

Oxalic Acid: Why, When, and How?

By Margarita M. López-Urbe

Oxalic acid dihydrate (OA) (also known as wood bleach) is rapidly becoming a popular method for varroa control in the US. It was legalized in the US only in 2015, but it has been used in Canada since 2010, and in Europe for more than 20 years. OA has proved to be an effective method to keep mite levels within manageable levels with an **efficacy that can reach 90%, if applied under ideal conditions**. We are still learning how to best use oxalic acid for mite control here in the US. Even though currently it is a great tool for mite control, by no means should OA be considered the ‘silver bullet’ to the varroa plight. Therefore, care must be taken in regards as to when and how to use it.

Why is oxalic acid so popular?

Chemically speaking, OA is an organic acid because at the molecular level it is made of carbon. OA is naturally found in plants, and it is part of our diet. For example, chives, parsley and cassava have an OA content of over 1%, and it is also present in other plants we eat including spinach, rhubarb, and carrots. Because OA is naturally found in plants and honey, it is usually considered a “natural treatment” for varroa mites. This is one of the primary reasons why OA has quickly gained popularity among beekeepers in the US. However, we should be aware that even though OA is considered a ‘soft chemical’—compared to synthetic pesticides—, it is a corrosive acid that can harm both beekeepers and bees if not used properly (see below). So when and how do we best use OA?

When to use it?

As with any mite treatment, it is **EXTREMELY** important to apply it at the right time of the year. Because OA most likely kills mites from direct contact (the details of the mode of action are currently still unknown), **the ideal conditions to treat with OA are when the colony is broodless**. For example, during winter months or in the spring before the queen starts laying. The reason

behind this “rule” is that one OA application is only effective for 3 to 5 days and thus will not kill mites that are developing in capped brood. Using this type of application as a summer treatment is therefore not very effective, and it may require multiple applications (but see below under ‘Other remarks’). In addition, **OA should NOT be applied when honey supers are present**. Some studies suggest that multiple OA treatments can lead to increased OA content in honey and increased bee mortality. High levels of OA in food can be harmful to humans, so beekeepers should avoid contaminating honey with these applications.

Because of the limitation of using OA exclusively during periods of no brood, **the best time to apply OA is during the winter** (November through January in Pennsylvania). The López-Urbe lab is currently running an experiment to test the efficacy of OA application against varroa in packages and its effects on year-round colony health. Stay tuned for our results this Fall!

How should OA be applied?

There are two common modes of OA applications: trickling (also called dribble), and vaporization. The trickle method—which is applied to colonies through a syringe with a mixture of 1:1 sugar water and 3.5% OA—is the most popular method of OA application in Europe and Canada because it is cost-effective and easy to use. Research has shown that concentrations higher than 3.5% do not necessarily result in increased efficacy against varroa and could cause harm to the bees. **It is important to highlight that OA should not be used above recommended levels**. The vaporization method uses a ‘vaporizer’ (heating apparatus) to evaporate OA dihydrate crystals inside the colony. In a recent study from our group, we found that the vaporization method is significantly more effective reducing mite numbers when compared to the trickle method (see article in

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American Bee Journal - May 2017). However, the negative aspects of the vapor method include that (1) it poses greater health concerns to the applicator, and (2) there are additional costs associated with this method, which includes the cost of the vaporizer and safety equipment for the people applying it. To learn more details about Oxalic Acid Application Protocols, please visit our website: <http://www.lopezuribelab.com/oxalic-acid/>.

Other remarks and future directions of research.

One of the major gaps in the available pest management practices for beekeepers is the availability of effective mid-summer varroa treatment methods. Randy Oliver

is working on developing an OA application method that would allow beekeepers to use during the summer. This new method, originally developed in Argentina by Matías Maggi, uses a combination of glycerine and OA in solution that is used to dampen 'blue towels' that are then introduced in the colonies. With this method of application, OA stays in contact with the bees and the mites for longer periods of time and could potentially be used as an effective summer mite treatment method. Even though Randy has been investing a lot of time in these trials (and he has some exciting results, see latest issue of American Bee Journal for more details), this OA method of application is still not legal in the US and it should not be used until more studies are done on

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the potential side effects of this method of application on bee health and honey residue. **Randy Oliver is the keynote speaker for our Pennsylvania State Beekeepers Association Meeting in November and he will be presenting more details about his new work with OA.**

The two major remaining questions are: (1) can mites develop resistance to OA?, and (2) how does oxalic acid kill mites? Even though a recent study from Argentina suggests that mites do not develop resistance to OA even after long-term exposure to this chemical, we should be cautious of over exposing bees to OA until we have more studies addressing this question. **My general recommendations for OA applications are to (1) use it only as a varroa winter treatment, (2) strictly follow the suggested dosage for the different methods of application, and (3) rotate OA applications with other chemical and non-chemical mite treatments, such as colony splits or essential oils.**