2 Organic Tree Fruit Production in New England

2.1 Introduction

There is more interest in organic tree fruit production than the actual number of certified orchards reflect and some growers are taking a new look at organic production, particularly organic apple production, given some recent research advances that address long-standing obstacles.

In the past, very few growers in the northeast have attempted to produce apples and other tree fruits organically because of the practical difficulties involved in managing pests in this region with organically-approved pesticides. Wet weather in the spring and summer coupled with the predominant apple cultivar grown in New England, ‘McIntosh’, present significant challenges in disease management, particularly apple scab. In addition, a large number of both native and introduced arthropod pest species attack apples and other tree fruits grown in commercial orchards.

Management of this pest complex is particularly challenging in New England, because unlike more arid production regions in the country, fruit orchards in New England are commonly in close proximity to semi-wooded areas with an abundance of naturalized and wild host species that can harbor populations of certain tree fruit pests. However, during the last 10-15 years studies have been conducted to develop management tactics that address key pests that can be incorporated into an organic program. For example recent studies have shown that the predaceous mite, *Typhlodromus pyri*, which is native to apple production regions in western New York and New England, can successfully manage populations of the key mite pest, European red mite, in commercial apple orchards so that no applications of miticides are required. Also, the trend of planting apple cultivars less susceptible to disease than ‘McIntosh’ may make organic production more feasible.

In addition, recent research in New York state and elsewhere has shown that pheromones can be deployed in orchards to disrupt mating of key lepidopteran species such as oriental fruit moth, and borer species, and substantially reduce damage from these pests. In addition, traditional management methods such as selective fruit thinning, pruning, sanitation (frequent removal of pest infested dropped fruit), removal of wild hosts near commercial plantings, and exclusion of pests, have been shown to reduce populations of some types of pests. Experience in Vermont has shown that non-managed *Malus* species can present significant inoculum for development of apple scab, fruit rot, and European apple sawfly outbreaks in adjacent organically managed apple blocks.

Ideally, organic fruit production is the synthesis of an entire suite of practices intended to take advantage of natural ecosystem interactions and minimize chemical intervention. In apples, such a system might start with the selection of disease-resistant cultivars to circumvent the need for the majority of normal disease sprays. This one tactic could eliminate or substantially reduce the need to manage apple scab, powdery mildew, cedar apple rust, and/or fire blight (Ellis et al., 1998). In lieu of resistance, a combined strategy of orchard sanitation and frequent applications of organic fungicides, such as elemental sulfur, throughout most of the season would be necessary.

Because spray materials acceptable under organic certification tend to have less target efficacy than many non-organic materials, growers should consider all management options. Pest management can be improved by addressing biological and physical components of the orchard system, including strict orchard sanitation, predator introduction and conservation, good groundcover and tree nutrient management, and regular scouting for orchard pests. Sprayer operation is more critical under organic management programs, requiring careful calibration to ensure effective material application. Sprays should penetrate fully into the top and interior of each tree without excessive drift occurring. One good way to quickly assess spray coverage is to observe the white surface residue if Surround (kaolin clay) is applied. The extent of the resulting residue will give some indication of the coverage of your sprayer. This is not a replacement for full annual sprayer calibration as discussed in Section 4 of this Guide.

2.2 What is Organic Agriculture?

In 1995, the USDA National Organic Standards Board (NOSB) defined organic agriculture as "an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain, or enhance ecological harmony…. The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people." Before a product can be labeled "organic," a Government-approved certifier must inspect the farm where the food is grown to make sure the farmer is following all the rules necessary to meet the USDA organic standards. Detailed records are required and reviewed by the certifier. It takes three years of organic management before a farm product can be “certified” as organic. Please note that the labels "natural" and "eco-friendly" which have been used to describe agricultural products may imply that some organic methods were used in the production of the product, but this labeling does not guarantee complete adherence to organic practices as defined by law.

IMPORTANT: It is the grower’s responsibility to ensure that any crop production practice or material used in the orchard is acceptable in their particular state’s organic certification program. Some materials deemed organically acceptable on the National List may

not be acceptable in some states. *Contact your certifier to know what is acceptable and to ensure compliance with regulations in your state.*

Federally accredited certifying agencies for the New England states include the following:

Maine
MOFGA Certification Services, LLC
294 Crosby Brook Rd.
P.O. Box 170
Unity, ME 04988-0170
Contact: Mary Yurlina
207-568-4142
E-mail: certification@mofga.org
www.mofga.org
Scope: crop, livestock, wild crop, handling

Connecticut and Massachusetts
Baystate Organic Certifiers
1220 Cedarwood Circle
North Dighton, MA 02764
Contact: Don Franczyk
(774)872-5544 Phone
(774)872-5545 Fax
E-mail: baystateorganic@earthlink.net
www.baystateorganic.org
Scope: crop, livestock, wild crop, handling

New Hampshire
NH Dept. Agriculture Markets, & Food
25 Capitol St.
P.O. Box 2042
Concord, NH 03302-2042
Contact: Victoria M. Smith
603-271-3685
E-mail: vsmith@agr.state.nh.us
http://www.nh.gov/agric/divisions/markets/organic_certification.htm
Scope: crop, livestock, wild crop, handling

Rhode Island
Rhode Island Department of Environmental Management
Division of Agricultural and Resource Marketing
235 Promenade St.
Providence, RI 02908
Contact: Matt Green
401-222-2781
E-mail: matt.green@dem.ri.gov
http://www.dem.ri.gov/programs/bnatres/agricult/orgcert.htm
Scope: crop and handling

Vermont
Vermont Organic Farmers, LLC
NOFA Vermont
P.O. Box 697
Richmond, VT 05477
Contact: Nicole Dehne
802-434-3821
E-mail: info@nofavt.org
www.nofavt.org
Scope: crop, livestock, wild crop, handling

Detailed recordkeeping is critical in organic production to receive certification and to maintain it. Contact your state certifier to find out what is required.

Organic apple production guidelines for New England have yet to be established. This publication uses the symbol **"§"** to indicate materials that are considered organic options under at least *some* state certifying programs. Again, before using any product or production practice, consult with your certifying agency. Look for remarks or estimates of potential levels of efficacy in the footnoted comments associated with these materials, located in the "General Pest Management Considerations" sections preceding the Pesticide Spray Tables, and also in the respective tables giving the activity spectrums for the different pesticide classes (e.g., Tables 6.1.1, 7.1.1 and 7.1.2).

2.3 Fungicide/Bactericide Options in Organic Apple Production

Ideally, organic fruit production involves a whole systems approach not just a substitution of materials. Research is currently underway in New England to examine the challenges and opportunities of organic apple production. Information from this and other research will be incorporated into future extension publications. The following information on organically acceptable fungicides is based on observations by researchers and extension specialists in New York.

Sulfur (Microthiol Disperss) is effective for controlling some fruit diseases, but it must be applied prior to infection. Sulfur is easily removed by rain. Thus, coverage must be renewed much more frequently than is required with conventional fungicides with better rain resistance. Sulfur is not very effective for controlling rust diseases on apples. [Note: Rust diseases in organic apple orchards can be minimized if cedars within 500 ft can be removed or if new orchards are established in areas isolated from existing or potential cedar habitat.] In more southern areas of the region, sulfur is also relatively ineffective for controlling flyspeck, bitter rot, black rot and white rot on apples during July and August, but sulfur may provide adequate suppression of these diseases in more northern areas. Liquid lime sulfur applied at 2 qt/100 gal on a 21-day interval or at 1 qt/100 gal on a 10-day interval provided good control of flyspeck in a 2006 trial in New York's Hudson Valley. However, the liquid-lime sulfur sprays did not control summer fruit decays. [Note: Copper fungicides applied once or twice during late July or August should help to control both flyspeck and summer fruit decays, but this strategy needs further evaluation under New England conditions.]

Whereas wettable sulfur has no post-infection activity, liquid lime sulfur provides 60–70 hours of post-infection activity against apple scab (counting from the beginning of an infection period). Liquid lime sulfur is also useful to "burn out" scab infections when they appear on leaves, but it has no activity against scab during the incubation period between 70 hours post-infection and appearance of symptoms. Unfortunately, research has shown that both sulfur and lime sulfur can suppress photosynthesis which can reduce yield (Burell, 1945; Palmiter and Smock, 1954). Therefore, the number of sprays should be kept to a minimum.

Copper fungicides (Champ, Nu Cop) also control many tree fruit diseases, but copper causes phytotoxicity under certain conditions. Copper is extremely phytotoxic to foliage on sweet cherries. On apples, copper applied between half-inch green and bloom usually causes fruit russetting. Copper applied between bloom and roughly July 4 will cause blackening at the lenticels. Copper applied later in July will provide excellent control of sooty blotch and flyspeck on red apple cultivars, but July applications may still cause severe fruit discoloration of yellow cultivars.

Note: Very few copper fungicides have labels that allow application to apples after bloom.

Summer applications of copper fungicides have been used effectively to control bacterial leaf spot on peaches, but care is required to avoid a build-up of copper residues that can result in severe leaf injury on peaches. Repeated summer applications of copper on peaches should be avoided unless rainfall has removed the residue from the previous application. Copper has also been used to control cherry leaf spot on tart cherry.

Bacillus subtilis (Serenade**)** is a biofungicide labeled for control of fire blight, apple scab and powdery mildew. Serenade is a wettable powder formulation of the bacterium *Bacillus subtilis*, a common soil resident. The bacterium acts by releasing cell contents during growth in order to eliminate or reduce competitors in its immediate environment. Serenade is relatively ineffective for controlling fungal diseases under the climatic conditions that exist in the Northeast. When used alone, Serenade provides only partial control of fire blight. In alternation with streptomycin, it sometimes provides control approaching that of a full streptomycin program. Serenade should be applied as a preventive and can be applied up to and including the day of harvest.

Potassium bicarbonate (Kaligreen, MilStop) and sodium bicarbonate (baking soda) have variable activity as a fungicide. These materials do not have post-infection activity and therefore need to be applied prior to infection. In addition, they have a short residual period and repeated applications are necessary. Bicarbonate products may provide some control of diseases, but have been insufficient in trials as an ineffective fungicide alone.

Hydrogen dioxide (Hydrogen peroxide) (StorOx and OxiDate) kills fungi and bacteria via surface contact with the organism. OxiDate is labeled for control of diseases in the field whereas StorOx is labeled for use as a surface disinfectant and as an antimicrobial for hydro coolers and water flumes. Hydrogen peroxide does not have residual activity, nor will it control fungi or bacteria that have already penetrated host tissue. Thus, it must be applied after pathogens have been deposited on plant surfaces but before they can initiate infections. Field applications to apples are not recommended because OxiDate can cause severe fruit russetting under certain conditions. Controlled inoculation trials indicate no significant effect of OxiDate on fire blight infection of apple.

Streptomycin (Agri-mycin) is a bactericide used for control of blister spot on 'Crispin' apples and fire blight of apples and pears. It is formulated as streptomycin sulfate in a 17% wettable powder. Streptomycin is commonly used during bloom at the rate of 1/2 lb/100 gal for fire blight control. It can be applied to pears until 30 days before harvest and to apples until 50 days before harvest. However, summer sprays of streptomycin are NOT recommended, except following a hailstorm.

Tests of streptomycin applied during bloom at a constant amount in different volumes of water indicated that control of fire blight was reduced at concentrations in excess of 6X. Thus, concentration of streptomycin sprays greater than 6X is specifically not recommended.

Resistance to streptomycin is widespread among populations of the blister spot bacterium. Resistance is also widespread among populations of the fire blight bacterium in Pacific Coast and Midwest production districts, and has recently been detected in NY. Indiscriminate use of this material (e.g., summer sprays) will hasten the development of resistance. [Note: Growers must contact their certifying agency to determine acceptable streptomycin formulations since some are not allowed under organic rules.]

In a review of biocontrols labeled for use against fire blight, University of Massachusetts research showed that overall, biocontrols were not as effective as streptomycin against blossom blight. Biocontrols were effective in far fewer tests, and if effective, generally controlled blossom blight half as well as streptomycin.

2.4 Insecticide Options in Organic Apple Production

Kaolin clay (Surround**)**, when used properly, has proven an effective organic option to deter pear psylla on pears, and plum curculio and first generation codling moth damage on apples. Later season use can suppress apple maggot damage and second generation codling moth, but when used past early July when apple maggot becomes a threat, the increased chance of a bothersome amount of Surround residue remaining on apples at harvest becomes a limitation. Also, full season use of Surround has been associated with an increase in mite populations.

Azadirachtin (Aza-Direct, Neemix) is derived from the seeds of the neem tree, *Azadirachta indica*, which is widely distributed throughout Asia and Africa. Azadirachtin has been shown to have repellent, antifeedent, or growth regulating insecticidal activity against a large number of insect species and some mites. It has also been reported to act as a repellent to nematodes. Neem extracts have also been used in medicines, soap, toothpaste and cosmetics. It shows some activity against leafminers, leafhoppers, mealybugs, aphids, caterpillars, tarnished plant bug and pear psylla, but repeated applications at short intervals are probably necessary for acceptable control of most pests. Azadirachtin is relatively short-lived and mammalian toxicity is low (rat oral LD50 >10,000). It can be used up to and including the day of harvest and reentry is permitted without protective clothing after the spray has dried. It is relatively nontoxic to beneficials, but toxic to fish, aquatic invertebrates, and bees exposed to direct treatment, although relatively non-toxic when dried. It is therefore categorized as having a moderate bee poisoning hazard.

Clarified Neem oil (Trilogy) is labeled for a wide range of pest control or suppression uses, including use as a fungicide, insecticide, and miticide. Specific uses have not been well-studied for every labeled pest; rates suggested on the label also vary widely. Neem oils have been found to suppress European apple sawfly and may deter feeding or egg laying of other insect pests. Research on its use as a scab fungicide has shown that it is ineffective as a stand-alone material. Because Trilogy is an oil-based material cautions against mixing with other pesticides incompatible with oil, such as sulfur, should be followed. Trilogy applications have been found to form a persistent film on fruit and foliage that may make removal of residues such as kaolin difficult at harvest or packout. This product is toxic to bees if exposed to direct treatment and is hazardous to fish and aquatic invertebrates.

Bacillus thuringiensis (Bt, Dipel, Deliver, Biobit, Javelin, Agree) is a microbial insecticide specific for the control of caterpillars. It contains spores and crystalline endotoxin that must be ingested by larvae with high gut pH to provide control. It is effective against many fruit pests, including leafrollers and fruitworms. Although this material will control codling moth and other internal lepidopterous apple pests, it does not provide as effective control as do most conventional insecticides. One exception is the obliquebanded leafroller, which has become so difficult to control with conventional toxicants that the Bt products work at least as well as any material available. Compared to conventional insecticides used against these pests, Bt insecticide coverage should begin earlier and requires shorter intervals between spray applications. This material is exempt from requirements for a tolerance on all raw agricultural commodities, thus it can be sprayed up until harvest. It is harmless to humans, animals, and beneficial insects, including the honey bee.

Spinosad (Entrust, GF-120**)** is an organically accepted formulation with the same active ingredient in the conventional insecticide SpinTor. Entrust can provide good control of codling moth, leafollers, and fair control of apple maggot and spotted tentiform leafminer. Formulations with an attractant bait (GF-120) can be used at low rates to manage fruit flies

Pyrethrin (Pyganic**)** is a material that has been used against European apple sawfly and for short term (relative to conventional insecticides) control of plum curculio, codling moth and apple maggot. Pyrethrins are rapidly broken down when exposed to UV-light and therefore applications before dawn or in late evening are recommended. For the duration of control it provides, Pyganic would be more expensive than conventional insecticides or other organic options as the foundation for an insect pest management program.

Insecticidal soaps (M-Pede) are concentrates made from biodegradable fatty acids and are contact insecticides that can be effective against such soft-bodied arthropods as aphids, mealybugs, and psyllids. They can provide suppression of pear psylla when used in a seasonal spray program, but the residual period is short, and uniform drying conditions are required to prevent droplet residues on the fruit surface. They have a low bee-poisoning hazard.

Horticultural oil is an effective tool against mite pests, San Jose scale, and pear psylla, and can contribute to suppression of codling moth and spotted tentiform leafminer. Oils act as physical pesticides by creating a film over eggs, spores, or soft-bodied insects, thus suffocating them. A dormant (or prebloom) oil application can help manage mite populations; additional summer oil applications can also lower populations. However, some apple varieties have different sensitivities to summer oil sprays that may result in fruit and foliar damage.

Codling Moth Granulosis Virus (Carpovirusine, Cyd-X). These products contain an insecticidal baculovirus, *Cydia pomonella* granulovirus, which is specific to the larval form of the codling moth, and is registered for use in apples, pears, and (Cyd-X only) plums. This biological insecticide must be ingested in order to be effective. The virus infects the moth larvae and causes it to stop feeding and eventually die. After death, the larva disintegrates, releasing the virus, which may infect other codling moth larvae upon ingestion. Applications are recommended at egg hatch, before the larvae penetrate the fruit. Best results are seen with repeated applications for each generation during the growing season. No adverse effect to fish, wildlife or beneficial organisms has been observed; it has a low bee-poisoning hazard.

Synthetic pheromones are available for disrupting the chemical communication of certain insect pests, thereby preventing them from mating and producing larvae that injure the crop. Pest-specific pheromones are released from dispensers or microcapsules placed or sprayed in the orchard before the initiation of flight, and can reduce or in some cases eliminate the need for supplementary insecticidal sprays. This approach works best in large (5-10A or more), rectangular plantings, where the pheromone concentration in the air is more uniform and can be maintained at a high level. Border insecticide sprays may be needed in orchards adjacent to sources of adult immigration or in other high pressure situations. Growers should contact their certifying agencies to determine which specific pheromone materials are acceptable in their state.

While the organically accepted fungicides and insecticides individually do not offer the same degree of efficacy or longevity as their conventional counterparts, used in concert with each other along with conservation of biological control agents, and cultural practices to reduce inoculait is possible to produce a high percentage of fruit free of insect damage and disease symptoms within organic certification restriction on allowable materials.

2.5 New England Organic Apple Production Resources:

- OrganicA Project: http://www.uvm.edu/organica/index.html
- Organic Apple IPM: http://www.uvm.edu/organica/OrganicOrchardInformation/OrganicIPM/organicIPM.html
- An Organic IPM Checklist for Vermont: http://www.uvm.edu/organica/OrganicOrchardInformation/OrganicIPM/checklist.html

Newly published by Cornell University Cooperative Extension is "A Grower's Guide to Organic Apples". NYS IPM Publication No. 223. http://nysipm.cornell.edu/organic_guide/apples.pdf

General Information on organic production can be found on the following websites:

- The National Organic Program: http://www.ams.usda.gov/nop/IndexIE.htm
- The National List of Allowed and Prohibited Substances: http://www.ams.usda.gov/nop/NationalList/ListHome.html
- The Organic Materials Review Institute (OMRI) Products List: http://www.omri.org/OMRI_brand_name_list.html
- Organic Food Production. Alternative Farming Systems Information Center: http://www.nal.usda.gov/afsic/ofp/

References

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Palmiter, D. H., and R. M. Smock. 1954. Effect of fungicides on McIntosh apple yield and quality: a five-year study under Hudson Valley conditions, 1949-1953. N.Y.S. Agric. Exp. Sta. Bull. 767. 40 p.