

How to Apply Oxalic Acid Via Sublimation to Control Varroa

Varroa mites are parasites of honey bees. They harm colonies by weakening the bees they feed on and by spreading virus diseases. Beekeepers use several methods to control varroa, including the natural chemical oxalic acid (OA).

Hives are treated with OA by *Trickling*, *Spraying*, and *Sublimation* (also called *Vaporization*). Trickling and spraying apply OA in solution. In sublimation, OA crystals are heated with an applicator tool. The heat causes the crystals to sublime (turn directly from solid to gas). LASI research compared these methods at several OA doses. Sublimation was best: killing varroa at lower doses, not harmful to the bees, and not needing the hive to be opened.



Trickling. Hive opened and oxalic acid solution poured onto the bees.



Spraying. Frames lifted and OA solution sprayed onto bees.



Sublimation. Tool in hive entrance vaporizing OA. Foam seals entrance.



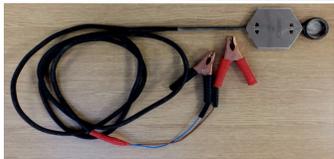
Phoretic. Varroa clinging to adult bees can be killed by OA.



In Cells. Varroa in capped cells are not killed by OA application.



Mask. For safety, use a mask that protects against dust and fumes.



Applicator Tool. Varrox M3080, 12 volts, 150 watts, as used at LASI.



Battery. This 12v lead-acid battery can power the tool for 8-9 hours.



Half teaspoon measure, 2.5ml, is c. 2.25g OA. OA stored in airtight jar.

To apply OA via sublimation you need: 1) applicator tool (several types are sold); 2) battery to power tool; 3) oxalic acid (technically "oxalic acid dihydrate"); 4) mask; 5) half teaspoon measure; 6) foam to temporarily seal hive entrance.

Place half teaspoon (2.0-2.5g) of OA into the holder at the end of the applicator. Insert applicator into hive entrance and seal entrance with foam. If the applicator is cold it will take several minutes to heat up, and then several minutes to vaporize the OA. If the applicator is on and hot the OA will start to sublime within seconds. Make sure the applicator is in the hive before OA vapour is produced so that it is confined to the hive. During and for up to 10-15 minutes after application, seal the hive entrance with foam.

Apply OA to broodless hives. If capped brood cells are present, many varroa will be in these and will not be killed by the OA. LASI finds that December is the month with least brood, but that late autumn and winter brood rearing varies year to year. It is best to check hives immediately or a few days before OA application and remove or scrape out any small patches of capped brood. It is recommended to apply OA at outside temperatures of 4-16C.

LASI finds that applying OA via sublimation is simple and can be done by one person. The main disadvantage is the need for the tool and battery. Take care as the tool gets hot! LASI recommends 2.0-2.5g OA via sublimation to broodless hives in winter. LASI's research was published, open access, in the *Journal of Apicultural Research*: <http://dx.doi.org/10.1080/00218839.2015.1106777>

Key Results of LASI Research Comparing Oxalic Acid Application Methods

- * 2.25g OA applied to broodless winter hives via sublimation killed 97% of the varroa.
- * Colonies treated with OA in winter via sublimation had 20% more brood in spring than those treated via trickling or spraying, or untreated control colonies.
- * Sublimation is effective at killing varroa at lower doses than trickling or spraying.
- * Sublimation has no negative effect on colony winter survival or bee mortality.
- * The exact amount of OA used is not critical. 1.125g and 4.5g were also effective.

Oxalic Acid Safety

- * OA is a natural chemical, and is found in honey and most vegetables.
- * Carrots are 0.5% OA. One pound contains enough OA, 2.25g, to treat one hive.
- * OA is toxic. It is estimated that 45g, enough to treat 20 hives, would kill if eaten.
- * OA is more harmful if breathed in, as it affects mucous membranes.
- * When handling OA crystals, wear a protective mask to protect against dust.
- * During sublimation, wear a mask that protects against dust and organic acid gases.

Official Regulations of the UK Veterinary Medicines Directorate

Please check the regulations in your country, as these vary. In the UK, a registered OA product, Api-bioxal, was approved in 2015 by the VMD. Api-bioxal is oxalic acid dihydrate (88.6% by weight), plus silica gel and glucose. The sublimation recommendation is for 2.3g Api-bioxal (= 2.04g OA) per hive as a single administration, one treatment per year. 2.3g Api-bioxal contains 2.04g OA. Api-bioxal is the only form of OA that may legally be applied to hives to control varroa in the UK.



LASI does research on honey bees & social insects, trains students, & provides outreach. This Information Sheet was written by Professor Francis Ratnieks & Hasan Al Toufailya and sponsored by the Eva Crane Trust. LASI research on controlling varroa with OA was funded by Rowse Honey, Burt's Bees & The Esmée Fairbairn Foundation. ©2016. www.sussex.ac.uk/lasi

