

Diatomaceous Earth & Kaolin Clay

In this series, we've discussed horticultural oils, neem and insecticidal soaps. Many of you have used these "soft" pesticides and are familiar with them. Generally, these have a mostly physical effect on the pests they are controlling (see [GNO Gardening November 2019](#) and [December 2019](#) and [January 2020](#)).

This month we will discuss a couple of insecticides that may be a little less familiar: diatomaceous earth (DE) and kaolin clay (Surround®).

Both are effective control measures because of their physical attributes and the physical effect they have on pests.

Diatomaceous Earth

Diatomaceous earth is made from the fossilized remains of diatoms, tiny organisms that lived in rivers, streams, lakes and oceans. Diatom skeletons are made up of silica (silicon dioxide), a combination of silicon and oxygen. Silica is common in nature and makes up 26% of the earth's crust by weight. Over a long period of time, diatoms accumulated in the sediment of rivers, streams, lakes, and oceans. Today, silica deposits are mined from these areas. Various forms of silica include sand, emerald, quartz, feldspar, mica, clay, asbestos, and glass. Silicon does not exist naturally in its pure form. It usually reacts with oxygen and water to form silicon dioxide or silica. Silicon dioxide has two naturally occurring forms: crystalline and amorphous. Most diatomaceous earth is made of amorphous silicon dioxide. However, it can contain very low levels of crystalline silicon dioxide.

The first pesticide products containing silicon dioxide (diatomaceous earth) were registered in 1960 to kill insects and mites.

Products containing diatomaceous earth are most commonly dusts but other formulations include

wettable powders and pressurized liquids.

Currently, there are over 150 DE insecticide products registered for use inside and outside of buildings, farms, gardens, and pet kennels.

There are also thousands of non

-pesticide products that contain diatomaceous earth. These include skin care products, toothpastes, foods, beverages, medicines, paints and water filters. The Food & Drug Administration lists diatomaceous earth as "Generally Recognized as Safe". "Food grade" diatomaceous earth products are purified and may be used as anticaking materials in feed, or as clarifiers for wine and beer.

Diatomaceous earth is not a poison; it does not have to be eaten in order to be effective. Diatomaceous earth causes insects to dry out and die by absorbing the oils and fats from the cuticle of the insect's exoskeleton and its abrasive, sharp edges speed up the process. It remains effective as long as it is kept dry and undisturbed. It is easily removed from harvested produce with water.

Kaolin Clay

Kaolinite is a clay mineral with the chemical composition $Al_2Si_2O_5(OH)_4$. Rocks that are rich in kaolinite are known as kaolin or china clay. Kaolinite clay occurs in abundance in soils that have formed

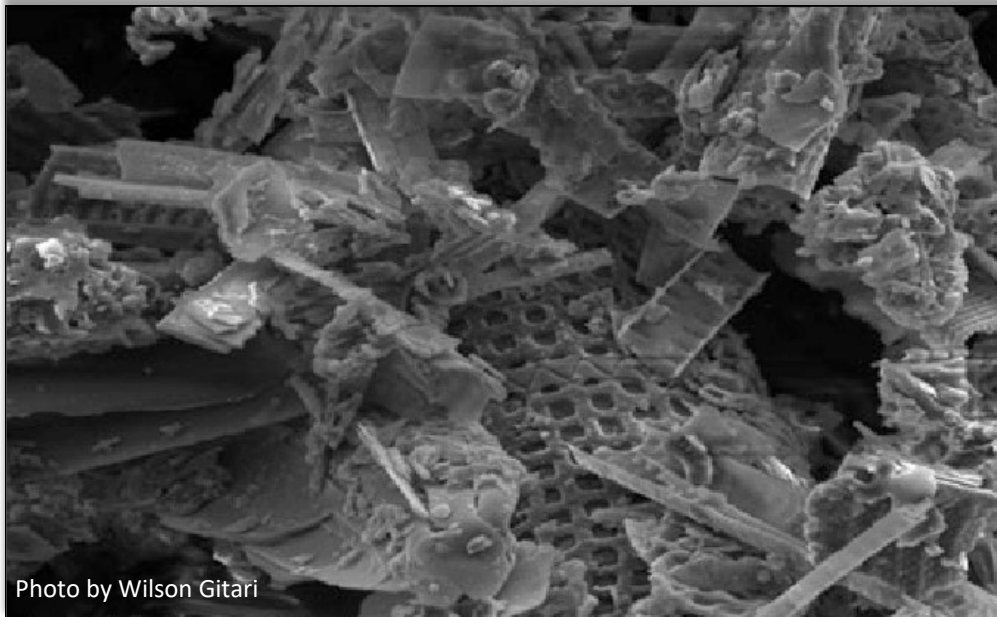


Photo by Wilson Gitari

Electromagnetic microscopy image of a sample of diatomaceous earth.

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from the chemical weathering of rocks in hot, moist climates—for example in tropical rainforest areas. The name kaolin comes from the Chinese for Kau-ling or “high ridge” in reference to a hill in China where the pure clay was first mined by Jesuit missionaries around 1700. It has been used in pottery and porcelain production for centuries. Work done in the 1920's and 1930's with pottery-grade kaolin proved unsatisfactory, as plant health suffered and insects still maneuvered through the large (relatively-speaking) clay particles. For effective use as a pesticide, a super-magnetic centrifuge in Georgia is used to refine the impurities out of raw kaolin and then filter the clay particles to a critical 1.4 microns in size.

I know of only one kaolin product (thus far) registered with EPA as an insecticide and crop protectant – Surround WP or Surround CF. From the Surround WP label: “Surround WP forms a barrier film, which acts as a broad-spectrum agricultural crop protectant for controlling damage from various insect and disease pests, a growth enhancer, and as a protectant against sunburn and heat stress.” Kaolin clay is non-soluble and is applied as a slurry making surfaces look as though they’ve been painted white. This change in plant appearance confuses feeding insects and creates a non-inviting environment on the leaf surface. The label indicates that three coats are required for full effects and all plant surfaces must be coated for good control. This means top and bottom of leaves. No negative effects on plant photosynthesis or respiration have been noted; however, it can delay fruit maturation time because it lowers the overall



Image of tomatoes coated with kaolin clay.

plant temperature. Regular reapplication is needed as the plant grows or as rain and irrigation wash the clay from the plant surface. Growing in greenhouses or high tunnels increases the longevity since the plants are affected by rain.

Exposure to kaolin is not expected to pose any health risks to people, including children and other sensitive populations. Kaolin has been extensively tested, and no evidence of toxicity to humans was detected. In addition to being an active pesticide ingredient itself, kaolin is also an inert ingredient in other pesticide products. FDA has granted kaolin GRAS

status (Generally Recognized as Safe) when used in human food. EPA finds that kaolin is not harmful to non-target organisms or to the environment.

The white kaolin coating is easily removed from harvested fruit and vegetables by wiping with a wet cloth or even a dry cloth. It can also be removed with a steady stream of water or water and soap.

Though both diatomaceous earth and kaolin are considered non-hazardous, they can be ocular and respiratory irritants. Therefore, proper protective equipment and activities to avoid creating excessive dust or inhaling dust should be used. Always follow label instructions and take steps to minimize exposure. If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 1-800-222-1222. If you wish to discuss a pesticide problem, please call 1-800-858-7378.