The Basics of Organic Pest Management

The goals of IPM are the same whether practiced on an organic or conventional farm. The main difference is that organic growers do not have as many options for chemical controls or soil fertility.

This guide sheet covers the basic steps needed to practice IPM, and discusses briefly several of the insecticides that can be used by organic producers.

Organic Integrated Pest Management

Integrated Pest Management (IPM) is a science that strives to keep pest levels low enough that economic damage is minimal. To do so, it uses a variety of methods. These include, but are not limited to, cultural, biological, and chemical controls. All of these tools minimize the risk to the surrounding environment and they maximize economic gain and social acceptance.

Sanitation: Removing residues eliminates feeding and overwintering habitat for many insects.

Removable row covers, such as this, provide protection from insects and frost but can be removed at pollination time.

Prevention

In IPM, everything starts with prevention. This is especially true for organic growers. When pests get out of hand, organic growers cannot turn to hundreds of quick-fix chemical controls. However, several other methods are available that will prevent pest problems. Healthy plants are better able to resist pests. So, it is best to start by choosing varieties that are disease- and insect-resistant. Field sanitation is needed to manage many types of pests. Keep a clean field throughout the season to minimize feeding, breeding and sheltering sites for many insects. In addition, it is important to clear out residues to remove insect pests and also pathogens that cause plant diseases. Doing some clean tillage can destroy pupae (insects in a stage of development between larvae and adults) and remove overwintering sites for unwanted bugs.

Avoidance

If you know that pests are already present, avoiding them is important. This can be done by using trap crops, row covers, repellents and by adjusting planting dates. Trap crops are highly attractive crops planted near cash crops that will draw insects into a small area; this protects the cash crop and makes control easier. Row covers create a physical barrier that many insects cannot get around; this means they cannot infest your crop. Just moving your planting date a little can help to avoid large seasonal surges of certain pests. The Organic Materials Review Institute (OMRI®) lists many repellents, such as kaolin clay, that may be used to push pests away from your crops.

Monitoring

Monitoring is the backbone of IPM. To make sound management decisions, growers must be aware of which pests are in their fields and how many pests there are. Before taking action, the results of monitoring should be assessed through established economic thresholds (i.e., the amount of pests that justifies intervention).

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Traps designed to monitor for Spotted Wing Drosophila (SWD) (left) and Brown Marmorated Stink Bug (BMSB) (right).

A variety of tools can make the monitoring process less labor-intensive. Traps come in a large number of shapes and sizes; they are very effective for passive monitoring. Tools such as sweep nets and beat sheets can be used to quickly sample an area of a field or orchard. Although it is time-consuming, direct scouting is a great monitoring tool. Close scrutiny of plants is the best way to discover the pest presence and level of damage.

Suppression

Even if everything is done right, pest quantities can still reach a level where extra control measures are needed. Remember that insect numbers can be lowered by using more than just insecticides. Many biological control options, such as insects that are predatory (they eat other pests) or parasitic (where one species benefits at the expense of another), are readily available. Buying them is an effective option. On a small scale, insects can be handpicked, flamed or sucked off with a leaf vacuum. In some situations, like in high tunnels, simply changing the environment by providing extra irrigation can greatly reduce pest numbers. When all other options have failed or cannot be used, organic insecticides can be used safely and responsibly to lower pest numbers to an acceptable level.

Organic Insecticides

As a general rule, organic insecticides cost more than their synthetic counterparts. Also, their residual effect is shorter. Ironically, this can lead to applying more organic product on an area because of the tighter treatment intervals. Never assume that something organic is safe. Many organic insecticides can be devastating to pollinators and aquatic life; they can also be dangerous to humans. So, always read labels carefully. Exercise extreme caution when using any insecticide—synthetic or organic.

This guide sheet focuses on three broad categories of organic insecticides: botanicals, microbials and insecticidal soaps. These categories are based on what makes up the insecticides. A botanical insecticide comes from a plant extract; one that is microbial is made from or is a fungus, bacteria or virus. Insecticidal soaps are potassium salts of fatty acids. Microbial insecticides are usually more specific in their application; they only kill certain pests. Botanicals or soaps are typically broad spectrum (able to kill a wide range of insects, even some that are beneficial).

Botanicals

Using plant extracts to kill bugs is not a new concept. For centuries, people all over the world have used plant poisons to kill insects and mites in their homes, fields and on their bodies. Botanical insecticides fall into several classes because of their various modes of action. Some are contact poisons while others inhibit insect development and are therefore called “Insect Growth Regulators” (see Table 1). Other insecticides rely on the use of live organisms that actively prey on the insect pest. Such is the case of nematodes (very small worms that live in the soil). When organisms such as fungi and nematodes kill pests then we say they are “entomopathogenic” (see Table 2).

Repellents, such as kaolin clay, form a barrier that is irritating and confusing to some insects.

Microbials

Scientists are discovering more and more ways to use biology to their advantage when creating insecticides. Some products are live organisms that can be applied to an area; others are simply toxins (poisons) derived from microbes (living organisms that are too small to be seen without a microscope). Microbial insecticides (some of which are listed in Table 2) are usually very specific in their application, only affecting a few species. This makes them a good choice when trying to preserve natural enemies. This group also contains several modes of action.

Insecticidal Soaps

Insecticidal soaps are extracted from plant or animal lipids (fats). They work by disrupting the structure of an insect's cell membrane (the barrier that separates the contents of a cell from the surrounding material). This causes the cells to leak and ultimately leads to their death. Insecticidal soaps only work by direct contact. They have no effect once the spray dries. Soaps work best on soft-bodied insects. They do not harm large predators, such as ladybugs and spined soldier bugs. However, soaps can be damaging to some plants, especially under certain environmental conditions. ■

What is the Organic Materials Review Institute (OMRI)?

The Organic Materials Review Institute (OMRI) is an international nonprofit organization that determines which input products are allowed for use in organic production and processing. OMRI Listed® products are allowed for use in certified organic operations under the USDA National Organic Program.

The OMRI Products List© is the most complete directory of products for organic production or processing. The List includes over 3,000 products that are "OMRI Listed®" to U.S. National Organic Program standards. The list can be purchased for $ 21 at: http://www.omri.org/omri--lists

Can I use lures / traps in organic systems?

The National List of Allowed and Prohibited Substances describes in detail materials that can / cannot be used for organic production. Specific examples of synthetic materials / substances that MAY be used given that no other control methods are available, and provided the materials are NOT in contact with the crop, soil, or water are:

- ✓ **As animal repellents**: Soaps, ammonium—for use as a large animal repellant only, no contact with soil or edible portion of crop
- ✓ **As insecticides (including acaricides or mite control):**
  - Ammonium carbonate—for use as bait in insect traps only, no direct contact with crop or soil
  - Boric acid—structural pest control, no direct contact with organic food or crops
  - Oils, horticultural—narrow range oils as dormant, suffocating, and summer oils
  - Sucrose octanoate esters (CAS #s—42922-74-7; 58064-47-4)—in accordance with approved labeling
  - Pheromones / plant volatiles
- ✓ **As slug or snail bait:** Ferric phosphate (CAS # 10045-86-0)

The list is extensive, so we recommend checking with an organic certifier. To access this list, you can do a search using "National List of Allowed and Prohibited Substances e-CFR" as key words.

Table 1. Insecticides that are approved for use in organic systems. IRAC is the acronym for the Insecticide Resistance Action Committee, a group that works to delay or prevent the development of insecticide resistance.

[1]IRAC groups (shown inside parenthesis) are represented by numbers and they refer to the mode of action (the way that an insecticide kills its target) of an insecticide. Rotating between insecticides with different numbers (different numbers mean that insecticides are killing the pest in different ways) helps to prevent insecticide resistance.

Chemical Family and (IRAC group[1])	Active Ingredient	Trade Names	Origin	Price	Comments
Pyrethrins (3A)	Pyrethrins	Pyganic	Chrysanthemum flowers	Pyganic: 5.0 EC $550 per gallon treats 7-28 acres	Very effective broad spectrum killer that is devastating to pollinators and aquatic life
Insect growth regulator (unknown)	Azadirachtin	Neemix, AZA- Direct, Molt-X, Azatrol	Neem tree seeds	AZA-Direct: 2.5 gallons $489; treats 10-20 acres	Most effective against immature stages of insects
Spinosyns (5)	Spinosad	Entrust, Seduce, Captain Jacks Dead Bug	Bacterial fermentation	Entrust: 1lb $450; treats 5-32 acres	Most effective against chewing insects, safe for beneficials once residue dries
Pyrethrins (3A and Unknown)	Pyrethrins and Azadirachtin	Azera	Chrysanthemum flowers and Neem tree seeds	Azera: $379 per gallon; treats 2.3-8 acres	Extremely effective and broad spectrum. Is devastating to beneficial insects and aquatic life
Not classified	Potassium Salts of Fatty Acids	Safer Insecticidal Soap, Garden Safe, M-Pede	Extracted from lipids such as those in olive oil	M-Pede: 2.5 gallons $56 makes 100-600 gallons of spray depending on concentration	Most effective against soft bodied insects, can be phytotoxic

Table 2. Biological pesticides that are based on fungi, bacteria and viruses, and that can be used to control insect pests organically.

Type of biological pesticide	Species / strain	Trade Names	Origin	Price	Comments
Entomopathogenic Fungi	*Beauveria bassiana*	Mycotrol, Botanigard,	Naturally occurring fungi	Mycotrol: $109 per quart treats 1-4 acres	Broad spectrum pathogen that can also affect beneficial insects. Slow to work, but effective.
Viral infection	Various virus species	Spod X, Gemstar, Madex HP, CYD X	Naturally occurring virus	Gemstar: $74.99 per quart, treats 3.2-8 acres	Species specific. Very safe and effective on certain caterpillars.
Entomopathogenic Nematodes	*Steinernema and Heterorhabditis spp.*	NeemaSeek, NeemAttack, Grub Guard	Naturally occurring endoparasitic round worms	NeemaSeek: $198 for 500 million nematodes treats 10 acres	Results are highly variable, but will attack a wide range of soil dwelling insects.
Entomopathogenic bacteria	*Bacillus thuringiensis* (*Kurstaki, Israelensis,* San Diego / *tenebrionis*)	Dipel, Monterey Bt, Trident, Novodor	Naturally occurring soil-dwelling bacteria	Dipel: $15-$30 per pound treats 1-2 acres	Species specific. Very safe and effective on certain caterpillars.

The USDA National Organic Program (NOP)

- The NOP is the federal regulatory framework governing organic food.
- The NOP Final Rule (USDA, 2000) emphasizes the use of preventive and cultural practices that enhance crop health, such as crop rotation, cover cropping, sanitation measures, cultural and biological controls, etc.
- In a total pest management program, organic farmers need to develop a system of cultural, biological and/or genetic strategies; they also need to describe this program in the Organic System Plan (OSP) before applying a pesticide as a control measure.
- Only when preventive practices have failed to prevent or control crop pests may an organic farm manager apply either
- (1) a biological or botanical material that is not prohibited on the National List of Allowed and Prohibited Substances in the section that lists nonsynthetic substances prohibited for use in organic crop production (from section §205.602 of the Code of Federal Regulations [CFR]), or
- (2) a substance included on the National List of synthetic substances allowed for use in organic crop production (CFR §205.601 [e]–[f]) to prevent, suppress or control pests.
- OMRI®-listed products are allowed for use in certified organic operations under the United States Department of Agriculture (USDA) National Organic Program.
- If you have questions about whether a particular practice or product is allowed in organic production, consult your certifier.

No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.

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USDA United States Department of Agriculture National Institute of Food and Agriculture

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