

# Basic IPM for Organic Apple in Pennsylvania

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## What is organic food?

Organic food is produced by farmers who emphasize the use of renewable resources and the conservation of soil and water to enhance environmental quality for future generations. Organic food is produced without using most conventional pesticides; fertilizers made with synthetic ingredients or sewage sludge; bioengineering; or ionizing radiation. Before a product can be labeled “organic,” a Government-approved certifier inspects the farm where the food is grown to make sure the farmer is following all the rules necessary to meet USDA organic standards. Companies that handle or process organic food before it gets to your local supermarket or restaurant must be certified, too.

To successfully grow apples organically under Pennsylvania conditions, growers must recognize that the limited number of organically approved insect and disease control chemicals that are available leave them particularly susceptible to some pests such as plum curculio, apple maggot, and Japanese beetle, since effective organic controls have not yet been devised for these insects. Major diseases of apples can be controlled but require many frequent sprays particularly from silver tip to 4 weeks after petal fall.

Disease control should concentrate on Apple Scab and Powdery Mildew since they can reduce crop dramatically and even cause near total leaf loss. The summer diseases of Sooty Blotch and Fly Speck are cosmetic problems that do not affect the health of the tree or the fruit quality. Other diseases such as Black Rot and Fire Blight are occasional problems and can be reduced by a strict sanitation program of pruning out infected branches each winter. Growing varieties that are not highly susceptible to fire blight is essential since antibiotics such as Streptomycin are a last resort in organic agriculture. Maintaining moderate rather than vigorous growth is also important since fire blight can quickly kill young tissue and easily kills wood up to 3 years old. It can also move into older wood and roots to eventually kill trees.

Controlling Scab and Mildew early in the season will insure little or no problem later in the year unless your neighbor's trees are heavily infected. Better yet, plant scab resistant apples. Begin your control program as soon as you see green in the apple buds. For the rains occurring prior to when the green tissue is ½ inch long copper or lime sulfur can be used either just ahead of the rain or within 48 hours of the start of the rain. Copper should be discontinued at ½ inch green tip or russeting of the fruit will result. Sulfur is applied every 3 to 5 days or prior to every rain from ½ inch green tip until 4 weeks after petal fall. If you cannot spray prior to a rain, use lime sulfur within 48 hours of the start of the rain. For summer disease control and if you have Scab infected leaves 4 weeks after petal fall you should continue sulfur sprays on a 2 week interval until harvest or the end of August whichever comes first. Spray until leaves are dripping. Leaves which fall from the tree should be mowed or removed and composted since the scab fungus overwinters in fallen leaves. Powdery Mildew overwinters in infected buds.

## Basic IPM for Tree Fruit – Monitoring/Scouting

An ecological approach to managing pests in agricultural crops is known as Integrated Pest Management (IPM). IPM involves compiling detailed and timely information about a crop and its pests to ensure that pest management decisions are economically, environmentally, and socially sound. In practice, it involves using several control tactics based on knowledge of the crop, weather conditions, pests and associated natural enemies to avoid crop losses and to minimize harmful effects on the environment. Implementing IPM requires not only an understanding of pest biology and control measures, but takes into account the financial, physical, social, and labor constraints of orchard operations. IPM requires a more tolerant approach to pest control than traditional insecticide-based programs. IPM programs recognize that pest populations vary from block to block and/or year to year and that flexibility must be built into control programs to allow for this variation. **One spray program does not fit the whole farm when IPM principles are applied.** Eliminating all pests from the orchard **is not** the objective of IPM. Natural enemies are to be conserved as much as possible and some non-economic damage (especially to the foliage) is to be tolerated. Benefits of IPM include: a) greater survival of natural enemies and non-target organisms, b) slower development of pesticide resistance, c) fewer outbreaks of secondary pests and less pest resurgence after pesticide applications, and d) reductions in pesticide applications and greater use pesticide chemistries that are safer to the applicator and to the environment.

At the farm level, IPM is approached as a series of activities that culminate in a control decision made by the grower or his consultant (Fig. 2-1). The first activity is gathering information about the environment, pest, potential biological control agents and the crop. This activity is termed scouting, or monitoring, and is performed frequently during the growing season to acquire periodic information about the orchard status so that timely decisions can be made and actions can be taken if necessary. Monitoring is the most fundamental, yet the most often neglected activity in an IPM program. Both the need for control and the effectiveness of any action taken are determined by monitoring pest and natural enemy populations.

In monitoring, the grower or an IPM scout takes representative samples to assess the growth status and general health of the crop and determines the presence and intensity of pest infestations/infection or the potential for future pest problems. If the block is not uniform, i.e. there are significant differences in topography (i.e. adjacent to a wood lot) or cultivar susceptibility, it may be necessary to subdivide the block into separate sections for sampling. Since it is impossible to count all the pests or beneficials present, only sub-samples can be made. To decide if control is required, pest density must be related to the potential damage and balanced against how likely it is that biological control agents can maintain control below damaging levels. Even if treatment thresholds are unknown for particular pests, sampling provides information on the insect's stage of development, population densities and the ratio of pests to natural enemies. This information forms a sound basis for decision making – the absence of this information usually leads to the overuse of pesticides.

In order for management decisions to be made in a timely fashion, information must be acquired on a frequent and regular basis, in most cases, **weekly**. A specific time should be scheduled each week for

monitoring activities, and growers/scouts should realize that a substantial time commitment is required in order to benefit from a monitoring program.

See the *Pennsylvania Tree Fruit Production Guide* or the *Mid-Atlantic Orchard Monitoring Guide* for more detailed discussions on pest monitoring techniques, phenological development and sample timings. Pesticide efficacy on various apple pests can be found in the attached tables.

### **Pheromone Traps & Pest Phenology Models**

Many of the most economically important insect pests are moths (i.e. codling moth, Oriental fruit moth, leafroller, lesser peachtree borer etc.). For many of moth pests, artificial lures have been developed based on the specific sex pheromone that the female of each species uses to lure males for mating. Pheromone traps using these lures and a sticky coating are a quick and convenient way to monitor the populations of such pests. Traps are placed in the orchard before the beginning of moth emergence and are checked daily to record the first capture, or biofix, and then again at weekly intervals throughout the pest's life cycle each season. Each week the trapped insects and debris are removed and trap bottoms (the sticky portion) and pheromone lures are replaced as necessary. The biofix can be used to begin accumulating degree days for use in insect development models to predict future insect stage distributions for various pests throughout the season so that growers will know the optimum timing to control various pests. Insect traps alone should not be relied on for management decisions, but should be used in conjunction with direct tree inspections in the orchards. Trap catches can be affected by many factors (pheromone mating disruption, weather, trap design, trap placement, trap maintenance, pesticide applications) as well as pest population pressure. Variability in insect trap catches can be minimized if the overall trapping program is standardized and consistent (i.e. same trap design, trap density, lure source and lure age).

The following species at minimum should be monitored in each of the following crops with at least 1 trap for each species in sets of 3:

- Apple & Pear – Codling Moth, Oriental Fruit Moth, Oblique-banded Leafroller. Pear Psylla and mite visual counts should also be made in both crops.

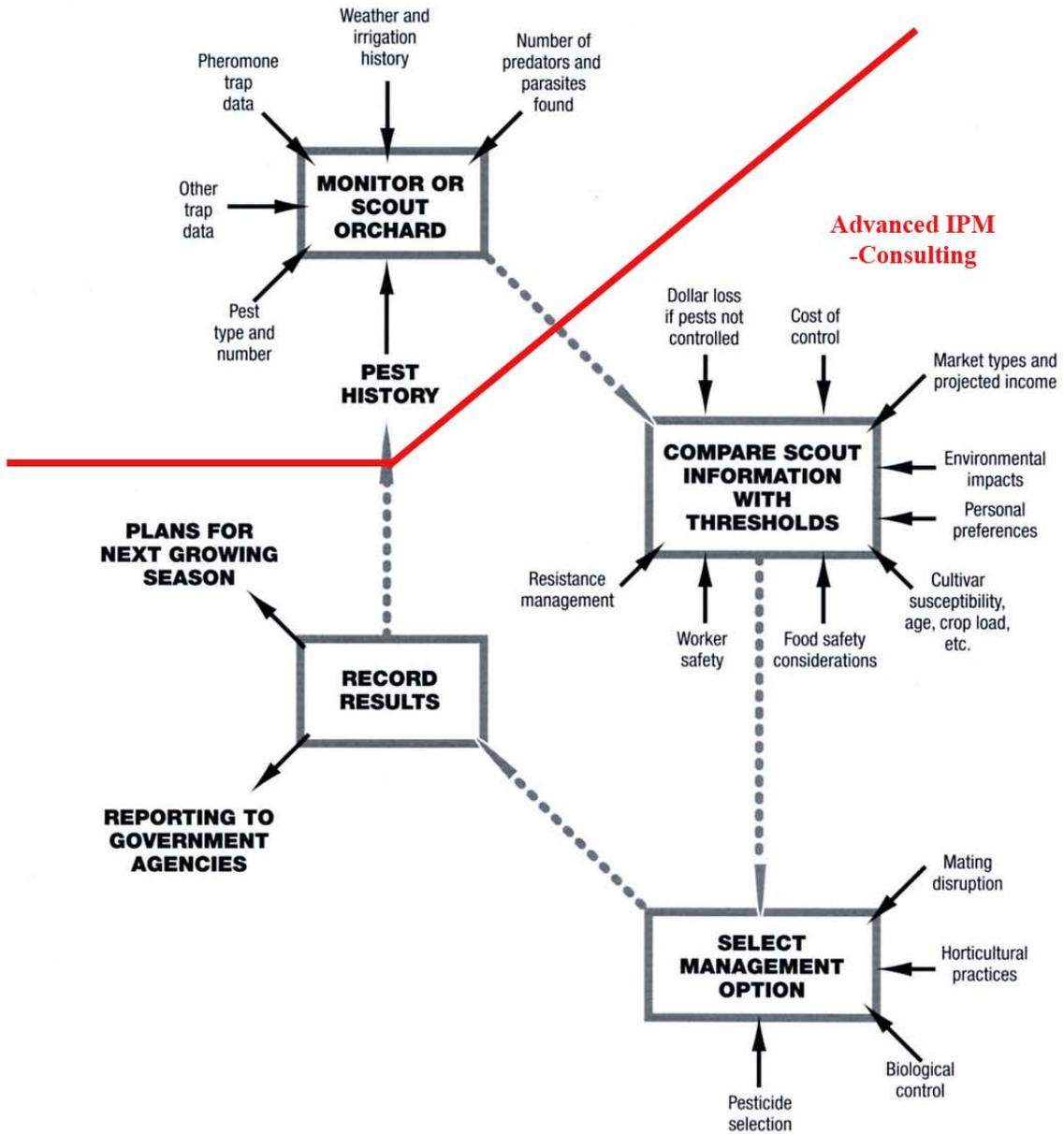
At least one set of sex pheromone traps (including all 4 species) should be used in each monitored orchard block, but no less than two sets of traps per orchard operation if the orchards are smaller than 25 acres, 3 sets of traps if the orchards are 26-50 acres; 4 sets of traps if the orchards are 51-75 acres; and at least 5 sets of sex pheromone traps if the orchards are 76-100 acres. Traps should be placed in the orchard at the beginning of flight of each species and maintained throughout the entire season (i.e., lures and floors exchanged every 4 weeks, traps checked weekly, moth capture data maintained for the entire season)

Disease phenology models based on daily temperatures and rain events also provide continuous current information on the timing of recommended fungicides or antibiotics against apple scab or fire

blight. This information can be combined with scouting information from individual orchards and used in making pest management decisions. Each season the information on moth captures in pheromone traps for codling moth, oriental fruit moth, leafrollers, and various other insect species as well as information on diseases in the Biglerville area are available at the PSU FREC web site: <http://frec.cas.psu.edu/> and it is also published by Penn State Cooperative Extension in the monthly newsletter, Fruit Times (<http://fruittimes.cas.psu.edu/Default.html>).



**Basic IPM**



Pennsylvania Tree Fruit Production Guide 2006-2007

Figure 2-1. How to make an integrated pest management decision.

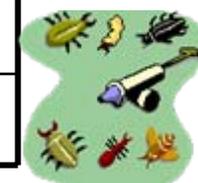
# Organic Apple Production Websites

- ATTRA (Appropriate Technology for Rural Areas, Nation Sustainable Agriculture Information Service)
  - <http://www.attra.org/organic.html#fruits>
  - 1-800-346-9140
  - Overview of Organic Fruit Production
  - Considerations in Organic Apple Production
- Pennsylvania Certified Organic
  - <http://www.paorganic.org/>
- Minnesota Department of Agriculture
  - [www.mda.state.mn.us/esap/organic/organic-pt2001](http://www.mda.state.mn.us/esap/organic/organic-pt2001)
  - Status of Organic Agriculture in Minnesota
  - [www.mda.state.mn-us/ipm/applemanuel/default.htm](http://www.mda.state.mn-us/ipm/applemanuel/default.htm)
  - Tips for Managing Pests in Organic Apples
- OMRI (Organic Materials Research Institute)
  - [www.omri.org](http://www.omri.org)
- OCIA (Organic Crop Improvement Association)
  - [www.ocia.org](http://www.ocia.org)
- USDA (National Organic Program)
  - [www.ams.usda.gov/nop/](http://www.ams.usda.gov/nop/)
- Rodale Institute (New Farm)
  - [www.newfarm.org](http://www.newfarm.org)

# Available organic compounds/methods for pest control



<b>Pests</b>	<b>Control methods</b>
<b>Codling moth</b>	<b>MD, Cyd-X, oils,</b>
<b>Oriental fruit moth</b>	<b>MD, oils, Entrust, Bt,</b>
<b>Leafrollers</b>	<b>Entrust, Bt,</b>
<b>Plum curculio</b>	<b>Surround, mass trapping, Pyganic,</b>
<b>Apple maggot</b>	<b>Entrust, GF 120 bait, mass trapping,</b>
<b>Tarnished plant bug</b>	<b>Aza-Direct, Pyganic, oils, soaps,</b>
<b>European apple sawfly</b>	<b>Surround, mass trapping, Aza-Direct,</b>
<b>Aphids</b>	<b>Natural Enemies, oils, soaps,</b>
<b>Leafhoppers</b>	<b>Surround,</b>
<b>San Jose Scale</b>	<b>Oils,</b>
<b>Leafminers</b>	<b>Biological control,</b>
<b>Mites</b>	<b>Oils, Natural Enemies,</b>
<b>Japanese beetle</b>	<b>Aza-Direct, Pyganic, Surround, mass trapping.</b>

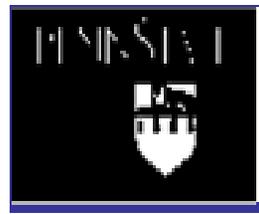


*Red color - recommended method(s)*

# Organic insecticide spray program during the 2007 season (PSU FREC)



Date	Compound	Target pest(s)
Apr 14	Azadirect	ERM, RAA, TPB, EAS
Apr 25	Azadirect	ERM, RAA, TPB, EAS
May 09	Azadirect	EAS, RAA, TPB
May 10	Suterra Duels MD	OFM, CM
May 18	Surround/Azadirect	RAA, plant bugs, PC
May 30	Surround/Azadirect	RAA, plant bugs
June 2	Surround/Azadirect	Aphids, plant bugs,
Jun 15	Dipel	TABM, OBLR
Jul 13	Surround	JB, June beetle
Aug 16	Dipel/Cyd-X	TABM, CM
Aug 30	Cyd-X	CM
Sep 14	Cyd-X	CM



## *Bacillus thuringiensis* (Bt)

**Able, Agree, Deliver, Javelin** (produced by Advan)

**Biobit, DiPel, Gnatrol, Vectobac, XenTari** (produced by Valent)

**Britz** (Britz Fertilizers), **Safer Brand Garden Dust**

### Comments:

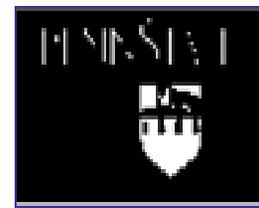
- naturally occurring spore forming bacteria
- very effective against various plant feeding larvae but must be ingested to work,
- some formulations or genetically modified Bts are not registered for organic use
- on apple very effective against leafrollers (OBLR, TABM, RBLR)
- not long lasting product, broken down by sunlight

## *Spinosad*

**Entrust, GF 120 NF Naturalyte Fruit Fly bait** (From Dow Agrosiences)

### Comments:

- spinosyns are produced by aerobic fermentation of *Saccharopolyspora spinosa*;
- fast acting, broad spectrum material, need to be ingested, acts on nervous system;
- excellent for leafroller, leafminer and thrips control, good for apple maggot



## *Neem (azadirachtin)*

**Aza-Direct** (from Govan)

**Neemix, Triact, Trilogy** (from Advan LLC)

### Comments:

- azadirachtin, neem oil or neem oil soap are derived from neem tree, *Azadirachta indica*;
- azadirachtin acts as an insect growth regulator, anti-feedant and oviposition deterrent;
- commercially available products works by contact and ingestion, broad-spectrum;
- on apple very effective against aphids, plant bugs, stink bugs, beetles, leafhoppers;
- not long lasting product, broken down by sunlight

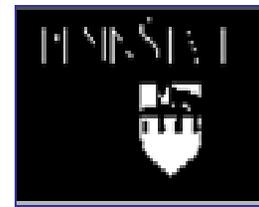
## *Pyrethrum*

**Pyganic 1.4, Pyganic 5.0** (from MGK Corp.)

**Safer Brand Yard and garden Insect Killer Concentrate**

### Comments:

- pyrethrum is derived from dried flower heads of the pyrethrum daisy  
*Chrysanthemum cinerariaefolium*, *C. coccineum* and *C. marshalli*;
- pyrethrum is a fast acting, contact compound, affecting the nervous system of insects, but if the dose is too low the insect can recover from the application;
- addition of oils can improve efficacy, but pyrethrum should not be mixed with lime, sulfur or soap solutions (acid or alkaline condition will drastically shorten residual activity) .



## *Sex pheromones*

**Checkmate products: CM, OFM, OLR, PTB** (from Suttera)

**Exosex products: CM, GBM, OFM, PTB** (from Exosect Lim.)

**Isomate products: C Plus, C TT, CM/OFM Combo, M100, M Rosso** (from Pacific Biocontrol)

**No Mate CM** (from Scentry Biologicals)

### Comments:

- disrupts insect natural communications;
- highly species specific, one product controls only one pest;
- single application of dispensers provide very long, seasonal control of disrupted pest;
- works better of larger areas (5 acres +), no practical for small plantations;
- sex pheromones used in traps are excellent monitoring tool.

## *CM granulovirus*

**Cyd-X** (from Advan LLC)

### Comments:

- *Cydia pomonella* granulovirus is specific to codling moth larvae;
- has to be ingested to control CM larvae, will reproduce inside the larval midgut;
- highly specific for CM control, but multiple applications per generation are necessary.



# *Oils*

Petroleum oils: **JMS Stylet oil, PureSpray Green**

Plant oils: **Concern Pesticide Spray oil, GC-3, GC-Mite, Vegol** and others

Fish based oil: **Feed-N-Gro Sea Cide, SeaCide, Organocide** and others

## Comments:

- petroleum oils block the respiratory systems and cause suffocation, possibly also some repellent and other behavior altering action, especially effective against soft bodied pests;
- oils can suppress some fungal diseases such as powdery mildew;
- oils used as adjuvant improve other product efficacies;
- fish oils in conjunction with lime sulfur are used in fruit thinning;
- please follow the label to minimize the risk of phytotoxicity (i.e, mixing, temperature, humidity, etc...)



## *Kaolin clay*

**Surround** (from TKI, NovaSource, formerly from Engelhard Corp.)

### Comments:

- naturally occurring clay resulting from weathering of aluminous minerals such as feldspar or kaolinite;
- works as natural physical barrier and also as repellent;
- the residual white plant coating may affect fruit marketability;
- kaolin provides possible suppression of multiple fruit pests.



## *Rotenone*

Currently none of the products are OMRI registered

### Comments:

- botanical insecticide found in subtropical leguminous shrubs;
- contact and stomach poison

# Organic Materials/Methods for Disease Control\*

## PSU – FREC Experience Organic Apple Orchard

<b>Early Season Diseases:</b>	<b>Control Methods</b>
Fire Blight	Copper, Streptomycin, resistant cultivars
Scab	Sulfur, Lime sulfur, copper, compost fall application fallen leaves, resistant cultivars
Powdery mildew	Sulfur, Lime sulfur, JMS Stylet oil, Pot. Bicarbonate (Armcarb, Kaligreen), resistant cultivars
Rust (cedar & quince)	Sulfur, Lime sulfur, Serenade, resistant cultivars
Black rot (frog eye)	Sulfur, Lime sulfur, resistant cultivars
<b>Summer Diseases :</b>	
Sooty blotch	Sulfur, Lime sulfur, low rate copper
Flyspecks	Sulfur, Lime sulfur, low rate copper
Bot rots	Sulfur, Lime sulfur, calcium, low rate copper
Bitter rot	Sulfur, Lime sulfur, calcium, low rate copper

\*Travis, J. W & Halbrecht, N. O. 2005 F & N Test 60:PF037 and PDMR 1-3:PF002, PF003, PF012, PF013, PF002, PF034, PF 035.