ALTERNATIVES IN PEST CONTROL FOR THE HOME GARDEN

Vegetable Gardens

The interest in exploring alternative methods of pest control has increased in recent years due to concerns for the environment and food safety. A variety of "organic" pest control methods are available for many of the fruits and vegetables that are commonly grown in Kansas. Gardeners wishing to use these methods should realize, though, that more input is required in the form of regular observations; familiarity with the life cycle of the different pests; and timely, appropriate, and sometimes tedious control methods.

It must be remembered that pesticides are just one choice of the many things that can be used to effectively manage pests. Before resorting to the use of any pesticide or control measure, the following checklist of good gardening practices should be consulted. By first adopting these practices, the need for pesticides for control measures can be greatly reduced, or oftentimes, eliminated.

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 unhealthy, poorly growing plants. Poorly growing plants also recover more slowly from insect injury. Have a soil test done and follow the recommendations to supply a full range of nutrients. Just adding extra fertilizer won't create healthy soil, since excess nitrogen or phosphorus can promote insect and disease problems. Add organic matter to the soil each year in the form of soil amendments or mulch.

> *"I suspect that the insects which have harassed you have been encouraged by the feebleness of your plants, and that has been produced by the lean state of the soil."* *Thomas Jefferson*

- ❏ **Choose pest-resistant or tolerant varieties.** Nursery and garden catalogs often contain this information. Or refer to the K-State Research & Extension publications, *Recommended Vegetable Varieties for Kansas*, L41 and *Fruit and Nut Varieties for Kansas*, MF 1028.
- ❏ **Start with healthy quality seeds and plants.** Purchase stocky, dark green transplants, certified virus-free seed potatoes and fruit plants.
- ❏ **Eliminate the competition.** Remove weeds and grass from the growing site since they compete for nutrients and water.
- ❏ **Keep the plants growing vigorously.** Rapidly growing fruits and vegetables can better tolerate or outgrow damage from insects and diseases, 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 K-State Research & Extension publication, *Fertilizing Gardens in Kansas.*
- ❏ **Keep it clean.** Remove plants and debris after harvest to avoid harboring insects and diseases. Remove weeds which may provide shelter 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 pests. Follow a crop rotation of at least three years for the four major vegetable plant families—solanum (tomato, potato, pepper, eggplant); cucurbit (melons, squash, cucumbers); cruciferous (broccoli, cauliflower, cabbage, Brussels sprouts); and allium (onion, garlic, leeks).

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- ❑ **Choose a sunny location away from large trees.** Eight to 10 hours of direct sunlight per day are necessary for proper growth, flowering, and fruiting of most vegetable and fruit crops. Sunlight also helps to dry foliage and reduce many fungal and bacterial diseases.
- ❑ **Water properly.** Plants suffering from an excess or lack of water will be less vigorous and more susceptible to diseases and pests. Consider using some form of drip irrigation, which keeps foliage dry and helps prevent foliage diseases, in addition to using water more efficiently.
- ❑ **Use mulch.** Mulches help control weeds and reduce moisture evaporation from the soil surface. They also help to prevent rot caused by fruit coming in contact with bare soil. When tilled under, organic mulches become valuable soil amendments.
- ❑ **Provide good air circulation.** Overcrowding plants can cause weak growth and an increase in foliage diseases. Staking, caging, trellising, 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 for rapid germination and growth of the young plants (refer to K-State Research & Extension publication *Vegetable Garden Planting Guide*, MF-315). Fruit should be planted by mid-April to allow good root development before the temperature increases.
- ❑ **Get to know the major pests in your area.** Learn the weaknesses in their life cycle, their habits, and at which stages they are most easily controlled. Refrain from using any pesticide until you have properly identified the pest. Your local Extension agent can help with positive identification.
- ❑ **Grow crops that have fewer pest problems.** Some plants that have few insect or disease problems include: Fruit—persimmons, elderberry, pawpaw, juneberry, jujube, strawberries and bush fruits; Vegetables—looseleaf lettuce, rhubarb, Swiss chard, garlic, cos lettuce, leeks, parsley, sweet potatoes, okra, beets, snap peas, parsnips, carrots, onions and kale.
- ❑ **Put up birdfeeders and birdhouses.** Birds are the leading predators of insects. For instance, more than a dozen species of birds are known to feed on codling moth larvae.
- ❑ **Inspect the entire garden at least weekly.** Check the undersides of leaves and bark. Catch any problems when they first develop, so they can be more easily controlled.
- ❑ **Be realistic about your expectations.** Don't expect picture-perfect produce every time. Accept the fact that there may be some damage and even occasional crop failure. This is also the case in many gardens using conventional pest control methods.

Definition: A pesticide is any substance or mixture of substances intended to prevent, destroy, repel, or mitigate any insects, rodents, nematodes, fungi, weeds, or other forms of life declared to be pests.

Types of Alternative Pesticides and Control Methods

Synthetic chemical pesticides provide many benefits to food production and human nutrition, but they also pose some hazards. Some synthetic pesticides may leave undesirable residues in food, water, and the environment when they are not used properly. Some insecticides are toxic to insect predators. As a result, many homeowners, growers and researchers are seeking less hazardous alternatives to conventional synthetic pesticides.

The following is a list of some of the various methods of alternatives in pest control and their advantages and disadvantages.

BOTANICAL INSECTICIDES Rotenone, pyrethrum, sabadilla, ryania, neem

- **Advantages:** Rapid breakdown, rapid action, low toxicity to mammals and plants.
- **Disadvantages:** Rapid breakdown requiring more precise timing and/or more frequent application; cost and availability; lack of test data; lack of state registration of some materials.

MICROBIAL INSECTICIDES Bacillus thuringensis, (Dipel, Thuricide, Attack, Catapiller Killer), M-One

- **Advantages:** Selective; non-toxic to wildlife and humans; may establish and provide control in the future.
- **Disadvantages:** Controls only one certain species or group of insects; broken down by the elements so timing is critical; special storage or application procedures may be necessary.

INSECTICIDAL SOAPS Safer's Insecticidal Soap,

- **Advantages:** Rapid breakdown, rapid action, low toxicity to mammals and other animals; low toxicity to most plants; selective, doesn't harm most beneficial insects.
- **Disadvantages:** Rapid breakdown—effective only against insects that come into direct contact with the spray before it dries; phytotoxic to some ornamental plants and houseplants.

ATTRACTANTS Pheromones, lures

- **Advantages:** Non-hazardous to humans or other animals; no residues; targets specific insects while leaving beneficials unharmed.
- **Disadvantages:** Variable results due to weather, physical conditions, etc; effectiveness limited to very specific adult insect populations; expensive, more useful for monitoring the presence of insects rather than for control purposes in most cases.

BENEFICIALS ladybugs, green lacewings, syrphid flies, trichogramma wasps, praying mantis

- **Advantages:** Non-toxic to mammals or wildlife. If established, may provide control in subsequent pest generations or seasons.
- **Disadvantages:** Variable results; careful handling required; some beneficials are very 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.

FUNGICIDES sulphur, copper, Bourdeaux mixture

- **Advantages:** Provides fungicidal action and disease control.
- **Disadvantages:** 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 ° to 85° F. Unsafe levels may build up in soil after years of use.

OILS dormant oils, horticultural superior oils, Volck

- **Advantages:** No residues on fruit when applied prebloom. Effectively controls many overwintering pests.
- **Disadvantages:** Must be applied while tree is dormant, though lighter weight oils are being developed that can be used in spring and summer.
  Must be applied when temperatures are above 40 ° F but below 80° F for several hours to avoid injury.

TRAPS Tanglefoot, sticky yellow or white boards

- **Advantages:** No residues, non-toxic to mammals, wildlife, or beneficials.
- **Disadvantages:** Can trap both pests and beneficials; some traps are expensive; must be maintained, cleaned, and recoated periodically; effectiveness varies.

PHYSICAL BARRIERS Row covers, netting

- **Advantages:** Non-toxic, no residues. Allows water, air, and sunlight to pass through.
- **Disadvantages:** Row covers prevent pollination of fruits and vegetables by insects; durability varies from 1 to 3 seasons; considerable damage may result from pests that emerge under row covers.

DIATOMACEOUS EARTH Perma-guard

- **Advantages:** Nontoxic to mammals and birds; works by dehydration rather than poisoning; contains beneficial trace minerals.
- **Disadvantages:** Affects both beneficials (such as ladybugs) and pests; thorough application needed; less effective in humid weather.

CULTIVATION AND HAND-PICKING 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.

ALTERNATIVES IN VEGETABLE PEST MANAGEMENT

Crop	Pest / Disease	Control
Various crops	Aphids, spider mites (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, so apply to a few “test” plants first.
Various crops	Flea beetles	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 Beetles	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 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.
Cabbage, broccoli, cauliflower, Brussels sprouts	Cabbage looper, imported cabbage worm, diamondback moth	Spray or dust thoroughly with Bacillus thuringiensis (Bt). Begin when worms are small and repeat as needed throughout the season. Use row covers.
	Black rot	Use disease-free seeds and plants. Do not work with wet plants. Use 3 to 4 year rotation. Destroy plants after harvest. Some resistant varieties are available.
Corn	Corn earworm	Apply a few drops of mineral oil to the silks just inside the tip of each ear before the silks have wilted and started to brown. Bt is not effective.
	Maize Dwarf Mosaic	Avoid planting near Johnsongrass, as aphids carry virus to corn. Control weeds. Choose tolerant varieties.
	Smut	Remove and destroy galls before they break open. Do not compost. Rotate crops. Plant tolerant varieties (Apache, Bellringer, Quicksilver, Seneca Scout).

Cucumber, melons, squash, pumpkins	Cucumber beetle—striped or spotted	Apply rotenone at 5-day intervals. Repeat after a rain. Or apply sabadilla. (Sabadilla is highly toxic to honey bees, so apply in late evening.) Use row covers.
	Squash bugs	Hand-pick. Trap under shingles placed beneath the plant. Remove the copper colored eggs.
	Anthracnose	Choose resistant varieties. Use 3-year rotation. Do not save seed. Avoid working with wet plants.
	Bacterial wilt	Remove and destroy entire infected plant along with immediately surrounding soil and soil clinging to roots. Clean up plants in autumn. Control cucumber beetle, which transmits the disease.
	Powdery mildew	Improve air circulation with proper spacing. Clean up in autumn. Plant resistant varieties.
Onions	Onion thrip	Insecticidal soaps. Use row covers.
Peas	Powdery mildew	Water early in the day. Improve air circulation by proper spacing and weed control. Clean up in autumn. At first sign of disease, spray or dust with sulphur.
	Root rot	Practice crop rotation. Plant seed as early as possible. Avoid wet soil and improve soil drainage.
Potatoes	Colorado potato beetle	Apply rotenone when beetle adult or larvae first appear. Repeat as needed. Hand-pick. Use row covers. New formulations of Bacillus thuringiensis for potato beetle control are relatively unavailable to home gardeners at present.
	Early blight	Water early in the day. Improve air circulation by proper spacing. Clean up in autumn and destroy plant residues. Practice crop rotation.
	Scab	Use certified seed. Practice crop rotation. Lower soil pH to 5.2–5.5 with sulphur. Plant resistant varieties (Chieftain, Norland, Russet Burbank, Superior). Avoid lime, manure and wood ash.
Tomatoes	Blossom end rot	Water during drought. Mulch to keep moisture level constant. Grow on soil high in organic matter. Avoid cultivating close to plants.
	Catfacing	Grow recommended varieties. Provide adequate fertilizer and water for vigorous growth.
	Early blight	Practice crop rotation. Water early in the day. Improve air circulation by proper spacing. Clean up plant residues in autumn.
	Fusarium wilt	Practice crop rotation. Remove and destroy infected plants. Plant resistant varieties (Pik Red, Better Boy, Supersonic, Jet Star and others).
	Septoria leaf spot	Water early in the day so foliage can dry quickly. Improve air circulation by caging, pruning and proper spacing.

ALTERNATIVES IN FRUIT PEST MANAGEMENT

Fruit	Pest / Disease	Control
Various crops	Mites, aphids, scale— overwintering	Dormant oil spray
Various crops	Mites, scale (crawler stage only), aphids—during growing season	Insecticidal soap. Or for mites, thoroughly spray with water under fairly high pressure.
Apples	Apple Scab	Throughout season, rake up and dispose of all fallen or diseased leaves and fruit. Prune in early spring to improve air circulation. Use wettable sulphur. Plant resistant varieties (Prima, Liberty, Freedom, Jonafree, Sir Prize).
	Cedar apple rust	Eliminate red cedars (Juniperus spp) in and around the orchard, or remove galls from the cedars. Avoid highly susceptible varieties (Akane, Jonathan, Lodi, Prima, Golden Delicious, Wealthy).

Apples (continued)	Codling moth	Often controlled by plum curculio sprays (see below). Pheromone traps can be used for monitoring, and in some cases of low-level populations, can be effective controls. Tie 6-inch-wide strips of burlap or cardboard around the trunk or large branches. Check in the fall for larvae and destroy. Pick up all drops in late August and September. Note: Bt is not registered for control of codling moth because these larvae do not feed much (if at all) on treated surfaces.
Apples, pears	Fireblight	Plant resistant varieties, such as: Apples—Red Delicious, Jonafree, Liberty, Prima, Pricilla; pears— Seckel, Magness, Moonglow. When trees are not wet, carefully remove and dispose of infected branches or fruit, cutting at least 6 inches below the obvious sign of infection. Dip pruning shears in rubbing alcohol between cuts to disinfect them. On trees where blight has been a problem, apply a 2-6-100 Bordeaux mixture or a commercially prepared mix containing copper at bloom.
	Leaf rollers	Dormant oil spray. During growing season, use Bacillus thuringenisis formulated for leaf rollers.
	Plum curculio	Cultivate soil around tree during late spring and early summer to destroy larvae & pupae. Pick up all drops in early summer. Spray with pyrethrum/rotenone or "tripleplus" (pyrethrum/rotenone/ryanodine) just after petal fall. Wait 7 to 10 days. Start checking for egg laying activity (fingernail-type puncture on fruit). Spray again if necessary. Or at evidence of egg laying activity, place sheets on ground around tree in early morning. Jar tree with padded mallet. Collect fallen beetles and destroy. Continue as long as adult curculios are active, approximately 2 weeks. Note: young trees can be severely damaged if hit too hard.
	Powdery mildew	Wettable sulphur. Prune in early spring to improve air circulation. Prune out infected terminals as they develop. Critical period is from tight cluster until shoot growth stops in midsummer. Sulphur may cause leaf injury when applied at temperatures above 80 °–85° F.
Brambles—raspberry, blackberry	Anthracnose	Lime sulphur.
	Cane borers	In spring and during the growing season, cut out and burn canes with swollen areas or canes that are wilting. If practical, eliminate all wild brambles in the area.
Grapes	Black rot	Clean up in autumn, practice sanitation to remove mummified grapes and infected canes. In early spring, cultivate to bury mummies. Susceptible varieties include Aurore, Baco Noir, Canadice, Cabernet Sauvignon, Catawba, Concord, Niagra, Pinot Noir, Reisling and Seyval.
	Downy mildew	Clean up in autumn, practice plant sanitation. Particularly susceptible varieties include Cabernet Sauvignon, Catawba, Chancellor, Chardonnay, Delaware, Fredonia, Niagra, Pinot Noir, Reisling, and Rougeon.
	Powdery mildew	Clean up in autumn, practice plant sanitation. If needed, apply sulfur every 7–14 days from bloom until Sept. 1, but not on sulfur-sensitive varieties (Chancellor, Concord, Foch, Ives, Rougeon).
Stone fruit—peaches, necturines, cherries, plums, apricots	Brown rot	Lime sulphur, wettable sulphur. Clean up and dispose of fallen fruit before and during harvest.
	Oriental fruit moth	Cultivate the soil carefully around infested trees to a depth of 1 to 4 inches (trees have shallow-roots) 1 to 3 weeks before bloom. If severe, use a dust impregnated with a lightweight oil (oil must have a viscosity of 100), such as 60% sulphur, 35% 30 mesh talc, 5% lightgrade mineral oil (percentages by weight). Apply at 5-day intervals, beginning about 20 days before peaches are picked. The dust acts as an irritant rather

Stone fruit *(continued)*		than a poison. Or use plastic ties, impregnated with sex pheromones that disrupt mating of moths.
	Plum curculio	See "Apples, pears."
	Scab	Wettable sulphur
Peaches	Peach leaf curl	Lime sulphur, wettable sulphur, or Bordeaux mix either in the fall after leaf drop or in the early spring before the buds swell.
	Peach tree borer and Lesser Peach tree borer	Start monitoring in late April-early June. Use wing traps baited with sex attractant, and hang 3 feet high on or adjacent to trunks, 1 trap per 2–2½ acres; at least 2 traps per orchard. Check trunks and limbs for borer holes twice weekly. Borers can often be killed by inserting a stiff wire, icepick, or pointed knife into the hole. Clear litter from base of trees to help locate borers. Keeping trees healthly and vigorous by proper cultivation, pruning, fertilization, pest control and watering will help the infested trees overcome the effects of borer injury. Refer to K-State Research & Extension bulletin *Fruit Pest Control*, C592 for use of PCB (moth) crystals for borer control.
Strawberries	Leaf spot	Renovate planting after harvest. Susceptible varieties include Catskill, Sunrise, Raritan, Honeoye, Midway, Sparkle, Jerseybelle, Veestar, Micmac, Tribute, and Kent.
	Red stele	Establish plants on well-drained soil or construct raised beds on heavier soil. Plant resistant varieties (Earliglow, Sunrise, Redchief, Scott, Guardian, Allstar, Tribute, Tristar, Surecrop, and Sparkle).
	Verticillium wilt	Practice crop rotation. Avoid sites where tomatoes, potatoes, eggplants, or peppers have been grown within 2 years. Plant resistant varieties (Guardian, Scott, Delite, Tribute, and Tristar).
All Crops	Weeds	Hoe. Apply mulch material around and under the vine, tree, or plants.
	Persistent weeds	Smother with layer of overlapping cardboard or thick layers of newspaper. Top with 6 inches of wood chips or shredded tree trimmings. Or till weed-infested area in late spring after danger of frost is past. Broadcast buckwheat at a fairly heavy rate. Till under when flowering. Sow second buck wheat crop a few days later and again till under when flowering. Reseed with winter rye. Till under the following spring.

Some of the information was adapted from: *Alternatives in Insect Management* series, 1989-90, Circulars 1295-1297, Cooperative Extension Service, University of Illinois at Urbana-Champaign. *Guide to Safe Pest Management Around the Home,* 1989-90, Misc. Bulletin 74, Cornell Cooperative Extension, Cornell University, Ithaca, New York.

While trade names are used in this publication, no endorsements are intended, nor is criticism implied of similar products not mentioned.

Read the label before applying any pesticide and follow label directions.

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KSU KANSAS STATE UNIVERSITY

Kansas State University Agricultural Experiment Station & Cooperative Extension Service
MF2065 December 1996

File Code: Horticulture-5