



# Insect and Disease Control

Control of insect and mite pests and diseases is essential for successful home gardening and part of general management practices for your vegetable garden. Plant symptoms may reflect disease injury from fungi, bacteria, nematodes, or viruses; insect or mite injury; chemical or herbicide injury; or physical or environmental damage caused by growing conditions, location, or soil fertility deficiencies or excesses.

Your local K-State Research and Extension agent or garden center professional can provide assistance in identifying or recognizing specific symptoms in your garden. It is best to provide a large, representative sample along with information on the variety, when symptoms first appeared, unusual recent weather or growing conditions, and general condition of other vegetables in the neighborhood.

## Checklist of Good Gardening Practices

- **Create a “healthy” soil.** In the rush to plant, this important step is often overlooked, yet it can make the difference between a productive and a so-so garden. Many insects are attracted to stressed plants. Poorly growing plants also recover more slowly from insect and/or mite injury. Conduct a soil test and follow the recommendations to supply appropriate nutrients as needed. Adding extra fertilizer won't create healthy soil, because excess nitrogen or phosphorus can promote insect and disease problems and can lead to run-off issues. Add organic matter to the soil each year in the form of soil amendments or mulch.
- **Choose pest-resistant or tolerant varieties.** Nursery and garden catalogs often identify such varieties. Additional information is available in the Extension publication *Recommended Vegetable Varieties for Kansas*, L-41.
- **Start with quality seeds and healthy plants.** Purchase stocky, dark-green transplants, and buy certified virus-free seed potatoes.
- **Eliminate competition.** Remove weeds and grass from the growing site because they compete for nutrients and water. Keep plants growing vigorously. Rapidly growing vegetables can better tolerate or outgrow insect, mite and disease damage, but they also quickly use up available nutrients. Applying fertilizer and

water at critical times during maximum plant growth is essential for producing pest- and disease-resistant plants. Refer to the Soil Improvement section on page 13.

- **Keep it clean.** Remove infected plants during the season to prevent spread within the garden, and remove plant debris after harvest to avoid harboring insects, mites and diseases. Remove weeds, which may serve as a reservoir for pests. Dispose of or burn diseased plants, fruits, and vegetables. Composting is seldom thorough enough to eliminate disease-causing fungi and bacteria.
- **Rotate crops.** Planting the same crop in the same place year after year invites losses due to soilborne diseases and overwintering insect pests. Follow a crop rotation of at least 3 years for the four major vegetable plant families—solanum (tomato, potato, pepper, and eggplant); cucurbit (melons, squash, and cucumbers); cruciferous (broccoli, cauliflower, cabbage, and Brussels sprouts); and allium (onion, garlic, and leeks).
- **Choose a sunny location away from large trees.** Eight to 10 hours of direct sunlight a day are necessary for proper growth, flowering, and fruiting of most vegetable crops. Sunlight also helps to dry foliage and reduce infection by many fungal and bacterial diseases.
- **Water properly.** Plants receiving either too much or not enough water will be less vigorous and more susceptible to insect and mite pests and diseases. Consider using a form of drip irrigation, which will keep foliage dry and prevent foliar diseases while at the same time using water more efficiently. If using a hose, direct the water towards the ground and avoid wetting the foliage.
- **Use mulch.** Mulch helps control weeds and reduces moisture evaporation from the soil surface. Mulch also helps prevent rot caused when fruit is in contact with bare soil. When tilled under, organic mulches become valuable soil amendments. (Refer to *Mulches and Living Organisms*, MF-2900, for more information.)
- **Provide good air circulation.** Overcrowding plants can result in weak growth and an increase in foliar diseases. Stakes, cages, trellises, and pruning all help to increase air circulation.
- **Plant at the proper time.** Seeds planted too early are more susceptible to rot. Delay planting until the soil has warmed to allow rapid germination of seeds and growth of young plants.
- **Get to know the major insect and mite pests and plant diseases in your area.** Learn their life cycle, their habits, and stages they are most easily controlled. Refrain from using any pesticide until you have correctly identified a given pest and determined the proper time for control. (You might identify a pest or disease but the window of opportunity for control has passed.) Your local K-State Research and Extension agent can help with identification. Some insect and mite pests and disease symptoms resemble improper cultural practices.
- **Grow crops that have few pest problems.** Plants that have few insect, mite and disease problems include loose-leaf lettuce, rhubarb, Swiss chard, garlic, cos lettuce, leeks, parsley, sweetpotatoes, okra, beets, snap peas, parsnips, carrots, onions, and kale.
- **Put up bird feeders and bird houses.** Birds are predators of insects. For instance, more than a dozen species of birds are known to feed on various moth larvae.
- **Inspect the entire garden at least weekly.** Check the undersides of plant leaves. Detect symptoms when they first develop so that pest problems can be more easily controlled.
- **Use chemical pesticides as a last resort, carefully and judiciously.** Several general-use insect pest and disease control measures are available that provide effective control with minimal environmental disturbance. Always read the label carefully and follow use directions.
- **If you use pesticides, apply them properly.** Thorough coverage of all plant parts is required. (Apply liquids to the point of run-off.) The use of a fine spray mist directed to all plant surfaces usually is the most effective way to ensure proper pesticide action while using or wasting as little material as possible.
- **Be realistic in your expectations.** Accept the fact that there may be some damage from pests and even an occasional crop failure.

### Alternatives in Pest Control

Control	Advantages	Disadvantages
<b>Botanical insecticides:</b> Neem rotenone, pyrethrum	Rapid breakdown; rapid action; low toxicity to mammals and plants. Rotenone is highly toxic to fish.	Rapid breakdown, requiring more precise timing of and/or more frequent application; cost and availability; lack of test data; lack of state registration of some materials.
<b>Microbial insecticides:</b> <i>Bacillus thuringiensis</i> (Bt), (Dipel, Thuricide, Attack, Caterpillar Killer), M-One	Selective; nontoxic to wildlife and humans; may establish and provide control in the future.	Controls only one species or group of insects; timing is critical; special storage and application procedures may be necessary.
<b>Insecticidal soaps:</b> Safer's Insecticidal Soap	Rapid breakdown; rapid action; low toxicity to mammals and other animals; low toxicity to most plants; selective, doesn't harm most beneficial insects.	Rapid breakdown—effective only against insects that come into direct contact with the spray before it dries; phytotoxic to some ornamental plants and houseplants.
<b>Attractants:</b> Pheromones, lures	Nonhazardous to humans or other animals; no residues; target specific insects while leaving beneficials unharmed.	Variable results due to weather, locations; effectiveness limited to specific adult insect populations; expensive, more useful for monitoring the presence of insects than for control in most cases.
<b>Beneficials:</b> ladybugs, green lacewings, syrphid flies, trichogramma wasps, praying mantis	Nontoxic to mammals and wildlife. If established, may provide control in subsequent pest generations or seasons.	Variable results; careful handling required; some beneficials are limited in the kind of insects they will eat; some pests must be allowed to remain in order to provide a food supply for the beneficials.
<b>Fungicides:</b> sulphur, copper, Bourdeaux mixture	Provide fungicidal action and disease control.	Toxic to mammals, wildlife, and many beneficials. Timing of application is critical. Sulphur should not be used within a month of oil sprays or when temperature is above 80–85°F. Unsafe levels may build up in soil after years of use.
<b>Oils:</b> dormant oils, horticultural superior oils, Volck	No residues on fruit when applied prebloom; effectively control many overwintering pests.	Must be applied while tree is dormant, though lighter weight oils are being developed for use in spring and summer. Must be applied when temperatures are above 40°F but below 80°F for several hours to avoid injury.
<b>Traps:</b> Tanglefoot, sticky yellow or white boards	No residues, nontoxic to mammals, wildlife, and beneficials.	Can trap both pests and beneficials; some traps are expensive; must be maintained, cleaned, and recoated periodically; effectiveness varies.
<b>Physical barriers:</b> Row covers, netting	Nontoxic, no residues. Allow water, air, and sunlight to pass through.	Row covers prevent pollination of fruits and vegetables by insects; durability varies from 1–3 seasons; considerable damage may result from pests that emerge under row covers.
<b>Minerals:</b> Diatomaceous earth, kaolinite clay	Nontoxic to mammals and birds; works by presenting a physical barrier rather than poisoning; contains beneficial trace minerals.	Affects beneficials such as ladybugs; complete application required; less effective in humid weather.
<b>Cultivation and hand picking:</b>	The least expensive of all control practices.	Must be used long before pest damage becomes apparent and at the proper stage of development of the insect.

## Integrated Pest Management

A concept of pest control or regulation emphasizes integrating preventive management, alternative pest control measures, and chemical controls to deal with the wide variety of pest concerns associated with growing vegetables. Chemicals are used only when necessary. Pest problems are often specific to one type of vegetable or vegetable types. It is difficult to generalize about specific insect, mite or disease problems because each is distinctly different. As such, integrated pest management requires knowledge of the pest, including the following:

- Life cycle and population dynamics.
- Level of plant damage that can be tolerated.
- Susceptible crops that may be damaged.
- Environmental factors such as temperature and relative humidity that may influence the pest and control measures.

With knowledge of the pest, specific control measures can be undertaken. Chemical controls should be reserved for difficult-to-manage pests that can spread to other plants.

## Pesticides





A pesticide is a substance or mixture of substances intended to prevent, destroy, repel, or mitigate certain insects, mites, rodents, nematodes, fungi, weeds, or other organisms considered pests.

Chemical pesticides provide many benefits in regards to food production and nutrition, but they also pose some hazards. Some chemical pesticides may leave undesirable residues on food, in water, and contaminate the environment when not used properly. Many conventional pesticides are toxic to humans and other animals. As a result, many homeowners and growers are seeking less hazardous alternatives to conventional chemical pesticides.

Interest in using alternative pest control methods has increased due to environmental and food safety concerns. A variety of “organic” pest control methods are available for vegetables commonly grown in Kansas. These methods require regular monitoring and familiarity with life cycles (e.g. egg, larvae, pupae and adult) of different insect and mite pests in order to appropriately time applications of pest control strategies.

Remember, pesticides are just one option available to effectively manage pests. Before using any pesticide or control measure, consult the checklist of good gardening practices. By first adopting these practices, you can greatly reduce or eliminate the need for pesticide use.

### Alternative Pesticides and Control Methods for Specific Crops

Crop	Pest/Disease	Control
Various crops	Aphids, spider mites, other soft-bodied pests	Insecticidal soaps. Effective only through direct contact with insect before soap dries. Some foliar burn may occur at high temperatures with too concentrated a soap mixture; apply to a few test plants first.
		
Various crops	Flea beetle	Spray or dust with rotenone when damage is first noticed. Use row covers.
		
Asparagus	Asparagus beetle	Hand pick. Use rotenone during cutting season.
		
	Rust	Choose resistant varieties like Jersey Giant or UC 157.
Beans	Bean leaf beetle	Spray or dust with rotenone on underside of leaves. Use row covers.
		
	Mildew	Improve air circulation with proper spacing. Water early in the day so that foliage will dry quickly.
	Root rots	Rotate crops. Plant in well-drained sites when soil is warm.
	Rust	Avoid wetting foliage. Use drip or soaker hoses to irrigate.