

## **Understanding Varroa Mites Lecture Series**

### **Varroa Mite Treatments: Procedures, Timing, Modes of Action**

#### **Q: Can you feed while treating?**

**A:** This is a great question, because especially in the fall, we often have treatments on at the same time that we want to put feed on for our bees, to get them ready for the winter. The simple answer is that yes, you can feed at the same time as having any treatment on – the treatments won't contaminate the feed, or anything like that. However, the one thing to keep in mind is that many of the fumigant treatments can cause the bees to move away from the pads or wafers. As a result, and because most of these treatments are placed on the top bars of the hive, the bees may avoid going up to the top of the hive and accessing a hivetop or pail feeder. So while the treatments will not contaminate the feed, they may cause the bees to avoid the feeder a bit, and take down slightly less feed. When using treatments like Formic Pro, MAQS, and Thymovar, it is best to put these treatments on and wait at least a few days before putting on a feeder. Most of the fumigation is going to happen in the first few days, so putting on your feeder after that – even though the treatment is still on – shouldn't have much of an effect on the bees avoiding the feed. With synthetic strips like Apivar and Apistan, you don't have to worry about the timing of putting on a feeder, as these treatments will not cause the bees to avoid the feed.

#### **Q: Does using something like Formic Pro in the spring, Thymovar in the fall, followed with oxalic acid in the late fall sound like a good approach to treating? In addition to using cultural control practices?**

**A:** Any good approach to treating and integrated pest management should include a variety of control methods, and building in rotation as much as possible. It should also come down to monitoring, and making an informed decision based on your mite counts. Remember to always use monitoring to guide when to treat, and what to treat with. Finally, incorporating cultural control practices is always a good idea, as these practices help slow mite growth, and allow for more options when treating, and longer periods of time between treatments. All of this helps with slowing the development of chemical resistance in mites. In terms of the example treatment plan described, it sounds like a good approach. Using a fumigant like Formic Pro or MAQS in the spring has the advantage of it being a shorter treatment period. As a result, there isn't any concern with putting on supers once the spring nectar flow begins. Synthetic strips in the spring can also be effective, but timing has to be carefully considered, to make sure the full treatment period plus a 2 week withdrawal period has passed before supers are put on. That being said, if mite levels are high in the spring, synthetic strips may be warranted, as mite levels will only sky-rocket from there. In the fall, assuming levels were controlled effectively with the spring treatment, another organic treatment like Thymovar could be used, followed by an oxalic acid clean-up. If a spring treatment was not needed or applied, Thymovar may still be appropriate, especially if cultural control practices were used, and kept mite levels relatively low. If not, and if levels are quite high in the fall, a synthetic strip could be used, also followed with an oxalic acid clean-up. Again, remember that this is just an example treatment plan, and adjustments should be made if monitoring shows very high levels, or shows that any of the above treatments did not seem to work.

#### **Q: If you are using the 65% liquid formic acid with the multiple application pads, how long do you leave the formic acid for it to soak in?**

**A:** When using the multiple application pads and liquid formic acid, it doesn't take long for the pads to soak up all the formic acid, assuming you are using the appropriate amount of 15-20 mL per pad. Beekeepers will often place a bunch of pads into a large plastic tote, measure out the total amount of liquid formic acid for all of the pads in the tote, and then pour that in. Doing this before going out to the yard should be enough time for that liquid to soak in. If you do this the day before treating, make sure

the tote is sealed in between, and that you use caution when opening the tote in the field the following day, as a small amount of the liquid will have begun to evaporate, and this is dangerous if it is inhaled.

**Q: What are the efficacies of the different treatments?**

**A:** Treatment efficacies can be difficult to pin down, as there are so many variables that can affect them. It is also important to remember that they are averages, calculated from many different studies. In general, the synthetic acaricides tend to have higher efficacy, usually reported in the range of 95-99%. However, this is usually more with Apivar, as there are fewer reported cases of Apivar resistance in mites (but some do exist, and are on the rise). Apistan and Bayvarol have more variable efficacies, with susceptible populations showing efficacies as high as 99%, but more instances of efficacies around 70-85% than is seen with Apivar. In resistant populations, these treatments can have efficacies lower than 40%. The organic treatments tend to have lower efficacies than the synthetic strips, but they are highly affected by things like temperature. Tested at different temperatures, formic acid can be anywhere from 50% effective, to 85-89%. Using formic acid products within the optimal temperature range generally achieves the higher efficacies. Studies have also shown efficacy to be slightly lower in doubles compared to singles. The efficacy of Thymovar is also generally reported to be around 85-89%, but again, can be reduced if it is used outside of ideal temperatures. HopGuard shows a lot of variability in efficacy, and this is largely related to the amount of brood present. When used with brood present, its efficacy is generally in the range of 50-65% or so. When no brood is present, efficacies of around 80-85% can be achieved. Oxalic acid is the most effective of the organic treatments, with both the drizzle and vaporization methods being 95-98% effective. However, because of the timing of when oxalic acid is used, it cannot be used as a main treatment. When used in the presence of brood, oxalic acid has a much lower efficacy (at the highest, around 70%, but often lower).

**Q: How many times can you use oxalic acid a year?**

**A:** With the oxalic acid drizzle, it is not recommended to use it more than twice a year. This is because using it more than twice a year would mean using it more than twice on the same bees, and it begins to damage their digestive systems at that point. While oxalic acid is very effective, it does not work well when there is brood present. As a result, it is best used in late fall when there is no brood, as a clean-up treatment. If it is used a third time – either again in the fall, or early in the spring – the treatment would still be applied to the same overwintering bees, and could therefore be damaging. Oxalic acid is not registered for use in the middle of the season while honey supers are on, so while this would be using it on a different group of bees, it is not registered for use this way, and it would not be effective, as there is brood present. Using a vaporizer appears to be a tiny bit safer for the bees (though not for you as the beekeeper), so using it more than twice is possible. However, keep in mind it is still hard on the bees, and should still not be used over and over again.

**Q: What should you do when using formic acid with a screened bottom board?**

**A:** When using any of the formic acid products, it is important to leave the main hive entrance open and unobstructed. However, all other entrances or openings should be closed / sealed. If your hive has a screened bottom board that sits on a normal bottom board, make sure the back is sealed off. If the screened bottom board is a complete unit that has a tray that opens from the side or back, just make sure that the tray is in place and securely closed, which should ensure that there aren't any openings.

**Q: What is the purpose of the 2 week withdrawal period for many of the treatments, and what is it based on?**

**A:** When new treatments are tested, they are looked at for their efficacy in killing mites, their danger to the bees, as well as the possibility of honey and hive products becoming contaminated for human

consumption. For the last point there, honey samples are generally taken before, during, and after treatments are applied to get an idea of whether chemical residues end up in honey, and how long they last. The 2 week withdrawal period is based on this research, and was determined to be an acceptable safety margin, so that residues were broken down and no longer present. This is the case for many Varroa treatments, but with oxytetracycline (used for the prevention of American foulbrood), the withdrawal period was determined to be 4 weeks. Again, these numbers are based on research with the different treatment products, and should always be observed when using any product.

**Q: The treatment label for Apivar says that the strips can be re-positioned and left for a total of 56 days (instead of 42) if the bees are found to have moved away from the strips. If the bees are found to have moved away from the strips earlier on – say, after week 3 or 4 – should you re-position the strips and leave them in for just the 42 days, or for the maximum 56 days?**

**A:** Even though you caught the fact that the bees moved away from the strips earlier, and were able to re-position them earlier (as opposed to finding this at the end of the 42-day treatment period), it would still be best to leave them in for the extra 2 weeks, to the maximum of 56 days. The idea behind the re-positioning is that you can't be sure when the bees moved away from the strips, so allowing that extra 2 weeks just ensures that the mites are coming in contact with those strips for as close to 6 weeks as possible. However, it is very important that the strips are not left any longer than 56 days, and that you remove them after that to prevent the development of chemical resistance.

**Q: What do you mean by rotating treatments, and why is this important?**

**A:** Rotating treatments refers to trying to avoid using the same treatment over and over again. The worst case scenario is using a treatment in the spring, then again in the fall, and then repeating that the next year, and so on. Building in any amount of rotation into that is great, and the more the better. For example, you could use an organic treatment in the spring, then a synthetic strip in the fall. Then the following spring, you use a different organic treatment, and then a different synthetic strip in the fall from the one you used the previous year. The idea is to increase the time in between using the same chemical as much as possible. This is especially important with synthetic acaricides, but building rotation with organic chemicals is also important. The more rotation you use (combined with things like cultural control practices), the longer it will take for Varroa mites to develop resistance to those chemicals, meaning treatments can be effectively used longer into the future.

**Q: If you put a fumigant treatment on your hive and early on realize that the temperature is going to spike above the maximum recommended temperature in a day or two, should you remove the treatment, or just leave it alone at that point?**

**A:** With the fumigant treatments, formic acid and Thymovar, there are temperature ranges where these treatments work best. For both types of treatments, there is a maximum temperature of around 30 °C, above which these chemicals can become damaging to bees and brood. It is best to pay attention to the weather, and put these treatments in the hive at a time when the temperatures will not go above 30-35 °C, especially for the first 3-4 days of the treatment application. After the first 3-4 days, it is not as important, as much of the chemical will have evaporated at that point. If you put one of these treatments on and didn't realize that the temperature will spike above that maximum threshold in the next day or two, it is best to go back and remove the treatments, and replace them when the temperatures have gone back down. Leaving them in could mean damaging your bees, killing brood, and/or killing the queen.

**Q: Can you comment on any entrance-based control methods? I've heard of one that seemed to be designed for bees to pick up treatments in powder form as they enter and exit the hive.**

**A:** One line of research that we've seen with this topic was testing different entrance attachments to control the flow of foragers so that they came in from one spot, but exited from another. The idea behind this was to put antifungal powders in a position where they would come in contact with exiting bees, but not returning bees. These antifungals were not for bee diseases, but for plant diseases. The bees were meant to pick up these antifungal compounds, and deliver them to certain crops when they were pollinating them. The design was specifically meant to prevent bees from coming in contact with the antifungals when returning to the hive, so as not to bring them into the hive and cause any kind of contamination. This research is still relatively new, so I don't know that any of these designs are being used commercially at this point. There was another kind of entrance-based control product that was circulating around a number of years ago, and that one was designed for controlling Varroa. The idea was that the bees coming and going from the hive would come in contact with a chemical that would kill the mites. The product was not registered here in Canada, and was not found to be very effective. One of the main reasons for this is the fact that this type of treatment does not really target mites in the most effective place. With all of the treatments mentioned in this presentation, placement near the brood nest is important. This is because mites are generally either found in brood cappings reproducing, or on young nurse bees, before jumping back into another brood cell. While mites can definitely be on older forager bees – especially with high infestations – most mites are in the brood nest, and the most effective treatments aim to control mites there, not at the entrance. A control method like this also has limited use, as it wouldn't be able to be used during the summer when most bees are coming and going as it would cause contamination of honey.

**Q: Are there treatments that you don't recommend mixing and using at the same time?**

**A:** In general, all of the Varroa treatments are designed to be used on their own, and we wouldn't recommend using more than one at once. In fact, I would question the need to use more than one at a time. If you are using, say, Apivar and Apistan at the same time, are you using both because you found one to be ineffective in the past? If that is the case, there is likely resistance to that chemical, and you should avoid using it. Having an approach where you rotate treatments helps to prevent the development of resistance in the first place, giving you more options when it comes to treating. If both treatments are effective, and there is no resistance, using one at a time is best. The other chemical can then be used the next year, ensuring there is a larger time gap between using the same chemical. With a treatment like oxalic acid, it is best used as a clean-up treatment later in the fall when no brood is present. This is often done after the main fall treatment (formic acid, a synthetic strip, Thymovar, etc.) has finished. It is possible to treat with oxalic acid while one of these other treatments is still in the hive (and not a problem or anything), but it generally makes more sense to wait until you are removing the main treatment. This is also beneficial as it saves you an extra trip out to the bee yard – you can just go out once, in the late fall, and remove the main treatment, clean-up with oxalic acid, and then wrap your hives for the winter. You don't have to do it this way, but this would be the only time really that you would see a potential overlap of Varroa treatments. One treatment overlap that definitely can happen is using a Varroa treatment at the same time as using oxytetracycline. Oxytet is a treatment used to prevent American foulbrood infections, and is applied mixed with powdered sugar, and sprinkled on the top bars at the back of the hive. For this treatment to work, the bees need access to this powdered sugar / oxytet mix, so that they can spread it around the hive as they try to remove it. It is not recommended to use oxytet at the same time as using one of the fumigant Varroa treatments. Because these treatments often cause the bees to avoid the top bars where the treatment is, the bees will not come in contact with the oxytet, and will not spread it around the hive. These fumigants can also cause the powdered sugar to harden, making it even more difficult for the bees to spread it around the hive. When treating with oxytet, it is best to apply all 3 doses first, and then apply a Varroa fumigant treatment afterwards. The other option is to use oxytet at the same time as using a synthetic strip Varroa treatment

instead. Because synthetic strips are contact treatments, and do not cause the bees to move around the hive any less or avoid the top bars, they can be used at the same time as oxytet without any issues.

**Q: When using the oxalic acid drizzle method, why is it mixed with sugar syrup? If it were mixed with something like water, wouldn't the bees consume less of it, and then it would be safer for them, and you could use it more times?**

**A:** This is a great question, because it is definitely the fact that the bees eat the sugar syrup containing the oxalic acid that makes it damaging to them. Repetitive oxalic acid use essentially causes crystals to form in the bees' digestive systems, in their Malpighian tubules (kind of like the insect equivalent of kidneys). This is why it is only recommended to use the oxalic acid drizzle treatment up to twice a year. If the oxalic acid were mixed with water instead, it would still achieve the low pH required to make it effective against mites. However, studies have shown that the water does not disperse the way that sugar syrup does. As a result, the bees don't move around and spread the oxalic acid / water solution, coating much of the colony. This is important, as using the oxalic acid drizzle means you are only hitting the bees that are closer to the top bars in between the frames. For the treatment to work, the bees have to move around, and spread the solution to all of the other bees. Sugar syrup stays sticky and wet longer, and allows the treatment to be effectively spread to many bees. The downside is that bees also lick each other and feed on the syrup, inadvertently consuming the oxalic acid, which is harmful, and not necessary for the treatment to work. There are research studies looking into using other solutions in place of sugar syrup, to make it safer for the bees. While some of these studies have found alternatives that are not consumed by bees, most of the studies are still preliminary, and have focused more on finding solutions with similar distribution properties to sugar syrup, but have not gotten to the stage of testing them mixed with oxalic acid to see if they still have the same efficacy on mites.

**Q: Could you comment on the use of oxalic acid / glycerin pads or strips, and whether that is something that will be registered here in Canada.**

**A:** There has been a lot of excitement about the use of strips soaked in oxalic acid and glycerin as a mite treatment to be used mid-season. A lot of the original work for this was done in Argentina, and there are a number of countries where this is currently registered. TTP did a mid-season treatment project a number of years ago testing glycerin / oxalic acid strips, as well as testing the drizzle method, but used repeatedly during the summer on a weekly basis, and a higher dose of the formic acid multiple application method. The glycerin / oxalic acid strips were found to be very promising. They were the most effective treatment that we tested in knocking down mites, and they did not have the effects on adult bee mortality that we saw with the repetitive oxalic acid drizzle treatment. This would be a treatment that could be used mid-season with honey supers on, so it is a very promising and exciting new treatment for that as well. In terms of the current status on that, Canadian Honey Council has taken on the registration of this treatment, and that is currently where it sits. Because this would be a label extension as opposed to registering a new active compound, and because this product / method is registered elsewhere, the registration through the Pest Management Regulatory Agency (PMRA) should be a little faster. However, it can still be a long process, so it may be another year or two before this product / method is registered for use.

**Q: Does HopGuard leave a smell or residue in honey? Is there a maximum temperature for using HopGuard?**

**A:** Unlike formic acid and Thymovar, HopGuard is not a fumigant – it works by contact, as the bees move around and touch the strips. Because it is not fumigating or evaporating the same way that formic acid and Thymovar do, there is less of an issue with the chemical absorbing into the honey, and leaving a residue or smell. The liquid does have a smell, but again, it isn't fumigating the hive, so it is only moving

around the hive by contact. HopGuard is registered for use with honey supers, so the studies necessary for the product to be registered would have found no residues or smell in the honey, which is why it was able to be registered for that time of year. This is not the case with Thymovar, for example, which is a fumigant, and also has a powerful smell that can get into honey. As a result, Thymovar is not registered for use with honey supers on, and a withdrawal period of 2 weeks needs to be observed after the treatment is finished before putting on honey supers. The only temperature consideration listed on the label for HopGuard is that the temperatures need to be above 10 °C. This is because below that temperature, the bees will be clustering, and not moving around the hive very much. For the treatment to work, the bees need to be moving around, and spreading the liquid from the strip to other bees in the colony. A maximum temperature is generally only given for the fumigant treatments, since higher temperatures mean that the chemicals are evaporating at a higher rate, and could potentially cause damage to the bees and brood. Since HopGuard is not a fumigant, higher temperatures just mean the bees will continue to move around, coming in contact with and spreading the treatment.

**Q: When treating a double with HopGuard, where do you place the strips?**

**A:** HopGuard is used very similarly to a synthetic acaricide strip, so placement of the strips would be similar. You use 1 Hopguard strip for every 5 frames of bees. In a single, you would use up to 2 strips, and place them in the brood nest, where they would come in contact with the most young nurse bees. In a double, assuming there are enough frames of bees, you would use a maximum of 4 strips. These strips would be placed in the brood nest as well – 2 in the top box, and 2 in the bottom box. As with a synthetic strip, if you are treating a double that is really only 5-10 frames of bees in one box, you would only put a maximum of 2 strips, and place them where the bees and brood are.

**Q: What are the temperature considerations with using an oxalic acid vaporizer?**

**A:** In terms of the outside temperature, the only consideration with using a vaporizer (or the drizzle method) is that you want it to be cold enough that the bees are all in the hive clustering. At temperatures of around 10 °C and above, there isn't a problem with the oxalic acid fumigating too much or anything like that, it is just that the bees will be more active, and will likely be flying in and out of the hive. Colder than 10 °C is necessary, ideally closer to 0 °C or so. In terms of the vaporizer temperature itself, you just want to make sure that you are avoiding vaporizers that are advertised as working "super fast." Vaporizers that work in this way generally heat up too quickly, to very high temperatures, and don't cool down properly in between treatments. At temperatures above 189 °C, the oxalic acid is not fumigating, it is decomposing into CO<sub>2</sub>, CO, and water vapour, and is no longer effective. It is important that the vaporizer does not heat up too quickly, and that you are giving it time to cool in between hives, to make sure that it is working.

**Q: When looking at maximum temperatures for using fumigant treatments, should you be including humidity?**

**A:** This is a tough question, because humidity is not something that is mentioned on the product labels for any of the fumigant treatments. That being said, it is best to take it into account, as the humidity will affect the rate at which these different treatments evaporate, at least to some extent. If the temperature is going to be 27 or 28 °C, but closer to or just over 30 °C with the humidity, you can probably get away with using a fumigant treatment. However, if the temperature with the humidity is going to be quite a bit higher than that, even if the base temperature is below 30 °C, it would be best to avoid putting the treatment on until it cools down.

**Q: Does Formic Pro penetrate the brood cappings?**

**A:** When using Formic Pro at full dose with two pads, it does penetrate the cappings. However, NOD Apiaries has stated that when used at the dose of one pad for 10 days, and then the second pad for another 10 days, the treatment does not penetrate the cappings. The treatment period is longer using this method, in order to hit more mites as they emerge from the cappings. This method is easier on the bees, but the label does contain a warning that efficacy will be slightly lower using this method, as opposed to using two pads at once. This safer method is best used when mite levels are slightly lower, and temperatures are hovering around the higher end of the 30 °C maximum. If temperatures are more favourable for using Formic Pro, and especially if mite levels are slightly higher, it is better to go with the two pads at the same time method, to ensure you are controlling your mite levels.

**Q: What would you recommend if it is August, temperatures are hot, and you find that you have high mite levels?**

**A:** This is a situation that you ideally don't want to find yourself in. The best way to not get into a situation like this is to make sure that you are monitoring regularly throughout the season, so that you are not caught by surprise in August with high levels. If your levels are climbing mid-season, you can use a treatment like Formic Pro, MAQS, or HopGuard to help knock those levels down, and to give you some breathing room until August / early September. Utilizing cultural control practices throughout the season will also help keep your mite levels lower, so that they don't get to such high levels in the fall. If you do find yourself in that situation, though, the best thing to do would be to remove honey supers and get a treatment on. It is not an ideal situation, and you will miss out on the goldenrod flow in early September, but it is better to save your colonies and miss out on some honey, than lose your colonies to mites. We generally recommend that that decision about whether or not to leave supers on until mid-September be based on what your Varroa levels are. If they are high, it is best to remove supers and get a treatment on earlier. If they are low or medium, you could leave supers on, and remove them mid-September at the latest, and treat then instead. If there happens to be a window coming up where temperatures will be a little less hot, you could leave supers on and treat in August with Formic Pro or MAQS. If not, and a fumigant just isn't an option, we would recommend removing supers and putting in a synthetic strip instead.

**Q: I've seen research from the southern US saying that oxalic acid is not super effective, and mostly just keeps mites at about the same level. With that in mind, what are better options for mid-season treatments?**

**A:** There are a few things to address with this question. To start off, beekeeping in the southern US is quite different from here in Ontario, and it is always important to keep that in mind when you are looking at videos, studies, posts, etc. talking about beekeeping management and pest and disease control in other parts of the world where the climate would be different. One of the big issues in the beekeeping industry in the southern US is the fact that they don't really have a time during the year where there is no brood production (or it is a very short window). There are times of the year where brood production is considerably lower, but there is often still some brood production. This means that Varroa mites can more or less reproduce all year round. In many places in the southern US, they are looking more and more into putting bees into cold storage for a few months of the year, specifically to cause a broodless period like you would see up here in Ontario with our winter. This would make it easier to use treatments like oxalic acid (drizzle or vaporizer), and they would be much more effective, as this treatment works best when there is no brood present. Here in Canada, it is important to point out that oxalic acid is not registered for use mid-season with honey supers on, and is best used as a clean-up treatment in the late fall. At this time, with no brood present, oxalic acid is a highly effective treatment. In terms of your options for mid-season treatments, the three treatments registered for use here in Canada with supers on are Formic Pro, MAQS, and HopGuard. The glycerin / oxalic acid treatment that

TTP tested a number of years ago is still in the process of being registered. However, when it does get registered, it will be an additional option for a mid-season treatment, as it does not work the same way that the drizzle or vaporizer works, but works much more like a synthetic strip that would stay in the hive for 6 weeks.

**Q: What is the proper way to dispose of used Apivar, Apistan, or other chemical treatments?**

**A:** This is a great question. Used Varroa treatments are considered hazardous waste, so they should not be disposed of with regular garbage. How to dispose of them properly will depend on your particular municipality, but keep an eye out for hazardous waste collection days, or livestock medicine disposal days, or contact your municipality to ask about them directly. Either of these types of collection days can be used to dispose of used Varroa treatments. (A good resource to check out for more information is <https://cleanfarms.ca/>)

**Q: How do beekeepers time treatments, taking into account temperature, supers, etc.? Could you give me an overview / example of what this might look like?**

**A:** There are a couple of things to cover with this question before going into an example or two. For starters, remember that chemical treatments are not the only tool that a beekeeper has in their toolbox for controlling mites. Using cultural control practices, as well as incorporating disease-resistant stock, all help to keep Varroa levels lower, which make treating easier. Lower levels mean more options for treatments, and also mean extending the time in between using the same treatment, both of which help prevent the development of chemical resistance in mites. The other thing to keep in mind is that while I can give an example of a treatment plan for a year, these decisions should ultimately be informed decisions based around your own mite levels. If you have mite levels that are different from what I describe in the examples, you will have to take different approaches for treating. To use my own operation as an example, I do drone brood removal, which is a cultural control practice that helps keep my mite levels lower. In addition, I try to sell a few nucs every spring. This creates a brood break in the colony, which also acts as a cultural control method to inadvertently control mite growth. As a result of these practices, my mite monitoring in the spring has never shown levels that warrant a spring treatment, or a mid-season treatment. My levels tend to be lower in the fall as well, so I have usually used organic treatments like Thymovar. Some years my fall levels have been slightly higher, so I have used a synthetic strip those years. In all years, I do an oxalic acid drizzle clean-up in the late fall before I wrap my hives. To use TTP as another example, we have quite a few more hives, and drone brood removal is not something that is super feasible to do in all of our yards. We do tend to do a lot of splitting for different research projects, so that does help with keeping mite levels a bit lower (in addition to often having disease-resistant stock as a result of different projects). At TTP, our spring monitoring has also never shown a need for a spring treatment. However, there have been a few years where a mid-season treatment was necessary, and we used MAQS in those years. Our fall mite levels tend to be a bit more variable depending on the projects we ran that year. Some years we have used an organic treatment like Formic Pro or Thymovar, other years we have had higher levels and used a synthetic strip (rotating between Apivar, Apistan, and Bayvarol for different years). At TTP, we also always clean up with an oxalic acid drizzle. These examples will help give you an idea of some treatment plans for a season, but remember that it will ultimately be based on your own Varroa levels from regular monitoring. In terms of timing and supers, always remember to follow the treatment labels. Many treatments cannot be used with supers, so they are used in the fall starting in early to mid-September after supers have been removed, or they are used in the spring before supers go on. If you are applying a spring treatment, try to do the math and work backwards. Supers may need to go on hives in late May or early June; you would need to get most treatments on 8 weeks before that to give enough time for a 6 week treatment



period, plus a 2 week withdrawal period for most treatments. If you are treating mid-season with supers on, the only registered treatments for that situation are Formic Pro, MAQS, and HopGuard.

**Q: Is it possible to treat too early? Could these treatments cause damage to a weak hive?**

**A:** With any Varroa treatment, there is going to be some inherent risk to the colony. This is especially the case with the organic treatments, and especially if they are used incorrectly. We like to remind beekeepers that just because a treatment is “organic” or “natural” does not mean it is safe and easy on the bees (or you as a beekeeper). This is why it is so important that you are always following the label instructions, and using proper personal protective equipment. In terms of treating too early in the spring, remember that your decision should ultimately come down to what the mite levels indicate from monitoring. If your levels are low in the spring and don’t warrant a treatment, it is probably best to not treat in the spring and wait until mid-season or the fall. If your levels are incredibly high, you will have to intervene in some way, as those levels will only increase from there, and will likely kill the colony. In a case like that, a treatment may be stressful, especially if the colony is weak, but your other option is to leave the colony alone, and let it die from Varroa mites and viruses later in the spring. This would also be damaging to other, healthy hives as those mites could spread to nearby hives, impacting them as well. It is better to treat the hive, even if it is weak, and hope that they will make it through into the summer.

**Q: Should you rotate organic treatments as well, or is that only an issue with synthetic treatments?**

**A:** While it is much more likely for mites to develop resistance to synthetic chemicals that act on one very specific site, it is not impossible for them to develop resistance to organic chemicals that act on a number of different sites. The target-site insensitivity that can develop in mites with prolonged synthetic chemical does not generally happen with organic chemicals; however, mites can develop improved detoxification to break down organic treatments, or develop ways to prevent these chemicals from absorbing through their cuticle. In either of these cases, the mites can then become resistant to the chemical in question. As a result, it is always a good recommendation to rotate treatments, even if you are rotating different organic treatments.