

ORGANIC & LOW-SPRAY PEACH PRODUCTION

HORTICULTURE PRODUCTION GUIDE

Abstract: This publication describes the major diseases and insect pests of peaches and discusses organic or least-toxic control options for each. It emphasizes the considerable climatic differences between the arid West, which is relatively amenable to organic peach production, and the humid East, where it is very difficult to grow peaches without synthetic fungicides and insecticides. It profiles a successful organic peach grower in California, discusses new-generation synthetic pesticides, and introduces a model reduced-spray program for the East. The last section lists additional references, publications, and electronic information sites.



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Introduction

Peaches can be difficult to produce even under good conditions and with a full spray schedule. At least two key insect pests and several serious diseases present formidable obstacles to organic or low-spray production. Nevertheless, with proper management, resistant cultivars, and a good site, growers can greatly reduce—and in some cases eliminate—their reliance on synthetic pesticides. Because of new directions in research emphasizing biological and other alternative pest and disease controls, the future looks promising for low-spray and organic peach orchards.

Many considerations and practices are the same for both low-spray/organic and conventional peach growers. For instance, all growers need to make variety choices with cold hardiness and chilling requirements in mind. Also, pruning and training will be approximately the same for all kinds of culture. Information on these topics is available through traditional resource channels such as the Cooperative Extension Service, state peach production councils, orcharding texts, and trade magazines.

This publication focuses primarily on controlling insect pests and diseases. Organic approaches to managing fertility, weed control, and orchard-floor vegetation apply universally to most tree-fruit crops (apples, peaches, pears, cherries, plums). For general information on these organic orchard practices, see ATTRA's *Overview of Organic Fruit Production*.



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A Note on Terms

The term *low-spray* has no precise definition. It simply refers to a reduced synthetic-pesticide spray program relative to a region's prevailing conventional practices. For example, instead of 8 to 12 spray applications during a growing season, a low-spray program may consist of 2 to 4.

The terms *organic* and *organically grown* have precise legal definitions. Organic production and marketing of food crops is now regulated at the federal level. Before land can be certified organic it must be free of synthetic pesticides and commercial fertilizers for three years, and thereafter only approved organic pest-control and fertilizer inputs may be used. Producers who want to label or market their produce as organic must be certified by an agent accredited by USDA's National Organic Program. For more information, see the ATTRA publication *Organic Farm Certification & The National Organic Program*. **If your operation is certified organic or if you are seeking certification, check with your certifier before using any pest-control material mentioned in this publication (whether we describe it as "organic" or not) to confirm its acceptability for organic production.**

IPM, integrated pest management, *IFM*, integrated fruit management, and *pheromone-based* pest management are modern fruit production systems that pay close attention to best management practices and reduced pesticide use. IPM guidelines are being used 1) as a checklist for farmers to evaluate their on-farm pest management programs and identify areas where management can be improved; 2) to verify and document that IPM is practiced on the farm; and 3) as an educational tool that describes the scope and complexity of IPM to farmers, government officials, community groups, and the general public. In addition, IPM labeling has emerged as a "green" marketing strategy parallel to organic food channels.

Related ATTRA Publications

- [Overview of Organic Fruit Production](#)
- [Organic & Low-spray Apple Production](#)
- [Organic Pear Production](#)
- [Low-spray & Organic Plum Production](#)
- [Organic Grape Production](#)
- [Postharvest Handling of Fruits & Vegetables](#)
- [Insect IPM in Apples: Kaolin Clay](#)
- [Farmscaping to Enhance Biological Control](#)
- [Notes on Compost Teas](#)
- [Use of Baking Soda as a Fungicide](#)
- [Biointensive Integrated Pest Management](#)

Geographic Factors that Affect Disease and Pest Incidence

Geographic location and climate play a particular role in the incidence and severity of peach diseases and pests. Primary threats in one growing area may be of little concern in regions where the weather is drier, insects or diseases are not established, or the growing season is shorter. Resistant cultivars, especially those suited to a specific climate, can also reduce the impact of certain diseases.

The plum curculio, a key pest of many tree fruits, is not present west of the so-called "tree line" (running roughly from Fort Worth, Texas, through Fargo, North Dakota). The curculio's absence—coupled with reduced disease pressure in much of the arid West—facilitates organic peach production. The peach twig borer, however, is a greater problem west of the Rocky Mountains than in the East. Meanwhile, in the high-rainfall areas of the Pacific Northwest and coastal California, peach leaf curl is a common disorder.

Eastern growers must contend with plum curculio, bacterial spot, and increased incidence of fungal diseases. At present, commercial-scale organic production of peaches in the East would

be very difficult, largely because of the plum curculio and the brown rot fungus, which is endemic under wet, humid conditions. However, some of the new-generation pest control products discussed here can improve the opportunity for low-spray peach production in the East.

Eastern commercial-scale growers wanting to reduce the amount of pesticides sprayed on their peach crop can take some encouragement from studies conducted by Clemson University Cooperative Extension personnel. Results of this South Carolina research indicate that under proper management the number of annual sprays can be reduced from 12 to 6, resulting in a savings of almost \$50 per acre (1). Details of this management program are presented in the box “A Reduced Spray Program for Eastern Growers.”

Pest and disease problems that can be economically damaging for peach growers include brown rot, peach leaf curl, plum pox, bacterial spot, peach scab, peach mosaic virus, peach tree borers, peach twig borers, Oriental fruit moth, plum curculio, and tarnished plant bug. These problems are addressed below. Information on other pests and diseases of local or intermittent importance is usually available from regional Cooperative Extension publications.

A Reduced Spray Program for Eastern Growers

More than 15 years ago Clemson University Extension specialists Clyde Gorsuch and R. W. Miller reported research that would allow peach orchardists to cut the number of pesticide applications in half, from 12 to 6, provided they met certain criteria (1). Gorsuch and Miller’s basic principles are still relevant, and better fungicides available today might allow for reducing pesticide use even further.

Their criteria for a minimal spray schedule included:

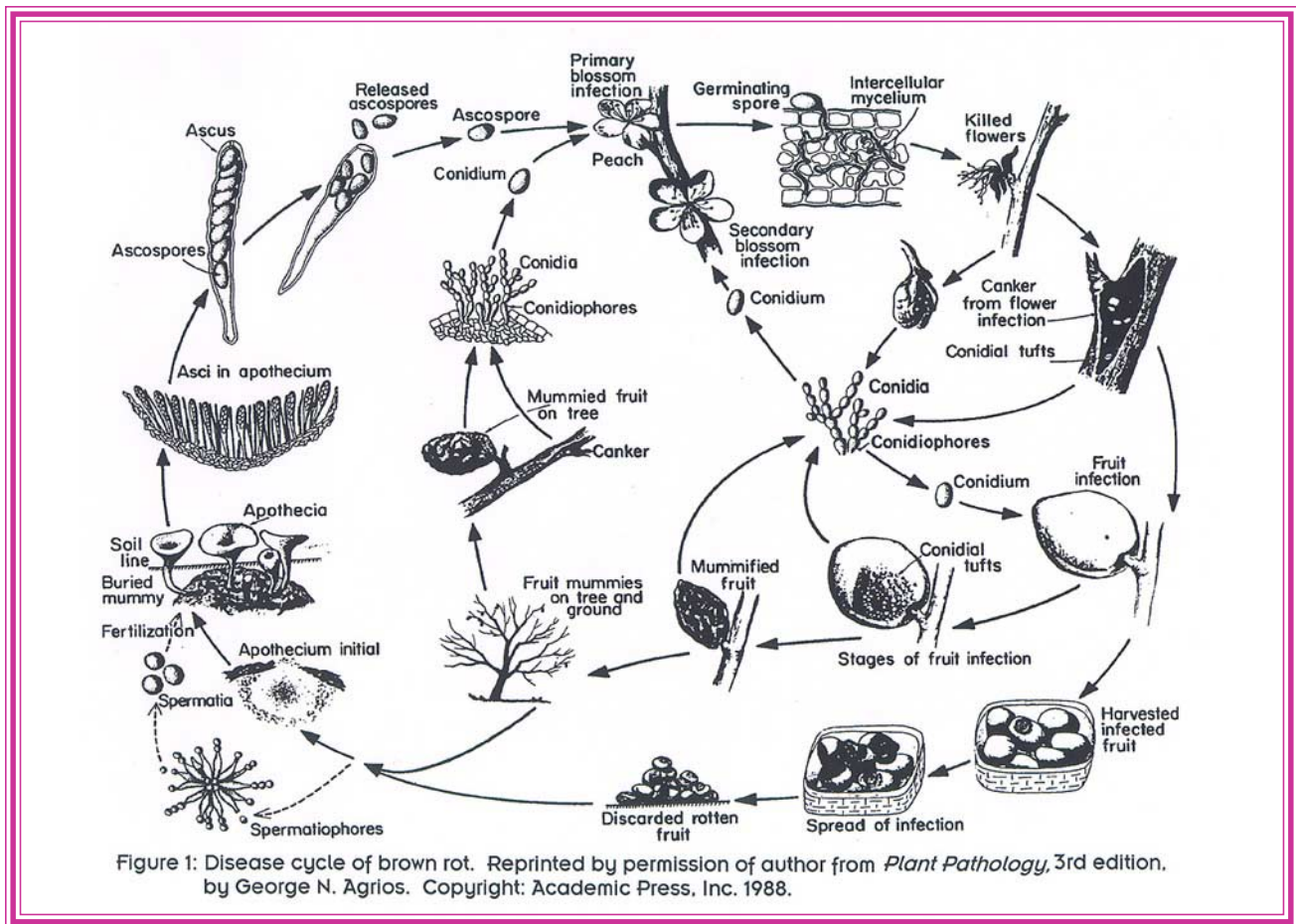
- All trees are sprayed thoroughly and applications carefully adjusted to the proper stage of plant development (e.g., a “petal fall” spray must be applied at petal fall);
- There are no sources of brown rot within a quarter mile (wild plums and unsprayed peaches are the main culprits to be eliminated);
- Anthracnose and powdery mildew are not a threat;
- Scab has been controlled in previous years;
- No resistance to Benlate or Topsin-M has been detected (newer fungicide options make this criterion a little less important than it was 15 years ago, though development of resistance to pesticides by pathogens must always remain a concern);
- The spray materials used are chosen according to weather conditions and disease development in the orchard;
- Weed control is excellent (unmown weeds and grass provide an ideal environment for spore production from peach mummies and provide habitat for catfacing insects like stink bugs); and
- Brush piles are destroyed before bloom.

A primary focal point of these criteria is sanitation in and near the orchard to remove sources of brown rot and of insects. Early-season sprays for plum curculio still have to be applied, and if diseases other than brown rot and scab are a problem, the producer may have to adjust the spray schedule accordingly.

The authors cautioned that this is an effective program for good managers *who are willing to scout the orchard on a weekly basis* for brown rot, scab, other diseases, plum curculio, oriental fruit moth, Japanese beetles, and other potential pests. If problems appear, prompt application of a pesticide will probably be required to avoid economic loss. *This reduced spray program should be attempted only when such prompt action can be applied when needed.*

BROWN ROT

When peaches are grown under the warm humid conditions conducive to fungal diseases, it can be difficult to forego the use of fungicides. Brown rot (causal organisms: *Monilinia fructicola* and *M. laxa*) is foremost among fungal diseases, and peach producers struggle with it continually, as it affects both fruit yield and quality, and infests blossoms, twigs, and fruit in all stages. Brown rot is less prevalent west of the Rocky Mountains than in the East, but even in the West brown rot can be troublesome in seasonably wet or foggy microclimates.



Life cycle information on brown rot is presented in Figure 1. Ideal conditions for infection arise during warm rainy periods (70–77°F is optimum). Brown rot occurs as blossom blight early in the growing season. Two to three weeks before harvest it infects the fruits as they soften and ripen, causing rot both at harvest and in storage—some of the infected fruit may not display symptoms until after harvest. Blossom blight during bloom is an indicator for extensive brown rot infections later in the season, although a wet year can produce heavy infections of brown rot from

residual inoculum present in cankers and fruit, even without blossom blight (2).

In the East, control of brown rot is complicated not only by higher rainfall and humidity but also by increased levels of insect feeding, which spreads the inoculum and opens the fruit to infection. Moreover, the presence of alternate hosts such as wild plums and other wild *Prunus* species can further aggravate the situation. Under such conditions, commercial-scale organic production of peaches is currently extremely difficult.

Control of brown rot involves the integration of several tactics. Cultural practices and orchard sanitation are the first line of defense. Planting-site selection and pruning are critical to providing sufficient air circulation within the canopy. Good air circulation through the tree facilitates rapid drying of the foliage and flowers after rain or overhead irrigation. Thinning branches to open the center of the tree is a good practice—this can be done in July, as well as during the regular dormant-season pruning. Orchard sanitation practices include pruning and removal of infected twigs and cankers and disposal of dropped, culled, or mummified fruit.

University of California researchers determined that excessive nitrogen fertilization increases fruit susceptibility to brown rot (3). They also found that pre-harvest sprays of calcium reduced brown rot infection over non-sprayed trees but were not equal to fungicidal control.

Organic growers have traditionally relied on sulfur to control brown rot. The first application of sulfur should be done at the “pink” stage, just before the petals open. This should be repeated at seven-day intervals, especially if rain occurs, for a total of three applications. Two other applications should be made—one at petal drop, the other at sepal drop (usually about 10–14 days after petal drop). The crop is still susceptible to infection later in the season, but treatments during the early “critical” stage will reduce the amount of crop loss without leaving a sulfur residue at harvest. When the weather is hot and dry, the need to spray is not as great.

A promising organic control strategy for brown rot, according to Dr. Michael Glenn at USDA’s Appalachian Fruit Research Station in Kearneysville, West Virginia, is to combine sulfur with Surround™ WP Crop Protectant. Derived from processed kaolin clay, Surround is an OMRI- (Organic Materials Review Institute) approved pest control product shown to control or suppress certain insects and diseases. The mechanism by which Surround suppresses powdery mildew, sooty blotch, fly speck, and fire blight (but not scab) in *apples* is thought to involve one or several of the following mechanisms: 1) physical separation of propagules from the plant surface, thus interfering with chemotactic responses required for infection; 2) physical abrasion of the hyphae leading to ineffective infection; 3) physical dilution of nutrients at the plant surface that reduces the vigor and

growth rate of the pathogen; and 4) removal of propagules from the plant surface through erosion of the particle film (4).

Carl Rosato of Woodleaf Farm near Oroville, California, received funding from the Organic Farming Research Foundation (OFRF), the Kokoro Foundation, and the University of California, to test “natural” anti-fungal substances on his 3-acre peach orchard during the 1992–’94 growing seasons. The substances included compost tea, hydrogen peroxide, kelp sprays, grapefruit seed extract, rock dusts, a pink mucoid yeast, copper fungicides, vinegar, and combinations of these. In descending order, better control was obtained with : Algrow kelp mixed with basalt rock dust (55% marketable fruit); Algrow kelp alone (42%); compost tea + pink mucoid yeast (41%); hydrogen peroxide + pink mucoid yeast (40%); and so forth. Rosato’s full research report, *Peach Brown Rot Control* (OFRF Grant 92-96), is available on the OFRF website (5).

In 2002, Rosato provided ATTRA with an update on his brown rot control strategy. First, it is helpful to understand that the part of California where his farm is located has a Mediterranean climate—a wet winter season alternating with a dry warm growing season—which is ideal for fruit production. Secondly, Rosato grows about 45 varieties of peaches selected for fresh-market quality as well as brown rot resistance.

For brown rot control, Rosato relies primarily on a spray mixture of micronized sulfur + rock dust (e.g., Azomite™). However, for a dynamic foliar spray that provides both nutritive and pest-control benefits, Rosato likes to blend a foliar “brew” for all pre-bloom, bloom, and post-bloom sprays. A common tank mixture (per acre) may include: 6–8 lbs Azomite; 5–15 lbs micronized sulfur; 5 lbs soluble potassium sulfate; 1 lb Solubor™ (boron); 5 lbs kelp; and a yucca extract for a sticker. For the pre-bloom spray, he adds copper specifically for brown rot control. When peach twig borer is present, he adds B.t. (e.g., Dipel™). Bloom sprays begin at one-third bloom and proceed every 5–7 days all the way through petal fall, for a total of 3–4 sprays altogether. Post-bloom sprays depend on the weather. When rain or humidity approaches, he religiously applies a brew spray as a prophylactic *before* weather arrives, again every 5–7 days depending on environmental conditions. Brown rot pressure decreases dramatically when it is hot and dry—around 85–90° F.

Rosato, who is also a soil consultant, emphasizes that nutrition is a fundamental aspect of orchard management. He follows the Albrecht approach to mineral balancing and soil management, paying attention to calcium-magnesium ratios, optimum micronutrient levels, and soil organic matter. For example, he applies 6 tons of compost per acre each year at the beginning of the growing season. He also feels the potassium and boron components of the brew mix contribute to brown rot control.

The Organic Farming Research Foundation also funded studies at Oregon State University, conducted by Hans Wittig and Dr. Jay Pscheidt between 1992 and 1995, that looked at anti-fungal properties of aerated compost tea, seaweed extracts, micronized sulfur, a yeast (*Aureobasidium pullulans*), and M-Pede™ insecticidal soap. Of these, insecticidal soap, sulfur, and a yeast + seaweed mixture were most effective in suppressing peach brown rot in the wet spring and arid summer conditions of western Oregon. A synopsis of Wittig's research is available on the OFRF website (6).

A new biofungicide, Serenade™ (*Bacillus subtilis*, QST 713 strain), has demonstrated laboratory and field control of brown rot in California, but is not yet labeled for peaches. Serenade is a broad-spectrum preventive product registered for cherries, grapes, apples, pears, walnuts, hops, and vegetables. Diseases targeted include gray mold, powdery mildew, downy mildew, and sour rot. Serenade is OMRI approved for organic production, and organic peach growers are especially interested in the product. For more information on Serenade, see the AgraQuest website <<http://www.agraquest.com>>.

A demonstration project in Fresno County, California, that was assessing the impact of composted yard trimmings in a commercial peach orchard found that composted green material not only compared favorably to other fertilizing materials tested, but may also suppress brown rot in peaches (7).

Harvested fruit is also susceptible to brown rot infection. To prevent infections at harvest and during storage, peaches should be picked and handled with care to avoid punctures and skin abrasions on the fruit. Any damaged fruit should be discarded, since wounds facilitate entry of the fungus. Rapid cooling or hydrocooling to remove field heat prior to refrigeration at 0° to 3° C. will also help reduce infection (1).

Hot water treatments hold some promise for post-harvest control of brown rot. The hot water treatment takes two basic forms, mist or dip. In both cases the water is 50–52° C (approximately 122° F), but the mist treatment lasts approximately 15 minutes, while the dip lasts only 2–4 minutes. Chlorinated water can be used, and some additional chlorine added to help prevent post-harvest diseases, but note that organic certification standards in California permit a maximum of 10 ppm residual chlorine downstream of the product wash step. For additional information, *Postharvest Handling for Organic Crops* is available from the University of California Division of Agriculture and Natural Resources (publication 7254) <<http://anrcatalog.ucdavis.edu>>.

Peach cultivar resistance to brown rot is not highly developed, yet some differences do exist. For example, see the table on peach cultivar susceptibility to brown rot fungus at the Kearneysville Tree Fruit Research and Extension Center (West Virginia University) website <<http://www.caf.wvu.edu/kearneysville/tables/brownrotsus.html>>.



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Farmer Profile: Carl Rosato, Organic Peach Pioneer

(Excerpted by permission from “Woodleaf Farm” in the Winter ‘97–‘98 edition of *California Certified Organic Farmers* newsletter; for subscription information call 831-423-2263 or see the CCOF website at <<http://www.ccof.org>>)

If Carl Rosato ever decides to erect a sign at the entrance to his Woodleaf Farm, it should read “Home of the Pampered Peach.” Tucked onto a hillside near Lake Oroville [California] are three and a half acres of Carl’s trees, producing peaches with a near-legendary flavor.

Carl’s fertility program would make any tree happy. When preparing a new orchard site, he starts with 50 tons per acre of organic matter, then adds limestone, gypsum, and kelp. For established trees, he applies six tons per acre of compost in the fall, and more in the spring if it’s been a wet winter. “After the heavy rains, the poor guys want to eat,” he says affectionately.

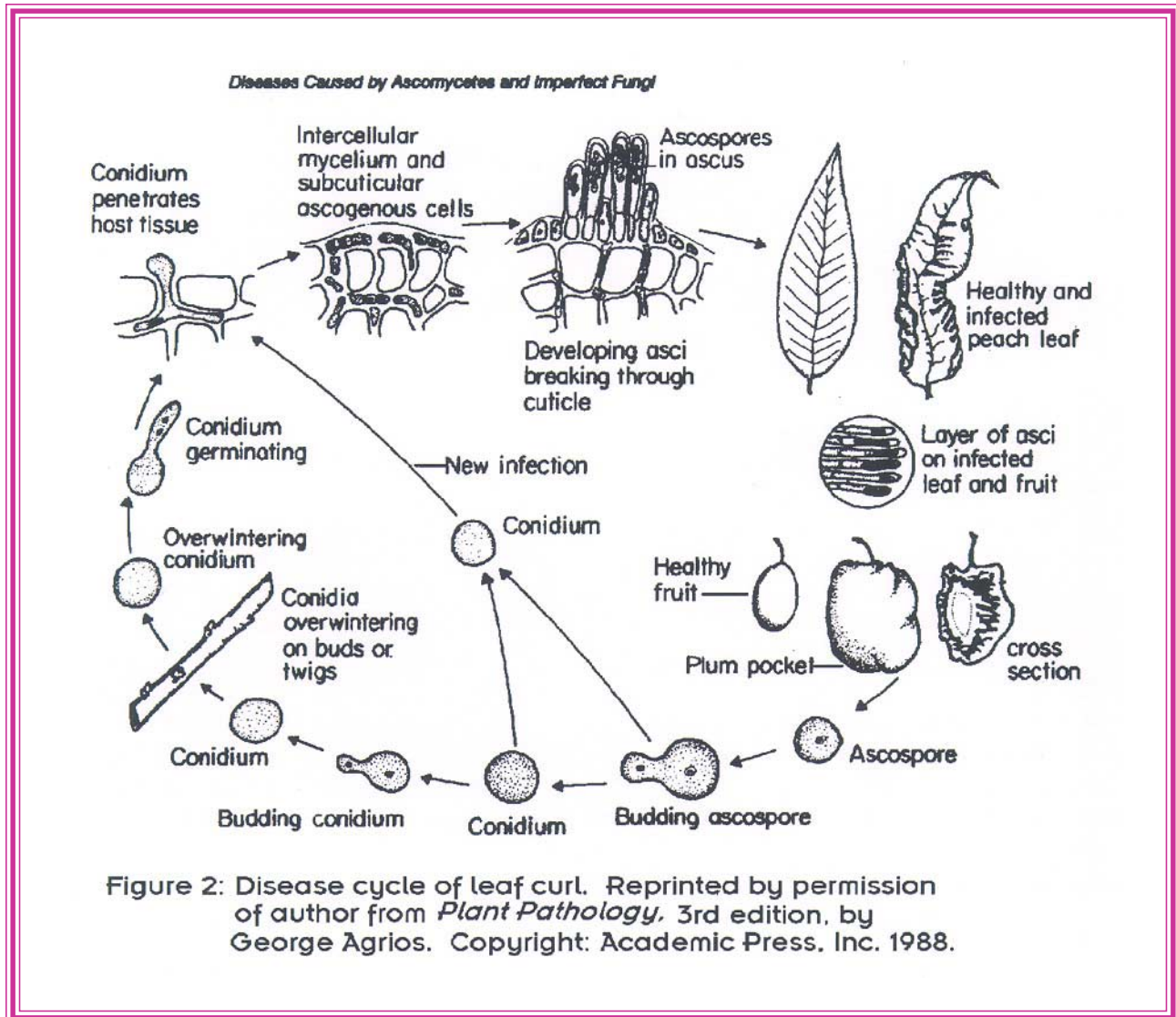
Carl also makes aerobic compost tea in a 3,000 gallon “brewer.” A circulating system pumps water through 1,500 pounds of compost suspended above the vat, so that plenty of air is introduced into the mix. Diluting 100 gallons of the brew into a 250 gallon sprayer, he foliar feeds each acre every ten days. “Then you’ve got it made,” he says. “You’ve got the soil fertility and you’re feeding them all the time—of course, you’re going to get good results.”

Farmers’ market shoppers throughout northern California agree. Carl commands top dollar for his product, working a staggering eleven markets per week in Berkeley, Marin, Sacramento and Davis. A master of understatement, he concedes that, “It gets a little intense during the peak ten weeks of summer.” After eleven years he knows many of his customers by name and acknowledges that their willingness to pay a premium price allows him to make a good living from three acres of trees.

Although there are few disease problems on the farm, Carl battles brown rot in some years. He’s experimented with different foliar sprays, including rock dust, sulfur, and kelp, and feels that rock dust works as well as anything. Peach twig borer is controlled with applications of Dipel (Bt) at bloom and with pheromone twist ties later in the summer. He worries about gopher control now that strychnine bait is no longer allowable by CCOF rules, and plans to install barn owl boxes to augment his trapping efforts.

PEACH LEAF CURL

Peach leaf curl, caused by the fungal organism *Taphrina deformans*, is a common disorder in peach and nectarine orchards, especially during wet springs. Infected leaves become misshapen, deformed, and necrotic, resulting in premature defoliation with subsequent re-sprouting of new leaves. This kind of stress reduces fruit yield and predisposes the tree to pest attack. Some “tolerance” to peach leaf curl exists in the Redhaven series of peach cultivars, but none are truly resistant.



The life-cycle diagram in Figure 2 shows that the infection period for leaf curl is when new leaves start emerging from buds in the spring. Spraying after the buds have opened is ineffective, because infection takes place as the young leaves emerge, and the fungus develops inside the leaf.

Accordingly, sprays must be applied during the trees’ dormant period – after the leaves have fallen and before the first budswell in the spring.

Many orchardists spray just prior to budswell during the months of February and March. Orchards with a history of severe peach leaf curl benefit from a double application: in the autumn at leaf fall and again in late winter or early spring just before budswell.

Fortunately for the organic grower, lime sulfur – one of the most effective fungicides for control of peach leaf curl – is allowed in certified organic production. Bordeaux and copper fun-

gicides – also approved for certified organic programs – are effective as well, but not as effective as lime-sulfur.

Pscheidt and Wittig (6) performed trials comparing Kocide™, lime-sulfur, several synthetic fungicides, and Maxi-Crop™ seaweed for leaf curl control. Lime-sulfur and one of the synthetics (ziram) were best, roughly twice as effective as Kocide. Seaweed sprays, despite positive anecdotal reports, were completely ineffective.

Severe leaf curl infection can cause the tree to shed many of its leaves and to replace them with a second flush of growth. At this time the tree will benefit from a light feeding with a quickly-available soluble fertilizer such as compost tea or fish emulsion to help it recover.

There are various levels of resistance to leaf curl among varieties; however, because of the relative ease of controlling the disease, breeding for resistance has not been a priority. Redhaven, Candor, Clayton, and Frost are some of the cultivars with resistance to leaf curl, though none is immune. In contrast, Redskin and cultivars derived from it are susceptible.

Pest Control Products in Organic Production, The OMRI List

OMRI is the Organic Materials Review Institute. It provides a technical review of organic crop production materials (fertilizers and pest controls) supplied by manufacturers to determine compliance with certified organic standards. Products that receive an Allowed or Regulated status may use the “OMRI Listed” seal on packaging and in literature.

The Brand Name Products List on OMRI’s website includes crop production materials organized alphabetically by Generic Material, Supplier, and Product. Farmers looking for pest-control products in organic production will find that the OMRI List is a helpful starting point.

OMRI’s Brand Name Products Lists
Organic Materials Review Institute
http://www.omri.org/brand_list.html

PLUM POX

In October 1999, the presence of plum pox, or Sharka Virus, was confirmed in Adams County, Pennsylvania – the first outbreak in North America. The disease has since been found in Cumberland County, PA, and in Canada. This has caused much concern among producers, because plum pox is an exceptionally destructive disease of stonefruit. Infected fruit are unmarketable because of spots and ring blemishes, and fruit may also drop prematurely. Plum pox is transmitted either by aphids or by grafting. The disease was not found in nursery stock, and an ongoing quarantine has apparently contained the outbreak of plum pox to a limited area, although testing continues.

BACTERIAL SPOT

The tell-tale symptom of bacterial spot (caused by the bacterium *Xanthomonas pruni*) is small light-brown lesions on leaves. Eventually the affected tissue falls out, leaving a characteristic shotgun-hole appearance. Severe bacterial spot infections may cause premature defoliation and subsequent re-sprouting, similar to peach leaf curl. Bacterial spot on fruit occurs as sunken, dry lesions that eventually crack, opening the fruit for secondary infections and reducing fruit quality. Selecting disease-resistant cultivars is the principle means of controlling bacterial spot. See the table on peach cultivar susceptibility to bacterial spot at the Kearneysville Tree Fruit Research and Extension Center (West Virginia University) website: <http://www.caf.wvu.edu/kearneysville/tables/bspotsus.html>.

Fortunately for organic growers, copper fungicides – unique in that they also function as bactericides – are recommended for control of bacterial spot. The first spray should be applied before the tree leafs out in the spring; this timing often allows copper-based peach-leaf-curl sprays to double for bacterial spot treatment. The next period when infection pressure is heavy is petal fall and three weeks thereafter. Additional spray coverage may be necessary depending on varietal susceptibility and humid weather conditions.

Since the occurrence and severity of bacterial spot depend on moisture, it is rarely a problem west of the Rocky Mountains, and in the East growers are able to rely on resistant varieties as the best line of defense. Contact the Coopera-

tive Extension Service for resistant varieties suited to your region.

PEACH SCAB

Peach scab is caused by a fungus (*Cladosporium carpophilum*) that overwinters in twig lesions. Splashing rain spreads the fungal spores to young fruit and new shoots. Scab symptoms include small dark-green spots on the immature fruit. As the fruit matures, the spots enlarge and turn brown, and may cause the fruit skin to crack. Sulfur and most other fungicides that are applied for brown rot will also control peach scab. There are no resistant cultivars. Pruning to improve air circulation and reduce wetness in the tree can help manage the fungus and prevent twig infection.

PEACH MOSAIC VIRUS

First identified in the United States in 1931, peach mosaic virus has since appeared in a number of western states. Spread by grafting and the peach bud mite, the disease results in delayed and rosette foliation, low fruit production, and deformed fruit. The disease has largely been controlled in the United States through quarantines and destruction of infected trees (9). In areas where peach mosaic virus quarantines have occurred there may be restrictions on planting susceptible cultivars.

OTHER DISEASES

Root and crown rot diseases like *Phytophthora*, *Verticillium*, and *Armillaria* are important when choosing planting locations and rootstocks. Other peach diseases that may be significant, depending on grower location, include peach rust, powdery mildew, and shothole fungus. Bacterial canker can also affect peaches, though research shows that hedgerows can provide a protective barrier for organic orchards (10).

*New-generation fungicides:
Safer and more effective*

Concerns about the toxicity of fungicide and pesticide residues on food have prompted re-

search that is yielding a new generation of safer and more effective fungicides. Some of these new fungicides are noteworthy because they meet guidelines for certified organic production. Other fungicides, though not permitted in organic programs, are based on new types of chemistry and biology that are seen as improvements over older fungicides.

“Organic” fungicides

New-generation fungicides approved for organic production are mostly microbial antagonists—they consist of “good guy” fungi, yeasts, and bacteria that suppress “bad guy” plant pathogens. Among the microbials, one of the most promising introductions is Serenade™, a product of AgraQuest, Inc. <<http://www.agraquest.com>>. The active ingredient in Serenade is a bacterium, *Bacillus subtilis*, QST 713 strain. This microbe inhibits germination of plant pathogen spores and restricts their growth once established through a number of biocontrol mechanisms. Though Serenade is not currently labeled for peaches, future developments may result in a new tool for peach growers.

In addition to biofungicides, other disease control products that may be used in organic production include fungicidal soaps, copper and sulfur fungicides, peroxides, and botanicals (products derived from plants). Because botanicals break down quickly, they are less persistent in the environment. This makes them more challenging to use—the grower must time applications very carefully, and in some cases make them more frequently. This can be a significant cost consideration since botanicals are generally more expensive than synthetic pesticides. Also, botanicals—particularly when frequently applied—can harm beneficial insects.

One of the most commonly used botanicals is Rotenone, derived from the roots of Southeast Asian and Central and South American plants. It is somewhat effective against a large number of insect pests, including the plum curculio and tarnished plant bug. Other botanical include:

- Azadirachtin, also called neem, derived from the seeds of the African and Asian neem tree. Field testing on single-tree plots in 2000 showed that it significantly reduced damage from certain insects including tarnished plant bug and oriental fruit moth (8).

- Sporan™, an OMRI-approved rosemary-oil-based fungicide developed by EcoIPM <<http://www.ecoipm.com>>. It's labeled for tree fruits, soft fruits, and vegetables, with activity for powdery mildew, botrytis, and late blight.
- Trilogy™, an OMRI-approved neem-based botanical fungicide from Certis <<http://www.certisusa.com>>. It's labeled for brown rot and shothole in tree crops, and for powdery mildew and Botrytis in wine grapes.
- OxiDate™, a hydrogen dioxide disinfect material with peroxide chemistry from BioSafe Systems <<http://www.biosafesystems.com>>. It's labeled for brown rot control on peaches, among other crops and diseases.

Although these compounds appear promising, field efficacy data are lacking for many of these new products.

Newer, safer synthetic fungicides

New classes of fungicides include strobilurins and phenylpyrroles, which were both initially discovered in nature (though fungicide formulations are synthesized analogs). Strobilurin, for example, was first isolated from wood-decaying European strobilurin mushrooms, while phenylpyrroles were first found in bacteria. The strobilurin fungicides Abound™ (azoxystrobin) and Flint™ (trifloxystrobin), and the phenylpyrrole fungicides Medallion™ (fludioxonil) and Scholar™ (fludioxonil), exhibit good activity against brown rot in peaches. Because these fungicides have low mammalian toxicity and short persistence in the environment, the EPA has classified them as reduced-risk pesticides.

The sterol inhibitors are the next class of new fungicides. They include Elite™ (tebuconazole), Indar™ (fenbuconazole), Nova™ (myclobutanil), and Orbit™ (propiconazole), all of which are registered for peaches and exhibit excellent brown rot control, yet boast very low mammalian toxicity. However, the nature of their mode of action predisposes them to development of resistance by the pathogen. One way to avoid this resistance is to rotate fungicide use among different chemical classes—for instance, alternate sprays of a strobilurin with a sterol inhibitor.

Insect Pests

PEACH TREE BORERS

The peach tree borer (*Synanthedon exitiosa*) and lesser peach tree borer (*S. pictipes*) can be major pests of peaches. Borers feed on the inner bark of trees, where they may kill the tree by girdling or cause the bark to peel away, exposing the tree to other pests and diseases. Other hosts for the borers include wild and cultivated cherry, plum, prune, nectarine, apricot, and certain ornamental shrubs of the genus *Prunus*. The adult peach tree borer is a clearwing moth, steel blue with yellow or orange markings. The moths are day fliers and can easily be mistaken for wasps.

These insects overwinter as larvae in burrows at the base of the host tree. Because the eggs are laid over a long period of time, the larvae vary greatly in size. Some are more than a half-inch in length, while others are very small, not more than an eighth of an inch long. The larvae pupate in the trunk of the tree, and usually begin to emerge as adults in June. Adult emergence and egg-laying occur from June through September, peaking during August.

The females are attracted to trees that have previously been damaged by borers, or to which some mechanical injury has occurred. Therefore, it is important to prevent damage to the tree trunk in order to minimize borer attack. Trees in poor vigor because of weed competition or drought stress also seem to be more susceptible to borer attack and damage.

Peach growers seeking to reduce pesticides can use a variety of tactics to control this pest. Interior white latex paint, painted or sprayed on the base of the trunks, provides a physical barrier, inhibiting newly hatched larvae from entering the trunk. The paint also fills cracks in the bark, the preferred site for oviposition and larval feeding. Because the paint is more a deterrent than a perfect control, some of these growers mix rotenone in with the paint; no data have been collected to verify that the rotenone increases the paint's efficacy. According to OMRI, use of latex paint is not allowed in organic production systems.

It is easy to detect a tree that is infested with peach tree borers, since large amounts of gum exude from the damaged areas. The grower can

use this exudate to locate a larva, and then kill it by using a knife or flexible wire to probe it out of the trunk. The soil should be removed from around the base of the tree to a depth of three inches before starting this process, since larval damage also occurs under the soil line. This method of control is feasible for small plots but probably not practical in a commercial orchard.

The bacterium *Bacillus thuringiensis* (B.t.) can be used to control the larvae before they have entered the trunk. The products Dipel™, Thuricide™, and Javelin™ are formulations made from this organism. Because B.t. does not have a long residual effect, the trunk should be sprayed weekly with one of these materials during the period of peak moth flight, late July through August.

A biological control, the commercially available insect-parasitic nematode *Steinernema carpocapsae*, has also been used to successfully manage peachtree borers, when applied as a lower-trunk drench in warm spring or fall weather (11).

PEACH TWIG BORERS

The peach twig borer (*Anarsia lineatella*) is only a minor pest in the eastern U.S., but it's a significant problem in Texas and the West. The larvae emerge in the spring and then bore into twigs and buds before pupating into dark gray moths. Later generations of larvae attack maturing fruit during the summer, entering fruit near the stem end and rendering it unfit for sale.

Treatment after borers have entered the tree is much less effective than treatment during the dormant or bloom period. Peach twig borers are usually not a problem in orchards that are sprayed each year at the delayed dormant period with lime-sulfur or with a 3% oil emulsion.



Minute pirate bug

Two to three *Bacillus thuringiensis* sprays at bloom also appear to be effective against the twig borer.

The peach twig borer has many natural enemies and parasites, including the parasitic wasps *Paralitomastix varicornis*, *Macrocentrus ancyliovor*, *Euderus cushmani*, *Hyperteles lividus*, *Erynnia* species and *Bracon gelechia*, as well as the grain mite *Pyemotes ventricosus*. The California gray ant, *Formica arrata*, can be beneficial when it preys on peach twig borer, but it unfortunately also protects aphids and scales (12). Other predators of the peach twig borer include lacewings, ladybugs, and minute pirate bugs. These insects can be attracted to the orchard by habitat plantings, cover crops, and hedgerows. The ATTRA publication *Farmscaping to Enhance Biological Control* provides information on this topic.

Mating disruption can also be effective if properly implemented (see the box, "Pest Control with Pheromonal Mating Disruption.")

Pest Control with Pheromonal Mating Disruption

Many growers use mating disruption with sex pheromones—chemicals naturally produced by insects as a means of communication—as part of an overall IPM program. Specific pheromones are available, in various types of dispensers, to control peach twig borers, peach tree borers, and Oriental fruit moths. The most common dispenser is a twist-tie that's attached to the upper limbs of orchard trees. During the mating period, female insects release pheromones that signal their location to males. By releasing quantities of these pheromones into the orchard, the grower can confuse and disrupt the insect's mating cycle. Efficacy is greatest in orchards that have low moth populations and are not close to other untreated peach or almond orchards. In order to work, the system must be applied as evenly as possible to areas at least three acres in size. Small orchard size and uneven orchard terrain will limit the success of mating disruption.

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Place pheromone dispensers in orchards according to state Cooperative Extension recommendations or when moths are first caught in pheromone traps. Correct timing during the pest life cycle is crucial in applying the pheromone confusion products effectively.

Monitor the orchard regularly to identify which species is emerging and when. It is also important to identify the time of second flight emergence for the peach twig borers, as well as the second flight of Oriental fruit moths, so that treatment can be renewed at the most effective time. Regular monitoring also verifies that the system is working and alerts the grower if additional or alternative treatment is needed.

Mating disruption twist ties or lures for either the peach twig borer or Oriental fruit moth are available through Peaceful Valley Farm Supply (13) or Harmony Farm Supply (14). Pacific Biocontrol Corporation (15) makes pheromone disruptors for peach tree borers. Its Isomate pheromone-based management systems are distributed through independent agricultural chemical dealers. In research trials, new high-dosage, low-density microsprayers and “puffers” have shown promise as a means of dispensing pheromones with improved consistency and less labor compared to the twist-tie system.

ORIENTAL FRUIT MOTH

The Oriental fruit moth (*Grapholitha molesta*) is related to the codling moth, a pest of apples, and causes the same type of fruit damage. Larvae burrow in the new shoots in the spring, then move through the stem into the developing fruit. They feed near the pit, so there may be no visible damage to the fruit on the surface, but the fruits become much more susceptible to brown rot, and they break down rapidly after harvest.

There are up to seven generations of worms each year, with the earliest one feeding on young leafy shoots in the same way the peach twig borer does, and later ones feeding on the fruit, like the codling moth in apples. The overwintering stage is a full-grown larva from the last generation of the previous season. The larva spins a cocoon in the litter around the trees or on the bark itself. Pupa-tion and adult emergence occur in the spring, and the moths lay their first eggs just after the peaches bloom. Trees that are allowed to grow dense succulent foliage are especially attractive to the moths.

Control measures begin with planting the right peach varieties. Early-maturing types discourage damage because the peaches are picked before the insects attack the fruit. This reduction in the moths’ food supply helps control their population. Remove infected fruit and stem tips to further reduce populations. Good orchard sanitation—removing leaf litter and dropped or culled fruit where larvae overwinter—will further reduce attacks. Dormant larvae can be destroyed by cultivating to a depth of 2–4 inches, 1–3 weeks before the peaches bloom. Another part of cultural control is annual pruning to control overly vigorous growth on the trees, making them less attractive to the moths.

Parasitic braconid wasps can be used as part of an IPM strategy against the Oriental fruit moth. Growers have had success with five releases of adult wasps four days apart, beginning in May and using about 500 adults per acre. To effectively control the moth, some growers supplement a parasitic insect program with a single spray of rotenone shortly before harvest.

Pheromone-based mating disruption systems for Oriental fruit moth have been available for several years. One product, the Isomate-M™ pheromone dispenser, has proved as effective as chemical control in California tests. See the box “Pest Control with Pheromonal Mating Disruption.”

Degree-day models or charts can help growers in timing pesticide application or placement of mating disruption lures to coincide with the emergence of the pest. Many state Extension offices or universities provide such tools developed specifically for their regions.

Surround™ WP Crop Protectant is a relatively new organic tool that is effective against codling moth. It is discussed in the next section.

PLUM CURCULIO

Another insect that frequently attacks peaches east of the Rocky Mountains is the plum curculio (*Conotrachelus nenuphar*). This pest is especially difficult to control organically. No effective attractant traps or selective monitoring tools are currently available for detecting this pest, though promising research on plum curculio traps is ongoing (16). Thus, biological monitoring is more difficult than for other insects and is more labor-intensive.

Visual observation of adult beetles and their crescent-shaped oviposition marks is the best technique available for detection. Since the plum curculio moves into orchards from woodlots, fence rows, or hedges during bloom, it is important to carefully check trees along the perimeter of the orchard. Observations in nearby abandoned orchards or other groups of trees will help to determine when intensive monitoring should begin in the commercial orchard.

Peach producers may have to employ a variety of strategies to control the plum curculio. Dr. Ron Prokopy, an entomologist at the University of Massachusetts, has been developing low-spray fruit production techniques for more than two decades (17). He uses 2–3 sprays of the synthetic pesticide Imidan™. If he does not spray, he experiences at least some damage on 80–99% of his fruit.

A 5% formulation of the botanical insecticide rotenone provides some control of the plum curculio. However, coverage must be very thorough, and applications made at roughly weekly intervals for a total of 12 to 15 treatments to keep crop damage under 25% (18). Such frequent treatments with rotenone are costly and can be detrimental to beneficial organisms.

Surround™ WP Crop Protectant, derived from processed kaolin clay, is an OMRI-approved organic pest control product shown to be effective for control of plum curculio. Developed by Drs. Michael Glenn and Gary Pertuka with USDA-ARS in Kearneysville, West Virginia, in cooperation with the Englehard Corporation, Surround is unique in that it provides pest control through particle film technology rather than toxic chemistry. Particle films deter insects by creating a physical barrier that impedes their movement, feeding, and egg-laying.

In addition to plum curculio, Surround suppresses Oriental fruit moth, stinkbug, tarnished plant bug, rose chafer, and Japanese beetles that attack tree fruits. Further details on the use of kaolin clay in fruit production can be found in the ATTRA publications *Insect IPM in Apples: Kaolin Clay* and *Kaolin Clay for Management of Glassy-winged Sharpshooter in Grapes*, as well as at Dr. Michael Glenn's website (19).

Several cultural control methods can be employed against the plum curculio, but none alone or in combination provides a cost-effective level of control for the commercial orchard. Fruits that are infested with curculio larvae normally drop from the tree before the larvae complete their feeding. Therefore, prompt gathering and disposal of these fruit drops – before the larvae leave them to enter the soil – reduces the number of first-generation adults. Sometimes the fruit that drops in May contains very few curculio larvae; in these cases the drop may be a result of heavy fruit set, poor pollination, or both. Examine a sample of the drops to determine whether enough are infested to justify quick disposal. The drops on the two or three outside rows of the orchard are more likely to be heavily infested than those farther inside the orchard. Carefully destroy the infested drops.

The adult beetles can be knocked from trees by using a padded board to jar the limbs. They “play dead” when frightened, and will drop from the tree and land on a tarp or sheet placed below. This practice should be done early in the morning, while it is still cool, or the beetles will fly away. Curculios caught in this manner can be crushed or dropped in a can of kerosene. The grower can encourage free-ranging fowl such as chickens, ducks, and geese to scratch for the larvae and beetles by mixing wheat seed into the soil under the trees. However, such methods by themselves do not provide commercial levels of control.

Disking during the pupal period is a mechanical control method. In its pupal form the plum curculio is very fragile. If the pupal cell is disturbed it fails to transform into an adult. Pupation usually occurs within the upper two inches of soil. The most desirable time to begin cultivation for destruction of pupae appears to be about three weeks after the infested fruits start to drop from the tree. Cultivation should be con-

tinued at weekly intervals for a period of several weeks. Cultivation before the curculios pupate is of little value. If the pupal cell is broken before pupation occurs, another cell is made by the larva. Covering the drops with soil before the larvae emerge from them is undesirable since it protects the larvae from drying in the sun.

Although whole-orchard cultivation is moderately effective in controlling the curculio, historically it was also responsible for severe erosion and loss of soil organic matter. It is a non-chemical means of curculio control, but its soil-degrading effects make it unsustainable in most situations.

TARNISHED PLANT BUG

Tarnished plant bugs, lygus bugs, and stink bugs are insects that pierce and feed on young fruit, causing depressions known as “catfacing” in the mature fruit. The best cultural control for these insects is orchard sanitation and groundcover mowing before bugs arrive, to keep the growing area free of weeds and ground debris that house these insects. An alternative strategy is to use habitat plantings that attract these bugs as well as their predators. Keeping the habitat watered and lush may keep the bugs from migrating to the crop. Predators of these pests include big eyed bugs, damsel bugs, assassin bugs, and collops beetle, as well as the egg parasite *anaphes ioles*. In addition to these potential controls, botanicals such as rotenone and neem appear effective against tarnished plant bug.



Adult lygus bug

OTHER PESTS

Other pests that may directly or indirectly affect peach crops, and whose severity varies depending on location, include Japanese beetle, Western flower thrips, and mites. Infestations of these insects and mites can reach levels that have an economic impact on the crop. Aphids and scale can also be major pests, particularly for organic growers in the West. Nematodes are another potential pest; nematode-resistant rootstocks are available.

Conclusion

Intense disease and insect pressure make peaches one of the most difficult tree fruits to produce organically. In parts of the arid West, commercial organic peach production is feasible when the grower adequately addresses brown rot, peach twig borers, and Oriental fruit moth.

In most of the East, commercial-scale organic production is greatly complicated by the plum curculio and brown rot. However, with new pest management tools – Surround™, Sporan™, Trilogy™, OxiDate™ – organic peach production is far more plausible than just a few years ago. Meanwhile, low-spray production with limited use of the least-toxic synthetic inputs is a proven alternative for eastern growers.

References

- 1) Agrios, George. 1978. Plant Pathology. Academic Press, Orlando, FL. p. 311-316.
- 2) Brannen, Phillip, and Guido Schnabel. 2002. Management of preharvest and postharvest brown rot of peach in the Southeast. Southeastern Regional Peach Newsletter. May. p. 5.
- 3) Burnham, T. J. 1994. UC researchers find dicloran alternatives for stone fruit. California Grower. September. p. 35-37.
- 4) Glenn, D. M., T. van der Zwet, G. J. Puterka, E. Brown, and P. Gundrum. 2001. Efficacy of Kaolin-based particle films to control diseases in apples. Plant Health Progress an on-line journal. doi : io. 1094/PHP-2001-0823-01-RS.
- 5) Peach Brown Rot Control. Organic Farming Foundation Research Report, Grant 92-26. Carl Rosato, Woodleaf Farm, Oroville, CA. Accessed July 2002. <<http://www.ofrf.org/publications/Grant%20reports/92.26.03.Rosato.Fall92.IB1.pdf>>

- 6) Wittig, Hans and Jay Pscheidt. 1996. Evaluation of organic foliar amendments for managing diseases of tree fruits and grapes. OFRF Information Bulletin. Winter 1996. p.6-7. <<http://www.ofrf.org/publications/news/ib2.pdf>>
- 7) California Integrated Waste Management Board. 1998. Compost Use on Peaches – Fresno County. Accessed July 2002. <<http://www.ciwmb.ca.gov/publications/organics/42198006.doc>>
- 8) Kain, Dave, and Art Agnello. 2001. Grow your own. Scaffolds Fruit Journal: Update on Pest Management and Crop Development. Cornell University. Vol. 10, No. 21 (August 6th).
- 9) Swift, Curtis. 1998. Peach Mosaic Virus in Western Colorado. Colorado State University Cooperative Extension Tri River Area. Accessed June 2002. <<http://www.colostate.edu/Depts/CoopExt/TRA/PLANTS/pmv.html>>
- 10) Tabilio, M.R., A. Chiariotti, P. Di Prospero, and M. Scortichini. 1998. Hedgerows: A barrier against pseudomonas syringae pv. Syringae infections in an organic peach orchard. Acta Hort. (ISHS) 465:703-708. Accessed at: <http://www.actahort.org/books/465/465_88.htm>
- 11) Hammon, Bob. 2001. Peach Tree Borer: Life History and Management Options for Western Colorado. Colorado State University Cooperative Extension Tri River Area. Accessed June 2002. <<http://www.colostate.edu/Depts/CoopExt/TRA/PLANTS/peachtreeborer.html>>
- 12) U.C. Statewide Integrated Pest Management Project. 1998. Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control. University of California Publication 3386. p. 18.
- 13) Peaceful Valley Farm Supply
PO Box 2209
Grass Valley, CA 95945
530-272-4769
<http://www.groworganic.com/>
- 14) Harmony Farm Supply
3244 Hwy. 116 North
Sebastopol, CA 95472
707-823-9125
<http://www.harmonyfarm.com/>
- 15) Pacific Biocontrol Corporation
620 E. Bird Lane
Litchfield Park, Arizona 85340
623-935-0512
<http://www.pacificbiocontrol.com/>
- 16) Prokopy, Ron. 2002. An odor-baited “trap-tree” approach to monitoring plum curculio. Fruit Notes. University of Massachusetts. Winter. p. 23-24.
- 17) Dr. Ron Prokopy
Department of Entomology
University of Massachusetts
Amherst, MA 01003
413-545-1057
E-mail: prokopy@ent.umass.edu
http://www.umass.edu/ent/faculty_staff/prokopy/index.html
- 18) Anon. 1990. Recent research on organic orcharding. NOFA-NY News. May-June. p. 12.
- 19) Dr. Michael Glenn - Particle Film Technology online resources
<http://afsrweb.usda.gov/mglenn.htm>

Additional Resources

PUBLICATIONS

Titles from the University of California:

Integrated Pest Management for Stone Fruits.
Publication 3389. 1999. 264 p.

A manual for managing pest problems and diseases in apricots, cherries, nectarines, peaches, plums, and prunes. (\$35.00)

Peaches, Plums, and Nectarines – Growing and Handling for Fresh Market. Publication 3331. 1989. 252 p.

From orchard site selection to produce distribution. 153 color photos, 36 black and white photos, 44 tables and charts, glossary, and index. (\$45.00)

Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control. Publication 3386. 1998. 162 p.

Illustrated how-to book that helps to identify natural enemies to control pests with a combination of cultural, physical, chemical and biological controls. (\$35.00)

IPM in Practice: Principles and Methods of Integrated Pest Management. Publication 3418. 2001. 296 p.

A comprehensive, practical field guide developed for setting up and carrying out an IPM program in any type of crop or landscape. (\$30.00).

These publications are available from:

DANR Communication Services
University of California
6701 San Pablo Avenue
Oakland, CA 94608-1239
800-994-8849 or 510-642-2431
Fax: 510-643-5470
E-mail: danrcs@ucdavis.edu

Selected titles from American Phytopathological Society:

Compendium of Stone Fruit Diseases. 1995. 128 p.

<http://www.shopapspress.org/41744.html>

168 color images (\$49).

Diseases of Orchard Fruit and Nut Crops – CD Rom. 2002.

<http://www.shopapspress.org/disoforfruit.html>

500 full color images (\$79)

These publications are available through:

APS Press
3340 Pilot Knob Road
Saint Paul, MN 55121-2097
800-328-7560 Toll-Free
651-454-7250
Fax: 651-454-0766
E-mail: aps@scisoc.org
<http://www.shopapspress.org>

Selected titles from North Central Regional Extension:

Diseases of Tree Fruits in the East, NCR 045. 116 p. (\$10)

Common Tree Fruit Pests, NCR 063. 252 p. (\$10)

Available through Michigan State University:

MSU Bulletin Office
10-B Agriculture Hall
Michigan State University
East Lansing, MI 48824-1039
Fax: 517-353-7168
<http://ceenet.msue.msu.edu/bulletin/>

From Natural Resource, Agriculture, and Engineering Service (NRAES):

Mid-Atlantic Orchard Monitoring Guide, NRAES-75. 1995. 361p.

<http://www.nraes.org/publications/nraes75.html>

322 color images.

Available through:

NRAES
152 Riley-Robb Hall
Ithaca, NY 14853-5701
607-255-7645
Fax: 607-254-8770
E-mail: nraes@cornell.edu
<http://www.nraes.org>

Titles from Good Fruit Grower:

Orchard Pest Management: A Resource Book for the Pacific Northwest. 1993. 276 p.

Published by Good Fruit Grower. (\$35).

Organic Tree Fruit Management. 1998. 240 p.

Published by Certified Organic Associations of British Columbia. (\$38).

Available through:

Good Fruit Grower
105 South 18th Street, Suite 217
Yakima, Washington 98901
509-575-2315 Local
800-487-9946 Toll-Free
Fax: 509-453-4880
<http://www.goodfruit.com>

WEB-BASED RESOURCES

Virginia Fruit Web Site: Virginia Stone Fruits
<http://www.ento.vt.edu/Fruitfiles/VirginiaPeachSite.html>

This site presents current information on peach research, as well as peach pest management.

University of California Fruit & Nut Research and Information Center: Fresh Market Stone Fruits

<http://fruitsandnuts.ucdavis.edu/crops/stonefruits.shtml>

This page provides links to University of California and other publications covering topics such as peach varieties, peach pests, retaining postharvest quality, and costs for establishing an orchard.

2002 North Carolina Peach and Nectarine Disease and Pest Management Guide

<http://ipm.ncsu.edu/peachguide/ncpeach2002.pdf>

This PDF publication from North Carolina Cooperative Extension Service and available online provides evaluations of the effectiveness of different cultural

and fungicidal controls for a range peach diseases and pests, as applied during each stage of the growth cycle.

Penn State College of Agricultural Sciences' Pennsylvania Tree Fruit Production Guide

<http://tfpg.cas.psu.edu/part1/part16a.htm>

A guide to conventional peach production, addressing site selection, cultivars, planting, and pruning.

West Virginia University Index of Fruit Disease Photographs, Biology, and Monitoring Information

<http://www.caf.wvu.edu/kearneysville/wvufarm8b.html#PEACH>

This portion of the Mid-Atlantic Orchard Monitoring Guide Web Site for Tree Fruit Pathology furnishes photos that can be used to help identify diseases on leaves and fruit.

Organic Control of Peach Brown Rot in California, USA

<http://www.agroecology.org/cases/brownrot.htm>

The Agroecology website from UC Santa Cruz includes a case study on Carl Rosato's organic peach orchard in Oroville, California.

Insect and Disease Control On Peaches, Apricots, Nectarines, and Plums

<http://entowww.tamu.edu/extension/bulletins/b-1689.html>

This Texas A&M online extension bulletin includes a spray schedule for peaches and contains information on pesticide toxicity.

The Georgia Peach

<http://www.griffin.peachnet.edu/caes/gapeach/>

*This site from The University of Georgia College of Agriculture and Environmental Science provides a variety of peach information, including IPM updates, research reports, and publications, as well as market updates for CA, GA, and SC, and posted copies of the quarterly **Southeastern Regional Peach Newsletter**.*



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Peach and Nectarine Information Links

<http://www.citygardening.net/peachinfo/>

The City Gardening website provides an extensive list of information links for both the home gardener and commercial grower, including sources in numerous states for publications and websites on peach varieties, diseases, and pests.

**Original publication by Guy K. Ames
March 2000**

**Updated by [Steve Diver](#), NCAT
Agriculture Specialist, and Tracy Mumma**

**Edited by Paul Williams
Formatted by Gail M. Hardy**

March 2003

IP047/35

The electronic version of **Organic & Low-spray Peach Production** is located at:

HTML

<http://www.attra.ncat.org/attra-pub/peach.html>

PDF

<http://www.attra.ncat.org/attra-pub/PDF/peach.pdf>

