

BEE YET

If We Only Followed The Directions!

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The Difference Between a Poison and a Remedy

Most people hate reading “the directions”. Who wants to waste all that time when we can jump in and just figure it out, right? Following the directions can be even worse. Just today, I was floating through my lab checking on students who were working on an assignment. When I asked one group how they were doing, they said “Fine, but we started on Exercise 1 and then realized the handout said to start on Exercise 3. So, we’ve wasted 20 minutes – if we only followed the directions!” Like teaching, medical directions are no exception to poor compliance. Most people do not like taking medications or giving medications to their animals. In fact, studies have shown that medical compliance with doctor’s orders is systemically low with up to 75% non-compliance (1). This trend is mirrored in veterinary medicine as well (2). I get it. I would prefer not to prescribe chemicals for my patients if I could avoid it. Unfortunately, many of the disease challenges our bees face do not allow us that utopian luxury.

Let me be clear about the decision of administering any drug, medication, or natural remedy treatments. No matter how they are

labeled (“hard”, “soft”), they are all chemicals. Antibiotics are chemicals. “Natural” products are still chemicals. Even “soft, natural” products come with a lengthy package insert of their chemical hazards, can kill bees/queens, and harm us, especially if they are not used properly. I do not care to take sides or discriminate based on common treatment categories. IPM is always part of the treatment plan considerations. My goal is to use whatever works with the least number of side-effects based on clinical evidence observed and documented in the bee yard. But if I could encourage beekeepers to follow one direction when administering treatment/s to your honey bees it would be, “Please, use the correct dosage.”

It is All about Balance: Considerations with Dosage

“All things in good measure” or “moderation” is good advice. In medicine, dosage is defined as the amount of a substance given to a certain patient over a period of time. The purpose of utilizing the correct dosage of a drug/chemical is to maximize treatment efficiency while minimizing possible side effects. Dosage can be further tailored according to the needs of a specific patient in a specific circumstance. Realize no two hives or bee yards are the same and may require different interventions. Since *Varroa* mites

are the single, biggest health threat to our bees, I will often use *Varroa* treatments as examples throughout this article, but the principles outlined here can be applied to any medical treatment for any pathologies. The following are important, practical considerations for beekeepers to master in determining dosage:

Timing: Most honey bee treatments are designed to be given during certain seasons and certain weather conditions. Understanding the biological rationale for when and why we use a treatment is critical for success. For example, oxalic acid treatments for *Varroa* mites do not penetrate wax cappings (where most mites reside), can kill open brood, and are thus intended to be used in broodless times. I am a big fan of oxalic when it is used properly. But if a beekeeper is employing oxalic acid multiple times during brood rearing times, (which is most of the main beekeeping season from about February through October in my PA neck of the woods), this treatment is unnecessarily exposing your colony and queen to a chemical that can acutely or subacutely effect bees and brood, and has low effectiveness on the mites at the time (see Box). Please be sure you have a plan as when and why you may use certain treatments during the beekeeping season.

As of February 23rd, the EPA has changed the rules per **Honey Residue and Oxalic Acid**;

<https://www.federalregister.gov/documents/2021/02/23/2021-03256/oxalic-acid-exemption-from-the-requirement-of-a-tolerance>

Oxalic Acid; Exemption From the Requirement of a Tolerance

A Rule by the Environmental Protection Agency on 02/23/2021

SUMMARY: This regulation establishes an exemption from the requirement of a tolerance for residues of oxalic acid in honey and honeycomb. This regulation eliminates the need to establish a maximum permissible level on these commodities for residues of oxalic acid.

A full discussion of the literature and background on the toxicological profile of oxalic acid can be found in docket number EPA-HQ-OPP-2020-0176 in the documents titled “Oxalic Acid. Label Amendment Regarding Use in Beehives with Honey Supers to Control *Varroa* Mites” and “Oxalic Acid. New Use in Beehives to control *Varroa* mites.”

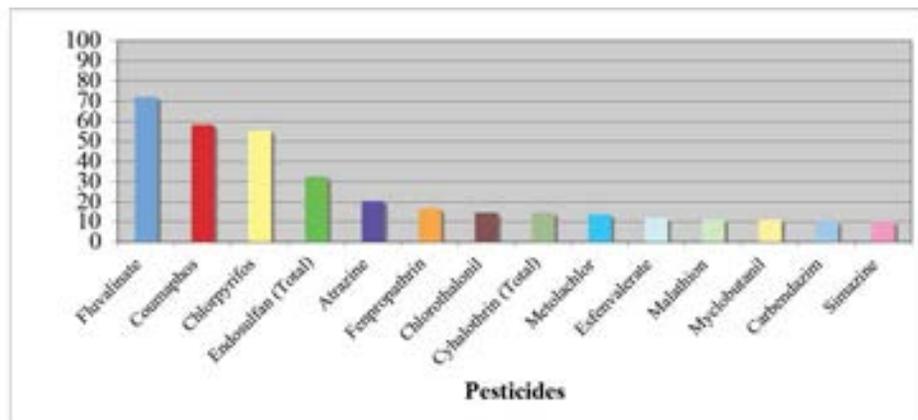
Do not assume that this means that improper exposure to oxalic acid for *Varroa* mites will not harm your colony or leave oxalic acid residues. Beekeepers still need to adhere to label directions.

Amount/volume/formulation: I must admit I am a “to taste” cook. I sort of follow recipes, but I like to add in my own amount of spice or variations. Does this sauce need more wine? Of course, it does!... at least two more “pours”...fun stuff. But in medicine, measuring the actual amount is critical to treatment success. This is the *dose* of medication. It is also critical to understand the concentration of the medication of different formulations of the same chemical may have different compositions and therefore amounts given. More is not better, that approach may be toxic. Less is not better, that approach may cause the medication to be less effective and promote drug resistance. In some cases, after careful evaluation and especially in weaker patients (colonies), veterinarians may adjust doses to the specific need of the hive.

Number of Doses/Frequency: I can remember when I used to make fun of those “old people” pill boxes with M-F designations. Now I have them in my house. Missing doses is a common reason for treatment failure. Remember a treatment is not complete until all the directed doses are given with the correct amount of time inbetween. There are good reasons for this. The number of doses and frequency of medication administration is often based on the lifecycle of the pathogen and/or the half -life of the chemical (essentially how long its effect lasts) in the patient. Be sure you mark the calendar for your bees’ meds, too.

Duration: The duration is how long a treatment plan lasts. Some regiments for bee treatments can be long and admittedly annoying – seven days, 21 days , 42 days – but like the number and frequency of doses, the duration is often based on the lifecycle of the pathogen and/or the half-life of the chemical in the patient. The important thing is to be aware of the necessary duration and do the “math” before you apply the treatment to your hives. What your plans are for your hives in a week, a month, two months in the future may determine the best treatment choice.

Application method and distribution: In apiculture, there may be different choices for delivery



of a medication to our bees: patties, dribble, vapor, strips, in sugar syrup, sugar dusting, etc. With application four things should be considered: 1. Is this the best treatment delivery to get adequate distribution of the medication to the bees? 2. Is this distribution method the safest/least toxic to the bees? 3. Am I comfortable using this application method, properly? 4. Is this method the most cost effective for my operation? Do some research here to be sure you are on the right track.

Expiration: Using medications that are expired may accomplish three things. Expired drugs are less effective in treatment, may contribute to resistance, and/or they break down and their metabolites can become toxic. Interestingly, many drugs after expiring usually just become less effective and not toxic. However, tetracyclines is one category of antibiotics that are known to increase in toxicity after expiration. Coming from a farm mentality, I get frugality. But believing that using expired drugs is working to treat or prevent disease and/or is economical is a dangerous fantasy.

Withdrawal times: Most drugs we use in animals have a time when food products cannot be used from that animal after a medical treatment. In honey bees, many medical treatments we use can have post-treatment time and some even a pre-superning timeframe, in which we cannot have honey or supers on our hives for honey intended for human consumption. Some of these times can be up to 6 weeks. Again, this takes careful pre-planning of your beekeeping season to be sure you are not contaminating your bee’s honey.

Combinations of meds: If you are a horse person or manage any kind of herd animal, you are likely familiar with “strategic deworming”. This means we know our pasture animals are exposed to parasites in the environment, so therefore we employ multiple drugs in “rotations” over the season to keep the parasites at a manageable level and avoid drug resistance development. We can monitor the effectiveness of our drug rotations utilizing periodic fecal egg counts. This is becoming our pattern with *Varroa* management. Please do not think that simply treating once for mites with formic acid or amitraz or thymol or whatever, and then you can check the box for varroa for the season. Most beekeepers are now employing multiple treatments over the beekeeping season at appropriate times to keep *Varroa* in check. For example, amitraz in the early Spring or Summer dearth, formic in the Spring/Summer (if it is not too hot), oxalic in the late Fall/early Winter. The only way to determine if your treatment plan is working is to do regular mite counts or other monitoring diagnostic for whatever disease or pest you are managing for. Our goal is still to use the least amount of chemicals for the highest effect. However, that formula may be a treatment plan involving several drugs. Using “more” effective drugs appropriately could mean using less overall.

Evidence of treatment success: Doing regular quantitative mite counts are the best thing you can do for the health of your hive. Learn how to do an alcohol wash correctly. I know, I do not like killing bees either, but 300 bees is a diagnostic sample that could save the life of a hive and tens of thousands of bees.

Many experts recommend doing counts monthly during the active beekeeping season. Personally, I think three counts a year is the minimum (Spring/Summer/Fall). If you have not done mite counts before, start with three and work your way up to what is manageable for your operation. Pre-treatment and post-treatment counts are best for evaluating treatment effectiveness.

Records: All medications with all the above considerations used in your bee yard must be recorded. This is the biggest favor you can do for your bees, yourself, and any other mentor beekeepers or veterinarian coming into your yard to assist you. Develop a system you can understand a year from now.

Purpose: In all these things, beekeepers must consider ultimately what they want to achieve with their bees. Depending on if you are a backyard beekeeper, a commercial beekeeper, a honey maker or migratory beekeeper, your goals, timeline, and environment will all differ and will impact the most effective treatment regimen for your bees.

Consequences of incorrect dosage
Ok, so that is a lot to consider for following “just” the one direction of correct dosage. However, avoiding serious consequences can be reduced or avoided by keeping the above in mind. In summary, these consequences could include:
1. Treatment failure. All that time,

money, and chemical exposure for nothing.

2. Queen effects. Death of the queen or sublethal effects that reduces her performance. Remember the queen lives longer than all other casts, so she must endure more treatment exposures.
3. Drug resistance development. Unfortunately, these poor choices end up affecting us all.
4. Death of the hive due to succumbing to the disease (with underdosing) or treatment toxicity (with overdosing).

Keep in mind that all these treatment failures can have significant economic impact on the beekeeper.

One last point I will leave you with to ponder, pesticides. While I am not about to jump into the ring of discussion about how much impact pesticides have on our bees, I will point out that the highest potential concentrations of pesticides and other chemicals in our hives are often the ones we use. Equip yourself with knowledge, pre-plan, and choose wisely. The season is starting. **BC**

References:

1. Panesar, Kim. “Patient Compliance and Health Behavior Models”, *U.S. Pharmacist*. April 23, 2012. <https://www.uspharmacist.com/article/patient-compliance-and-health-behavior-models> accessed 02/01/2021.
2. Little, Geoff. “Concordance and Compliance.” *Veterinary Practice*. Feb. 2013. <https://veterinary-practice.com/article/concordance-and-compliance> accessed 2/01/2021.

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