously.

To learn more about the EPA's decision you can go here http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2015-0043-0119 and to see the draft label go here http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2015-0043-0018.

Articles: Genersch, E. et al. 2010 Apidologie DOI: http://dx.doi.org/10.1051/apido/2010014; Guzmán-Novoa, E. 2010 Apidologie DOI: http://dx.doi.org/10.1051/apido/2009076; Lee, K. V. 2015 Apidologie http://link.springer.com/article/10.1007/s13592-015-0356-z; Rademacher, E. and Harz, M. 2006 Apidologie DOI: http://dx.doi.org/10.1051/apido:20050 63; Johnson, R. M. 2013 PLoS ONE. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0054092#pone-0054092-g004

Remote Hive Monitoring

I have been hearing about the use of remote hive monitoring for a while, but honestly I wasn't quite sure how it could all be used to better the beekeeping world. So I was glad I had an opportunity to attend a presentation by Dr. Huw Evans who talked about his company Arnia (http://www.arnia.co.uk/).

Sensors used by Arnia allow for monitoring of the hive temperature (including the temperature in the brood area), humidity, sound inside the hive and sensors can also pick up if the hive is being moved. That's pretty neat, but what can it really tell us. Well, as it turns out it could be pretty useful. For example, tracking the brood temperature can tell you if the brood area is the correct temp which would indicate that the queen is there and egg-laying. Indeed, it would take some time for you to realize that the queen is not there based on this, but it is certainly a step in an interesting direction.

Another possible use is for swarm predictions. The audio recording of the hive can actually tell us if the hive is preparing to swarm as the bees simply sound different than when not initiating swarming. Apparently this process is recordable quite a bit in advance so you'd have plenty of time to manage the colony to prevent the swarm. In the light of recent increased hive thefts this system could be useful for alerting beekeepers their hives are being moved. Finally, while it is still being tested, sound

and vibration recordings could indicate parasite and/or pathogen presence.

In addition, hive scales have also been receiving some interest in the beekeeping community. Best Informed Partnership has rolled out a program where the beekeepers and beekeeping organizations can obtain hive scales to monitor their hives for nectar flow (as seen by increase in hive weight) and other parameters. This data is routed to a national database and the beekeepers can see what is happening in their region or elsewhere. BIP is planning on using this data to help improve hive management practices. Even though this technology is far from being mainstream in beekeeping (partially due to a relatively high price tag), it certainly is looking promising. Man, I do love the techy age we live in!

To learn more about the hive scale program go to http://beeinformed.org/hive-scale-program/.

Queen Rearing Techniques Short Course (*)

At the very end of 2014 the E.L. Niño Lab group was delighted to announce our inaugural Queen Rearing Techniques Short Course. The course was full within four days and with a growing waiting list we decided to offer a second session to accommodate the overwhelming demand. The course was held at the Harry H. Laidlaw Jr. Honey Bee Research Facility on the UC Davis campus on March 28&29 and again on April 11&12.

While we feel it is important to offer science based theoretical background we know that the tested and proven hands on activities are crucial to best prepare the participants for their next steps in queen rearing and beekeeping endeavors. We strive to offer participants as much quality information as possible with various options so they are able to make the best and most informed decision for themselves so we were really happy to hear from Sue: "The Queen Rearing Short Course grafting experience gave me the confidence to begin a small queen rearing program in our home yard."

The course covered a variety of topics geared towards the novice queen rearer, yet offered even an experienced queen "maker" some new information and perspectives to continue to hone their craft. Lectures included: queen development and biology, setting up colonies, various queen rearing techniques, cell transport and queen introduction methods, breeding basics and selection, and a talk about queen pheromones from our graduate student Cameron Jasper. These lectures were complemented with ample field and hands-on activities led by Billy Synk and Bernardo Niño with excellent support from our visiting scholar Stefanie de Heij.

Participants had a chance to try their hand in hygienic testing assay, they learned about *Nosema* screening, mite monitoring methods, royal jelly collection, queen installation, and various queen rearing methods. A large portion of the course focused on grafting (Doolittle method) with one-on-one attention and instruction provided by Dr. Elina L. Niño. As, Bar, one of the participants stated: "In a very clear way, the course walked us through the process of Queen rearing and each phase was followed by great hands on experience! And guess what, we even walked away with some queen cells." We were thrilled to get

this and other positive feedback from the students.

Participants in the March course also had an opportunity to interact with the Northern California Bee Informed Partnership Tech Team. Rob Snyder and Ben Sallmann offered an enlightening perspective from their experience working directly with the large scale queen producers in California. They took the lead on the hygienic behavior assay and discussed *Nosema* screening. They further discussed their evaluation process for the California queen breeders and some of the results. Students obviously found this tobe valuab;e information, as Knute stated: "We also enjoyed meeting the NorCal tech team from Bee Informed and learning about what they do in supporting commercial operations and breeders. "

Participants came from all over California, Utah, Washington, and even the U.K. They also had a wide range of expertise and background, ranging from beginning backyard beekeepers to former state apiary inspectors. Some participants have only had a few colonies whereas others manage over a hundred. However, in this course they all stood on common ground and not only learned valuable information from the instructors but, again, the participants themselves offered many interesting perspectives and useful information that only added to the curriculum. Small class size and informal setting facilitated easy interaction between instructors and participants, and the conversation continued at the optional dinner on Saturday.

We received a lot of positive and constructive feedback from the participants, and they all seemed to enjoy it. Yes, we might be tooting our own horn a bit, but we are all so very happy that we were able to provide this learning experience for the beekeepers and we had such a wonderful time getting to know everyone. If we had to evaluate them we would have to say what Thea said: "You are all the Bees Knees!"

A big thank you also to Mann Lake LTD and JZ- BZ Queen Rearing Supplies.

Kids' Corner: Putting the royal in royal jelly (*)

Everyone knows you are what you eat and in the case of honey bees this is particularly true. Royal jelly is the food that creates honey bee royalty - my favorite individual in the colony: the queen! For a long time beekeepers have known that royal jelly creates honey bee queens but a relatively recent study by a Japanese scientist Masaki Kamakura discovered it is a very specific protein (you know, that stuff your mom makes you eat the chicken for so you can build your muscles) in royal jelly that is crucial for causing this incredible transformation in the honey bee. This protein was appropriately named royalactin!

Kamakura found that heated royal jelly doesn't create honey bee queens, but rather more worker-like individuals. The heat causes proteins to breakdown and not function properly. This discovery helped focus the search. Now that it was clear a protein was responsible for turning female larvae into queens, Kamakura began to narrow down the individual proteins. He determined that royalactin degraded over time when stored at high temperature and so did several other possible candidate proteins.

However, only when he added active royalactin back into royal jelly and fed it to the developing young larvae, honey bee queens were made once again. Isn't it pretty impressive that a single protein can have such a dramatic effect on the future of this insect?! Remember that any fertilized egg can become a queen, but it is royalactin that puts that crown on their head.

Article: Kamakura, M. (2011) http://www.nature.com/nature/journal/v473/n7348/abs/nature10093.html

Upcoming Events

1.) **5th Anniversary of the Häagen-Dazs Honey Bee Haven** May 2 (10am-2pm)

2.) **Bee Symposium: Keeping Bees Healthy.** May 9 (8am-6:30pm)

3.) **A TEASER** – we will be offering a beginner beekeeping course "Planning Ahead for Your First Hives" in September, 2015. Thinking ahead allows for better planning and preparation so you are completely ready for when your first bees arrive in the spring! For more information please email us at elninobeelab@gmail.com.

(*) Articles contributed by Bernardo Niño

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Sincerely,

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