Can I Use this Pesticide on My Organic Farm?

Brian Baker

Overview

Organic agriculture relies primarily on biological and cultural practices to manage pests, weeds, and diseases. However, there are circumstances where some form of direct-kill method to control pests would be needed. There are also some pesticides that have a non-toxic mode of action that are compatible with organic production.

As a general rule, most pesticides are prohibited for organic production. There are a limited number of exceptions found in the US Department of Agriculture's National Organic Program (NOP) rule [7 CFR 205]. Naturally occurring active ingredients, such as plant extracts, insect pathogens, and fungal derivatives may be used, provided they are not explicitly prohibited on the National List [205.602]. The standards also permit a few synthetic pesticides that are relatively low risk or have a non-toxic mode of action. To be allowed under the NOP, these substances must appear on the National List of synthetic substances allowed for use in organic crop production [205.601] with classifications and annotations consistent with their use as pesticides.

A partial list of pesticide active ingredients allowed for organic production appears in a table at the end. Pesticides used in organic production are subject to the same laws and must meet the same requirements as all pesticides. That means that they must be registered with the US Environmental Protection Agency (EPA) to be legally sold as pesticides in the US. While most pesticides permitted in organic production are rated in the least hazardous category (Category III) by EPA, they are still pesticides and must be handled appropriately. A number of substances allowed in organic production are limited to non-food use either by their EPA approved registration or by NOP's rules.

All ingredients in the product must comply with the NOP rule, not just the active ingredients that appear on the label. Non-active or inert ingredients are classified according to the level of toxicological concern. EPA has changed how it lists inert ingredients, and the NOP has taken over the maintenance of the list of substances used as inert ingredients that EPA determined to be of minimal concern prior to 2004. To be NOP compliant, all synthetic inert ingredients in pesticides must be classified as minimum risk. Inert ingredients do not appear on labels, so verifying compliance with this annotation requires the cooperation of the pesticide registrant.

Various entities may identify pesticides that comply with organic production. These include the EPA, the Organic Materials Review Institute (OMRI) and the Washington State Department of Agriculture (WSDA). EPA has approved 'For Organic Production' on labels that it finds to meet the NOP requirements. However, specific uses and applications must still conform to the label and the NOP rule. OMRI and WSDA both publish lists of formulated products that they have reviewed.

Before any pesticide can be used, the producer must include specific information on it in the Organic System Plan (OSP) [205.201(a)(2)]. When preventive practices and non-synthetic materials are insufficient to prevent or control production problems, allowed synthetic materials may be used. For any pesticide to be used for crop pest, weed or disease management, the producer must demonstrate that biological, mineral, cultural, or mechanical practices are insufficient to manage the problem. Any pesticide use must be consistent with the OSP [205.203(e)]. The OSP should include a clear threshold or decision rule for when a synthetic pesticide is to be applied, and a system to monitor its use. The Accredited Certifying Agent (ACA) needs to approve the OSP before the farm is certified as organic. If a farm uses a pesticide that is not on the OSP approved by the certifier, that farm may lose its certification.

Preventive Practices

The organic standards mandate that producers must use practices that prevent production problems that would otherwise require pesticides [205.206(a)]. Crop rotation [205.205] and nutrient management practices [205.203] are expected to be part of an overall system to prevent crop pests, weeds and diseases [205.206(a)(1)]. A growing body of literature provides supporting evidence of the theory that underlies the success of biological and cultural pest control practices. Biodiversity creates a more stable environment than a monoculture in most cases. Healthy plants without nutritional imbalances are less likely to be infested or infected by opportunistic diseases and pests, so are less likely to require the application of pesticides.

Sanitation measures are supposed to help to prevent the spread of diseases, break pest cycles and help prevent weed seeds from germinating [205.206(a)(2)]. Another preventive strategy that organic farmers need to document is the selection of suitable varieties that are resistant to diseases, pests, and weeds. Another cultural practice that may be used is the transplanting of seedlings rather than direct seeding, particularly for early season crops.

Pest Management

Protection of organic crops from insects, mites, mollusks, and rodents is part of the pest management practices described in the OSP. In addition, producers are expected to engage in cultural practices that enhance crop health [205.206(a)(3)]. Farmers may release beneficial organisms, such as predators and parasites. Another way to enhance beneficial populations is to maintain habitat that attracts and maintains populations of the natural enemies of pests. Lures, traps, and repellants are also seen as compatible means to reduce pest populations.

If these cultural practices are not sufficient and thresholds are exceeded, then a producer may apply a pesticide prescribed in the OSP. The OSP is supposed to describe the monitoring practices and procedures to prevent pest outbreaks [7 CFR 205.201(a)(3)]. Given their slower acting and either non-toxic or less toxic modes of action, pesticides permitted in organic production are not necessarily supposed to be used as a last resort. The decision rule may involve a threshold levels established to prevent populations from

reaching a destructive level. Degree-day models may also be useful to predict when a given substance should be used before it is too late.

Non-synthetic substances used for pest management include the microbial pesticide *Bacillus thuringiensis (Bt),* various botanical insecticides such as pyrethrum and neem, fungal derivatives such as spinosad, and mined minerals like kaolin clay. Highly toxic natural substances, such as arsenic, lead, nicotine, and strychnine are prohibited, as are substances shown to be harmful to the environment such as sodium fluoaluminate [205.602].

Several biological pesticides are effective only if used at the early stages of an outbreak. For example, *Bt* is most effective against young larvae and is ineffective on adults. The fungal insecticide *Beauvaria bassiana* is also more effective against young larvae.

A number of synthetic substances are permitted to protect crops from pests. These often have non-toxic modes of action and work indirectly with traps and lures, such as sticky traps, barriers, pheromones, and ammonium carbonate used to bait various fly pests. These serve to prevent the insect from feeding or mating. The active and inert ingredients are not in contact with the edible parts of the crops in most cases. For this reason, passive pheromone dispensers in particular are permitted to use inert ingredients of unknown toxicity.

Insecticidal soap, sucrose octanoate esters and horticultural oils work by suffocating the target pests. The sulfur products elemental sulfur, lime-sulfur and copper sulfate all have similar modes of action. Botanical and fungal insecticides comprise some of the most toxic compounds used for organic production.

Weed Management

Weeds are frequently identified by organic farmers as the most serious problem they face. Very few herbicides meet organic standards. There are practical reasons why organic farming relies mainly on non-chemical methods. Cultivation and hand weeding are the most common practices. With perennial crops, a ground cover that is mowed can help keep invasive noxious weeds from being established. Mulching with biodegradable material—such as straw or newspaper—can reduce weeds as well as increase soil organic matter and improve water retention. Non-biodegradable plastic mulches may also be used. However, plastic mulch must be removed from the field at the end of the growing or harvest season [205.206(c)(6); 205.601(b)(2)].

Timing is crucial and maintaining a weed-free period is important to give the crop a chance to establish. Transplanting and direct-seeding have advantages when it comes to weed management. When seedlings are transplanted into a field cleared of weeds by cultivation, they have an advantage of a more developed root system and faster establishment than weeds germinating. The advantage is even more crucial for early season crops when soil temperatures are cool. Transplants are also easier to see for the purpose of cultivation and hand weeding.

Not all crops can be transplanted. Carrots and beets must be direct seeded. Direct seeding can help avoid transplant shock. Dense plantings of seed can suppress germination or smother weeds, particularly with vigorous, fast-establishing crops. Such plantings still require thinning and hand weeding.

No-till planting into mulch is receiving greater attention as a soil conservation method. Direct-seeding into mulch may require special equipment, such as a roller-crimper. At this point, most organic no-till systems involve a grain-cover crop-grain rotation, with different grains used to suppress weeds through the chemicals that they produce. However, some systems have successfully transplanted vegetables into cover crop mulch rather than use cultivation and incorporation.

Herbicidal soap may be used, but only for non-food crop use, such as roadways, rights-of-way, ditches, and building perimeters. Ornamental crops also may be treated with herbicidal soaps [205.601(b)(1)].

Various natural substances have been tried as herbicides with mixed success. Clove oil is a botanical that is effective. Corn gluten meal can inhibit the germination and emergence of broadleaf weeds. Concentrated acetic acid is known to have herbicidal properties. While vinegar is one natural source of acetic acid, the substance can also be synthesized. Only non-synthetic forms of acetic acid are permitted in organic production. To be sold as an herbicide in the US, acetic acid must be registered with EPA for that use. Natural arsenic is prohibited as an herbicide [205.602(b)]. Synthetic micronutrients such as boron and zinc may not be misused as herbicides [7 CFR 205.601(j)(6)].

Disease Management

The first lines of defense against crop diseases are expected to be management practices that suppress the spread of disease organisms [205.206(d)(1)] and the application of non-synthetic biological, botanical, or mineral inputs [205.206(d)(2)]. Cultural practices such as quarantine, using seed that is indexed for various seed-borne diseases, hot-water treatment of seeds, plant spacing, pruning or roguing infected plants, and water management can help prevent the infection and spread of disease. Various microorganisms that serve as antagonists or hyperparasites, such as the fungi in the *Trichoderma* genus and bacteria such as *Bacillus subtilis* can help protect plants from opportunistic infections. Some plant extracts, such as garlic, are also known to inhibit the growth and spread of certain plant pathogens.

When these cultural and natural methods are not sufficient, synthetic substances in the OSP may be used. These synthetic substances must appear on the plant disease control subsection of the National List [205.601(i)].

Sulfur and copper are the disease control materials most applied on organic farms. Elemental sulfur may be used for a broad range of diseases in a wide variety of plants. Copper products must be applied in a way that minimizes copper accumulation in the soil. Among the copper products allowed are copper sulfate, copper hydroxide, copper

octanoate, copper oxide, and copper oxychloride. Bordeaux mix (copper sulfate combined with hydrated lime) and lime-sulfur are also permitted.

Hydrogen peroxide and potassium bicarbonate, two familiar substances that are relatively new as fungicides, are also permitted. Potassium bicarbonate may also be used for disease management and is used for partial control of powdery mildew in a range of crops. As such, it offers an alternative to sulfur.

Growers of pome fruits whose crops are infected with fire blight can use peracetic acid, streptomycin (in apples and pears only), and tetracycline (oxytetracycline calcium complex). Antibiotic resistance is a concern, so growers with fireblight are advised to prune and rotate antibiotics with other tools, such as copper. Finally, narrow range oils may also be used for disease management.

In some cases materials can be used for some uses but not others, so make sure that the product is permitted for the use you intend. Hydrated lime can be used for disease control, but not as a soil amendment. The antibiotics streptomycin and tetracycline are allowed for fire blight control only.

Conclusion

In order to use a pesticide on an organic farm, the operator should remember:

- Organic crop protection is based on an approach that integrates biological and cultural methods.
- Only a very limited number of pesticides may be used.
- The entire formulation needs to meet organic standards.
- The intended use must be consistent with the organic standards.
- All pesticide laws must be followed.
- Any pesticide used must be included in the Organic System Plan (OSP).
- The decision to use a pesticide must be consistent with the OSP.
- All uses must be documented and available for inspection.

Revised July 2009

This resource guide builds upon two other articles written by Nick Andrews (Oregon State University) and Brian Baker (Organic Materials Review Institute) and published by the eXtension Foundation, For more information, view the following articles at the websites indicated:
Can I Use This Input On My Organic Farm?
http://www.extension.org/article/18321

Can I Use this Product for Disease Management on my Organic Farm?
http://www.extension.org/article/18360

Table

Partial List of Pesticide Active Ingredients
Permitted for Organic Production Under the NOP

Active Ingredient / Substance	Annotations / Restrictions
Acetic acid	Non-synthetic only, must be EPA registered for use in the US
Ammonium carbonate	As a bait in insect traps
Bacillus subtilis	Non-GMO sources only
Bacillus thuringiensis	Non-GMO sources only
Beauvaria bassiana	
Boric acid	Structural pest control, no direct contact with organic food or crops.
Chitin	Non-synthetic sources only
Copper hydroxide	Must be used in a manner that minimizes accumulation in the soil.
Copper oxide	Must be used in a manner that minimizes accumulation in the soil.
Copper oxychloride	Must be used in a manner that minimizes accumulation in the soil.
Copper sulfate	Must be used in a manner that minimizes accumulation in the soil; use for tadpole shrimp in aquatic rice production limited to one application every 24 months.
Ferric phosphate	Molluscicide
Granulosis virus	
Horticultural oils	Narrow-range oils as dormant, suffocating or summer oils
Hydrated lime	For disease control only.
Hydrogen peroxide	
Lime-sulfur	
Limonene	
Neem	
Peracetic acid	For fireblight, as a treatment for seed and asexually propagated planting material, and to clean equipment
Pheromones	Passive pheromone dispensers may use
Potassium bicarbonate	
Pseudomonas spp	Non-GMO sources only
Pyrethrum	Non-synthetic only, must be EPA registered for use in the US
Quassia	Must be EPA registered for use in the US
Rotenone	Must be EPA registered for use in the US
Ryania	Must be EPA registered for use in the US
Sabadilla	Must be EPA registered for use in the US
Soap	Permitted only in non-crop areas when used as an herbicide
Sodium bicarbonate	Non-synthetic only, must be EPA registered for use in the US
Spinosad	
Sticky traps and barriers	
Streptomycin sulfate	For fireblight in apples and pears only.
Sucrose octanoate ester	
Sulfur	
Tetracycline	For fireblight control only
Vitamin D3	Rodenticide

Note: All ingredients in formulated products must be classified as minimum risk, be non-synthetic, or appear on the National List of synthetic substances allowed for crop production.