

CHAPTER 8

MANAGING PESTS, WEEDS, AND DISEASES



§ 205.206 Crop pest, weed, and disease management practice standard

This section of the USDA organic regulations requires that producers use a three-tiered approach in deciding how to deal with pest, weed, and disease problems. This can most easily be explained by designating these levels A, B, and C.

Level A, § 205.206 (a), is prevention of the problem.

Level B, § 205.206 (b, c, d), involves the use of mechanical or physical methods.

Level C, § 205.206 (e), is the application of allowed materials.

Each level is explained in more detail later in this section.



Related ATTRA publications

www.attra.ncat.org

Intercropping Principles and Production Practices

Farmscaping to Enhance Biological Control

Principles of Sustainable Weed Management for Croplands

Farmers who transition from conventional to organic production systems often find that pest, disease, and weed control are their biggest challenges. For insect control, conventional farmers can wait until they see an outbreak of insects and then choose a chemical to control the insect. This approach is workable for conventional farmers because they have a large toolbox of chemicals available. For disease prevention, conventional farmers can fumigate the soil with broad-spectrum pesticides. Fumigation also kills beneficial soil organisms, which has negative long-term consequences. Organic farmers have fewer chemical tools available because there are far fewer insecticides, fungicides, and herbicides allowed for application to organic crops. In order to successfully transition to an organic system, farmers should be willing to approach these challenges from a different perspective. The key difference is preventing problems by designing a system that prevents most of the pest problems. Preventing severe pest outbreaks will allow the farmer to avoid broad-spectrum pesticides that will lead to future imbalances in the ecosystem.

Three levels of pest management

The USDA organic regulations are written to require farmers to employ tactics to minimize pest and disease problems using a three-level hierarchical approach.

Level A

The first line of defense in managing weed, insect, and disease pests is a systems-based approach. It is based on the fact that a well-designed and healthy organic system will naturally have fewer pest problems. The system is designed to prevent pest and disease outbreaks.

Level B

The second line of defense is utilized if the practices of level A are not sufficient to control the weed, insect, or disease problem. Level B generally includes mechanical and physical practices that are traditional in organics, as well as the use of nonsynthetic or natural materials.

Level C

The third line of defense is used if the level of pest control required is not achieved after A and B control options are applied. Level C practices include the use of inputs such as biologicals and botanicals to control pests. This level also provides the option of using those

materials included on the National List under § 205.601 Synthetic substances allowed for use in organic crop production.

If you anticipate the need for level C control measures, be sure that you indicate this in your Organic System Plan. Be specific about the control materials you might be using and outline the indicators or thresholds you monitor that will trigger the use of those materials. See Chapter 9 “The National List of Allowed and Prohibited Substances” for information on choosing materials, verifying that they are allowed, and informing your certifier regarding their use.

The organic regulations prescribe the type of practices but allow farmers to choose the specific practices that will work best for their systems. The remainder of this chapter will discuss specific level A and level B practices. Since many practices control both diseases and arthropod pests (insects and mites), these will be discussed together, and weed management will be discussed separately.

Pest and disease management

Organic producers maintain that organic soil-building practices will result in crops that are properly nourished and thereby less susceptible to attack by pests and diseases. Natural biological pest control arises in a healthy organic system in the form of an active complex of natural predators and parasites that suppress pest populations. Incorporating habitat and food sources for beneficial insects into your farm, known as farmscaping, can provide long-term benefits.

In many field crop and vegetable systems, maintaining a diverse, healthy ecosystem and using well-timed cultural practices are sufficient for pest management. Pests may not be eliminated, but damage levels are low enough to be tolerated.

Examples of Level A practices to manage pests and diseases

Cover crops: Some cover crops, including sudangrass, rapeseed, and mustard, are effective at suppressing nematodes.

Crop rotation: Solanaceous crops, including tomatoes and potatoes, are planted in rotation with other crops that are not in the same family. This minimizes the risk of late blight disease and Colorado potato beetle outbreaks. Grain crops, including wheat, barley, and corn, are susceptible to Fusarium head blight. Moving to a legume or oilseed in the rotation can help break this disease cycle by allowing the grain crop residues to decompose fully.

Cultural practices: Use of disease-resistant varieties is a common cultural control. In addition, delaying spring planting until the soil is warmer minimizes fungal diseases and allows the crop to establish a healthy stand.

Intercropping: Two or more crops grown in close proximity is known as intercropping, strip cropping, or companion planting. This approach increases biodiversity and decreases pest outbreaks.

Providing habitat for insect predators and parasites: In organic apple orchards, natural populations of predatory mites become high enough to control the plant-eating spider mites because the orchard provides a good habitat for the predatory mites. Conventional orchards, by contrast, are susceptible to outbreaks of spider mites because pesticides reduce the populations of beneficial predatory mites. Growing some plants that attract ladybugs or other beneficials will help reduce populations of plant pests.

Resistant varieties: As one example, tomato varieties advertised as VFN are resistant to Verticillium, Fusarium, and nematodes. Stem rust is a common grain disease that can be managed by selecting resistant varieties.

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Sanitation: Sanitation entails the removal of sources of disease infection or insect pest infestation. For example, apple and pear growers remove branches infected with fire blight (strikes). The strikes are removed from the orchard and burned to kill the bacteria that cause fire blight. Mushroom growers pasteurize the compost to kill fungi that would compete with the mushroom crop.

Trap crops: These are small plantings of a crop or crop variety intended to draw a particular pest away from the main crop. For example, alfalfa planted in strips amid cotton attracts lygus bugs away from the cotton crop. Typically, trap crops must be destroyed to kill the pests that have been attracted to them. Use of trap crops requires a good understanding of the biology of the pest.

Examples of Level B practices to manage pests and diseases

Burning crop residues: In organic production, the burning of crop residues is allowed only for suppression of disease. Rice straw often is burned in the field. Before using this disease-control practice, it must be clearly stated in the organic system plan and approved by the certifier.

Canopy management: By training and pruning trees, orchardists can increase airflow and decrease disease pressure. Viticulturists practice leaf removal to control Botrytis bunch rot of grapes.

Introducing insect predators and parasites: Several types of insects can be purchased in large quantities and released on the farm. For example, to control aphids, release ladybugs and provide favorable conditions to encourage the ladybugs to stay and eat the aphids.

Mulching: Mulching can reduce disease on tomatoes and similar crops by reducing soil contact and maintaining an even soil moisture. However, organic mulches also can serve as habitat for certain pests, such as the squash bug and slugs.

Row covers: Floating row covers, made of lightweight fabric, can keep insects out of short-season crops. For example, they can prevent flea beetles in arugula and prevent cabbage root maggots in radishes.

Solarization: Soil solarization is achieved by covering the soil with plastic during the summer. This allows the soil to get hot enough to kill many pathogens, yet it allows microbial spores to survive. Survivors can re-establish the microbial populations needed for healthy soil.

Weed management

According to the USDA's Invasive Weed Management Unit, the most critical problem facing today's organic grower is weeds. Weeds compete with crops for moisture, nutrients, and sunlight. Weeds do not always need to be eliminated—short weeds in a tall corn crop may be harmless—but weeds do need to be managed. Fortunately, there are many classic ways to reduce the number of weed seeds, and new ways are being developed to remove weeds that compete with crops. The appearance of many difficult-to-control weeds may be an indication that the soil has nutritional or physical problems and nature is trying to restore health and balance.

Examples of Level A practices to manage weeds

Variety selection: Select grain varieties that emerge early and close the canopy as quickly as possible. This shades the soil so weeds are not as competitive.

High-crop seeding rates: Some crops can be planted at high rates to smother weeds. Another strategy is to increase the crop density by decreasing within-row distance or between-row distance. This is especially true when planting cover crops, forages, or grains.

Nurse crops: Companion crops can be sown with other crops to suppress weeds during the establishment year. A common example is planting oats to serve as the nurse crop for alfalfa.

Sanitation: For long-term weed control, it is important to avoid letting weeds go to seed. This keeps the field free of weed seeds for the next crop. Crops that go to seed also can become weeds the following year.

Cover crops: Rotations that include cover crops can provide some weed control, especially fast-growing cover crops, such as buckwheat. If cover crops are likely to self-seed, it will be necessary to mow them before seed sets.

Solarization: Clear plastic traps the sun's heat to raise the soil temperature.

Examples of Level B practices to manage weeds

Cultivation: Mechanical cultivation is effective in killing weeds, especially if done at the seedling stage. Hilling potatoes controls the weeds while covering the tubers with soil.

Flaming: Flamers kill the above-ground portions of plants. They do not kill the roots, nor do they prevent weeds from re-sprouting. Several types of flamers are available, including small hand-held propane flamers and tractor-mounted flamers typically used in orchards.

Grazing: Animals such as goats or geese can control the height of cover crops sown in the drive rows in orchards. Animals must be removed 90 days before harvest of the crop, in accordance with the 90-120-day rule on manure applications. Chickens in movable pens can remove all weeds from small areas.

Hand weeding: Organic growers are all too familiar with the expense (if you hire someone) and exhaustion (if you do the work yourself) of hand weeding. However, hand weeding is still an effective method of weed control.

Mowing: In orchards, the cover crops in the drive rows are kept mowed.

Mulching: A thick layer of mulch can smother weed seedlings. Mulch is less effective on perennial weeds because weeds that emerge from rhizomes, stolons, or tap roots may be able to grow through the mulch. Mulches are most commonly used when they can serve more than one purpose because applying mulch can be labor-intensive and therefore costly. For example, wood-chip mulches are commonly used in blueberry plantings to smother weeds, add organic matter, reduce soil pH, retain moisture near the soil surface, and keep the soil cool, all of which are important for shallow-rooted blueberry plants.

Transplanting: Transplanting onions rather than direct seeding gives the onions a head start on the weeds.

Weed cloth or black plastic: Weed cloth is often used in perennials, such as organic blueberry plantings, because the cloth controls weeds for several years. Black plastic is more commonly used in annual crops, such as tomatoes. Plastic mulches should not be allowed to photodegrade or deteriorate in the field; they may not be disced, plowed, or otherwise incorporated into the soil. In annual production systems, plastic mulch must be removed at the end of the growing season.



Online Resources

Biorationals: Ecological Pest Management Database, www.attra.ncat.org/attra-pub/biorationals

Organic IPM Field Guide, www.attra.ncat.org/attra-pub/summaries/summary.php?pub=148



Questions

- Does your production system keep insects and diseases at manageable levels? Yes No N/A

- Which of the following practices do you use?
 - Beneficial insects Yes No N/A
 - Canopy management Yes No N/A
 - Companion planting Yes No N/A
 - Cover crops Yes No N/A
 - Crop rotation Yes No N/A
 - Cultivation Yes No N/A
 - Flaming Yes No N/A
 - Grazing Yes No N/A
 - Habitat for beneficial insects Yes No N/A
 - Habitat for predators Yes No N/A
 - Hand weeding or hoeing Yes No N/A
 - High crop seeding rates Yes No N/A
 - Intercropping Yes No N/A
 - Mowing Yes No N/A
 - Mulching Yes No N/A
 - Resistant crop varieties Yes No N/A
 - Row covers Yes No N/A
 - Sanitation Yes No N/A
 - Solarization Yes No N/A
 - Trap crops Yes No N/A
 - Weed cloth Yes No N/A

- Are all of the insect, pest, weed, and disease control materials you are using allowed in organic production? See Chapter 9 “The National List of Allowed and Prohibited Substances” for more information on choosing pest-control materials. Yes No N/A

CHAPTER 9

THE NATIONAL LIST OF ALLOWED AND PROHIBITED SUBSTANCES

The National List of Allowed and Prohibited Substances identifies substances that may or may not be used in organic crop production. In general, synthetic substances are prohibited unless specifically allowed and non-synthetic substances are allowed unless specifically prohibited.

§ 205.105 Allowed and prohibited substances, methods, and ingredients in organic production and handling

There are two main criteria that determine whether a given substance, such as a fertilizer or pesticide, is allowed in organic crop production:

1. Synthetic substances are prohibited unless specifically allowed on the National List.
2. Nonsynthetic (natural) substances are allowed unless specifically prohibited on the National List.

In addition to these guidelines, genetically modified organisms are prohibited because they are produced by a prohibited method. Sewage sludge is prohibited because it usually contains prohibited substances.

§ 205.601 Synthetic substances allowed for use in organic crop production

The National List of synthetic substances includes materials that are specifically allowed in organic crop production. The list includes algaecides, disinfectants, sanitizers, irrigation system cleaners, herbicides, animal repellents, insecticides, miticides, pheromones, rodenticides, slug baits, plant disease controls, soil amendments, and plant growth regulators; in short, many of the materials needed for crop production. Any synthetic substance that is not on the National List is not allowed. For example, herbicides containing the synthetic material glyphosate are prohibited. Herbicides containing only natural substances, such as vinegar and clove oils, are allowed.

§ 205.602 Non-synthetic substances prohibited for use in organic crop production

This is the National List of natural, or nonsynthetic, materials that are specifically prohibited in organic crop production. This list includes natural—but highly toxic—materials, such as arsenic.



Related ATTRA publications

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Sources of Organic Fertilizers and Amendments

First, it's important to define a few terms. An “input” is any material applied to a crop, including compost, pheromones, and any pesticides. The term “pesticide” refers to any agent used to kill a pest. For example, insecticides kill insects, fungicides kill fungi, and herbicides kill plants. The National List uses the word “substance” to include not only inputs to crops but also any materials used for other purposes, such as rodent baits. All substances are listed by the generic terms only (e.g., sodium bicarbonate), not by the brand name (e.g., Arm and Hammer baking soda). This avoids suggesting that any one brand is better than any other.

In this context, the term “product” will refer to the brand name of an input material. For example, Biomin® Calcium 2-0-0 is the name of a calcium product manufactured by JHBio-tech, Inc. Pesticides contain an active ingredient, which is the material that kills the pest. Both pesticides and fertilizers also have inert ingredients, which make up the remainder of the product. Active ingredients are listed on the label, but inert ingredients typically are not listed. Although the inert ingredients are not listed on the product labels, they must be allowed for organic production, in order to use a specific product.

There are two organizations that review products and publish lists of products allowed for organic production: the Organic Materials Review Institute (OMRI) and the Washington State Department of Agriculture (WSDA) Organic Food Program. These organizations obtain information about all the inert and active ingredients in a product formulation, review them, and assess whether the product is allowed.

As explained in the previous chapter, the USDA organic regulations require that farmers implement pest-management practices in a hierarchical fashion, beginning with a systems approach. If that approach is not sufficient, inputs may be needed, whether for plant nutrition, disease prevention, or pest management. This chapter explains broadly the types of materials allowed and specifically how to choose a product that will be approved by your certifier.

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Allowed pesticides

Generally speaking, pesticides derived from natural materials or living organisms are allowed in organic production as long as they do not contain synthetic additives or are not specifically prohibited on the National List under § 205.602. By contrast, most synthetic pesticides are not allowed; those few that are can be found on the National List under § 205.601.

Allowed inputs typically include but are not limited to the following:

- Biological pesticides
- Botanical pesticides
- Dormant and summer oils
- Fatty acid insecticidal soaps
- Minerals
- Pheromones

Biological pesticides

Biologicals may contain living microbes, such as the fungi *Beauveria bassiana* or *Trichoderma harzianum*. Other biologicals contain toxins derived from naturally occurring microbes, such as the Bt toxin, produced by the bacterium *Bacillus thuringiensis*. There are various formulations of Bt, all of which control insect larvae.

Spinosads are a relatively new class of biological insecticides derived from a rare form of soil-dwelling actinomycete. Spinosads control a variety of insect pests, including thrips, fruit flies, and caterpillars, without harming beneficial insects.

Botanical pesticides

Botanicals are derived from plants. They include pyrethrum, rotenone, sabadilla, neem, ryania, and garlic. Strychnine and nicotine are also botanicals, but are expressly prohibited in organic production. Since botanical pesticides are relatively nonselective, they can affect natural predators and other nontarget organisms. Rotenone, for example, is highly toxic to fish. For this reason, many organic growers use botanical pesticides only as a last resort.

Spray oils

Vegetable- or animal-derived oils are generally allowed as suffocating (stylet) oils, summer oils, dormant oils, and surfactants. Some petroleum-derived oils, referred to as “narrow-range oils,” are allowed for the same purposes. Spray oils are commonly used to control scale and mite pests.

Insecticidal soaps

Fatty acid insecticidal soaps are synthetic pesticides specifically allowed in organic production. Safer® Brand Insect Killing Soap Concentrate II is a product that is commonly used by organic farmers. Insecticidal soaps can be hard on beneficial predatory mites, so they should be used with caution.

Minerals

Mineral-based pesticides include sulfur, copper products, diatomaceous earth, and kaolin clay. These must be used with caution, even though they are allowed. Sulfur can reduce the populations of some beneficial insects and may burn plants if used during hot weather. Diatomaceous earth can cause respiratory problems and itching in the farmworkers who apply it. Copper can accumulate in soils, so it is allowed with restrictions. The organic regulations state that “copper-based materials must be used in a manner that minimizes accumulation in the soil...” Certifiers may require soil testing to verify that copper is not accumulating in the soil. Certain highly toxic minerals, including arsenic and lead, are specifically prohibited.

Pheromones

Pheromones are chemicals released from insects that cause other insects of the same species to change their behavior. Pheromones are not considered pesticides because they do not kill the insects. The pheromones used for pest control are often called mating disrupters because they alter mating behavior. Being totally natural, the pheromones themselves are allowed in organic production. However, some of the inert ingredients in mating disrupter products are prohibited.

Allowed fertilizers

Allowed fertilizers and amendments typically include, but are not limited to, the following:

- Plant materials such as crop residues
- Rock dusts such as gypsum, rock phosphates, granite dust, greensand, natural potassium sulfate, sulfate of potash-magnesia, and glacial gravel dust
- Animal byproducts
- Manures
- Composts
- Marine products and byproducts, such as seaweed and fish emulsion
- Non-GMO microbial inoculants
- Sodium nitrate (Chilean nitrate), only if its use constitutes no more than 20 percent of the crop’s total nitrogen requirement

How to determine if a product is allowed for organic agriculture

The allowed pesticides on the National List are called active ingredients when they are formulated into a commercial product. Even if the active ingredient in a pesticide is allowed, if an inert ingredient is not allowed, the pesticide may not be used in organic crop production. The U.S. Environmental Protection Agency provides four classifications of inert ingredients: List 1, List 2, List 3, and List 4. At this time, only a small fraction of the inert ingredients on these lists is allowed in organic production.

Even if the catalog or the manufacturer claims that a product is allowed, it's a good idea to verify that the product approval is current before it is applied to organic land.

The active ingredient is listed on the product label, but the inert ingredients often are not listed, and companies may choose not to reveal that information. Determining whether a commercial pesticide is allowed for organic production is a daunting task.

The same situation holds true for fertilizers and soil amendments. For example, the commonly sold agricultural gypsum often is made from recycled wallboard, a construction material that contains synthetic chemicals. For that reason, gypsum used in organic production must be obtained only from a mined source.

The safest option for organic farmers is to avoid using any product unless you're sure that it is allowed. One way to verify the product's status is to review the lists published by OMRI and the WSDA Organic Food Program. When companies develop a fertilizer or pesticide that they believe is suitable for organic production, they typically list the product with OMRI or WSDA, or both. The organizations review the products, including the inert ingredients, and determine if they meet the requirements of the USDA organic regulations. Organic farmers can use these listed products with confidence that their use will not jeopardize their organic certification. The review does not include a review of product effectiveness, and the listing is not an endorsement of the product. On the other hand, organic producers should be aware that many companies choose not to list their products with OMRI or WSDA, yet their products are allowed in organic agriculture.

Using the OMRI list

OMRI has two lists: the OMRI Products List and the OMRI Generic Materials List. Both include materials for crops, livestock, and processing. To use either OMRI list, start on the OMRI Web site home page, and click "OMRI list" on the left side of the page. The next screen allows you to search the OMRI lists for your product.

For example, if you search using the word "gypsum," the Products List will include brand names of several products (e.g., Ida-Grow Pelletized Gypsum). The generic materials list will simply list gypsum.

At the bottom of the page, there is a link to download the Products List as a PDF file. If you use the downloaded file, be sure to update it frequently, as new products are added and others are removed on an ongoing basis. The OMRI Web site also has links to the names and addresses of suppliers to make it easier to purchase approved materials.

Using the WSDA Brand Name Materials List

The Brand Name Material List (BNML) is maintained by the WSDA Organic Food Program and can be accessed on its Web site. There are three versions: Sorted by Product, Sorted by Company, and Sorted by Type. Each of these lists can be downloaded as a PDF file. The list of materials sorted by product is best used to look up a specific product, such as MicroPak PolyAmine, which is a fertilizer sold by Northwest Agricultural Products. The list of materials sorted by company is useful when searching for products from a particular company, such as Bio-Gro, NuFarm, or Northwest Agricultural Products. The list of materials sorted by type can be used to find an approved product. For example, searching under D&PC (Disease and Pest Control), there are numerous sub-types, including neem, pheromones, and fungicides.

Although this list was developed by one certification agency, it is accepted by most of the certifiers in the United States.

Caveats

Companies that sell agricultural products will often state in their catalog that a product is OMRI or WSDA approved. Some manufacturers will state on the package that the mate-

rial is listed with OMRI or WSDA. Even if the catalog or the manufacturer claims that a product is allowed, it's a good idea to verify that the product approval is current before it is applied to organic land.

When using either WSDA or OMRI lists to verify the product's status, be sure to check the most recent version. Each list is updated several times each year, and the most current version is posted online. Using the complete and correct name of the product will make it easier to find the product if it is listed.

Restrictions on use of approved products

Although products may be listed by OMRI or WSDA, there may be restrictions on their use. The WSDA indicates restrictions in the column on annotations. For example, the product Biomin Zinc is allowed as a fertilizer, but there is a restriction: soil deficiency must be documented by testing. Before applying zinc to crops, farmers are required to obtain a soil test to verify that the crop needed additional zinc. Some certifiers will accept fruit or leaf tests that indicate a deficiency in the plant, as opposed to the soil.

The Organic System Plan

Each year, when a farmer prepares the paperwork to renew organic certification, one of the questions will be: "Please list any materials you plan to use in this year's growing season." This list should be based on the types of inputs applied in the previous year or the past few years. This is a list of materials that might be applied, but they should only be applied if they are needed. Always, if it is necessary to use a product that is not on the Organic System Plan, the certifier must be notified before use.



Online Resources

OMRI Materials Lists, www.omri.org/omri-lists

WSDA Materials Lists, www.agr.wa.gov/FoodAnimal/Organic/MaterialsLists.aspx

Biorationals Database, www.attra.ncat.org/attra-pub/biorationals



Questions

- Do you have a list of all inputs used for insect control in the previous growing season? Yes No N/A
- Do you have a list of all inputs used for weed control in the previous growing season? Yes No N/A
- Do you have a list of all inputs for disease control in the previous season? Yes No N/A
- For a product listed by OMRI or WSDA, do you have evidence that it is allowed for organic agriculture? This can be a label or a copy of the online listing. Yes No N/A
- If you are using natural materials such as gypsum, do you have evidence that they are from a naturally mined source? Yes No N/A
- Do you understand any restrictions on the use of the products and have you complied with the restrictions? Yes No N/A
- Have you kept invoices of all materials purchased? Yes No N/A