chapter 17

Organic Gardening

In a nutshell...

- Organic gardening does NOT necessarily mean gardening without chemicals. Chemicals from natural sources are allowed in organic production, despite the fact that they may be just as unsafe as any synthetic product.
- Organic gardening may not be what you think it is (or what anyone else thinks it is).
- Just because it's organic, doesn't mean it's safer, healthier, or more nutritious.
- There's no such thing as organic certification when it comes to lawn care.
- Organic gardening uses the same techniques as conventional gardening.
- Check the resources at **hort.extension.wisc.edu** for issues not covered in this chapter.

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Introduction

In agriculture, the word "organic" has come to mean "foodstuff grown or raised without synthetic fertilizers or pesticides or hormones." Organic techniques promote diversity and enhance biological cycles on the farm to reduce the need for either natural or synthetic inputs.

Organic gardening, like organic agriculture, is aimed at making the garden self-sufficient, sustainable, and productive. The big difference between organic and non-organic gardening is when you reach into your integrated pest management toolbox—you use cultural, mechanical, and biological options first. The last option to be used is chemical, and then only products from natural sources.

Organic gardening practices can be applied not only to vegetables and fruits you grow but to the ornamentals in your garden as well. This chapter provides a short overview of organic gardening.

Learning objectives

1. Understand why "organic gardening" can be difficult to define.
2. Identify the general gardening practices and integrated pest management (IPM) principles that are also applicable to organic gardening.
3. Explain chemical management options in organic gardening.

What is organic gardening?

Organic gardening can be more like a holistic philosophy than a specific method of gardening. While there is a federal, legal standard for commercial growers (see sidebar on national organic standard), home gardeners are left to make their own definitions of what organic gardening means to them. However they define it, the basis of organic gardening takes concepts drawn from IPM (see chapter 4, Pest Management) and general gardening practices (see chapter 9, General Gardening Practices), and uses them in such a way to minimize negative environmental impact.

- Plant health is maximized through cultural practices and building the soil.
- Pests (insects, diseases, and weeds) are managed by a variety of means, including organic pesticides when needed.
- Synthetic fertilizers and pesticides are not used.

Organic gardening concepts

Organic gardening uses integrated pest management and general gardening practices to manage soil fertility and plant problems while minimizing impacts on the environment.

Soils

Healthy plants start with healthy, fertile soil. See chapter 2, Soils.

- Where you are growing vegetables or planting annuals, build the soil every year. Add organic matter to help provide nutrients, develop good soil structure, and improve moisture-holding capacity. Double-dig to incorporate organic materials.
- In perennial beds, top dress with compost annually. Digging or tilling is not recommended as it may damage the roots of the perennial plants.

National organic standards

To become "certified organic," growers must undergo a certification process that meets federal standards for organic production. Some of these standards exclude the use of synthetic fertilizers, sewage sludge, irradiation, and genetically engineered plants (source: USDA's National Organic Program). Some agencies go above and beyond the federal guidelines. Becoming certified allows producers to market their product as organic, indicated by the USDA Organic seal. Small farmers who sell less than $5,000 annually are exempt from the certification process.

Note: At this time, there are no standards for organic home gardening.

For complete information on the federal organic standards, look on the USDA website (https://www.ams.usda.gov/about-ams/programs-offices/national-organic-program) or search the internet for "National Organic Program."

In this course we are using the federal definition as the minimal definition of organic. Individual gardeners, however, may adopt philosophies that go beyond the strict legal definition of organic.

For example, using black plastic mulch to control weeds in the vegetable garden is very effective, reduces labor, and eliminates the need to use a synthetic herbicide on the soil. Using plastic for mulch is a legally accepted organic practice. However, some people feel that because the plastic is a synthetic material, uses a fair amount of energy to produce, and eventually has to be disposed of in landfill, it has a significant environmental impact and is therefore not an acceptable product in their "organic" gardening system. Those gardeners might use a natural mulch—such as compost, straw, or grass clippings—instead.

Organic fertilizers

Organic fertilizers are derived from natural sources. You can make some of them—like compost—at home. And you can purchase many other organic fertilizers, including composts, manures, and fish emulsions.

In general, when compared to synthetic fertilizers, organic fertilizers have a lower nutrient concentration, may provide a broader range of micronutrients, and must be broken down by bacteria to release their nutrients. They may act as a slow-release source of nutrients and, depending on the type, provide beneficial organic matter.

Compost tea is often touted as an especially effective fertilizer, but in research trials it does not appear to live up to its claims. Use compost tea if you'd like, but regular additions of compost and watering may be just as effective.

Crop and variety selection

The right plant for the right place is especially important for perennial plants but also applies to annual flowers and vegetables. A plant adapted to the soil, moisture, and climate conditions where it is planted will be healthier and better equipped to resist diseases and insects. And you won't need to water or fertilize it as much.

- Only buy your plants and seeds from reputable sources.
- When possible, choose plants and cultivars that are resistant to common insects and diseases. Avoiding problems in the first place is better than controlling or eliminating pests later.
- Inspect all plants for diseases and insects before bringing them into your garden.
- Monitor your plants' needs and be sure to fertilize and water them regularly. Keep plants from becoming stressed, so they are better able to defend against pests.

Dealing with pests

As discussed in chapter 4, Pest Management, plants can generally tolerate a certain amount of damage before there's a significant decrease in yield or a risk of dying. As a rule, organic gardening emphasizes prevention of problems in the first place and regular monitoring to keep track of the amount of damage so you know when the damage has reached the point where a response is necessary. You may also have to raise your tolerance threshold to some pest damage. For example, you may need to accept a few blemishes on your apples.

When you do respond, use all the cultural, mechanical, and biological options in your IPM toolbox to manage pests BEFORE selecting an organic pesticide option.

- Keep your garden clean and promptly remove sources of diseases and insects. When problems are caught early, they are much easier to manage.
- Physically remove pests, such as squashing egg masses before pest insects hatch or remove foliage with early signs of disease.
- Keep weeds out of the garden as they can compete with your plants for resources and harbor insects and disease.
- Use proper **crop rotation** to help prevent diseases or insects that may overwinter in the soil (see chapter 14, Vegetables).

If a chemical response is ultimately necessary, many organic pesticides are available for home garden use. Keep in mind, however, that just because something is considered organic, labeled "natural," or is derived from a plant, it does not mean it is safe and nontoxic. Many organic pesticides are highly toxic and should be used with caution. Use organic products with a narrow (targeted or selective) range rather than products with a broad (or nonselective) range. Also, start with the least toxic option, if one is available. As with all pesticides, read the label and know the pest for optimal timing of product application and judicious use. See chapter 4, Pest Management.

Likewise, "home remedies" made from products commonly found around the house may also be **phytotoxic** or have adverse effects on the environment and should only be used with full knowledge of potential consequences. For example, you may see a recommendation to use "tobacco juice" as part of a homemade insecticide. The nicotine in the tobacco, however, is an extremely toxic nerve poison and very dangerous to many animals. Avoid concoctions containing tobacco or nicotine.

Insects

Encourage natural enemies. Plant a variety of plant species that will attract beneficial insects to help control pests. Learn to identify which insects are beneficial and which are actually pests. See chapter 4, Pest Management and chapter 5, Entomology.

- Scout regularly. Using insect **traps** will help you know when pests are present and when they are reaching levels at which management is warranted.
- Use barriers like row covers and plant collars to create physical barriers that keep pests from accessing your plants.

Organic insecticides

- *Bacillus thuringiensis (Bt)* is a soil-dwelling bacterium that has been incorporated into a foliar application to control certain insects. Bt has minimal effect on beneficial insects. It acts as a stomach poison, so the targeted insect needs to take a few bites in order to be affected. Once sprayed or dusted onto leaves, it will be effective for approximately 3 to 5 days. The three main strains of Bt target different insects, so it's very important that you apply the correct strain to control your specific pest.
  - *Bacillus thuringiensis kurstaki* and *B.t. aizawai* target only caterpillars, which are the larval stage of moths and butterflies.
  - *Bacillus thuringiensis israelensis* targets mosquito larva, with some effect on blackfly larva and fungus gnat larvae.
  - *Bacillus thuringiensis tenebrionis* (San Diego) targets beetle larva, specifically Colorado potato beetles in their first and second instars.
- **Boric acid** is a useful pesticide for many crawling insects and is most often sold as bait in traps for ants or cockroaches. When used in traps, it is safe for beneficial insects.
- **Capsaicin**, derived from hot peppers, can be used as a repellent to deter pests. Some pest insects are repelled by the smell, while others simply won't feed on plants that have been treated with capsaicin.
- **Diatomaceous earth** is mined from the earth. It consists of diatom skeletons made of silicon dioxide, which is basically glass. When an insect crawls over diatomaceous earth, its cuticle is abraded and the insect eventually desiccates and dies. It is relatively safe, but extreme care must be taken when applying diatomaceous earth to not inhale it, as it can cause significant lung damage.
- **Horticultural oils** coat insects and cause them to suffocate. They can be very effective on insects such as aphids, scale, and mites. Dormant oil sprays are more effective than those used in summer and are less likely to damage foliage. But many oils are derived from petroleum products and therefore are not organic.
- **Insecticidal soaps** sprayed on insects can dissolve their waxy cuticle, causing them to desiccate and die. They are especially effective on soft-bodied insects. However, soaps can also dissolve the waxy cuticle on plant leaves, so care should be taken and soap residues rinsed off plant foliage. Most soaps have insecticidal activity, but those with specific chemical compositions work best. Don't substitute dish detergents, since many have additives that can be phytotoxic to plants and won't be as effective.
- **Kaolin** is a type of clay that can be applied to plants to create a barrier that prevents insects from feeding on them.
- **Neem** comes from the tropical tree *Azadirachta indica*. It is a common organic insecticide that also can control some fungi, such as powdery mildew. Neem works by causing insects to stop feeding and by acting as a growth regulator interfering with the insects' ability to molt. Neem is toxic to many aquatic organisms. Allergic reactions in people have been reported, so it should be used with caution.
- **Pyrethrum**, derived from a species of chrysanthemum, acts as a nerve toxin in insects. It is fast acting and very effective but has a very short residual effect. It also is just as toxic to beneficial insects as it is to pests, and should therefore be used with caution.
- **Spinosad** is a biologically derived insecticide produced via a fermentation culture of a bacterial organism isolated from soil. It kills insects that ingest it, affecting their nervous system. It is effective against a wide variety of insects—including caterpillars, thrips, flies, and some beetles—but not against sucking insects. It is of low risk to beneficial insects.

Diseases

Try to prevent plant diseases with cultural practices such as species selection, adequate plant spacing, proper watering practices, and removing infested plants. Once diseases do occur, few organic products can effectively cure them.

- Space plants properly to allow for good air circulation. Most fungal diseases thrive in moisture and high humidity. Good air circulation helps dry foliage and allows sunlight to reach more of the plant surface.
- Water the soil and root zone—rather than watering or sprinkling from above—to prevent wet leaves, which encourages disease.

Organic fungicides

- ***Bacillus subtilis*** is a naturally-occurring saprophytic soil bacterium. The patented strain QST713, marketed under various brand names such as Serenade and Natria® Disease Control, produces lipopeptide antibiotics that either kill or reduce the growth rate of other microorganisms. It protects against many plant diseases, including black spot, powdery mildew, rust, gray mold, leaf blight and scab, but does not persist so reapplication is necessary.
- **Bicarbonates** (brands with potassium bicarbonate such as Bi-Carb,® GreenCure,® Kaligreen,® and Remedy®) are protectants that prevent foliar diseases, especially powdery mildew, but do not penetrate plant tissues to provide lasting disease protection. Baking soda (sodium bicarbonate) can be effective against plant diseases when used with oil (but rarely alone), but its sodium component can build up and become toxic to plants.
- **Bordeaux mixture** is a fungicide containing water, lime, and copper sulfate. It has been around for a long time and is effective against some bacteria as well. It should be applied before infection occurs, as it will not cure an existing disease. Bordeaux mixture washes off easily and lasts for only a short time. Care should be used, however, because copper sulfate can be toxic to mammals and aquatic organisms. Overuse can also lead to copper toxicity in plants, beneficial soil microbes, and invertebrates.
- **Oils**—various plant-derived oils, including canola, cinnamon, clove, and rosemary—can prevent germination of spores or inhibit growth of fungal cells, with various levels of efficacy. They are best used before disease symptoms are seen.
- **Sulfur** is an effective fungicide that controls diseases like rusts, black spot, and powdery mildew and some insects, including spider mites and thrips. When the temperature is high (over 80˚F), however, it can damage plants, and it may also be toxic to some beneficial insects.
- **Lime sulfur**, a mixture of lime and sulfur, works as a fungicide and also kills some insects, such as scale. Note that it can damage plants, especially if applied in warm temperatures (above 80˚F).

Weeds

Use mulches to prevent weeds. Mulch options include wood products, pine needles, straw, cocoa bean hulls, newspaper, or any other organic material you have available.

- Use **cover crops** in vegetable gardens to keep weeds from establishing.
- Mow lawns high to help grass out-compete weeds.
- Use mechanical means to remove weeds, using equipment and methods that best protect the soil structure (see chapter 7, Weeds).

Organic herbicides

Corn gluten meal can be used as a natural pre-emergent herbicide for use on turf and organic crop production.

- The product must be applied before weed seeds germinate. Once they germinate and form a shoot, the corn gluten meal prevents a root from forming.
- This product is usually effective for about 5 to 6 weeks and contains about 10% nitrogen, so it is a good "weed-and-feed" product. With the exception of radishes, corn gluten does not work well with seeded garden crops but generally works well with transplants or mature plants.

Horticultural vinegar (acetic acid) can be applied as a postemergent, nonselective herbicide for herbaceous weeds.

- Horticultural grade is more concentrated than the kind of vinegar typically found in the kitchen.
- Vinegar is sprayed onto actively growing plants.
- Research trials show that vinegar kills 100% of the herbaceous shoots of perennial weeds but does not effectively target the root system.

Resources

Wisconsin Horticulture publications are available at hort.extension.wisc.edu.

Conclusion

"Organic" can mean different things to different people. Farmers selling organic food products abide by a legal definition from the USDA. For homeowners, there are no legal definitions to follow. Most organic gardening methods are the same as conventional, non-organic gardening methods. The big difference is the use of chemicals in the IPM toolbox.

With organic gardening, your chemical options are limited to products derived from natural sources. Because you have fewer products to choose from, preventing or minimizing pest problems is all the more important. As with conventional gardening, treat your soil well, select your plants with care, regularly scout pests, and use mechanical, cultural, and biological options whenever possible in response to problems when they do crop up.

FAQs

Can I use Borax or vinegar in my garden?

Many "home remedies" call for use of Borax, household vinegar, and other over-the-counter ingredients. None are labeled for use as herbicides, and need to be used at such high rates they are toxic to other plants. Only use products labeled as herbicides.

Are organic pesticides safer to use around pets or small children?

Not necessarily. Pesticides kill things. Read the label to determine toxicity to humans and animals.

What does it mean to be an organic gardener?

There is no legal definition of "organic" for the home garden. Typically organic means striving to make the garden self-sufficient, sustainable and productive using only products from natural sources. Building soil fertility is a big focus and IPM is the foundation for managing plant problems.

Organic gardening, practice exam questions

1. **Organic gardening is:**
   a. A legal standard for home gardeners defined by the USDA
   b. A holistic philosophy that utilizes planting by the phases of the moon and other rituals
   c. A set of practices that encourage diversity and sustainability with no synthetic inputs
   d. A set of practices that enhances biological cycles and eliminates all natural or synthetic inputs
2. **Characteristics of organic fertilizers include:**
   a. Have a high nutrient concentration
   b. Are slow-release as they must be broken down by bacteria to release their nutrients
   c. Are always water soluble
   d. Contain few micronutrients
3. **When dealing with pests in organic gardening you should:**
   a. Lower your tolerance threshold for all pest damage
   b. Make your own pesticides from common household products
   c. Apply a commercial broad-spectrum, all-natural pesticide at the first sign of damage
   d. Use all the cultural, mechanical, and biological options in the IPM toolbox first
4. **To effectively control insects organically, you should:**
   a. Learn to identify which insects are beneficial and which are actually pests
   b. Use barriers like row covers and plant collars
   c. Scout regularly to know when pests are present
   d. All of the above
5. ***Bacillus thuringiensis* is:**
   a. A bacterium that can control certain insects
   b. A stomach poison
   c. Effective for only 3-5 days after application
   d. All of the above
6. **Horticultural oils:**
   a. Are effective against caterpillars and wood-boring insects
   b. Are most effective in the summer
   c. Coat insects, causing them to suffocate
   d. Are not derived from petroleum products so can alway be used in organic control
7. **Which of the following products are approved for organic control?**
   a. Pyrethrum, spinosad, capsaicin, and kaolin
   b. Pyrethrum, sevin, capsaicin, and kaolin
   c. Pyrethroids, spinosad, sevin, and diatomaceous earth
   d. Pyrethroids, neem oil, kaolin, and diatomaceous earth
8. **Bordeaux mix is an organic fungicide that:**
   a. Contains water, lime and copper sulfate
   b. Can cure existing infections
   c. Is completely non-toxic
   d. Is beneficial to soil microbes and invertebrates
9. **Weeds are best managed in organic gardening by:**
   a. Rototilling frequently
   b. Using cover crops
   c. Covering the area with black plastic and then an organic mulch
   d. All of the above
10. **Corn gluten meal used as an organic herbicide:**
    a. Must be applied before weed seeds germinate
    b. Is effective for 5-6 weeks
    c. Is also a fertilizer, as it contains about 10% nitrogen
    d. All of the above

Answer key
1. (c) 2. (b) 3. (d) 4. (d) 5. (d) 6. (c) 7. (a) 8. (a) 9. (b) 10. (d)