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SPEAKERS

Jamie, Stump The Chump, Guest, Amy, Honey Bee

Jamie 00:05
Welcome to Two Bees in a Podcast, brought to you by the Honey Bee Research and 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. In this episode of Two Bees in a Podcast, we will be talking with Dr. David Tarpy, a professor from North Carolina State University. He is a world expert on what it means to have a quality queen, and furthermore, he'll be chatting with us about his queen and disease clinic run out of NC State. That will be followed by a segment where Amy and I discuss the biggest stressors that honey bee colonies face, and of course, we'll end today's podcast with our question and answer segment. Hello, everyone, in this segment, we're going to be talking with Dr. David Tarpy, who's a professor and extension apiculturist in the entomology and plant pathology department at North Carolina State University. David, thank you for joining us on Two Bees in a Podcast.

Guest 01:30
Thanks for having me, guys.

Jamie 01:32
It's really cool to have you on. I see that we're talking specifically about one of the programs that you run out of your lab at NC State, the queen and disease clinic. Before we get there, David, I've known you for about a decade now. I'm curious if you could tell our listeners how you got into bees, beekeeping, and how you found yourself at NC State?

Guest 01:51
Well, I got into honey bees as a model system for the study of social behavior and behavioral ecology. They're kind of the white lab rat for social insects because they're just so highly amenable to

experimental manipulation and those kinds of things, going all the way back to Carl von Frisch and his Nobel winning research on the dance language and everything in between. I've always been really fascinated at the collective decision making and how colonies work together, and especially centered around queen biology. I got into it from that aspect, but beekeeping is part of having to do research on honey bees, and so I love to tell beekeepers that I actually didn't read my first beekeeping book until about seven years after I had been keeping bees because I knew enough about the biology that the beekeeping was just kind of obvious. It just made a lot of sense, knowing how the bees work themselves. Once I took the position here at NC State in 2003, the extension mandate that comes as part of our program really fostered that communication and working together with beekeepers. The applied research and the beekeeping became a lot more prominent in what we did, but that wasn't how I started out.

Jamie 03:26
Now, what is your academic history? What universities did you pass through to get to NC State?

Guest 03:32
I got my undergrad at a small liberal arts college called Hobart in upstate New York. And then I got a master's degree.

Honey Bee 03:39
Really? Me too! No, I'm just kidding.

Guest 03:42
You're not because that's an all male college.

Jamie 03:44
You gotta watch Amy, she tries to be funny.

Guest 03:46
That's an all male college. The all female college is called William Smith, and it only has 1700 students, and I've only met one person down here ever since. So I highly doubt that. I got my undergrad degree at a small liberal arts college called Hobart in upstate New York and then I got a master's degree with my academic mentor, David Fletcher, at Bucknell University. That's where I first got into honey bees, where we were studying the competitive balance between virgin honey bee queens to see who takes over the nest. I saw actually, incidentally, that your last podcast dealt with the tooting and quacking between the virgin queens and that kind of communication. So that's actually kind of what got me into honey bee research. I then went from there to UC Davis with Rob Page, and got my PhD and then a postdoc with Tom Seeley at Cornell before I got this job here at NC State.

Honey Bee 04:59
That's really awesome. I love hearing about everyone's story and their background.

Guest 05:04

Well, just on a side note, Amy, as Jamie probably knows, we're all inbred. It's not too far to say, Jamie is probably my academic second cousin or something. I'm not quite sure how we're related. I'd have to think about it. But I know we are.

Honey Bee 05:23
I feel like we need to make a family tree with all the podcast guests that we've had, Jamie.

Guest 05:27
I've always wanted to do that. If you guys are up for it. I'm totally down for it. In fact, I've always wanted to write a book, Six Degrees of Separation from Roger Morse. It all goes back through Roger Morse, obviously.

Jamie 05:41
I think David, we were all probably one or two degrees from Roger Morse, because a lot of the individuals who are leading labs these days were in his lab, which is pretty fascinating to think about.

Guest 05:41
Well, now, it's actually a second generation from that. Sorry, that's gonna be edited out later. I'm down for that. You broke the seal there, Amy, with your jokes?

Honey Bee 06:07
I do, I tend to do that. Alright, so I guess one of the things that we like to tell all of our audiences, our three main focuses when we're talking about research and honey bee research in general is Varroa, queen quality, and nutrition. So those are the three things that we really focus on. Of course, there are other factors; there are other stressors that we look at. but primarily, those are the three. You have a queen and disease clinic at your lab, so can you tell us about the clinic that you have?

Guest 06:37
Yeah, so the clinic is really an outcome from a lot of our research. We did a lot of the basal research of understanding what makes a good queen good and what makes a bad queen bad. Trying to understand the bounds of that from the queen's perspective, is where a lot of this started out. Both their physical prowess, as well as their mating success and their mating quality. That then led to these questions about, does a good queen make a good colony and does a bad queen make a bad colony, and so we did some of those studies, and found that there is an association. It's not an absolute one to one association, but there definitely is that better queens make better colonies. We then started offering this service in 2013, to put to bring to bear the same scientific techniques that we use in our research, to inform beekeepers about the quality of their queens in much the same way that we do in a very high throughput way. Beekeepers can send us queens, it's a destructive sampling, so unfortunately, we can't send the queens back, but we can measure them in a very high throughput way for both their physical abilities as well as their insemination success, looking at sperm viability, sperm count, and those types of things that are invisible to the beekeeper, but can have profound effects on the colonies. Then we send reports back to the beekeepers to say how good those queens were. Ifa beekeeper makes 1000 queens and they send us 10, and we tell them how they rated on this the scale that we've developed

through our research, then that will give them information about the other 990 that they can then turn around and sell to other beekeepers. So it's a way of providing some quality assurance of queens that are produced by queen breeders large and small. We also do a lot of research on pathogens and colony health, and so the other half of that clinic is the disease side, where we do pathogen screens for beekeepers, usually on the workers to be able to look at other invisible or asymptomatic pathogens such as viruses.

Jamie 09:11
Let me ask, David, there's actually two questions that come out before I even get to the scheduled question I have for you; what are the qualities that you're looking for with a queen to make her good or bad when she comes to you in the clinic? And also, how many pathogens are you screening for? Are they principally viruses or do they include bacteria as well? I know that's two questions, but if you can address those, I'm curious.

Guest 09:31
I will, and I'll repeat the questions. What we look for with queen quality, we really break down into two general categories. That is the physical size of the queens and then the mating success of the queens. The physical size are things like body weight, and head width, and thorax width, some of the easy, low hanging fruit that we can measure using digital photographs very accurately. Larger queens tend to do better and tend to score better in our system, and that's again been borne out by the science. Then the other category, we dissect out their spermatheca, the sperm storage organ, where the queens store their sperm for their lifetime, we dissect that and we stain the sperm, and we can we use an automatic cell counter to look at both live and dead sperm. So we can give sperm counts, sperm viability, and other measures dealing with reproduction. We can put those both of those things together to provide an overall assessment of quality. So there's lots of measures that go within each of those, but those are the two general buckets.

Jamie 10:44
And you generate a score? Is it like a 1 to 10? Is it 100? I mean, what does the beekeeper receive in return?

Guest 10:50
So you can see examples of the reports that we give back at NCSUapiculture.net but we're at the university, so we got to give out letter scores, right? We actually have broken down this standard measuring stick that we know on the one end are good queens, and on the other end are bad queens. We just give a letter grade, an overall letter grade, and then we give letter grades for both the size and then the insemination success. Then we actually give the raw data for each individual queen in case the the person is interested in differences between different breeders stocks, or different mating yards, or those kinds of things. We're very willing to work with beekeepers to be able to troubleshoot, or even engage in custom collaborations, where we can answer very specific questions for them. So for example, we've had beekeepers who are worried about how long is too long to bank their queens, and then be able to sell them as high quality queens, so we've worked with them on that, we've worked in beekeepers to see how early in the season is too early, and how late in the season is too late. We've

done temporal analyses of their queens, we've looked at all different aspects, like looking at this new mite control product, does that sterilize their drones? There's all sorts of ways that this clinic can be brought to bear.

Amy 12:20
That's really interesting. I'm thinking of a queen coming in, and basically going into the equivalent of a Planet Fitness to do a health analysis and coming out with a score and what their body weight is.

Jamie 12:33
Except this one dies, Amy.

Amy 12:35
Well, okay, some people feel like they want to die after that.

Guest 12:41
We're definitely working towards some sort of non-destructive sampling, that would be ideal, but right now, it's this kind of sub-sampling of a larger cohort is really the only way around it. We could do the non-destructive if the body size was a better proxy for the overall quality, instead, the size does matter, but what really matters is that sperm count and some of those other measures that can only be attained through destructive sampling. So we'll work towards that, it would be nice to put them on a treadmill and just see how they are and then give them back to the beekeeper, but we're not quite at that point.

Honey Bee 13:22
That's fair. How long does it take from the time that beekeepers send in samples to when they receive information back?

Guest 13:31
Well, when we first started the clinic, it was something like two to three weeks or even more, but now we have it down to a turnaround time of one to two days, depending on the schedule and the number of other samples that we're doing at the same time. The main person who really runs the queen side of our queen and disease clinic is Dr. Brad Metz, who does that, and then on the disease side, it's our genetics technician, Erin McDermott. Beekeepers can work directly with them as far as shipping logistics and all of those other thing, but usually on the queen side, it's a very quick turnaround and it's very, very helpful, especially for larger commercial queen producers.

Jamie 14:17
And the pathogens, what pathogens do you screen for? You don't have to name them, I guess. How many do you screen for, and how long does that take as well?

Guest 14:24
That takes a little bit longer because we're using quantitative PCR in order to diagnose those. Right now, we screen for largely viruses. So acute bee paralysis, black queen cell virus, the both the A and the B forms of deformed wing virus, which is that calling card of Varroa and it's really problematic and

nearly ubiquitous, right? Israeli acute paralysis virus like Sinai viruses, but then we also look at both nosema species as well as trypanosomes. It isn't just the viruses per se, but we are looking at some of those other pathogens. Now, we're not looking at the brood diseases and those things, although Erin is busily working on creating a second panel of potential pathogens for things like European foulbrood, American foulbrood, whatever this not brood issue is, sacbrood virus, and chalkbrood. So we're working on a second panel and the logistics for that, but right now we're just looking at those main economically important diseases that can be found in the workers of the colonies.

Jamie 15:42
Sure. And David, do you see hobbyist beekeepers using this a lot? Or is it principally for commercial beekeepers? Or it services any beekeeper who's interested in knowing about their disease and pest load or their queen quality?

Guest 15:54
We are open to anybody to use it, and we do argue that it is just as useful for hobbyist beekeepers, or smaller scale beekeepers as the larger scale beekeepers, but because on the queen side, it is destructive, the quality assurance part is not as amenable to somebody who's only raising five queens. It's hard to get a meaningful sub sample with smaller populations. It is really useful to say, hey, this queen is kind of pooping out. I wonder if it's because she's running out of sperm or for some other reason, and so hobbyists can send in their samples in those ways, kind of in a troubleshooting way rather than in that quality assurance aspect. Then also, again, the viruses, these invisible, but incredibly important harbingers of problems and health problems that beekeepers are having, beekeepers large and small can use that for sure.

Amy 16:58
That's great, we're gonna definitely add some of your resources onto our website onto the additional notes. People can go to that. My question is, do you take samples from beekeepers around the nation? How does someone get involved in this? And if you don't mind, can you tell us what the cost is for the clinic? Because I know if it's for me, if I'm a hobbyist beekeeper, I guess, depending on how much I really love my bees, there's a certain threshold I'd be willing to pay to figure out what happened versus just starting fresh and starting new.

Guest 17:32
Yeah, so we do take samples from all across the nation. It's not limited to just North Carolina at all. In fact, most of our beekeepers that we're working with are in fact out of state. The costs for the standard reproductive quality assay and report is about the price of a queen. It's actually $24 a queen or a drone. We've also added drones to the mix. It's about the price of a queen that again, unfortunately, you don't get back. For the pathogen screening, it's $55 a colony, but we also offer kind of a pooled sample for an entire apiary, where you can do up to 10 colonies for $220 if you're interested more at kind of the apiary level rather than individual colonies, and so those are actually very competitive for these processes. The genetic analyses, obviously are a lot more expensive, and while the techniques that we use are fairly standard, nobody's able to put the queen quality measurements together, and especially in such a high throughput and fast turnaround way that we can through this clinic.

Jamie 18:46
That's really neat, David, I'm really impressed, specifically too, about the price of the queen one, that's really neat. I think that a lot of people could take advantage of that, and as Amy mentioned early on, we hear a lot about queen quality. You see it in the BIP reports every year in the top five people are talking about queen quality, and anytime people asked me about that it's a little amorphous to talk about. Well, it may be brood pattern or not, I saw your paper come out talking about brood patterns and predictors of queen quality. It may be size or not. Just yesterday, for example, I was speaking to a group on Zoom in Ohio, and they were asking me about size of queen versus quality. So, we hear people telling us queen quality matters, but then we're not sure how to tell people to improve that or how to assess that. It's really neat that you guys -

Guest 19:31
Jamie, that's an incredibly important point. I'm so glad that you brought that up because what we are learning through this clinic is that beekeepers are really well trained to blame the queen even when it's not her fault. I would say the majority of the queens that were sent in, being accused of being trash, not well mated, early drone laying, any of these queen problems, as you said -

Honey Bee 20:05
Who should we accuse? Who would we blame?

Guest 20:07
This is the difficult part, right? Like, it's very easy to blame the queens but we often test these failing queens and they're perfectly fine. So that then opens up an entire can of worms that, well maybe there's something with the management practices, maybe there's something, other things that are going on. So it makes these queen events, these queen problems much more complicated and many different routes to that same end. We need to get away from that blame the queen first mentality, I think as beekeepers, if we're really going to solve some of these problems. We're really finding that it's really the environment, the nest environment, the toxic, illogical environment, the nutritional environment, many of those other things that you mentioned earlier, can affect queens. So if you think about it from the colony's perspective, if they're being besieged by all of these other stressors, but there's not really much they can do about those things, kind of like us, right? We can't do much about our government, but once every four years, we can vote the president out or not. It's the same kind of collective decision making process that's going on for the queen, that, hey, there's something wrong with the colony, must be the queen, let's get rid of her. Then you have these early supersedure events. I think we need to collectively step back as beekeepers and stop blaming the queens in the individual sense, but really looking at the queen as a reservoir, or as the receptacle from all of these other stressors that the bees can take it out on her. So if anything has really taught us anything from the clinic, it's been that.

Jamie 21:55
It is pretty interesting to think about it. Worker bees can live six weeks. In the summer, they can live six months, etc. Drones can live their period of time, the queens in theory can live a year or longer, and so they're really the bee that's in that colony that has the maximum amount of exposure to everything

that's in that hive. They'll have the maximum amount of exposure to pesticides, they'll have the maximum amount of exposure to diseases and pests, because they live longer. All of that can manifest, it seems like what you're saying, if you set a pretty average queen in a colony that is otherwise doing well, you're setting her up to succeed and a lot of problems will go away altogether. It's neat that you offer this service. I think what we're going to do is make sure we have links to all of this information that you've talked about in our show notes, you can find that on our website. Everyone listening, just go to our podcast on the website, check out show notes, and you'll see all this, the links to the disease and pests clinic, etc. But David, before I let you go, I'd be a little bit remiss if I don't ask you just to talk very briefly about your job at NC State. You've talked great about this, this disease and pest clinic, that's fantastic, this queen clinic that you guys have up and running. I know you guys are a land grant, which means you have responsibilities in research, teaching, and extension. Could you give us a very short overview of what your program does in all three of these areas? You don't have to go into great detail, we'll have you back in the future to talk about these, but I want to make sure that our listeners are just intrigued to go to your website and visit it and check out what all you guys do.

Guest 23:27
Just like your program, Jamie, we pretty much have the exact same three-way split, I'm sure, our research, extension, and instruction. Just like you, we run our program where we don't have these silos of those things, that it's all encompassing, and one in the same. The clinic is really a great example of that, where it is an extension initiative that we currently have. It wouldn't exist without our research, a decade or more of research that went into that. It's really a continuum where these things feed on each other. We can't do extension without the research. The research has no meaning if we don't do any extension. Then the instruction, of course, is centered on all of that, both instruction in the traditional sense for the students on campus, but also instruction in the non-traditional sense, that starts to bleed into extension. I really see it as a circular continuum of all of those things, rather than these dichotomous, siloed things, that don't inform on each other. Just like you guys, we see that in its entirety.

Jamie 24:45
David, thank you so much for joining us on Two Bees in a Podcast. Everything you've talked about is intriguing and I'm sure our listeners are gonna want to check out your website to find out more about what you do.

Guest 24:54
It was a pleasure. Keep up the good work.

Jamie 24:56
Absolutely. Everybody, that was Dr. David Tarpy. He's a Professor and Extension Apiculturist in the Entomology and Plant Pathology Department at North Carolina State University.

Honey Bee 25:09

Have questions or comments? Don't forget to like and follow us on Facebook, Instagram and Twitter @UFhoneybeelab. All right, everyone. In this segment Jamie and I just wanted to talk, and I mean, that's what we're here for, is to just talk.

Jamie 25:30
So that's what podcasts are.

Honey Bee 25:34
We wanted to talk about the specialty that we have in the lab and all of the research that we focus on in the lab. Just generally speaking, we're always talking about Varroa, nutrition, and queens. So in every single one of our segments, there's always something about one of those three, and so, we have had a lot of questions, just practical questions from the audience on what all of those things even involve? Why do we care about Varroa? I feel like people generally know why we care about Varroa, but where did it come from? We kind of talked about that too. Then we'll move on to nutrition a little bit. And then queens, of course. I for some reason, Jaime have had a lot of questions about queens lately. People want to know about queen rearing, breeding.

Jamie 26:20
It's just one of those things that people really are gravitating towards. I think the more we talk about it, the more it incites people to ask more and want to hear more about it. So I think it's kind of a vicious cycle, Amy.

Honey Bee 26:30
Yeah, definitely. Okay, so let's start with the first one, Varroa. We have news reporters that call us all the time asking about Varroa, we always talk about Varroa. So let's just start there. What's the deal?

Jamie 26:44
Varroa are a mite that came from Asia. There's nine different species of honey bees, and Varroa's natural host is one of those nine species, and it's one of the species that lives in Asia. The reason Varroa is such a problem for our bees is because when European derived Apis mellifera were taken into Asia, Varroa got on them and then spread into Europe, Africa, North America, all around the world. Essentially, you take this mite, that is not a big problem for its natural host, Apis cerana, move it to a new honey bee, Apis mellifera, the bee that we keep, and all of a sudden, it just wreaks havoc. That's because our honey bees don't have a lot of natural defenses against a mite that they quote, "didn't grow up with." Now we have this mite, that was introduced in North America, or at least found in North America in 1987, had been in Europe longer, some other places around the world as well, and it came over and it just started killing colonies. It's been the world's biggest honey bee related problem since. In addition to the damage that it does to bees, physically, it also has been shown to spread pathogens, so you've got this big ol thing feeding on you, and furthermore, when it feeds on you, it's going to give you diseases and I mean, this is like the perfect mess. Varroa has just been that thing that's so good at killing our bees. I almost refer to it as the cancer of the bee world, where millions upon millions upon millions of dollars have been poured into trying to address Varroa, though we're only taking these small, modest steps, and a lot of what we do just seems still, very brutal to try to address Varroa, so I'm sure

we'll talk more about that. It's just a big problem. It's a big problem everywhere that Apis mellifera, this Western honey bee, is kept.

Honey Bee 28:43
Well, so you were talking about Apis cerana, and Apis mellifera, and you said there were how many other species?

Jamie 28:49
There are nine total species. Well, there's probably more, but at the moment we recognize formally nine, even though some of the research in our lab suggests that there may be more. You guys just need to stay tuned. Nevertheless, there's nine recognized species, eight of those occur in Asia. The only honey bee that occurs naturally outside of Asia is the honey bee that we keep, which is not called the European honey bee, contrary to most popular myths, it's called the Western honey bee. It's distributed in Europe, the Middle East and Africa. The ones that we have in North America came from Europe, which is why people like to call it the European honey bee, but it's most appropriately called the Western honey bee. Anyway, cerana is an Asian species of bee, and it's the natural host for Varroa and then of course, the rest is history once it made it to mellifera.

Honey Bee 29:35
Does Varroa have an impact on the other species of the other eight species?

Jamie 29:40
Not really. It's funny that you asked that. I mean, because even on cerana, its natural host, it obviously is reproducing, it's feeding on cerana etc. Cerana has a few behavioral mechanisms, grooming, it has some root development issues that help kind of combat Varroa, but I've just not reread a lot of papers about the movement of Varroa to these other Apis species and the impacts that it has. I mean, the biggest impact that Varroa has seems to be on mellifera. It's possibly because that it developed away from mellifera. Just significantly away.

Honey Bee 30:14
You were talking about feeding, what does Varroa feed on? I mean, how are they doing damage? You said they're doing damage, but how are they actually doing damage?

Jamie 30:22
That's a great question. Ever since people have been aware of Varroa, people have believed that Varroa has fed on honey bee hemolymph. Hemolymph is just a fancy word for insect blood, honey bees have hemolymph for blood. It's kind of like what mosquitoes would do, but it also makes sense when you look at a Varroa, it's affixed or adhering to the bee a lot like a tick would on us. If you walk through the forest, ticks like to kind of crawl up and get in those little tight spaces, around the clotheslines and things like that, and they'll embed and they'll suck your blood. When you see Varroa doing something similar, you're like, oh, gosh, yeah, that's what they're doing. They're getting on bees, and they're feeding on bee blood. We just perpetuated this idea in the literature, while we talk about it, just in our belief system, that Varroa fed on bee blood. That's just what they do. Last year 2019, a team of

scientists from the University of Maryland, the USDA in the Beltsville, Maryland area, [and] my team here at the University of Florida, we collectively published a paper showing that Varroa in fact, feed on fat bodies and fat bodies are these lipid tissues that are around the bees that have a lot of different functions: pesticides, detoxification, nutrient handling, etc. We could go on for days. What we now know is that Varroa feed on these fat bodies and when they're removing these fat bodies from adult honey bees, there can be this cascade of impacts that we see with honey bees that more appropriately match what you would expect if fat body was the food resource rather than hemolymph. It's funny because Allen Cohen, who's a specialist with mites, he is the one who suggested that this was the case in the first place. He looked at Varroa morphology, he looked at the mouth parts. He looked at excretion, the poop, and suggested that all of these things don't point to a liquid diet, which is what you would expect if they're feeding on hemolymph, but instead point to a more solid diet, which is what you would expect if they feed on fat body. So the abbreviated history of that system is that Allen told Jerry Hayes, a former colleague of mine here in Florida, (he's now moved on) he's the editor of Bee Culture, Jerry Hayes told me and Dennis vanEngelsdorp, who's a professor at the University of Maryland, and very quickly that project trickled down to one of Dennis's PhD students at the time, Sammy Ramsay. Collectively we worked with Sammy to help put the pieces together, and Sammy published that paper as lead author, talking about Varroa feeding on honey bee fat bodies, and it's already made a huge impact, literally around the world. It's probably the most significant Varroa discovery in the last two or three decades.

Honey Bee 33:10
That's pretty cool. Is there a possibility that there's anything else that they're feeding off of?

Jamie 33:17
You have to know, if something is piercing an insect, it's likely not just fat bodies that are getting into the Varroa, I think there's no doubt a little bit of hemolymph going in as well, perhaps some other tissues, but it appears, at least appears for the moment, that the bulk of the diet is fat bodies. It's funny, if you were to remove this particular tissue from the bee, you would expect to see problems like we see when Varroa in the colonies, and it's also doubly alarming, because probably some of these Varroa induced issues can mask themselves as nutritional issues or toxicity issues. because if you're taking out this important tissue, you're not able to handle nutrition as well, or toxins as well, or whatever. So Varroa are just really bad, and then don't even forget that they're putting in these pathogens, and then you just get this double-edged sword. It's just a whammy for bees. I mean, it just absolutely kills honey bees.

Honey Bee 34:16
Can you talk a little bit about the pathogens that Varroa transmits?

Jamie 34:20
Varroa are known to transmit at least a few viruses. The most notable of those is deformed wing virus. The beauty of talking about Varroa viruses is you can often know what they do based on their name. So deformed wing virus, of course, results in deformed wings of adult bees that had been parasitized by Varroa when they were young. Varroa will invade immature bee cells, these larval cells when the cells

are capped over, they'll feed on the pupi, they'll transmit the pathogen, and since the pupi are the ones developing the wings, these adults are growing inside the shell of the pupa. The wings become malformed the adult bee is born with the shriveled wings. The deformed wing is really only the most visible manifestation of the virus. The virus also shortens lifespan [and] causes behavioral issues. There's just this kind of cascade of impacts that this particular virus brings out in bees. What I usually tell people, when you have the Varroa without the viruses, you've got this minor nuisance. When you have the viruses without the Varroa, you've got this minor nuisance, but when you have the viruses with the Varroa, you have dead bees. That's how well they work together to impact our bees. Just to put this in perspective, and if our listeners have ever seen me give a talk about Varroa, they've heard this analogy, but if you were to scale a honey bee up to the size of a human, the Varroa would be somewhere in the neighborhood of a softball to a volleyball sized critter. So imagine sticking a softball to a volleyball sized tick on your body, and you get this image of the size of a Varroa to the bee. It's really small to the naked eye but compared to its host, it's one of the largest known parasites on planet Earth.

Honey Bee 36:09
That's pretty crazy. I mean, what we recommend is to monitor, right?

Jamie 36:15
You absolutely have to monitor for this pest.

Honey Bee 36:19
What are the different ways that people can monitor Varroa?

Jamie 36:22
Yeah, so there's a few different things. You can put in sticky boards, which are these pieces of cardboard that go underneath the hive and if they're covered in a sticky coating and Varroa will rain down on those. Those have pros and cons. I much prefer to suggest alcohol washes or powdered sugar shakes. They both work on a very similar premise: you put about 300 adult bees in roughly the size of a quart jar, then you pour it alcohol or powdered sugar. If you do the powdered sugar, you put it about two tablespoons of powdered sugar, in the powdered sugar case you let the bees tumble over themselves for about two minutes. You replace that jar lid with screen mesh. So after those two minutes you invert it and lightly shake out the powdered sugar in the Varroa, and you can count the Varroa. The alcohol wash is a similar premise; you put the alcohol in there, you shake the bees for 30 seconds, and then you try to wash off and count the Varroa. The magic here is is we are trying to estimate a Varroa to adult bee ratio, and that magic number seems to be somewhere around three. There's a slightly sliding scale but it's easiest to teach it from the three Varroa per 100 bee perspective. An infestation rate of about 3% so three Varroa per 100 bees. Now, if you're doing 300 bees in an alcohol wash, or in a powdered sugar shake, you're needing to see nine or more mites before you do something about it. The powder sugar shake is great because you don't kill the bees but you also can't count the bees because you release them back into the hive. You get a kind of a loose approximation of the Varroa to adult bee ratio. Of course the downside of the alcohol wash is you kill the bees, but the upside is, is you can count the Varroa and the bees and get a more accurate Varroa to bee ratio. A lot

of commercial beekeepers will monitor for this in the field and they'll make treatment decisions based on that number three. If they have zero or one mites per 100 bees, they won't do much. If they have two mites per 100 bees, they're kind of on high alert. Three mites per 100 bees, they'll start treating, so when we talk about treatment, people are going to say, well do I have to use chemicals? Can I use chemicals etc? Well, the purpose of not using chemicals is to keep those mite loads below three. The idea is not using chemicals, using resistant stock, or screen bottom boards, or drone brood removal, etc. You're not keeping those mite numbers below three forever, you're just delaying the time it takes for them to reach three and once they reach three, you are able to interject with some sort of chemical response, Apivar, Apistan, whatever is your treatment of choice. That's kind of the overall recommendation: monitor, monitor, monitor. If you see three mites per 100 bees, then you need to treat. You need to do something or your bees are going to suffer.

Honey Bee 39:23
Sure, and we're definitely going to get further into Varroa in more practical segments here in the future. I hope that's okay. And we'll move on.

Jamie 39:33
I know what we're gonna do, though, Amy, if we leave, people are going to be hungry for more Varroa so what I'm gonna do instead of going into any more detail, I know we're gonna save a lot of this for future talks. What I will say, is if you guys listening to me Google search for "Honey Bee Health Coalition Varroa," "Honey Bee Health Coalition Varroa," if you google search that term, "Honey Bee Health Coalition Varroa," you'll be able to go to the Honey Bee Health Coalition's page on Varroa, where they have a PDF that explains in great simple detail how to monitor and treat for Varroa. They'll have a video showing how to do this. They'll have decision support tools, and they even have a presentation that you can download and show at your local bee club about monitoring for and treating for Varroa. I know a lot of people don't want to be left hanging. What I would recommend to you guys is Google "Honey Bee Health Coalition Varroa." You'll see this wealth of resources and we'll make sure to link that site in today's show notes for this particular segment so that you guys can find it easy.

Honey Bee 40:36
I always crack up because I tell people to Google things, right. Of course, we're here to provide information, but I feel like part of our job is to help people find the most accurate scientific information. We're not just telling you to go Google "honey bee."

Jamie 40:51
It's crazy that you say that. I can't answer about most of the questions. You thought I was gonna say about half the questions. I can't answer about most of the questions that beekeepers ask me. So do you know how I have to find the answer?

Honey Bee 41:03
You're just really good at Googling,

Jamie 41:04

I have to always tell myself, if I could just teach beekeepers to Google then I'd never have to answer questions.

Honey Bee 41:11
And I mean, it's not just teaching them how to put in google.com and writing honey bee, it's actually finding accurate, scientifically based information because that information is available out there. It's just a matter of being able to find it.

Jamie 41:25
We need to do another segment on that. I've been giving a talk recently on online resources for beekeepers and I go through the five or six websites that I kind of fully endorse, maybe we ought to save that for a future segment and get the beekeepers excited about listening to that.

Honey Bee 41:40
Definitely. We'll teach them how to think critically on google.com.

Jamie 41:44
Or at least let Google think critically for them.

Honey Bee 41:47
Okay, that's fair. All right. So we have two more things to talk about, nutrition and queen. So let's talk about nutrition. You know, what are we focusing on when we talk about nutrition? All I know is that honey bees need to be fed and most people feed them sugar water. Why are we worried about nutrition.

Jamie 42:03
This is another series of good questions. Let me just tell the listeners the reason we're talking about Varroa, nutrition, and queens in the first place is when you look at the Bee Informed Partnership surveys, talking about yearly loss rates of honey bees, and they ask those beekeepers who are completing surveys one of the biggest stressors that your bees face, always, always, always in the top five include Varroa, nutrition, and queens. There's a couple of others that we could talk about later. But the point is, is beekeepers themselves are saying these are the big issues that we face for nutrition in queens. That's why we harp on it. When we talk about nutrition, the surveys the Bee Informed Partnership surveys, almost always talk about it from a perspective of - they use the word starvation often - and starvation usually implies a lack of carbohydrates, which we know as beekeepers to mean that they don't have enough honey stores. But I like to discuss nutrition from a broader perspective and not just from the carbohydrates. Let's think about this critically. Essentially bees forage for two, I'll call them foodstuffs, that collect nectar that they bring back to the hive and convert to honey. Honey is not really a food, per se, it's really just energy. It's liquid energy for the bees. Bees consume honey to move [and] to do the things that they need to do.

Amy 42:30
It's like a five hour energy shot.

Jamie 43:26
Except it's a lifestyle energy drink. Imagine if all we ate was honey. Oh my gosh. For adult humans, I'm sorry. We became adult bees I guess, all we would eat was honey. They eat honey to move, it's their energy source. So when we talk about nutrition from the carbohydrate perspective, what we're having to do is ensure that they have enough honey or honey substitute. In this case we don't extract all their honey. I've got this long-standing tradition in my own management system as I just leave a medium super full of honey on their hive year round. When honey flow starts, all the supers I put on above that medium super are mine, but that one medium super is theirs and they always fill it first so they get the first dibs and then I get everything I can manage them to make above that. If they exhaust that throughout the year, beekeepers usually try to respond to that by feeding either sugar syrup, with granulated sugar, mixed with water, or they feed high fructose corn syrup. I'm not going to get into necessarily the pros and cons of both. But essentially what the beekeepers are trying to do is replace that carbohydrate deficiency that the bees have if they have no honey. I know this sounds harsh to the outside world. A lot of beekeepers question this practice, but in reality the research suggests it's just fine for the bees that bees just need sugar to move.

Amy 44:50
They're not gonna get diabetes?

Jamie 45:00
Anyway, so it looks like feeding sugar syrup and corn syrup is okay for the bees. Now there's the other half of the nutrition paradigm as well, which is what most people usually mean when they say nutrition, which is pollen deficiencies. Bees collect pollen, bring it back to the hive, convert it to bee bread, and will feed bee bread into the larval diet and the nurse bees, the younger adult bees, will eat it as well to mature the glands that produce the food that they feed to the immatures. Pollen is important. It's their protein, vitamin, mineral, nutrient source. Pollen deficiencies are usually addressed by beekeepers with pollen supplements. They're trying to supplement the available pollen in the environment. We often call these things pollen patties, these little pancake size things that we throw into hives. Now a lot of beekeepers might get angry with me at this statement, but if you look at the literature on pollen patties, it's incredibly mixed. You would think the fact that a lot of commercial beekeepers do it a lot of the time [would indicate] there would be better literature support for these things; that universally the studies would show that if you put patties in hives, the bees are going to improve. That's not the case. Emily Nordyke, who just finished her master's degree in our lab, she did projects on pollen subs, and she did a comprehensive literature review that we hope to be publishing relatively soon, and the literature is incredibly mixed.

Amy 46:39
Is her literature review like two pages long?

Jamie 46:43
I think it's probably 50 or 60. She also made like an incredibly massive series of tables, where any document that's ever been published on a pollen patty studies is in it, so you listeners stay tuned. It's a

great resource for beekeeping. but the point I'll make is that at least half of the studies showed no impact to feeding pollen subs at all, but the industry wide practice of doing it. But again, I've been shouted off the stage by beekeepers who say it saves their colonies. And I'm not suggesting it does, I'm just suggesting -

Honey Bee 47:20
Shouted off the stage, Jamie?

Jamie 47:21
Well I hate to give an example. I think even making that statement cost me a job one time, and I'm not going to go into any more details. I'm obviously happy to be at UF and that was decades ago, but nevertheless, the point is that I've had people tell me that it's just not possible, pollen subs saved my hives. That may be what we suggest. It's very situational. Number one and number two, the greatest improvement that can be made in bee nutrition is the development of pollen subs, that bees very much use and very much benefit from using and I just don't know that we're there yet.

Honey Bee 48:03
I mean, it's just like human nutrition, right? I mean, there's always science going on to see what's better for us and what works well for us or not.

Jamie 48:10
Sure, absolutely. I mean, if you think about it, there's so little we know about honey bee nutrition, and it's really an exploding science right now. To complicate matters even more, there's a handful of commercially available pollen subs, but a lot of commercial beekeepers just mix their own formulas, which may or may not work. If there's no formal studies on it, it's hard to know if it's beneficial at all. Of course, a lot of our listeners will probably get angry with me and you'll post about all the ways that pollen subs have helped your colonies, and I'm not denying it. What I'm telling you in return is that it's just not universally true. It seems to be very situational. They benefit under certain circumstances, but not others. So the listeners are hearing me say this and they're going well, Jamie, the beekeepers through the Bee Informed Partnership saying nutrition is a big deal for bees and you just told us that we don't know about pollen sub use all the time, what should we do? You should encourage research on this topic, so that the scientific community at large can try to address one of these important stressors that bees faced?

Honey Bee 49:14
Well, that was gonna be my question. What would happen if we just didn't feed them?

Jamie 49:20
Well, you're asking a politically charged question. I have been keeping bees for 30 years and have never in my life fed pollen subs. I know plenty of beekeepers who say the same thing. But I also don't manage 5, 10, 15,000 colonies. I also don't move those colonies around the country four or five different places every year. I also don't move my bees to monocultures or to pollen deserts. I would argue is that there are certainly times where they seem to work. It's just that our research in Florida,

we've not found those times. We're trying to figure out when they benefit beekeepers most, and it looks like, at least from our research in the ways that we've done it, they'd benefit most when there's truly nothing else available, because it appears that when they're at least in our research, where we've done it and how we've done it, when there's anything else at all available, we lose the effect of pollen subs altogether.

Honey Bee 50:27
And ultimately, it could be a waste of money, right?

Jamie 50:31
That's right. But the thing is, is I'm not writing it off. There's absolutely evidence that these things work in some studies. What I am hoping that this does, is it breeds a more honest discussion, and also pours more research funds into these topics. Emily did a fantastic job with her research, she'll have three papers coming out from her thesis, the general intro, which is this huge review of all pollen sub literature. The second chapter will be where she dyed pollen subs and fed them to colonies and tried to trace them through colonies and only the adult bees had them.

Honey Bee 51:07
Jamie, all I heard you say was she died.

Jamie 51:10
No, she's still alive. She dyed the pollen subs, traced them through colonies, and only the adult bees had them. She didn't find it in the immature bees and didn't find it in the bee bread. At least in her study, they didn't seem to be feeding it to immature bees, or even storing the stuff, it just seemed to go straight into adults. Then she did a second study where she fed bees in a pollen dearth in winter, no less in Florida winter for what that's worth, and she tried to estimate if you feed this much weight of pollen patties to bees, how much mass of bees does that produce? These papers will hopefully be in review soon. Maybe even by the time some of you are finding our podcast they may be published, so keep checking our website or subscribe to our blog for updates on these topics.

Honey Bee 51:56
Awesome, and of course, we'll get into nutrition and starvation and into other segments. So let's move over to queens, queen quality, queen quality, queen quality, is that what we are looking at, queen quality?

Jamie 52:12
Yeah, we are, but you know what's funny Amy is that when we talk about queen quality, basically we're blaming everything that happens in a colony on the queen. She gets the credit when things go right, and she gets the blame when things go poorly. Now, I don't know when this particular episode will come out, but you and I were fortunate to be able to interview Dr. David Tarpy last week. I know that that segment will probably precede the one I'm talking about now. But in his segment, in his interview, he does a lot of work on this where he looks at queen quality parameters and tries to improve queen quality. One of the things that I remember him saying during the interview is oftentimes what people

blame on queens is unrelated to queens at all. Nevertheless, in the surveys, beekeepers say queen quality. Dr. Tarpy from NC State was suggesting you might be claiming queen quality, but it's often not related to the queen, it's often related to these other things, and we need to learn how to address those other things better before we blame everything on the queen. It's very common practice to say, if you have this problem in your hive, you should do this and requeen. If you have this problem, you should do this and requeen. We always put "and requeen" in as an afterthought thinking, well, if all else fails, just change the queen. That'll probably fix it, but the case is it won't necessarily always fix it.

Honey Bee 53:37
Well. What about factors that affect queen quality? When we're talking about Varroa, nutrition, and queens, what I've heard is that maybe there's some - are there? I don't know if this is true, you can let me know if this is true: are there mitocides that affect queen quality?

Jamie 53:56
There is some evidence from some research, Dr. Jeff Williams, from Auburn and some other places around the world have looked at the impact of pesticide exposure while queens were developing, on longevity and subsequent performance, and all of these things. I even think Dr. Tarpey mentioned, looking at or at least being aware of literature where people look at the same thing for drones. There is some evidence out there to suggest that pesticide exposure while in materials can have downstream impacts on queens, but I would argue that there's other things as well, [like] nutrition. I want you to think about this: worker bees live six weeks in the spring and summer. They literally work themselves to death. They can live six months and follow winter. But we are so up in arms about nutrition for an individual that lives six weeks during the production season, yet the queens can live one to two years. If you think about it, she has maximum exposure to nutrition issues. She has maximum exposure to pesticide issue. She has maximum exposure to virus issues and bacterial issues because she's the longest-lived individual in the hive. If there is something to experience, she experiences it most. There's lots of potential stressors that can impact the queen. A lot of people are beginning to look at this people often bring blame. They'll say, oh, gosh, my colony has a bad brood pattern. So it's the queen's fault. David Torpy, and colleagues have shown that that's not the case. Usually, when we talk about queen quality, we talk about egg output, we talk about their productivity of her offspring. Are they gentle? Do they produce a lot of honey? Do they grow strong colonies? Are they resistant to diseases and pests. And that last one's the one I'll mention even more, this idea that we can breed queens to produce offspring that are resistant to, or tolerant of, a lot of diseases and pests. Even though those queens aren't widely used in our industry, there are definitely pockets of beekeepers who invest in these queens, but it's not used blanket across the industry. You go to cattle farmers and they're all concerned about their breed, the best bulls, the best heifers, where do I get the stocks from, but in the bee world, we'll just buy a queen from anybody who can produce them. We need to have this demand for quality, this disease and pest resistance, this tolerance, high productivity, etc, o that we can improve our stocks by first improving the whole process of producing and breeding queens.

Honey Bee 56:43
Cool. I have so many questions about queens, but we'll talk about that in a later segment.

Jamie 56:48
We'll make our podcast as long as you want. As long as you and I are at UF we'll be doing this podcast. So if it goes on into perpetuity, or at least until one of us retires.

Honey Bee 56:57
I was about to say I have like at least 50 years till I retire. I don't know who's first.

Jamie 57:01
I mean, you're younger than me. But anyway, we're going to cover these topics ad infinitum. These people are going to be tired of hearing us talk about queens, nutrition, and Varroa. What I hope Amy's that in 10 years, we don't have to talk about three of these things anymore, because we've addressed them and moved on to something else, that people are able to address these stressors significantly and hive health is improved overall. That's my big desire.

Honey Bee 57:23
Yeah, I mean, in a perfect world, everyone would just remember everything we've said, and then we'd be out of a job and we would have been successful at our job by being out of a job.

Jamie 57:37
I'd be okay if I got to the point where I could sit back and be out of a job because the bee industry just got better. Bees are healthier, life is good.

Honey Bee 57:42
That's great. I remember we were talking to Jennifer Serato, and she said, if you want me to stop talking about Varroa, let's fix the Varroa problem! I kind of agree with that.

Jamie 57:54
I'll make a political statement. Here's just my feeling, I'm going to preach this increasingly, in the coming months at the talks I've been invited to give and other things. But if Varroa's really the problem, and the viruses they carry are really the biggest issues that bees face, then, in my opinion, every research lab on honey bees in North America should have some sort of Varroa control program. We should all come together and work with beekeepers to stamp this thing out. In my opinion, we have the knowledge and expertise collectively to do this. Here's my call to arms. Let's get together and let's do this thing. Let's defeat Varroa. Anyway, I could go on and on as an impassioned Braveheart-esque speech, but I'm going to stop there because I'm not going to be as good as that speech and neither do I wear a kilt.

Honey Bee 58:56
Oh, all right. Well, so those are just general conversation about Varroa, nutrition, and queens. This is not the first time we've talked about this. This is not the last time we'll be speaking on it. There's a lot to discuss, lots of questions from our listeners, so keep the questions coming [and] that way we'll find more topics and segments to discuss with you all.

Stump The Chump 59:23

It's everybody's favorite Game Show, Stump the Chump!

Honey Bee 59:37
All right, we have question and answers for today. We've got something about honey, something about bees, something about honey bees.

Jamie 59:44
Wouldn't you expect that from a question and answer segment on a bee podcast?

Honey Bee 59:48
Maybe, I don't know. I mean, we've talked about other things in this podcast. We've talked about ants and other things, plants, etcetera. All right. So I I've got three questions. And the first question we have is that this person had harvested honey and there are a lot of air bubbles in their honey. Is this okay? And do they need to wait for the bubbles to go away before they put the lid on?

Jamie 1:00:13
I would definitely encourage allowing honey to settle before you bottle it. Let me just start from the beginning. That was the short answer. Here's the deal. It is possible in the extraction process for honey to acquire a lot of bubbles, especially if it has to drop, it's falling from the extractor into a bucket, or going through some sort of filter and into a bucket. Which is why you really want it to go to a settling tank first. What you would do is, as honey is extracted, you would move it into that settling tank and allow it to sit for a couple of weeks for those bubbles to go to the top and then you will bottle off of the bottom. If you put it straight into the bottle with all those bubbles, what you're going to get is this kind of bubbly scum across the top of all of your honey. As your consumers open up the lids of your jars of honey, they're going to see that scuzz and even though it's perfectly okay scuzz, they're going to be grossed out by it. What I do, especially if this is a question from a hobbyist beekeeper, I would extract into a five gallon bucket and then tote the five gallon bucket over to a settling tank. Settling tanks are really good investments, make sure it's food grade, you keep it on a stand. When I produced a lot of honey in my youthful days, I actually kept a settling tank in my parents' carport. It was warm. The settling process happened faster. I would always bottle off of the bottom of that settling tank and get really good and clear, honey. That's my advice.

Honey Bee 1:01:43
Yeah. And we also have the honey judge program through UF. Some of the classes that we offer through the university is to help with the quality of some of the value added products of what you all are harvesting.

Jamie 1:01:56
That's a good point, Amy.

Honey Bee 1:01:58
I'm gonna put that shameless plug in.

Jamie 1:02:02
I hate to give it away too much, but we've moved so much content online anyway, I wouldn't be surprised if very soon we didn't have a honey judge online component where people can learn all about handling bubbles, etc. and that process as well or in that program as well.

Amy 1:02:16
A whole class about bubbles. Alright, so the second question is, what is the best way to raise a hive? What kind of stand is the best? I've actually seen some pretty creative stands. I'm excited to hear your answer?

Jamie 1:02:27
That's a good point Amy, the deal is that there's about a zillion and one different types of stands. Really, to me, there's a couple of key things to consider with stands. Number one, I do not like to bend over for anything. The older you get.

Honey Bee 1:02:44
How do you tie your shoe?

Jamie 1:02:46
That's why I have kids.

Amy 1:02:47
Do you have velcro shoes?

Jamie 1:02:50
No, but I have children. In all seriousness, I don't like to bend over while I'm working bees, especially if you're picking up boxes or moving boxes. What I like is when I get to my brood box, I like the brood box to be naturally about waist height. The top of the brood box to be somewhere right at or just below the belt on me, so I'm not having to bend over to work. What I have discovered is if I use two of those very standard cement blocks, so one stacked on the other. And then I have a four by four that runs from two cement blocks to another two cement blocks. Basically, the cement blocks are spaced seven feet apart to one side, two on the other. And then I have two four by four runners, going from one pair of cement blocks to the other, that raises the brood box to the level where I don't have to bend over. Why then would I make it seven feet long? Well I keep one colony on one side of that stand, one colony on the other side of that stand and [in] the space in the middle, I can put the lids in the supers on as I'm working a particular hive. So if I'm working hive one, I'll take the lid off, I'll turn it over onto the four by four space between the two hives and then I'll put the supers on that lid and more supers on that lid until I get to the brood box and work the brood box, etc. I know it's kind of a little difficult to describe that way. There are some documents that we have that show this setup. They're not documents about setting up hive stands, they're just documents [in which] you can see the hive stands that we use. Maybe we can link to a few of those. That's just a very simple one. It just basically takes four cement blocks per two colonies with seven foot four by four runners, again two cement blocks on one side, two cement blocks seven foot away, and I'll put the runners on top. Now, with that said I've seen people do

the same thing but rather than use four by four runners, they use ladders, like step ladders. I've seen people only put on cement blocks, but I think the real key is not what you're putting them on. It's how high off of the ground that you're keeping them to make it convenient for you. That's what I shoot for when I'm working my bees.

Amy 1:03:03
When I first started beekeeping, we were friends with this arborist and he had all these huge tree stumps and they were perfect. They actually worked out really well as far as putting a hive on the tree stumps.

Jamie 1:05:21
That's super cool. One of the things I'll say, Amy, is that when I'm thinking about hive stands, I'm trying to think about things I don't have to replace and the beauty of using cement blocks is you won't have to replace them unless you break them. And four by fours, you can use the treated four by fours, and they'll last for a very long time as hive stands. So yeah, when I think about tree stumps, I would worry, I suppose, over time about rot, but at the end of the day, you really just want those colonies up off the ground where it's convenient for you. With that caveat, obviously most commercial beekeepers work their colonies on pallets. A pallet is super thin, so you're four or five inches from the ground, six inches from the ground, but that's what they have to do because they work so many bees and have to move them around.

Honey Bee 1:06:03
Yeah. All right. The last question is, would it be okay if I got rid of deeps and use something smaller? Are their pros and cons to using mediums only?

Jamie 1:06:13
It would be more than just okay, here's what I say. There's some basic biology facts that you have to know about bees to keep bees. At least 80% of the management is opinion: whether or not you use excluders, whether or not you use deeps, whether or not you use mediums, whether or not you use eight frame colony or 10 frame colonies, it really doesn't matter, the bees don't care. Really all of that stuff is stuff that's up to you. Historically, the colony style I use is a deep brood box, 10 frames, a metal queen excluder, and then a medium 10 frame super, that's what I use, but I know plenty of people who use exclusively mediums, because it's easier to pick up mediums than it is to pick up deeps, for the same reason I know people who use exclusively shallows, just a whole hive made of shallows. That's also fine. I would argue though, the only drawback to using mediums and shallows is you have to buy more boxes, and they're not priced based on their size really well. It's not like a shallow's half the price of a deep. It's still fairly expensive, so there's a little bit more cost the other drawback that I see to them is that when I have to look for a queen, for example, I'm looking amongst 10 frames in a deep brood box, but if I'm having to use two shallow supers to make up one equivalent of a deep brood box, now I'm looking through 20 frames for a queen. There's just a few little oddities like that, that you'll find that the fewer boxes you have to use, the easier it is in those things, but the fewer boxes you have to use, usually the heavier the box. That's the long answer. The short answer is it really doesn't matter. Feel free to experiment with hives composed exclusively of mediums. Lots of people like them. You can

even experiment with eight frame mediums or eight frame deeps, whatever. All of that stuff is just personal preference, the bees don't care at all.

Honey Bee 1:08:21
So there's no one hive fits all.

Jamie 1:08:24
That is right. In fact, Amy, we have a document somewhere that maybe we can put in the show notes. It talks about hive choice and configuration where I wrote specifically about this topic. What are the different configurations, and what pros and cons are associated with each, and so all of that stuff is covered in that document. Maybe we can make sure and link it.

Honey Bee 1:08:42
Awesome. Thank you for that, for all the questions. Audience, I hope you all are keeping your questions and sending them in. I am receiving some questions, but we need more.

Jamie 1:08:54
Absolutely. Make sure you go to your favorite podcast platform and rate us so we can spread the news and while you're there, make sure you drop us some comments and questions. We appreciate your listenership.

Honey Bee 1:09:06
Hi, everyone. Thank you so much for listening to this week's episode of Two Bees in a Podcast. We would like to give an extra special thank you to our audio engineer James Weaver, and to our podcast coordinator Jacqueline Allenje. Without their hard work, Two Bees in a Podcast would not be possible.

Jamie 1:09:24
For more information and additional resources for today's episode, don't forget to visit the UF IFAS Honey Bee Research and Extension Laboratory's website, UFhoneybee.com. Do you have questions you want answered on air? If so, email them to 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.