

ACTRA
Appropriate Technology Transfer for Rural Areas

**Reduced-Risk
Pest Control
Factsheet**

Insect IPM in Apples
Kaolin Clay



Biopesticides and Risk Reduction

This factsheet is part of a series highlighting the latest breakthroughs in biorational pest control. There is a growing commitment among producers to use the least toxic methods for protecting crops. Increased awareness of the many benefits of advanced integrated pest management (IPM) are at the heart of this change. Meanwhile, FQPA (Food Quality

Effects of SurroundWP™ in trial applications on apples:

- Control: leafrollers, leafhoppers.
- Suppression: mites, codling moth, plum curculio, apple sucker, stink bugs, apple maggot, thrips.
- Horticultural Benefits: reduced heat stress and fruit drop, reduced sunburn, improved color in certain cultivars.

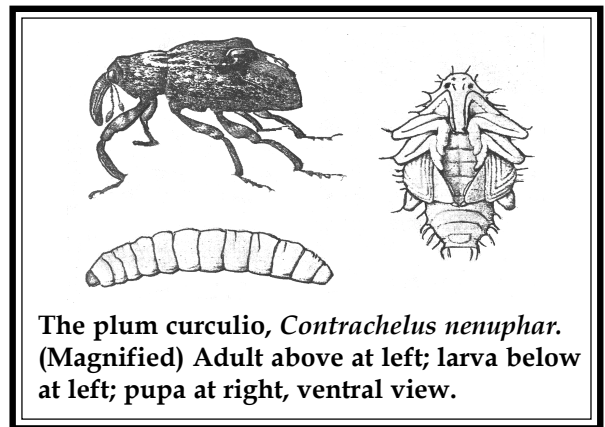
Protection Act) and other regulations have given short-term urgency to the quest for reduced-risk alternatives to the most toxic chemicals, including the organophosphates.

Important additions have been made in recent years to the arsenal of reduced-risk pest management tools. This series of factsheets is intended to put the latest information on these new tools in a convenient, farmer-friendly format. Special effort has been made to include efficacy information, discussion of relative costs, contact and supplier information, and interviews with farmers who have used these new tools in commercial production.

This factsheet looks at the use of kaolin (the main ingredient in SurroundWP™) in apple IPM. While kaolin is registered for many crops, it seems especially promising for apple growers.

What is kaolin and how does it work?

Surround WP presents a unique form of pest control: a non-toxic particle film that places a barrier between the pest and its host plant. The active ingredient is kaolin clay, an edible mineral long used as an anti-caking agent in processed foods, and in such products as toothpaste and Kaopectate. There appears to be no mammalian toxicity or any danger to the environment posed by the use of kaolin in pest control.



The plum curculio, *Conotrachelus nenuphar*. (Magnified) Adult above at left; larva below at left; pupa at right, ventral view.

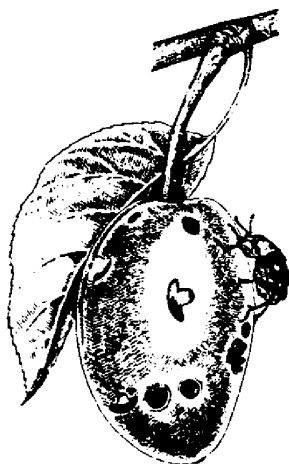
The spray was developed by Drs. Michael Glenn and Gary Puterka of the USDA/ARS at Kearneysville, WV, in cooperation with the Engelhard Corporation, which began marketing the product in 1999 on a limited basis. Surround was available in 2000 in much of the U.S., and it was listed by The Organic Materials Review Institute for use in organic production on March 7, 2000.

Surround is sprayed on as a liquid, which evaporates, leaving a protective powdery film on the surfaces of leaves, stems, and fruit. Conventional spray equipment can be used, and full coverage is important. The film works to deter insects in several ways. Tiny particles

of the clay attach to the insects when they contact the tree, agitating and repelling them. Even if particles don't attach to their bodies, the insects find the coated plant or fruit unsuitable for feeding and egg-laying. In addition, the highly reflective white coating makes the tree less recognizable as a host.

The standard Surround spray program for plum curculio and first-generation codling moth starts at first petal fall and continues for 6 to 8 weekly sprays or until the infestation is over. Discontinuing sprays at this point will leave little or no residue at harvest because of rain and wind attrition. If a full-season program is used to suppress later-season threats such as apple maggot, growers will need to use a scrubber/washer to remove any dust remaining on the fruit for fresh market sales. Although this residue is not considered harmful, it might be considered unsightly by consumers. However, the dust residue is not a problem for processing fruit.

Trial applications of the spray showed that where plum curculio damage was 20–30% in unsprayed checks, the treatments receiving the particle film had only .5–1% damage. Dr. Puterka is careful to say that his trials indicate “suppression” of PC damage rather than complete control. For the organic grower looking to achieve an economic level of control, the distinction is probably not relevant. What the researcher terms “suppression” in these USDA trials is very close to control, far closer than any other organically suitable option. For the non-organic grower, kaolin alone will not achieve quite as high a level of control as is ensured by the organophosphates. However, Surround is comparable to the OPs in that it's a broad-spectrum tool effective against most of the major pests of apple. As growers gain experience in timing applications of this new tool, efficacy data will very likely improve.



The plum curculio: Adult female on plum, showing the circular feeding punctures and the crescent-shaped egg-laying punctures (shown larger than natural size.)

Horticultural Benefits

Although at first glance the film may appear to block light, Surround actually increases net photosynthesis, and can provide secondary benefits to the trees' overall health, according to Dr. Glenn. Surround keeps the tree cool so that photosynthesis can continue longer into the afternoon on hot days, after untreated trees have already shut down because of heat stress. In a two-year study, 'Empire', when sprayed during the first six to eight weeks after petal fall, had increased yields and increased red color. Growers have reported similar results with 'Stayman' and 'Gala'. An MSU study reported increased return bloom where Surround had been used the previous season. Growers in hot

areas benefit from a marked reduction in sunburn damage, often 50% or greater.

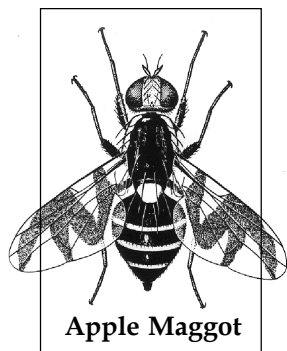
A Systems Approach

Surround will be most effective when used within a well-managed agro-ecological *system* combining the most appropriate cultural and chemical methods for the specific orchard situation, pest complex, and local climate. Such a system will integrate soil building, habitat for beneficial organisms, and well-tuned nutrient and water management. Soil building and nutrient/water management are two sides of the same coin and could be considered preventative pest management. A healthy soil high in organic matter will have better water and nutrient holding capacity. Plants receiving too much or too little of either water or nutrients, particularly nitrogen, are more attractive *and* more susceptible to damage by insects and diseases. Good water management, through water-stress monitoring, conserves valuable (and expensive) soil nutrients, reduces contaminated runoff, and conserves water. Providing habitat for beneficial organisms is like hiring millions of helpers whose sole aim in life is to eat pests. Nitrogen-fixing cover crops can do double duty as habitat for beneficial organisms if managed correctly.

Northeastern U.S. Grower Report:

Eric Rice, Middletown, Maryland

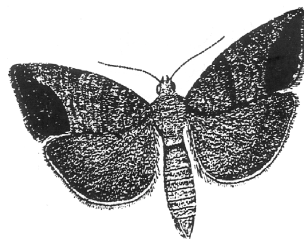
One of the first orchardists to use the kaolin spray, Eric Rice is confident the product will help him fare better in his packout next year. Rice, whose farm is certified organic, hopes to boost the percentage of select grade fruit from 50% to 70% of his apple crop. He expresses optimism about Surround's effectiveness against insects like the plum curculio, codling moth, leaf rollers, mites and aphids. "It doesn't bother beneficials," he says, adding that the ladybugs and other predators continued to thrive in the rich ground cover of clover and grass.



Apple Maggot

Trials at the Rice orchard have shown over 90% control of the "big ones" – codling moth, plum curculio, and apple maggot. While Surround has also had a positive effect on fungal diseases like sooty blotch, fly speck, and fire blight, Rice cautions that it is not a panacea. It has had no effect on apple scab, a disease that often poses a bigger problem to growers than insect pests (initial research with kaolin focused on disease suppression, but the results were inconsistent.)

Rice says that Surround is far more useful than any other organic options available on the market. The only disadvantage he cites is the necessity of washing the clay off the fruit after harvest. Referring to the uniformly white appearance of the trees after spraying, Rice says, "It looks like Christmas. People who drive by stop to inquire if something is wrong."

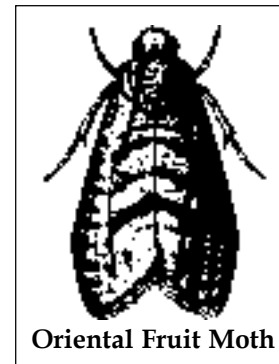


Codling Moth

"However, in 2000 I've been more attentive to keeping Surround on the trees in the early part of the season. Compared to last year I appear to be getting good to excellent control of tarnished plant bugs and stink bugs, two of the pests that I was targeting with Surround.

"Other observations: It did not wash off in rain as readily as I had feared; didn't seem to clog up or corrode any sprayer parts; I like being able to see my spray coverage; too early to see if it has helped to control oriental fruit moth as I hope it will." Ames adds that Surround may prove key to making organic apple production economically viable in the Eastern U.S. by providing the long-sought organic control for plum curculio.

Another Arkansas grower reports that "it's a real challenge to keep the trees covered." This is his first season using Surround. One technical limitation he has encountered is with his sprayer: it has been impossible to achieve full coverage of the tops of the trees using his present equipment. *Full coverage is critical to achieving good pest control.*



Oriental Fruit Moth

Southeastern U.S. Grower Report:

Guy Ames, Fayetteville, Arkansas

"I've used kaolin clay for two seasons now. Last year I was slow in getting the first sprays on, and late May through early June was an exceedingly wet period during which I had competing interests. In short, I can't claim to have given Surround a valid test in 1999.

Economics

It seems likely that kaolin clay, when used in a well-managed IPM program, will be an appropriate and effective reduced-risk replacement for synthetic insect pesticides. To be viable in commercial production however, it must be *cost-effective* as well. At this time, Surround seems to be roughly comparable in relative cost to the commonly used OP insecticides, while providing comparable broad-spectrum coverage. Of course, there are variables that make this a tentative statement: relative pest pressure and rainfall, for example, influence how many sprays of Surround must be made in a season. Over the next few years we will gather data on the cost of using kaolin and report our findings.

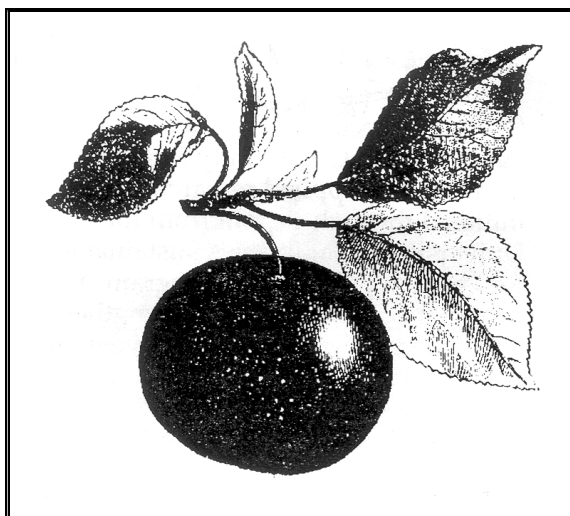
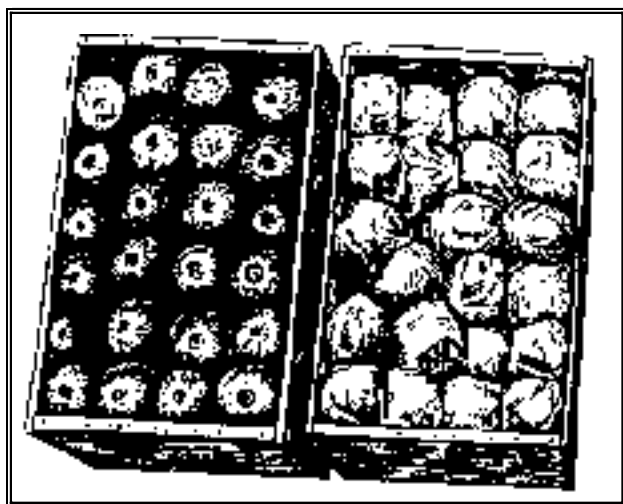
Compatibility

Surround is generally not affected by most other insecticides, miticides, and fungicides. However, the user should test tank-mixes before use. When mixing with other products, make up a small batch and observe slurry and film characteristics. Curdling, precipitation, lack of film formation, or changes in viscosity are signs of incompatibility. Do not tank-mix with sulfur or Bordeaux mixture fungicides.

Note: "Raw" kaolin clay is not the same... as SurroundWP. We have heard of one grower who bought a traincar load of "generic" kaolin clay, and killed most of his apple trees! Surround is, at this point in time, the *only* kaolin product suitable and registered for horticultural use. The kaolin in Surround is processed to a very fine particulate size, and combined with a sticker-spreader. Other forms of kaolin clay are phytotoxic and should be used under no circumstances.

Summary

Surround is an environmentally benign, worker-friendly and cost-effective tool that can provide many pest management and horticultural benefits. It is most effective when used in an agricultural ecosystem managed for healthy soils with well-balanced nutrient and water budgets. Providing habitat for beneficial organisms (in the form of cover crops and unmown wildflower strips) complements the pest control benefits of kaolin clay and builds soil quality as well.



Further Resources

SurroundWP manufacturer:
Engelhard Corporation
101 Wood Avenue, P.O. Box 770
Iselin, NJ 08830-0770
877-240-0421 (toll free)
732-321-1598 FAX
<http://www.surround.engelhard.com>

EPA biopesticides website:
<http://www.epa.gov/pesticides/biopesticides>
Latest information and news, with fact-sheets on individual biopesticides.

Pesticide Environmental Stewardship Program Website:
<http://www.pesp.org/>
A public/private coalition committed to reducing the risks from pesticide use. Risk-reduction strategies, information on least-toxic pest control, grants, news updates, links to IPM websites.

Organic & Low-Spray
Apple Production
<http://www.attra.org/attra-pub/apple.html>
Detailed info on IPM in Apples, featuring a chart of disease-resistant cultivars and an extensive Resources section with supplier contacts and sources of further information. A free print copy of this 38-page booklet is available by calling ATTRA at 800-346-9140.