

# Episode 7 Mixdown PROOFED

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## SUMMARY KEYWORDS

beekeepers, bees, pesticides, colony, people, research, varroa, impacts, toxicity, exposure, bee, hive, honey bees, compounds, exposed, risk, kill, formulation, funded, judy

## SPEAKERS

Guest, Jamie, Amy, Honey Bee

### Jamie 00:05

Welcome to Two Bees in a Podcast brought to you by the Honey Bee Research Extension Laboratory at the University of Florida's Institute of Food and Agricultural Sciences. It is our goal to advance the understanding of honey bees and beekeeping, grow the beekeeping community and improve the health of honey bees everywhere. In this podcast, you'll hear research updates, beekeeping management practices discussed and advice on beekeeping from our resident experts, beekeepers, scientists and other program guests. Join us for today's program. And thank you for listening to Two Bees in a Podcast. Welcome to Two Bees in a Podcast. In today's episode, we will be interviewing Dr. Judy Wu-Smart from the University of Nebraska. She will be talking to us about some of the pesticide research that she does. She looks a lot at pesticides and their impacts on bees, and so we'll have a great discussion with her about that. We will follow that discussion by having an in-depth review of risks associated with pesticide exposure. Amy and I will be talking quite a bit about that. Of course, we will conclude our podcasts today with questions from our readers and our attempt to answer those questions. So thanks for joining us on Two Bees in a Podcast. Hello, everyone, I think we have a really good segment here for you. We are going to be interviewing Dr. Judy Wu-Smart. Judy is an Assistant Professor and Extension Specialist in the Department of Entomology at the University of Nebraska-Lincoln Bee Lab where she's been working for four years. Dr. Wu-Smart. Thank you for joining us on Two Bees in a Podcast.

### Guest 01:47

Thanks for having me, Jamie. I'm really happy to be here.

### Jamie 01:49

Hey, we're totally excited. I'm joined by Amy. Amy, are you as excited as I am?

### Amy 01:53

I am excited. We get to talk about pesticides today. Everyone's favorite topic.

**Jamie 01:57**

Yeah. I don't know why you're excited about that because pesticides are obviously a hot button issue. So I'm going to introduce a little bit, Judy, if I might, and then we'll start questioning you about some of the work that you've been doing and your feelings on pesticides. So this topic of pesticides is obviously a big deal. In fact, in many ways, it's both dangerous to study the pesticides and dangerous to talk about pesticides because there are fanatics on both sides of the aisle -- people who are uber pro-pesticides and anything you say against them, you're dead, but even more so, people who are uber against pesticides and anything you suggest that they don't harm bees in certain ways, and then you're all of a sudden tagged. And so you're wanting to talk about this, and I'm looking forward to seeing where this discussion goes. So let's just start from the beginning. I mean, could you give us an overview of the type of work you do with pesticides there at the University of Nebraska?

**Guest 02:54**

Yeah, so my area of interest, particularly the research efforts, are really trying to just better understand what the roles of pesticides and their exposure causes in terms of bee health and colony production and survival. And so a lot of the research that we've been looking at has been kind of moving away from whether or not a chemical can kill, whether they're lethal, or they're getting acutely exposed, but more about the nuances of these sub-lethal and indirect effects. So how is it impacting their behavior? How is it impacting their ability to perform as a colony, as a social unit? And so a lot of that research is just kind of really leading to highlighting some areas where we can improve in our protections and our regulations and our practices.

**Jamie 03:50**

Well, how did you get interested in studying pesticides in the first place, with honey bees specifically?

**Guest 03:57**

I've always actually had kind of an interest, or maybe more of a concern for conservation and environmental protection. I really didn't know much about bees growing up. But when I was working in Florida as an intern in 2007, that's when CCD happened. That's when we started learning about it in the media. And it was a really nice kind of opening of perspectives of, yes, I love environmental science, I love conservation, and bees are a perfect system to study both something that is important for our long-term sustainability, but also for our food production or economic production.

**Amy 04:44**

Yeah. So, Judy, can you tell us some of the impacts of the pesticides on bees or some of the stuff that you've been finding in your lab with some of the research that you've done?

**Guest 04:52**

Right, so I think with the research that I'm focusing on, I'm specifically looking more at a particular type of pesticide. And I think people commonly lump pesticides all together and think that they're equally harmful or affecting bees. And really, there are insecticides, there are fungicides, there are herbicides, these things are targeting different organisms, but can also impact bees in different ways. So I think that's important for people to understand that, even if I am studying a particular class of insecticides,

like neonicotinoids, the impacts on bee health and the effects that we see on the colony level are really very specific to that compound, that circumstance. And there are just hundreds of active compounds that are being used, and even more formulations that are being used out there. So I think the impacts of pesticides is wide-varying. And it's not just, is it killing them, is it lethal, is it toxic? But how are these other impacts affecting their ability to survive? So like herbicides, they target weeds, but we know that if you are removing all your unwanted weeds, you're altering the habitat and you're making the available bee forage like dandelions and clovers just unavailable for them. And so that is causing malnutrition, which could lead to higher susceptibility of pests and pathogens. With fungicides growing research with like, their impacts of the microbiome, so again, affecting their nutrition, their ability to absorb nutrients, I think these are things that people are just starting to really focus on in terms of these colony level impacts, rather than, "Hey, did it hurt a bee? Did it affect one individual bee? How is it affecting the entire colony?" That's what my research is trying to do.

**Jamie 06:52**

Yeah, so I think you raised so many interesting points in that dialogue. Let me, just kind of for the sake of the listeners, explain just a few things. You'd mentioned, for example, the different classes of pesticides. That is true. So pesticide, the word "pesticide" broadly means anything used to kill a pest. And insecticides are one of those groups. Insecticides kill insects, fungicides, target fungal pathogens, and so on. Within insecticides, there are different classes, you mentioned neonicotinoids. There are also organophosphates, etc. And one of the things that's interesting, but hard to teach beekeepers is this idea of formulation. So let's look at glyphosate as an example. Glyphosate is the active ingredient in the formulation called Roundup, but it might be formulated different ways. It might have different surfactants and adjuvants that are added to it to improve its efficacy in the field. So, a lot of research is done on active ingredients, the pure active ingredient like glyphosate, rather than the formulation, like Roundup, and the same is true, really across the board with a lot of pesticides. As a result, it's somewhat hard to predict their impact based on what we find out about them just from active ingredients, right?

**Guest 08:12**

Yeah, you're absolutely right. In order for a researcher to assess the risk of a compound, we have to do all of our research with the active ingredient, that one ingredient, but that ingredient makes up a very, very small proportion of the total formulation. So like what Jamie had mentioned, the formulation could have surfactants, additives, inert ingredients, and we're starting to find that even some of these quote, unquote, inert ingredients are causing direct harm on bees. Unfortunately, most of these formulations are patented products. So we know what the active ingredient is, but we don't know what the other 90% of that compound or that formulation is. So as a researcher, it's much difficult to -- I mean, if you were to try to test every single formulation out there, that would just take an entire lifetime to just test a particular class.

**Jamie 09:06**

Then you've got to do factor in the issue that there's rarely just one compound present in a colony, right? So then there are potential interactive effects and then, how do the presence of these compounds interact with nutritional stresses or Varroa stressors or small hive beetle stresses, etc.?

There are a lot of potential impacts of pesticides on bees. I use the word potential, but just because the possibility exists for an impact, doesn't mean the impact is actually going to happen in field.

**Guest 09:33**

Right. You're absolutely right. Yep. Something that is tested in the lab, like many of our toxicity tests are done in a laboratory setting, once you take that into the field, now you have to account for all the variables of the climate, the weather, the temperature, the other bees in the colonies, and many of those definitely complicate our ability to measure those impacts, especially the subtle ones.

**Amy 09:59**

This is probably a really stupid question, but I'm going to ask it anyway.

**Jamie 10:02**

All right. We love Amy's stupid questions.

**Amy 10:03**

Yes, I have a lot of them. So I mean, when you're doing research, why wouldn't you be able to just test products, one product versus another product, things that people would normally use? Can you explain that?

**Jamie 10:17**

So why test glyphosate? Why not test Roundup rather than glyphosate? And again, for the listeners out there, I'm just using Roundup because you're familiar with it. I'm not making claims here that it is killing our bee population, I'm just using that for that purpose.

**Amy 10:29**

We are not getting paid by --

**Jamie 10:32**

Despite what you think.

**Guest 10:35**

Yeah, so I can give you an example. Just more recently, the neonicotinoids, this is a newer class of insecticides that a lot of people have concerns about because of their systemic action, meaning, you can apply it to the plant and it can translocate to all parts. If you apply it to the seed or the soil or the water, the plant can take that up, and then express those residues in the nectar and the pollen where the bees are then going to be exposed. So when we're studying neonicotinoids, this class of insecticides, there are seven different active ingredients that could be any one of those classes. So within neonicotinoids, there are seven different types of active ingredients. And then within those, one particular active ingredient like imidacloprid could have literally hundreds of formulations, hundreds of formulator products, depending on the company and depending on the brand, depending on the use. Some of these are used in homeowners situations, some are for agricultural production, some are commercial application only. And so each formulated product would then have to be tested for toxicity.

So you can imagine that within a product itself, you would need to vary the doses of one particular formulation. So it's just endless, endless testing. I'm not sure how much benefit that would give us.

**Jamie** 12:00

Judy, I also do or have done a lot of pesticide research. You're talking about all the things that I had to deal with, mentally, early in my career. It's like, do I test formulations? Do I test actives? Do I test interactions? And it just gets complicated incredibly fast in the pesticide world. To me, it's doubly complicated because, unlike a lot of research where this is just interesting for science purposes, pesticide research is interesting for political purposes. So you really have to dot your i's and cross your t's and know that at some point, you are going to be in someone's crosshairs. So I want to talk to you about that. I mean, have you had issues with the press or the public, your beekeepers, etc., when you present data on pesticides? Have you had any issues publicly?

**Guest** 12:52

Oh, definitely. There are always people who want to bring you into their efforts, whether they want to ban chemicals, or they want to argue that they are not causing harm, people are always trying to rally you to their side. So when I'm presenting the research, I tried to do a lot to just explain, "This is the scenario that we tested, and this is what we found. Where do we need to go from there?" So try to add in the conversations, not just reporting the research and the data and showing, yeah, it causes harm, trying to tease out what it means to the big picture. So, for example, I've been studying neonicotinoids, and the impacts on queen egg-laying behavior, and how that's affecting honey bees and bumble bees alike. But the messaging that I kind of bring to beekeepers is a larger one that's more related to something they can do about it. So my research is narrowly focused on neonics. But even if we banned all the neonics, there would still be problems with other compounds and the ability to monitor how they're being exposed and how the bees are being impacted. So putting efforts into banning one class is really not going to solve anything. What we need to do is make changes in the policy and the monitoring efforts because, right now, everything is focused on lethality. Does it kill? Are bees getting killed? Is a colony getting outright killed? So bee kills really follow the older classes of chemicals where you saw bees just spilling out, dying outside the hive. We don't see that classical bee kill as much anymore. What we're seeing are what I call bee incidences. So these are exposure events that might have caused a minor die-off or a minor issue with a colony that can then subsequently shift the colony functions in a hive that makes them more susceptible to disease or reduces their likelihood of overwintering. So, for example, contaminated pollen. This is one that I'm really interested in looking into research more because bees foraging for pollen will bring it into the hive. They're not consuming them, they're putting it on their legs and they're bringing it back in. So that is a potential food source that could be heavily laden with chemicals and be brought back to the hive. If honey was highly contaminated with pesticides, the bees still have to consume that. And if it was highly laden with chemicals, the likelihood of them returning to the hive is much lower. So this pollen is a really interesting exposure route because we know that in a social colony like honey bees, only a small proportion of those bees are consuming that pollen, and those bees are your nurse bees. Those are the bees that are going to take care of the brood. So if you can imagine foragers bringing in contaminated pollen, and if that pollen is disproportionately affecting the nurse bees in the hive, the beekeepers may miss that. But the end result is four weeks later, when you have natural die-off of your foragers, your naturally aged bees, you

don't have young bees to replace those. The beekeeper sees his dwindling population, this either stagnant growth or dwindling of the adult worker force, and they can't tie that back to the exposure. So we're trying to work with beekeepers on how to identify an exposure incident and how to mitigate that. So if you see nurse bees dying outside your hive, you shouldn't see fuzzy nurse bees, you can replace a frame or replace the nurse bees that were lost to kind of mitigate some of that further impact on the colony.

**Amy 17:03**

Yeah, so Judy, can you talk to us about ways that beekeepers can mitigate those pesticide issues? So, what would you recommend or what are you teaching beekeepers?

**Guest 17:13**

Well, the first step is identifying when you have an incident and that was the biggest problem, right? We have such a complicated system where colonies are put in a landscape where they may be exposed to a cocktail of chemicals at any time in the season, and beekeepers have no idea when bees are actually being exposed. So we've been recommending, and part of our research is developing dead bee traps as a monitoring tool for abnormal losses of workers. So not looking for acute kills, but this is just an easy setup that puts a light-colored platform in front of the entrance to capture dead bees falling out of the hive. Then I've been teaching beekeepers to pick those dead bees up and identify what age group they think those bees are because you can easily tell the difference between a very young fuzzy light-colored bee from an old, tattered forager. If they see that there are lots of young nurse bees coming out or deformed wing or ejected larvae or any of those hygienic behavior signs, then the beekeeper has an indication that they should do a more thorough inspection of their hive than just a quick check. If I see a loss of nurse bees in my hive, I might replace those nurse bees with from a healthy colony so that they can continue to rear their brood without that dwindling effect. So that's what I've been trying to teach beekeepers is how do we monitor for incidences, not bee kills but incidences? Because really, I mean, where are we going with bee kill investigations? Where does that go? It doesn't do anything for beekeepers, researchers, or policymakers.

**Amy 19:06**

Yeah, so just kind of taking a step back, when you were talking earlier about policymakers, can you talk to us about what researchers -- beekeepers are trying to mitigate the pesticide issues -- but what are all these stakeholders doing about the concerns with pesticides and bees? And then what would you recommend that they could do better?

**Guest 19:27**

Yeah, so I mean, researchers are doing their very best during the residue studies, the toxicity studies, all of the background information to figure out the harm and the environmental exposure of these compounds. The farmers that are aware of these issues are applying compounds according to the label. So they're following labels. And many of the ones that we're talking about are very concerned about bee health and their impact and their role on this. So they are doing their best to follow those pesticide labels. I think what's happening is that, sometimes, we have perfectly legal application of compounds that are being applied to multiple areas simultaneously. Think about a beekeeper that is



snug across three different farming cropping systems or in an area owned by different landowners. They're addressing the same cropping pests, but they might be spraying different compounds. And so you might have bees getting exposed to a mixture, either through kind of a tank mix, or just multiple applications happening at the same time. Another thing that we're starting to find is that with the West Nile virus problems and the mosquito-borne diseases, there's a lot more mosquito abatement that's happening that we don't know when and where it's occurring. Beekeepers have to be a little bit more aware of looking at signs in the hive because we can't rely on reports and people to call us to let us know that a spray is going to happen. We don't know when the spraying is happening. And right now all we're doing is addressing the issue after the fact rather than finding ways to address it as it's happening or preemptively preparing for those.

**Jamie 21:23**

Well, Judy, I'm personally very glad that you're on the issue. You're clearly very knowledgeable on this topic. I mean, it's a difficult topic to investigate because there's always someone unhappy with you, regardless of what you find. So I really appreciate your work in this field. It's so important for beekeepers and bee health in general for us to understand what's happening at the colony level with potential exposure scenarios.

**Guest 21:47**

Yeah, and it's an exciting area. I think there are ways that we can address this. I just think we have to think outside the box. I mean, the beekeepers are really the boots on the ground force that move everything right. So once we empower the beekeepers to identify when exposure is happening and how and what time in the season, then maybe, as researchers, we can narrow down the testing field. Part of the problem with testing is it's very expensive to test for 200 different compounds. But maybe if we can narrow down the window of when that exposure happened, we can reduce the cost of testing, we can reduce the cost of screening. Beekeepers might feel more encouraged to report because right now they don't report because nothing results from a bee investigation.

**Jamie 22:39**

Yeah, nothing happens. Sure.

**Guest 22:42**

They get a pesticide result, but their bees are dead, and they can't really infer anything from that exposure.

**Jamie 22:50**

So, Judy, I really appreciate you joining us.

**Guest 22:54**

Yeah, I'm happy to be here.

**Jamie 22:56**

So listeners, I just want to thank, publicly, Dr. Judy Wu-Smart. Judy is an Assistant Professor and Extension Specialist in the Department of Entomology. She is the Director of the University of Nebraska-Lincoln Bee Lab where she has been for four years and is continuing some great work on pesticides. Thank you so much, Judy, for joining us on Two Bees in a Podcast.

**Guest** 23:16

Absolutely.

**Jamie** 23:17

Can we have you back again in the future?

**Guest** 23:20

Absolutely. I'd love to.

**Jamie** 23:22

Well, we're looking forward to it. Thank you so much.

**Honey Bee** 23:26

For more information about this podcast, check out our website at [www.UFHoneyBee.com](http://www.UFHoneyBee.com).

**Amy** 23:37

Hey, listeners, we are back, and we just heard Dr. Judy Wu-Smart from the University of Nebraska-Lincoln talk about pesticides and some of the pesticide risks. I know she had mentioned pesticide risks a couple of times. So I just wanted to ask Jamie a couple of questions so you all could hear about pesticides and pesticide risk and what that actually means. So with your toxicology work, Jamie, do you want to talk a little bit about what that actually means? Because I definitely don't understand what that is.

**Jamie** 24:06

Sure, Amy. I'm gonna put this out there before we even get started. There's no question that this is kind of a controversial subject. And maybe by the time I address risk, I will talk more about the controversy and the issues with being a researcher who studies pesticides.

**Amy** 24:22

How many people are we going to -- how many followers are we going to lose?

**Jamie** 24:25

Well, we'll lose followers, we're going to get some hate posts. It's just inevitable --

**Amy** 24:30

Don't hate us.

**Jamie** 24:30



-- when we talk about pesticides, but it's hard because this is such an emotional issue. But let's save that until after we talk about something that's a little less emotional. So Dr. Wu-Smart mentioned multiple times risks. She mentioned toxicity of pesticides to bees, she mentioned sub-lethal effects. There are really two levels of toxicity that you can think about. There's acute toxicity and chronic. Acute means you get exposed to a level that produces a near instant impact, right? In the most acute sense, when you get exposed to a high level, you just die. Or you get exposed to a level and there's instantly a behavioral change. Acute just simply means there's a high enough residue or exposure that you instantly show signs of intoxication.

**Amy 25:19**

So it doesn't mean you're getting it in small doses.

**Jamie 25:21**

Yeah, exactly. Well, unless a small dose is acutely toxic. There are some compounds that are highly toxic, so a small dose will produce a very quick acute response. Now, chronic means that you're getting exposed to lower doses, the sub-lethal doses, doses that don't boom, kill you, or boom, change your behavior, but these little exposures might change the gut bacteria in your stomach or behaviors. Chronic is really what Judy was talking about a lot. You heard her say, "We don't just need to look at the toxic response." By that she meant acute response. "We also need to consider these sub-lethal impacts." By that she meant chronic exposure. Now, here's the simple truth. When you take a toxicology course, all toxicologists say that everything is toxic if you get exposed to enough of it. So toxicity is all about dose. Dose and exposure. When Judy mentions risk, that is really the key to understanding potential impacts of pesticides on bees. This is super controversial, but it's super important, I think, for our listeners to understand. So risk is simply the product of multiplying toxicity and exposure. So what do I mean by that? So a compound is going to be toxic to honey bees at some level, right? Let's just pick on neonicotinoids and imidacloprid. There is a level of imidacloprid that if honey bees are exposed to it, they are going to die. All right. And there's a level of imidacloprid that if honey bees are exposed to it, they're not going to die. There might be some sub-lethal impacts. And then there's a level that's so low that it will neither produce sub-lethal impacts nor death. Alright, so there's this range. As you increase the level of imidacloprid, the toxicity goes up. Now, exposure is how much of it or how do bees get exposed. They might get exposed by contacting blooms and sucking up nectar that has this compound in it, they might get exposed by collecting pollen and bringing it back, they might get exposed by residue levels in the wax, and so on. So risk, which is the subject of our discussion now, is toxicity by exposure, right? So what you're seeing is a lot of bee research done on toxicity, they'll take one really high dose, expose bees to it, it'll kill the bees, they'll announce to the world this compound is toxic, and now all of a sudden, we need to ban it. But just because a compound is toxic doesn't mean that it poses a high risk. Are you ready for a good analogy, Amy?

**Amy 26:03**

I'm ready.

**Jamie 28:05**

I think this is important. You're laughing behind the scenes. You're like, "I love good analogies. Right?"

**Amy 28:11**

Yep. Let's see.

**Jamie 28:14**

I had a former postdoc who explained risk perfectly. Alright, you ready to understand risk in its entirety?

**Amy 28:24**

I don't believe in anything being perfect.

**Jamie 28:25**

It's going to be nearly perfect. So, remember, risk is toxicity by exposure. So think about it this way. Lions are 100% toxic to humans.

**Amy 28:37**

I'm like, "To what?"

**Jamie 28:38**

Yeah, to us. If a lion elects to kill us, and our exposure is such that it can, we're going to die. If it says, "I'm going to eat you, Jamie," and I'm in the cage, it's going to kill me. So the toxicity of a lion is very high. So remember, risk is toxicity times exposure. So the toxicity of a lion is really high. But I want to paint for you three exposure scenarios. Exposure scenario one, you're in the Serengeti and you happen upon a lion, your exposure is high, the toxicity is high, the exposure is high, so the risk of that is high. Now, let's say that that same lion is removed from Africa and put into a zoo, a cage where there are bars on the cage. So the toxicity has not changed. That lion is still very toxic to me but the risk has changed because the exposure has changed. Unless I put my arm into the cage or stick my head in the cage, the exposure is moderate, because it's barred, I can still be exposed, but it's moderate. So, therefore, the risk is moderate. Toxicity didn't change, but the exposure did. Now, in the third scenario, the toxicity is still the same. If a lion wants to kill me, it can. But if I'm at a zoo, and that lion is behind a glass so that I have no exposure to it, the toxicity doesn't change, but the exposure is incredibly low. So the risk to me is low. So what made it a high risk or a moderate risk or a low risk was not how toxic it was to me, but the exposure I experienced with it, and that's honey bee toxicology research in a nutshell. Everyone is doing toxicity work, very few people are doing exposure work. So as a result, we're making pronouncements that these compounds are highly toxic to bees, everyone goes crazy about it, we want to ban them, etcetera, etcetera, when the risk can still be low. So the EPA, for example, has developed a risk assessment model, a tool that helps us understand the risk of any particular pesticide to honey bees. And it's called BeeREX, B-e-e-R-E-X. And it's an Excel file that you can download, you can do toxicity work, you can plug in your data into this model, and it will say, given the exposure scenarios with the toxicity of this compound, you have a high risk, a moderate risk, or a low risk. And I'm not telling you this to suggest that all compounds are completely innocuous to honey bees. What I'm telling you is when you hear about toxicity, you're only hearing about part of the equation. So when Judy mentions risk, that's essential to understand because something can be highly toxic to bees, but still be a low risk to them, and vice versa. Something can have a low toxicity to bees,

but the exposure is incredibly high. Therefore, the risk is high. Do you kind of understand? Yeah, that makes sense. I don't know if I agree with the lion thing though. Oh, it's perfect. It's perfect. Well, let me tell you, my wife and I lived in South Africa, and we walked upon a lion when we were out in the woods doing research one day. It was about five yards from us. And that lion elected not to kill us. I think it was wise because I was faster than the people I was with. But that lion elected not to kill us, and I'm here to give that lion analogy. But, had that lion want to go after me, I was dead. The exposure was quite high. The toxicity was quite high. And even still, I didn't get charged. All right. Well, can I ask you something then? If necessary. I guess an argument might be that you were aware you were around a toxic chemical, or you were exposed, or you were exposing yourself. Could someone argue that honey bees don't necessarily know what they're being exposed to? Yeah, I mean, absolutely. But, we, through our research, can determine what the level of exposure is through those exposure scenarios. So yes, maybe honey bees aren't aware that they're visiting a flower that has high neonics present in the nectar. But that's stuff that we can do through research. We can create those exposure data, and by create, for those of you conspiracy theorists out there, I'm not saying fabricate, I'm saying we can do experiments to generate those exposure data to go along with our toxicity data so that we are more informed with our understanding of risk. And so the reason this is controversial is because, obviously, there are pesticide haters and there are pesticide lovers and there are people in between, who are trying to wrap their mind around it. I mean, if you do research with honey bees and pesticides, you are going to be the target of a hit piece. My colleagues have been targets of hit pieces. I've been targets of hit pieces, and by that I mean people who are pretty convinced that you're in the pocket of the pesticide companies, and you're doing research to find what they want. Likewise, the reverse can be true. I always tell people, but people don't believe me, that the greatest pressure I get with pesticide research often comes from beekeepers, and not pesticide companies, which is completely contrary to what the world believes. But it's difficult to do research in pesticides and honey bees because of our responsibility to digest the information out there, and say, "Yeah, it's toxic. That is true, but the risk is low or the risk is moderate, or the risk is high." It's just been a very difficult tightrope to walk for me and my team and for others who have investigated pesticides.

**Amy 34:21**

Yeah, I remember going to Bee College a couple years ago. It was in Central Florida, and it was a talk on bees and pesticides. At the time, I wanted to educate the community more about pesticides. So I decided to go to your talk. And this was before I was working here, obviously. I just remember the first thing you said was, "We're talking about pesticides, and we're talking about bees. Insecticides are a type of pesticides. Bees are insects. So yes, insecticides are probably going to kill bees."

**Jamie 34:48**

Yeah. I mean, every year, insecticides kill bees. I am not at all suggesting that they don't. The question is, where do they fit in the level of stressors that bees face. If I don't mitigate pesticide exposure, I won't lose my bees all the time, but if I don't mitigate Varroa exposure, my bees are going to die. So to me, Varroa are a big issue. Now, it's funny because one of the recent hit pieces that came out was, "pesticide companies are trying to get everybody to say that Varroa is the number one killer of honey bees so that pesticides..." I just don't have time for conspiracies like this. The beekeepers are saying Varroa are among their principal stressors. This is coming out in beekeeper surveys. So it's just so

difficult. So you're going to make someone unhappy. I know I can say this, and there gonna be people who listen and believe what I say, and people who don't, but my loyalty is to truth. We generate data, we try to understand those data the best we can and the data speak for themselves. I think most of my colleagues around the country believe the same thing about their work. So we're loyal to truth. And I think it's going to take working together to understand the impacts of pesticides on bees, stop calling each other names, stop believing in all these crazy conspiracy theories, maybe some of which are true. But, knowing that we have to work together to understand stressors and knowing, also, that pesticides are one of 5, 6, 8, 10 different things in a colony at any given time, right? Pesticides are present in a lot of Florida bee colonies, a lot of Wisconsin bee colonies, but Varroa are present in all those colonies and viruses are present in most of those colonies and small hive beetles are present in a lot of those colonies and those colonies are going to experience nutritional stresses at some point in the year. So, understanding the interactions between the stressors is really what's going to go a long way in helping us understand what's contributing to bee losses in general.

**Amy 36:52**

Awesome. And I just want to make a point that we do not get paid by the pesticide companies or other different manufacturers, because trust me, I think maybe if I did, I'd probably get paid a lot more.

**Jamie 37:02**

Well, Amy, I'm going to say what the common critique is. It's when people make the claim that you claim, which is true, I personally don't drive a Bentley, is that, well, they fund research. We have been funded, some of our research here at the lab has been funded. And that statement right there is going to get us a lot of heat. But we've also been funded by beekeepers. We've also been funded by the federal government. We've also been funded by nonprofits. And we've also been funded by small business and big business. So the funny thing to me is that the world feels that only pesticide companies are capable or want to buy you off. It's not possible for beekeepers to want to buy you off, it's not possible for beekeeper associations, it's not possible for business or industry or government. It's only pesticide companies who are interested in what they want to fund. And it's all hogwash. I mean, many of these arguments that people pose are self-defeating. We've been funded by lots of people. It takes money to do research. And if you're angry about that, then fund some research. Fund some research. There are structures in place at universities to minimize the impact that a funding agency can have on the research. We have to enter contracts with pesticide companies, we have to enter contracts with beekeeping organizations that want to fund research, so there are safeguards in place. Does that mean humans are not capable of being swayed one way or the other? No, it doesn't mean that. But it does mean that there are a lot of safeguards in place. And I will say that the finger that you point and use to accuse pesticide companies because they are funding research is the same finger, that, well, by extension, you'd have to point at all funders. We can't do research without funding.

**Amy 38:49**

I remember at the American Beekeeping Federation, the conference that was in this past January 2020, there was a speaker there and he basically said, "The reason why there are so many stakeholders that contribute to funding is there are a couple hundred people there at the top," and he

said, "If every single person in this room pooled all their money together, it still wouldn't be enough to fund the research that is being done."

**Jamie 39:13**

Sure.

**Amy 39:14**

I thought that was a really great point, actually. I mean, it just takes so many people and so many resources, so many people that come to the table.

**Jamie 39:20**

So many avenues. That's the thing. Like I said, I'll make this point again, we've received lots of funding from beekeepers. So by the very criteria that they used to bash pesticide companies, they themselves are guilty, right? We have got to collaborate to address this issue. It cannot be done through name calling or shouting. We have to come together. And that's one of the reasons that pesticide work is so controversial. When someone has convinced themselves that a product is killing bees and your research, in the limited fashion it is, shows that it's not in this particular scenario, you just instantly become a target. So it's not fun, but it's intellectually rewarding. And like I said, the key is to be loyal to truth. That's what I feel is that my team and I and other teams are loyal to truth. And again, we're going to get hate mail and hate comments, but it is what it is. So we need to end on a lighter note, Amy.

**Amy 40:24**

I was about to say, "And there we have it." What month is this that we're recording this right now?

**Jamie 40:29**

February 2020.

**Amy 40:30**

Alright, so February 2020. So if you all don't hear from us February 2021, it's because you've cut off all of our funding and we are not allowed to share this information anymore.

**Jamie 40:39**

There you go, Amy. You just contributed to the conspiracy. But, with all that said, we value our partnerships with anyone who ethically wants to partner with us and help us find answers to the solutions that are impacting bees.

**Amy 40:55**

Absolutely. We're getting all riled up over here dropping things.

**Jamie 40:59**

My blood pressure hasn't increased yet, but I'm sure it will in response to this particular podcast.

**Amy 41:04**

Don't forget to ask us questions on social media, make sure that you comment on our posts, email us, feel free to email us. We love to have this conversation and continue this conversation.

**Jamie 41:14**

Yeah, if there are things that you've heard in our podcast today that you want addressed in further detail, please leave those comments in social media. That's why we're doing this podcast. We want to go after the difficult topics and address the concerns and comments, queries, conundrums, and quandaries that our beekeepers have.

**Amy 41:37**

It is that question and answer time, one of our favorite segments.

**Jamie 41:41**

It's your favorite segment.

**Amy 41:42**

Jamie.

**Jamie 41:42**

I just get stumped.

**Amy 41:43**

I have a surprise for you.

**Jamie 41:45**

Did you get me candy corn or gummy bears?

**Amy 41:47**

Hold on.

**Jamie 41:48**

My favorite candies? What is that?

**Amy 41:53**

It's to calm our nerves to get ready for the podcast. What do you think?

**Jamie 41:58**

Well, the Q&A is at the end of the podcast.

**Amy 42:00**

Ah, dang it.

**Jamie 42:03**



Too little too late, or is it to set the mood for Q&A?

**Amy 42:07**

All right. All right, whatever. I guess we can stop the music.

**Jamie 42:10**

No, I'll see if it helps my answers get better.

**Amy 42:13**

It might. Okay, so we have actually had a lot of questions from the audience. Well, we're just gonna go ahead and keep this music on, aren't we?

**Jamie 42:21**

Does that mean a lot of people are listening to our podcast?

**Amy 42:23**

I would say so. Yeah, I mean, we've had almost 5000 listens from all over the world. And I've started getting voicemails on my telephone.

**Jamie 42:32**

What?! I need to email my mom and tell her thank you for listening so many times.

**Amy 42:37**

That's fair. All right. So we do have a lot of questions from the audience, and we are going to try to acknowledge as many of them as we can. The first question I have for you, Jamie, is there anything interesting about the bee's knees?

**Jamie 42:50**

There are six of them. Actually, they have multiple joints in their legs so probably each leg has at least two knees. So that would be at least 12 knees on the bees.

**Amy 43:00**

I bet dance class is really hard for them. All right, that's not actually --

**Jamie 43:04**

They don't just have one left foot.

**Amy 43:05**

That actually was a question.

**Jamie 43:06**

They have three left feet. So dance is probably hard for them.

**Amy 43:13**

We can talk about the waggle dance again another time.

**Jamie 43:16**

Alright. Go through the serious questions.

**Amy 43:17**

Let's be serious, okay.

**Jamie 43:18**

How can I be serious? Okay, we're ready.

**Amy 43:18**

Okay, so do commercial beekeepers do preventative treatments for American foulbrood and should backyard beekeepers also be doing preventatives?

**Jamie 43:30**

So to answer the first question first, the answer is yes and no. Some commercial beekeepers do preventative treatment, so that's prophylactic, right? They're treating their bees in advance of having a problem. They're doing that with antibiotics, and they may do it multiple times per year. A good question is, is that the best strategy? Really, that kind of goes into the second question, should backyard beekeepers do it? So what's the best strategy? The best strategy was really discussed by Dr. Meghan Milbrath who joined us on a past podcast. She's from Michigan State University. She says rather than doing prophylactic treatment for American foulbrood, you should do metaphylactic treatment. So you're not treating in advance of having a problem, what you're doing is you're managing your bees, and when a colony becomes positive for American foulbrood in your apiary, if that happens, you destroy that colony, you burn it, then you treat the remaining colonies with an antibiotic, a labeled antibiotic. So rather than blanket treatment every apiary every year, you're killing the colony you find that has it, and then you're treating the rest. That's similar to what you would do, maybe, in livestock. If there's a cow that has really bad disease, you cull it and then you treat the rest of the herd. And so that's what I would recommend. I think that's a good strategy, metaphylactic treatment for American foulbrood.

**Amy 44:44**

Yeah, so backyard beekeepers and all beekeepers should really be --

**Jamie 44:46**

I think it's a good strategy. A lot of people would argue with me and want to have that prophylactic treatment, but really, if you're prophylactically treating, you could have American foulbrood, but you just won't see it because you're keeping it down and as a result, you can be spreading it around. Failure to treat then could cause it to pop up. So I think treating the rest of the apiary in response to finding it in one colony that you eradicate is a more responsible and appropriate response.

**Amy 45:12**

That's fair. We'll play that Mortal Kombat music when people want to fight with you. Alright, so for the second question that we have --

**Jamie 45:18**

I was a kid and Mortal Kombat was popular when I was a kid. Quit laughing. I used to be a kid, Amy.

**Amy 45:23**

That's great. Okay, so for the second question, someone is asking about heat treatments. So heat treatments for mites. Does this work? And what do you recommend?

**Jamie 45:30**

Okay, so I would argue that the jury is still out. I think it's a little early to be making comments about heat treatment from an academic perspective. I know a lot of people are excited about this. There are a lot of instruments that you can put on colonies that are out there, a lot of beekeepers telling me that heat treatment works for them. I just haven't seen enough data. The moment the data are available, I'll be the first one to believe it once that data set is robust. But I still think the jury's out. I think that there are people studying this and it's kind of exciting. And for those of you listeners who are not even sure why we're talking about this, there are some indication, maybe anecdotal, that heating colonies will cause Varroa to die and lower Varroa populations. And so there's all these contraptions out now that you can purchase and put on colonies to raise the temperature. But I still think we need a lot to know about these things. So that's just kind of where I am. If you've got some money and want to tinker around with it, I think that's okay. But I'm kind of stopping short of a wholesale requirement or recommendation of the use of these things.

**Amy 46:28**

Yeah, and on that comment, actually, the person said that they had 10 hives in one yard, and they could only do one or two a day. And that's assuming they can make it there every day. I don't know if that seems very practical as far as people with thousands of hives.

**Jamie 46:40**

That's the thing. Just like so many other things, a lot of these cool ideas that pop out, if they work, they're really only relevant to backyard beekeepers. It's going to be very difficult for commercial beekeepers to implement. You're right. It's one of these things you put on a colony. They're usually expensive, \$400 or \$500, you put them on a colony, and then you have to switch them and then you gotta have a power source. It just gets complicated fast. But if it works, if it turns out to work, it's going to be worth doing. We just need to know more about it.

**Amy 47:04**

I can imagine a really, really long extension cord. All right.

**Jamie 47:08**

For shizzle.

**Amy 47:09**

Okay, so our last question for the Q&A. What methods do you recommend? I feel like I need to speak differently because of the music.

**Jamie 47:17**

I feel like we're talking in an elevator. Push the first floor.

**Amy 47:21**

Alright, alright. I'm gonna push every button. That's the type of person I am.

**Jamie 47:24**

I feel like you have already, Amy.

**Amy 47:26**

So what methods do you recommend the most to prevent and/or recover from heavy losses such as winter losses?

**Jamie 47:32**

Well, prevention is going to be very difficult because there are a lot of things to talk about there. But what I would argue is you got to keep your Varroa under control, and you've got to make sure they have enough nutrition well in advance of heading into winter. You can't just control Varroa in June and expect your bees to be okay heading into winter in October and November. So I think you've got to have Varroa managed, adequate nutrition in the colonies, especially in the form of honey, they've got to have a lot of nectar resources available to them in their hive, or honey resources available in their hive so they can survive winter. Really, I think the question is about, what do you do if you've experienced high losses, and what I would recommend is I would very quickly try to understand what those losses are caused by. What caused those losses? Because you're going to need to remedy that in the colonies that actually survived. If you're coming out of winter with weak colonies, you need to check Varroa populations, you need to check Nosema levels, potentially, you need to look at their food resources. And you need to address them quickly. If you have colonies survive, and even beekeepers who have high colony losses, if they have colonies surviving, they usually do, they invest heavily in growing those colonies that are then splittable and can help you recover your losses. The entire commercial industry really is built on splitting colonies to recover losses from bees that are coming out of winter.

**Amy 48:45**

So would you say that people should assume that they're going to be losing those colonies and split before?

**Jamie 48:51**

Yeah, I mean, there's no doubt that if you keep any number of colonies, you're going to lose some through winter. Now, your losses may be as low as 5%, or they could be as high as 50% or greater. So, really, a lot of commercial beekeepers understand what their average losses are. So they try to

overcompensate for that by having colonies strong, a lot of them heading into winter, so that if they experienced what they call typical losses, they will still have a critical mass coming out that they can split again to recover those losses.

**Amy 49:19**

Awesome. All right. Well, we're trying to acknowledge everyone's questions. There are just so many coming in. So we're just taking a couple at a time, and we have questions for the rest of our life to answer.

**Jamie 49:29**

Hey, I'm glad. That indicates that people are listening this podcast. We want you to ask your questions. The ones that we feel like we can answer, we will do our best to answer. So thank you so much for submitting them on social media.

**Amy 49:47**

We'd like to give an extra special thank you to the following to our editors Shelby Hal and Bailey Carol, and to our audio engineer James Weaver. Without their hard work, Two Bees in a Podcast would not be possible. So thank you.

**Jamie 50:02**

For more information and additional resources for today's episode, don't forget to visit the UF/IFAS Honey Bee Research Extension Laboratory's website [ufhoneybee.com](http://ufhoneybee.com) Do you have questions you want answered on air? If so, email them to [honeybee@ifas.ufl.edu](mailto:honeybee@ifas.ufl.edu) or message us on Twitter, Instagram or Facebook @UFhoneybeelab. While there don't forget to follow us. Thank you for listening to Two Bees in a Podcast!