



IPM-1305

# Home Garden Vegetables



Insect Control Recommendations for 2017

## Making Your Garden Vegetables Less Susceptible to Insect Damage

Integrated pest management or IPM is the judicious use of multiple pest management tactics when pest populations reach above the action threshold. The action threshold is simply the level of pest populations when control should be implemented to avoid damage to the crop. Action thresholds help determine both the need for control actions and the proper timing of such actions.

Homeowners and gardeners can practice IPM by using cultural control practices and pest exclusion methods, by employing alternative pest management strategies, and by conserving natural enemies. There are many ways to reduce or eliminate the need for insecticides; some of these are described in the sections that follow.

To stay informed about pest occurrences and IPM recommendations, readers can subscribe to the [Alabama IPM Communicator](#) newsletter, an official publication of the Alabama IPM Center. To subscribe, visit the newsletter website at [www.aces.edu/ipmcommunicator](http://www.aces.edu/ipmcommunicator). For pest alerts, subscribe to the Alabama Vegetable IPM channel on Facebook.

### Healthy Soil

Healthy soil will result in plants better able to resist insects and diseases. Before planting, the garden soil should be turned over and organic matter, such as manure or compost, should be added to supply essential nutrients. Organic nutrients are released slowly, in contrast to synthetic fertilizers, which provide “quick-fix” nutrients. When possible, good compost should be purchased from a trusted local source; buying poor quality compost may result in insect infestations like maggots and grubs.

### Sustainable Pest Management Practices

The USDA [National Organic Program](#) Standards for Pest Management provides some excellent steps that can be used in vegetable gardens. These standards are three-tiered recommendations that are as follows:

Level 1: Systems-based practices. These include cultural tactics such as variety selection, crop rotation, water management, sanitation (starting with clean fields), trap cropping, and companion planting.

Level 2: Mechanical and physical practices. These include installing barriers like insect netting and row covers; using lures, traps, and repellents; regular mulching; and hand removal of insects from the foliage.

Level 3: Biorational and other insecticidal materials.

Only approved insecticides can be used in commercial organic farming. Home gardeners can also use these organic insecticides some of which are very expensive; thus, cost could be a limiting factor. Home gardeners who wish to garden more sustainably may also use conventional insecticides for spot applications. Prevention of pest establishment is more important than therapeutic treatment of insects in the garden.

For a specific list of organic insecticides, refer to the Alabama Extension publication “Insecticides for Organic Commercial and Backyard Vegetable Production” (ANR-1428). For tips about insect monitoring using pheromone traps, refer to the Alabama Extension publication “Pheromone Traps for Monitoring Insect Pests” (ANR-1431).

### Beneficial Insects

Most insects encountered in nature are beneficial and have a critical role in the natural food chain. Therefore, a gardener should be able to identify garden insects and determine whether they are harmful or beneficial. Table 4 provides a short list of insect predators that help seek and destroy insect pests and that are commonly seen in the garden. There are also many insect parasitoids that are too small to see individually. Refer to the Alabama Extension publication “Pest and Beneficial Insects” (ANR-2031) and “Beneficial Insects, Spiders, and Mites in the Southeast” (University of Georgia circular 1055).

Applying conventional insecticides can destroy the natural balance by eliminating beneficial insects. Switching to one early season application of systemic insecticides on labeled garden vegetables can provide early season insect control and allow establishment of natural enemies. Use selective insecticides later in the season to protect natural enemies. Many vendors now provide natural enemies for use; examples include Arbico Organic and GardenersAlive.com.

### Crop Rotation

Planting vigorous vegetable varieties and using proper crop rotation are two basic IPM tactics. Planting vegetables in a different section of the garden from year to year may help reduce pest infestation by disrupting insect life cycle. Some insect pests overwinter in the garden soil and emerge in the spring and begin searching for food. If the plant they prefer to eat is located several yards away, the insect must move to the source. Many will die along the way or will fall prey to birds and other predators. Also, many vegetables remove nutrients from the soil; by rotating vegetable crops each year within the garden, the soil in a particular section will have the opportunity to rest and regenerate.

## Diversified Planting

A common practice among home gardeners is to plant a single crop in a straight row. This encourages pests because it makes it easy for them to travel from one host plant to another. By intermingling different types of plants and by not planting in straight rows, an insect is forced to search for a new host plant, thus exposing it to predators. This approach also works well with companion planting where insect control benefits occur with good placement of different crops.

## Trap Cropping

If given a choice, some insects will opt to feed on one plant type over another. For example, pickleworms prefer squash to cucumbers, and leaffooted bugs prefer certain varieties of soybean and sorghum over tomatoes. Trap crop arrangement or layout is critical to the success of this IPM method. Trap plants should be planted 2 to 3 weeks ahead of the main crop. Once the trap plants have become infested, the target insect can be picked off and dropped in soapy water or the entire plant can be disposed of. For stink bug management, addition of early-planted trap crop (such as okra, beans, or sunflowers) followed by insecticidal or cultural pest management tactic can also be beneficial. In large gardens or farm settings, trap plants can be planted within the main crop in strips to attract and retain insect pests. For more information, watch the trap crop training module with videos and publications on the Alabama Vegetable IPM website.

## Barriers and Traps

Barriers and traps can be employed to capture or impede the movement of pests. Gardeners can use pest exclusion fabric — such as SuperLight Insect Barrier and Agribon — for excluding early season pests from crops. A board or thick piece of paper painted bright yellow and coated with a sticky substance, such as Tanglefoot®, will attract and intercept aphids, whiteflies, and other small flying insects. Use of Superlight Insect Barrier wrapped around the base of squash plants or put over the plants to cover them completely can help reduce squash vine borer moths early in the season.

## Mulch

Mulching is the spreading of organic matter in the garden and around plants. It is an effective method to control weeds and serves as a refuge for predatory insects like ground beetles and spiders. Mulch also helps the soil to retain moisture, which promotes plant vigor and reduces abiotic stresses. Mulch should be added to the garden when plants are 4 to 6 inches high. Grass clippings, leaves, hay, sawdust, wood chips, and compost make excellent mulches. Some mulches may slow down insect pest movement or deter them early in the season. One drawback of using mulch may be increased numbers of slugs in the garden that feed on young and succulent plants.

## Insect Sampling Techniques

Both pest and beneficial insects can be sampled by home gardeners to assess the level of insect activity before and after an insecticidal spray. Some simple techniques to frequently sample insect populations include the following:

- **Yellow sticky cards:** Many insects and spiders can be intercepted on colored sticky cards as they migrate long distances. Yellow sticky cards can be placed at several locations around a garden to monitor the aphid migration while blue cards can be used to monitor thrips.

- **Drop cloth/shake cloth:** Gardeners can use a drop cloth spread between the rows of vegetables to gently shake off slow-moving insect pests (such as caterpillars) and beneficial arthropods for counting.

- **Sweepnet sampling:** Gardeners can use a sweep net for collecting insects off the plants by vigorously moving the net through crop canopy. A relatively easy way of viewing insect collection is to empty the contents of the net into a gallon-size Ziploc bag. The bag can then be frozen in a refrigerator to preserve specimens for later viewing or identification.

- **Pitfall traps:** Pitfall traps can be placed in the ground and are excellent for estimating the population/activity of soil-dwelling insect pests and predators (like tiger beetles, ants, etc.).

## Proper Use of Systemic Insecticides

Systemic insecticides (imidacloprid-containing products) are now available for home gardeners; these insecticides should be used early in the season so that the insecticide is not present at flowering. The product should be applied as a drench soon after transplanting or when the first sucking pests are noticed on leaves. A systemic insecticide also requires a few days to get absorbed and translocated throughout the vascular system of plants. For more information about proper use of the new insecticides, contact a Regional Extension Agent at the county Extension office and read the insecticide label very carefully.

## Insect Monitoring Using Pheromone Traps

Moths can be detected using pheromone traps around the garden. Research at Auburn University and elsewhere indicates that detection of the first flight of moths may indicate the need to scout crops for other life stages of the insect pest; for example, if 7 to 10 corn earworm and fall armyworm moths are found in separate pheromone traps each week, then vegetable crops should be examined immediately for larval feeding damage. To a limited extent, it may be possible to “trap out” or intercept moths in an area using multiple traps (e.g., in small greenhouses).

Pheromone traps are available for almost all major insect pests of vegetables including corn earworm (tomato fruitworm), fall armyworm, cutworm, tobacco budworm, and squash vine borer. Pheromone traps can be purchased in bulk from vendors like Great Lakes IPM (Vestaburg, MI) or in the form of kits from Internet sites like Arbico Organics (Tucson, AZ) and Planet Natural (Bozeman, MT). Place pheromone traps away from the main crop because the lure is attractive to target insects over long distances. Most lures attract male moths but some attract both sexes of the species.

## General Recommendations for Managing Soil Pests in the Garden

Many soil insect pest populations reach high numbers in grass or turf. Home gardens are often established in areas previously covered with grass. To reduce soil insect problems, thoroughly till or spade the area well in advance of planting (30 days or more) and again just before planting. This will bring soil pests up near the surface where their chances of mortality are increased.

A broadcast soil insecticide applied properly 2 weeks before planting will help to control some soil insects like cutworms, wireworms, and white grubs. See the note on applying broadcast soil insecticides at the end of Table 1 (page 14) for instructions on this topic.

## Managing Pests That Feed Above Ground

This section provides some non-chemical methods for management of insect pests that feed above ground. Insecticide recommendations are provided in the tables that follow.

### Aphids, Flea Beetles

- Control aphids in early stages when aphids are in low numbers.
- Use of SuperLight Insect Barrier can prevent aphids and the beetles.
- Knock aphids from plants with a strong spray of water from the garden hose.
- Spray plants with insecticidal soap. Test tender plants first to ensure they are not burned by the soap solution.
- Aphids can transmit plant virus disease; remove and destroy diseased plants to delay spread of the virus to healthy plants.
- Conserve and/or release insect predators like lady beetles and lacewings as soon as aphids are detected. For fast control of aphids, release larvae stages in the garden.
- Parasitoids such as *Aphelinus abdominalis* and *Aphidius ervi* are effective against potato aphids. *Aphidius colemani* is effective against green peach aphid.

### Cutworms, White Grubs, Wireworms

- For wireworms, plan your crop rotation.
- Most can be excluded by using fine insect mesh or fabric (SuperLight Insect Barrier).
- If you suspect larvae in soil, then keep garden weed free and turn soil to expose larvae to natural enemies.

### Cabbage Loopers and Cabbageworms

- Cover plants with a floating row cover to reduce pest establishment and egg laying.
- Handpick and destroy the worms. Green worms are much easier to spot on red-leaf cabbage varieties.
- Spray plants with *Bacillus thuringiensis* when worms are still small. Repeat spraying at 5- to 7-day intervals until insects are gone.
- Remove alternate host weeds such as wild mustard and shepherd's purse from the garden.

### Colorado Potato Beetles

Potato beetles are infamous for insecticide resistance to synthetic pyrethroids; therefore, use insecticides sparingly and try the following alternative management methods.

- Potato beetles prefer to feed on potatoes, eggplants, and tomatoes. Rotate these preferred hosts with other crops in alternate years.
- Interplant or rotate with non-host crops (e.g., beans) with preferred host crops.
- Handpick and destroy orange egg masses, which occur on the underside of leaves, reddish-brown larvae, and yellow and black striped adults. Two to three generations of the insect occur in Alabama and throughout the South.

- Place straw mulch around plants to hinder movement of the beetles.

### Corn Earworms (Tomato Fruitworms)

- Plant and harvest corn as early as possible to avoid infestations.
- Select tight-husked corn varieties for planting; this inhibits worm movement into the ear.
- Beginning at the flower stage, check upper tomato leaves once per week for the small, round, white fruitworm eggs. Also look for the greenish caterpillars on foliage and fruits. Spray plants with *Bacillus thuringiensis* weekly as long as larvae are detected.

### Cucumber Beetles

- Use New England Hubbard squash as trap crop for cucumber beetles and squash bugs. Watch the IPM training module on the Alabama Vegetable IPM website for more information about the effectiveness of trap crops.
- Cover young plants with floating row or SuperLight Insect Barrier covers until the vines start to run.
- Eliminate weeds in and around the garden; some weeds are hosts for bacterial wilt disease, which is spread by the cucumber beetles.

### Grasshoppers

- Grasshopper populations are most damaging in late summer; a floating row cover can be used to protect late-season plantings.
- Fall plowing of the garden, including fence rows and garden borders, exposes the grasshopper eggs to the weather and to insect predators.

### Japanese Beetles

- Avoid planting the garden near lawns or in previously grassy areas.
- Sunflower and sorghum trap crops also seem to deter Japanese beetles feeding on main crops.
- Protect plants with floating row covers.

### Mexican Bean Beetles

- Handpick and destroy the egg masses and beetles in early morning before they become active.
- Interplant nonhost crops like potatoes among bean plants to disrupt egg-laying.
- Soybeans are preferred by bean beetles over snap or lima beans; thus, soybeans planted nearby can be used as a trap crop.

### Spider Mites

- Mites don't like moist conditions. Keeping the foliage wet can deter mites, but it can also encourage plant diseases.
- Keep plants adequately watered and stress free. Do not use synthetic pyrethroid insecticides too often to avoid mite outbreaks.
- Do not mow grass located close to the vegetable garden during hot and dry weather.

### Squash Bugs

- Use New England Hubbard squash as trap crop for attracting squash bugs and cucumber beetles. Watch the IPM training module on the Alabama Vegetable IPM website for more information about trap cropping.
- Remove and destroy any clusters of oval, orange-brown squash bug eggs.
- Remove and destroy vines and unused fruit after harvest to eliminate overwintering sites.
- Place shingles or boards near squash or pumpkin plants in spring or early summer to attract squash bugs. Then, collect and destroy the adult bugs that gather under the boards each morning.

### Squash Vine Borers

- Pest exclusion is critical in managing vine borers. To delay infestation, cover small plants with a row cover until female flowers appear. They have a bulge between flower and stem that is absent in the male flowers.
- Squash varieties with long vines may continue to grow despite borer damage.
- Cut open borer entry holes in the stem with a knife. Then, remove the worm and pack moist earth around the stem. This is a more labor-intensive method.

### Tomato Hornworms

- Handpick worms from plants during evening hours.
- *Bacillus thuringiensis* will be effective if sprayed when the worms are small.
- Dill planted next to tomatoes will serve as a preferred trap crop; handpick worms off the dill.
- Do not destroy hornworms that have small, white cocoons attached to their bodies. These are parasite cocoons from which small beneficial parasitic wasps will emerge.
- Turning the soil in the fall will expose hornworm pupae to weather and predators.

### Whiteflies

- Whiteflies are rarely a problem in outdoor gardens. Make sure any purchased transplants are not infested with whiteflies (or other insects).
- Use bright yellow sticky cards to monitor aphids and whiteflies.
- Use beneficial insects like *Encarsia*, which are very effective in enclosed areas.

## How To Use The Tables

In Table 1, you will find (1) the names of the vegetables grown in most home gardens in Alabama, (2) the names of the insects that are likely to attack each vegetable, (3) the common (or generic) name of the recommended insecticides, and (4) the number of days you must wait after applying each insecticide before harvesting the vegetable. This is important for the safety of anyone eating the food.

Table 2 provides some insecticides recommended for organic production and conventional insect management. Note that the list of commercial insecticidal products is not all inclusive. Read the insecticide label before using any product.

**Home garden insecticides** are available as liquids, granules, dusts, and wettable powders. Concentrated liquid formulations must be mixed with water and applied as a spray. Some insecticides may be bought ready to use (RTU)

and do not need to be mixed. They can be sprayed from the container. CAUTION!! Dusts are also applied directly to the plants without any mixing by the home gardener. Use of dust formulations is problematic due to uneven distribution of products and deposition of the active ingredient on only the top surface of leaves. Purchase a dust applicator that can uniformly deposit products. Also watch for drift when using dust formulations and avoid application on windy days.

Refer to Table 3 for insecticide classifications, modes of action, and efficacy for controlling major insect pests of vegetables in home gardens. Use this to plan your insecticide rotation.

Table 4 provides a list of common insect predators and Table 5 lists commercial vendors that sell beneficial insects. Follow instructions provided by the vendors for releasing natural enemies.

**Table 1. Home Garden Vegetables Insecticide Recommendations <sup>1</sup>**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>ASPARAGUS</b>			
<b>Aphids</b>			
	insecticidal soap	0	No residual activity. Do not apply at temperatures above 90°F.
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
<b>Asparagus Beetles, Cutworms</b>			
	carbaryl	1	Prefer the liquid over dust formulations to reduce non-target effects of drift.
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low. Will work against cutworms.
	pyrethrin	1	
<b>BEANS, PEAS</b>			
<b>Aphids</b>			
	acetamiprid	7	Direct spray on top and bottom leaves. Weekly spray until pest is under control not to exceed three applications per season. Rotate with other pesticides to prevent resistance.
	bifenthrin	3	
	esfenvalerate	3 (green) 21 (dry)	
	insecticidal soap	0	No residual activity
	gamma-cyhalothrin	7	
	malathion	1 (beans) 3 (peas)	
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
<b>Mexican Bean Beetles, Bean Leaf Beetles, Corn Earworms, Cowpea Curculio, Stink Bugs</b>			
	acetamiprid	7	Direct spray on top and bottom leaves. Weekly spray until pest is under control not to exceed three applications per season. Rotate with other pesticides to prevent resistance.
	bifenthrin	3	For cowpea curculio make three applications at 5-day intervals starting when pods are 0.5 inch long.
	carbaryl	3 (fresh) 21 (dry)	Will not control stink bugs.
	esfenvalerate	3 (green) 21 (dry)	
	gamma-cyhalothrin	7	
	spinosad	3	For caterpillar pests and thrips.
<b>Spider Mites</b>			
	insecticidal soap	0	No residual activity
	malathion	1 (beans) 3 (peas)	Malathion provides marginal control of spider mites.
	paraffinic oil	–	Do not apply in hot weather or during times of moisture stress.
	sulfur	0	Do not use if temperature is greater than 95°F. Do not use within 3 weeks of oil spray.
<b>BEETS</b>			
<b>Flea Beetles</b>			
	carbaryl	7 (roots) 14 (tops)	

<sup>1</sup> Always read pesticide labels before use and do not use insecticides without confirming a problem.

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>BROCCOLI, BRUSSELS SPROUTS, CABBAGE, CAULIFLOWER</b>			
<b>Aphids</b>			
	acetamiprid	7	Direct spray on top and bottom leaves. Do not exceed four applications in a season. Rotate with other pesticides to prevent resistance.
	bifenthrin	7	
	esfenvalerate	3	Not for use on brussels sprouts
	imidacloprid	21	Apply as drench early in the season soon after transplanting. Also controls thrips and whiteflies.
	insecticidal soap	0	No residual activity
	gamma-cyhalothrin	1	
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
	malathion	3 (broccoli) 7 (others)	
	permethrin	1	
<b>Caterpillars (on foliage)</b>			
	acetamiprid	7	Target spray in hot spots when caterpillars are small.
	<i>Bacillus thuringiensis</i> (Dipel/Thuricide and other formulations)	0	Treat as soon as damage is found and repeat as needed. Susceptible larvae will stop feeding soon after eating treated foliage but may not die for several days.
	bifenthrin	7	
	carbaryl	3	
	esfenvalerate	3	Not for use on brussels sprouts
	gamma-cyhalothrin	1	
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Apply when caterpillars are small and in low numbers.
	permethrin	1	
	spinosad	1	For controlling cabbage looper, diamondback moth, imported cabbageworm, and leafminer. Good rotation partner with other insecticides.
<b>Cutworms</b>			
	bifenthrin	7	
	esfenvalerate	3	Not for use on brussels sprouts
	gamma-cyhalothrin	1	
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Apply early at first detection of problem when caterpillars are small.
<b>Flea Beetles, Stink Bugs, Harlequin Bugs</b>			
	acetamiprid	7	For immature stink bugs. Repeat application every 7 days and rotate with other insecticides for best control of stink bugs. Use trap crops in pots around garden to deter stink bug and leafhopper feeding.
	bifenthrin	7	
	carbaryl	3	Will not control stink bugs and Harlequin bugs.
	esfenvalerate	3	Not for use on brussels sprouts
	gamma-cyhalothrin	1	
<b>CANTALOUPE, CUCUMBER, PUMPKIN, SQUASH, WATERMELON</b>			
<b>Aphids</b>			
	acetamiprid	0	Target spray affected leaves with full coverage. Stop spraying when aphid populations start declining.
	bifenthrin	3	
	esfenvalerate	3	
	imidacloprid	21	Apply as drench early in the season soon after transplanting. Also deters thrips and other early season pests.
	insecticidal soap	0	No residual activity

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>CANTALOUPE, CUCUMBER, PUMPKIN, SQUASH, WATERMELON (cont.)</b>			
<b>Aphids (cont.)</b>			
malathion		3 (pumpkin) 1 (others)	Use and registration varies with specific product. Do not apply unless leaves are dry.
neem (with azadirachtin)		–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
permethrin		0	
<b>Cucumber Beetles (adults), Squash Bugs, Pickleworms, Melonworms, Rindworms</b>			
acetamiprid		0	Frequent application every 5 days may be necessary along with insecticide rotation to manage beetles and squash bugs.
bifenthrin		3	Late planted crops may be heavily attacked by pickleworms and melonworms. Begin treatments at first bloom and repeat weekly as needed.
carbaryl		3	May not control squash bugs. Use the liquid formulation for better canopy penetration.
esfenvalerate		3	
imidacloprid		21	Apply early in the season soon after transplanting.
neem (with azadirachtin)		–	Apply weekly, targeting nymphs of squash bugs and stink bugs. Cover plants thoroughly.
permethrin		0	
<b>Squash Vine Borers</b>			
bifenthrin		3	Direct spray at base of plants. Use pheromone traps to detect moth flight and treat early with insecticide in highly infested areas. Use mechanical control to prevent or deter infestation.
esfenvalerate		3	
<b>Spider Mites</b>			
insecticidal soap		0	No residual activity
malathion		3 (pumpkin) 1 (others)	Use and registration varies with specific product. Do not apply unless leaves are dry. Malathion provides marginal control of this pest.
paraffinic oil		–	Apply weekly. Thorough coverage is essential. Do not apply in hot weather or during times of moisture stress.
<b>Whitefly</b>			
acetamiprid		0	Treat hot spots thoroughly and rotate with other insecticides.
bifenthrin		3	
imidacloprid		21	Apply as drench early in the season soon after transplanting.
insecticidal soap		0	No residual activity
paraffinic oil		–	Apply weekly. Thorough coverage is essential. Do not apply in hot weather or during times of moisture stress.
pyrethrins+PBO		0	No residual activity
<b>COLLARDS</b>			
<b>Aphids</b>			
acetamiprid		7	Treat hot spots thoroughly and rotate with other insecticides.
esfenvalerate		7	
imidacloprid		21	Apply early in the season soon after transplanting. Also controls thrips and whiteflies.
malathion		7	Use and registration varies with specific product.
neem (with azadirachtin)		–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>COLLARDS (cont.)</b>			
<b>Caterpillars (on foliage)</b>			
	acetamiprid	7	Apply weekly at low insect numbers.
	<i>Bacillus thuringiensis</i> (Dipel/Thuricide and other formulations)	0	Treat as soon as damage is found and repeat as needed. Susceptible larvae will stop feeding soon after eating treated foliage but may not die for several days.
	carbaryl	14	
	esfenvalerate	7	
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Apply when caterpillars are small and population is low.
<b>Grasshoppers</b>			
	<i>Nosema locustae</i> (Nolo Bait)	–	Broadcast bait close to fence line in a wide swath and other grassy areas when they are small. Pathogen is specific to grasshoppers and crickets.
<b>Flea Beetles, Harlequin Bugs, Stink Bugs</b>			
	carbaryl	14	Does not control stink bugs.
	esfenvalerate	7	
<b>EGGPLANT</b>			
<b>Aphids</b>			
	acetamiprid	7	Target treatment of hot spots when populations are low. Rotate with other insecticides listed.
	bifenthrin	7	
	esfenvalerate	7	
	imidacloprid	21	Apply as drench early in the season soon after transplanting.
	insecticidal soap	0	No residual activity. Apply weekly or more frequently if rainfall is heavy.
	gamma-cyhalothrin	5	
	malathion	3	Use and registration varies with specific product.
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
	<i>B. bassiana</i>	0	Spray when aphid populations are low. Rotate insecticides with other active ingredients.
<b>Colorado Potato Beetles</b>			
	acetamiprid	7	Foliar application and targeted sprays. Make no more than four applications per season.
	bifenthrin	7	
	carbaryl	3	
	esfenvalerate	7	
	imidacloprid	21	Apply as drench early in the season soon after transplanting.
	gamma-cyhalothrin	5	
	neem (with azadirachtin)	–	Apply against immature stages when larvae are small. Cover the foliage thoroughly and repeat application in alternation with other products.
	permethrin	3	
	spinosad	1	Provides broad-spectrum control of many pests. Do not spray more than six times per season.
<b>Flea Beetles</b>			
	acetamiprid	7	Apply early in the season to protect transplants. Early planted eggplants or okra may serve as target crops for flea beetles to protect later plantings.
	bifenthrin	7	
	carbaryl	3	
	esfenvalerate	7	
	imidacloprid	21	Apply as drench early in the season soon after transplanting.
	gamma-cyhalothrin	5	

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>EGGPLANT (cont.)</b>			
<b>Lacebugs</b>			
	acetamiprid	7	May suppress lacebugs with frequent application.
	bifenthrin	7	
	carbaryl	3	
<b>Spider Mites</b>			
	insecticidal soap	0	No residual activity
	malathion	3	Use and registration varies with specific product. Malathion provides marginal control of spider mites.
	paraffinic oil	–	Do not apply in hot weather or during times of moisture stress.
<b>Whiteflies</b>			
	acetamiprid	7	No residual activity
	bifenthrin	7	
	insecticidal soap	0	
	paraffinic oil	–	Do not apply in hot weather or during times of moisture stress.
	pyrethrin+PBO	0	No residual activity
<b>IRISH POTATOES</b>			
<b>Aphids</b>			
	acetamiprid	7	No residual activity
	esfenvalerate	7	
	insecticidal soap	0	
	malathion	0	Spray weekly. Use when insect pressure is low. Avoid applications on a hot day and when plants are under moisture stress.
	neem (with azadirachtin)	–	
	permethrin	14	
<b>Colorado Potato Beetles, Flea Beetles</b>			
	acetamiprid	7	Make no more than four applications per season. Rotate with different insecticides to avoid insecticide resistance.
	carbaryl	7	
	esfenvalerate	7	
	neem (with azadirachtin)	–	Apply against immature stages when larvae are small. Cover the foliage thoroughly and repeat application in alternation with other products.
	permethrin	14	Do not apply more than six times per season.
	spinosad	1	
<b>Potato Tuberworms</b>			
	esfenvalerate	7	Treat when foliage or tuber damage is noticed. Store tubers promptly after digging to avoid tuber worm infestation in storage.
	permethrin	14	
<b>LETTUCE, SPINACH</b>			
<b>Aphids</b>			
	acetamiprid	7	Approved for both head and leaf lettuce and all spinach types.
	bifenthrin	7	For use on head lettuce only.
	insecticidal soap	0	No residual activity
	imidacloprid	21	Apply as drench early in the season soon after transplanting. Also controls foliar thrips and whiteflies.
	gamma-cyhalothrin	1	For use on lettuce only.
	malathion	7 (head) 14 (leaf) 7 (spinach)	Use and registration varies with specific product.
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
	<i>B. bassiana</i>	0	Spray when aphid populations are low. Rotate insecticides with other active ingredients.

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>LETTUCE, SPINACH (cont.)</b>			
<b>Caterpillars (on foliage)</b>			
	acetamiprid	7	Apply when caterpillars are small. Rotates with different insecticides.
	<i>Bacillus thuringiensis</i> (Dipel/Thuricide and other formulations)	0	Treat as soon as damage is found and repeat as needed. Susceptible larvae will stop feeding soon after eating treated foliage but may not die for several days. Apply product to both top and underside of leaf surfaces.
	bifenthrin	7	For use on head lettuce only.
	carbaryl	14	
	gamma-cyhalothrin	1	For use on lettuce only.
	neem (with azadirachtin)	–	Apply when caterpillars are small. Rotate neem with other products or methods of control.
	permethrin	1	
<b>Flea Beetles, Harlequin Bugs, Stink Bugs</b>			
	acetamiprid	7	
	bifenthrin	7	For use on head lettuce only.
	carbaryl	14	Does not control stink bugs.
	gamma-cyhalothrin	1	For use on lettuce only.
	spinosad	1	Broad spectrum insecticide for beetle and caterpillar control. Apply weekly as needed. Do not overapply. Apply during evening hours and allow the product to dry on leaf surfaces.
<b>MUSTARD GREENS</b>			
<b>Aphids</b>			
	acetamiprid	7	Maximum number of applications per season is four.
	insecticidal soap	0	No residual activity
	malathion	7	Use and registration varies with specific product.
	neem (with azadirachtin)	–	See Lettuce, Spinach.
	<i>B. bassiana</i>	0	Spray when aphid populations are low. Rotate insecticides with other active ingredients.
<b>Caterpillars (on foliage)</b>			
	<i>Bacillus thuringiensis</i> (Dipel/Thuricide and other formulations)	0	Treat as soon as damage is found and repeat as needed. Susceptible larvae will stop feeding soon after eating treated foliage but may not die for several days.
	carbaryl	14	
	neem (with azadirachtin)	–	
	spinosad	1	Broad spectrum insecticide for beetle and caterpillar control. Apply weekly as needed. Do not overapply. Apply during evening hours and allow the product to dry on leaf surfaces.
<b>Flea Beetles</b>			
	acetamiprid	7	
	carbaryl	14	
	spinosad	1	Broad spectrum insecticide for beetle and caterpillar control. Apply weekly as needed. Do not overapply. Apply during evening hours and allow the product to dry on leaf surfaces.
<b>OKRA</b>			
<b>Aphids</b>			
	imidacloprid	21	Apply as drench early in the season soon after transplanting. Also controls flea beetles.
	insecticidal soap	0	No residual activity. Timely harvest will prevent crop losses.
	malathion	1	Use and registration varies with specific product.
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
	<i>B. bassiana</i>	0	Spray when aphid populations are low. Rotate insecticides with other active ingredients.

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>ONIONS</b>			
<b>Onion Maggots (adults)</b>			
	gamma-cyhalothrin	14	
<b>Thrips</b>			
	gamma-cyhalothrin	14	
	malathion	3	Use and registration varies with specific product.
	paraffinic oil	–	Do not apply in hot weather or during times of moisture stress. Apply during low pest pressure conditions.
<b>PEPPERS</b>			
<b>Aphids</b>			
	acetamiprid	7	Maximum number of applications is four per season. Rotate with other contact insecticides and treat hot spots.
	bifenthrin	7	
	esfenvalerate	7	
	imidacloprid	21	Apply early in the season soon after transplanting.
	insecticidal soap	0	No residual activity
	gamma-cyhalothrin	5	
	malathion	3	Use and registration varies with specific product.
	neem (with azadirachtin)	–	Spray weekly as needed. Cover plants thoroughly. Use when insect pressure is low.
	<i>B. bassiana</i>	0	Spray when aphid populations are low. Rotate insecticides with other active ingredients.
<b>Flea Beetles, European Corn Borers</b>			
	acetamiprid	7	Apply early in the season for flea beetles. Rotate with other contact insecticides. Use trap crops to deter flea beetle feeding.
	bifenthrin	7	May provide some control of grasshoppers at high rates.
	carbaryl	3	
	cyfluthrin	7	
	esfenvalerate	7	
	imidacloprid	21	Apply as drench early in the season soon after transplanting. Will not control borer.
	gamma-cyhalothrin	5	
	permethrin	3	
	spinosad	1	Broad spectrum insecticide for beetle and caterpillar control. Apply weekly as needed. Do not overapply. Apply during evening hours and allow the product to dry on leaf surfaces.
<b>Spider Mites</b>			
	insecticidal soap	0	No residual activity
	malathion	3	Use and registration varies with specific product. Malathion provides marginal control of spider mites.
<b>RADISHES</b>			
<b>Aphids</b>			
	esfenvalerate	7	
	insecticidal soap	0	No residual activity
	malathion	7	
	neem (with azadirachtin)	–	Cover plants thoroughly. Use when insect pressure is low.
	<i>B. bassiana</i>	0	Spray when aphid populations are low. Rotate insecticides with other active ingredients.
<b>Flea Beetles</b>			
	carbaryl	7	
	cyfluthrin	0	
	esfenvalerate	7	

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>SWEET CORN</b>			
<b>Corn Earworms, Fall Armyworms, European Corn Borers</b>			
	bifenthrin	1	Begin treatment when silks appear. Repeat at 2-day intervals with sprays directed at ears.
	carbaryl	2	
	cyfluthrin	0	
	esfenvalerate	1	
	gamma-cyhalothrin	21	
	permethrin	1	
	spinosad	1	
<b>Flea Beetles, Cucumber Beetles</b>			
	bifenthrin	1	Early season application. Rotate with other products. Apply during evening hours. Do not overapply.
	carbaryl	2	
	cyfluthrin	0	
	esfenvalerate	1	
	gamma-cyhalothrin	21	
	permethrin	1	
	spinosad	1	
<b>Stink Bugs</b>			
	bifenthrin	1	
	cyfluthrin	0	
	esfenvalerate	1	
	gamma-cyhalothrin	21	
	permethrin	1	
<b>SWEET POTATOES</b>			
<b>Flea Beetles, Cucumber Beetles</b>			
	acetamiprid	7	Spot treat when insect is present. Do not overuse insecticide.
	carbaryl	7	Early season application. Rotate with other products. Apply during evening hours. Do not overapply.
	spinosad	1	
<b>Caterpillars (on foliage)</b>			
	<i>Bacillus thuringiensis</i> (Dipel/Thuricide and other formulations)	0	Treat as soon as damage is found and repeat as needed. Susceptible larvae will stop feeding soon after eating treated foliage but may not die for several days.
	carbaryl	7	
<b>Sweet Potato Weevil</b>			
	carbaryl	7	Also labeled as pre-plant dip; follow label directions.
<b>TOMATOES</b>			
<b>Aphids</b>			
	acetamiprid	7	Rotate with different contact insecticides and incorporate softer chemistries in your IPM plan. Okra could be used as a trap crop along with labeled insecticides to reduce pest pressures. Make no more than five applications per season.
	bifenthrin	1	Apply as drench early in the season to soil soon after transplanting. No residual activity. Can reapply several times. Cover thoroughly.
	cyfluthrin	0	
	esfenvalerate	1	
	imidacloprid	21	
	insecticidal soap	0	
	gamma-cyhalothrin	5	
	malathion	7	
	neem (with azadirachtin)	–	
	<i>B. bassiana</i>	0	

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>TOMATOES (cont.)</b>			
<b>Cutworms</b>			
	bifenthrin	1	
	cyfluthrin	0	
	esfenvalerate	1	
	gamma-cyhalothrin	5	
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low. Neem inhibits molding and deters feeding in small insects and caterpillars. Do not apply on a hot day.
<b>Flea Beetles, Colorado Potato Beetles, Fruitworms, Hornworms, Tomato Pinworms</b>			
	acetamiprid	7	Rotate with different contact insecticides and incorporate softer chemistries in your IPM plan. Okra and peppers could be used as perimeter trap crops along with labeled insecticides to reduce pest pressures. Maximum application is five per season.
	bifenthrin	1	
	carbaryl	3	
	cyfluthrin	0	
	imidacloprid	21	Apply as drench early in the season soon after transplanting. Will control flea beetles but not caterpillars on foliage.
	esfenvalerate	1	
	gamma-cyhalothrin	5	
	permethrin	0	Do not use on varieties with fruit less than 1 inch in diameter.
	spinosad	1	Broad spectrum insecticide with action against beetles and caterpillars. Apply during evening hours.
<b>Grasshoppers</b>			
	<i>Nosema locustae</i> (Nolo Bait)	–	Pathogen is specific to grasshoppers. Use this bait when plants are small and vulnerable to grasshopper feeding. Grasshopper nymphs are easier to control compared to the large adults. Re-apply bait in high pest pressure situations.
<b>Spider Mites</b>			
	bifenthrin		
	insecticidal soap	0	No residual activity
	paraffinic oil	–	Apply weekly when mite populations are low. Do not apply in hot weather or during times of moisture stress.
	sulfur	0	Do not use if temperature is above 95°F. Do not use within 3 weeks of oil spray.
<b>Stink Bugs, Leaf-footed Bugs</b>			
	bifenthrin	1	
	cyfluthrin	0	
	esfenvalerate	1	Weekly treatments may be needed for late season control.
	gamma-cyhalothrin	5	
<b>Whiteflies</b>			
	acetamiprid	7	
	bifenthrin	1	
	imidacloprid	21	Apply as drench early in the season soon after transplanting.
	insecticidal soap	0	No residual activity
	neem oil (with azadirachtin)	–	Apply to a low population of whiteflies. Rotate to different product to avoid insecticide resistance. Reduce plant stress with proper nutrition and irrigation.
	paraffinic oil	–	Apply weekly when mite populations are low. Do not apply in hot weather or during times of moisture stress.
	pyrethrins+PBO	0	No residual activity

**Table 1. Home Garden Vegetables Insecticide Recommendations (cont.)**

Insect	Insecticide Common Name	Number of Days to Wait from Application to Harvest	Comments
<b>TURNIPS</b>			
<b>Aphids</b>			
	insecticidal soap	0	No residual activity
	malathion	7	Use and registration varies with specific product.
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
	<i>B. bassiana</i>		Spray when aphid populations are low. Rotate insecticides with other active ingredients.
<b>Caterpillars (on foliage)</b>			
	<i>Bacillus thuringiensis</i> (Dipel/Thuricide and other formulations)	0	Treat as soon as damage is found and repeat as needed. Susceptible larvae will stop feeding soon after eating treated foliage but may not die for several days.
	carbaryl	7 (roots) 14 (tops)	
	neem (with azadirachtin)	–	Spray weekly. Cover plants thoroughly. Use when insect pressure is low.
<b>Flea Beetles</b>			
	carbaryl	7 (roots) 14 (tops)	

**NOTE: Applying Broadcast Soil Insecticides**

**Slugs** and **snails** can be controlled in home gardens with a 2% methaldehyde bait. Consult the label for specific vegetables on which it may be used. The bait is applied to the soil surface and should not contact foliage or edible parts of the plant.

Infestations of some **soil dwelling pests**, such as **cutworms**, **armyworms**, and **crickets** can be controlled with 2% carbaryl (Sevin). Combination baits of carbaryl and methaldehyde are also available. Many soil dwelling pests can also be controlled in vegetable crops by applying bifenthrin granules (0.115%) prior to planting at the rate of 1 pound of product per acre. Work the insecticide granules into the top 4 to 6 inches of soil and provide moisture for activation. Wait for a few days before planting crop in case of heavy infestations.

Active ingredients available in some commercial products labeled for **fire ant** control in home gardens include spinosad (Fertilome Come and Get It!, Safer Brand Fire Ant Bait, Green Light Fire Ant Control With Conserve, and HiYield PayBack Insecticide), pyriproxyfen (Esteem Ant Bait), and (S)-methoprene (Extinguish Professional Fire Ant Bait). Approximate time required for the active ingredients to give noticeable results are as follows: spinosad, 2 to 4 weeks; pyriproxyfen, 6 to 8 weeks; and (S)-methoprene, 8 to 12 weeks.

No general use insecticides provide control of **leafminer** larvae inside leaves. Leafminer problems are frequently caused by overuse of insecticides. Hand-pick mined leaves or plant tolerant varieties.

**Table 2. General Use Insecticides for Conventional and Organic Vegetable Production**

Active Ingredient	Formulation	Application Rates <sup>1</sup>	Examples of Products	LD <sub>50</sub> (oral)
acetamiprid	0.006% concentrate	1.5 oz./gal. of water	• Ortho Flower, Fruit and Vegetable Insect Killer	
azadirachtin (neem)	3.0-4.5% azadirachtin	8 oz./A Follow label directions.	• Neemix 4.5 • Molt-X <sup>6</sup>  • Azamax	
<i>Bacillus thuringiensis</i> (Bt)	Dipel liquid and dusts Thuricide liquid Bt worm killer Other formulations	Follow label directions. Rates vary with Bt concentration.	• Bonide Dipel 150 Dust • Bonide Thuricide Concentrate • Xentari	>5,000
<i>Beauveria bassiana</i>	11.34% strain GHA spores 0.06% strain GHA +0.75% pyrethrins	0.25–1 quart/acre  8–32 oz./acre	• BotaniGard ES or WP  • BontaniGard Maxx	
bifenthrin	0.3% liquid  0.115% granule	1.5 oz./gal. of water. Wet plants thoroughly, but avoid runoff.  1lb./500 sq.ft.	• Ortho Bug B Gon Max Lawn and Garden Insect Killer  • Ortho Bug B Gon Max, HiYield Vegetable Formulation Granule (Insect Killer for Lawns)	54
carbaryl	23.7% liquid  0.126% RTU <sup>3</sup>  5% dust 2% granule	Follow label directions. <sup>2</sup>  Spray until surface is wet.  0.25–1 lb./1,000 sq.ft. <sup>2</sup> 2.25 lb/1,000 sq.ft	• Fertilome Carbaryl Garden Spray • GardenTech Sevin Ready-to-Use Bug Killer (in various sizes) • GardenTech Sevin 5% Dust • GardenTech Sevin Lawn Insect Granules	250–850
cinnamaldehyde	30% cinnamaldehyde 0.03% cinnamaldehyde	0.85 oz./gal. of water	• Cinnamite (Mycotech) • Monterey All Natural Mite and Insect Control	5,000
cyfluthrin	0.75% liquid	1 T/gal. of water	• Bayer Advanced Multi-Insect Killer	
esfenvalerate	0.425% liquid	2 T/gal. of water	• Ortho Bug B Gon Multi-Purpose Insect Killer • Monterey Bug Buster • Bengal Lawn and Garden Insect Control Concentrate	
garlic juice (Repellent)	99.3% garlic extract	Consult product label.	• Garlic Barrier AG+ <sup>6</sup>	
insecticidal soap	Insect killing soap 49.2%	5 T/ gal. of water	• Spectrum Garden Safe Insecticidal Soap • Eight Insecticidal Soap (Bonide) • Bayer Advanced Natria Insecticidal Soap <sup>6</sup> • Natural Guard • Safer Brand Insect Killing Soap	
imidacloprid <sup>4</sup>	0.235% concentrate	0.5 oz./ 10 sq.ft. of vegetable row (apply as drench in water)	• Bayer Advanced Fruit, Citrus and Vegetable Concentrate • Monterey Fruit Tree and Vegetable Systemic Soil Drench	450

**Table 2. General Use Insecticides for Conventional and Organic Vegetable Production (cont.)**

Active Ingredient	Formulation	Application Rates <sup>1</sup>	Examples of Products	LD <sub>50</sub> (oral)
gamma-cyhalothrin	0.25% concentrate 0.5% liquid 0.002% RTU	1 T/ gal. of water	• Spectracide Triazicide Insect Killer	
lambda-cyhalothrin	0.5%	0.5 fl.oz./gal. of water	• Cyonara	
malathion	50% and 55% liquid	1.5–2 T/ gal. of water. <sup>3</sup> Use and registration vary with specific product.	• Hi-Yield 55% Malathion • Gordon 50% Malathion • Bonide 50% Malathion (Cythion)	1,000
<i>Nosema locustae</i>	Bait		• Nolo Bait	
Diatomaceous Earth	Dust		• Diatomaceous Earth • Perma Guard (has natural pyrethrin)	
oils, insecticidal	Various concentrations and mixtures	Check product label before use (may cause foliage burn if used without caution). Do not spray if temperatures exceed 90°F. Do not spray if sulfur was applied to foliage.	• Bonide All Season's Horticultural Oil6 • Green Light Neem Concentrate (70% neem oil) • Bonide Mite-X (0.4% cottonseed oil, 0.2% clove oil, 0.1% garlic extract) • Take Down RTU (Monterey) • Natural Guard 70% Neem • Monterey 70% Neem oil	
paraffinic oil	80-97% petroleum oil	1.2 oz./gal. of water See label for rate.	• Suffoil-X <sup>6</sup> • JMS Stylet-Oil <sup>6</sup>	
pepper extract (Repellent)	0.185% capsaicin	Consult product label.	• Bonide Hot Pepper Wax <sup>6</sup>	>2,500
permethrin	2.5 % liquid  0.25% dust	1-3 oz./gal. of water <sup>2</sup>  Dust lightly. <sup>5</sup>	• Eight Insect Control Vegetable, Fruit, and Flower Spray Concentrate (Bonide) • Green Light Conquest Insecticide Concentrate • Gordon Bug-No-More Multi-Purpose Concentrate • Ortho Bug B Gon Multi-Purpose Garden Dust • Gordon Garden Guard Insecticide	200
pyrethrins + PBO	13.3% liquid Various concentrations and mixtures. These are not organic products.	Check insecticide label. Follow label directions.	• Bonide Eight Insect Control • Spectrum Garden Safe Insect Killer RTU • Take Down Garden Spray (0.01% pyrethrin, 1.00% canola oil) • Bonide 1% Pyrethrin Guard Insect Spray • Fertilome Triple Action	

**Table 2. General Use Insecticides for Conventional and Organic Vegetable Production (cont.)**

Active Ingredient	Formulation	Application Rates <sup>1</sup>	Examples of Products	LD <sub>50</sub> (oral)
spinosad	0.5%	2 oz./gal. spray	<ul style="list-style-type: none"> <li>• Fertilome Borer, Bagworm, Tent Caterpillar, and Leafminer Spray</li> <li>• Bonide Captain Jack's Deadbug Brew</li> <li>• Monterey Garden Insect Spray <sup>6</sup></li> <li>• Bonide Colorado Potato Beetle Beater Concentrate <sup>6</sup></li> <li>• Natural Guard RT Spray</li> <li>• Pay Back Fire Ant Bait</li> <li>• Seduce</li> </ul>	LC <sub>50</sub> 11.5 ppm
	0.015%	Bait formulation		
	0.07%	Bait formulation		
sulfur	2% RTU	Spray until surface is wet.	<ul style="list-style-type: none"> <li>• Bayer Natria Insect, Disease, and Mite Control <sup>6</sup></li> </ul>	

<sup>1</sup> Use pesticides only according to the directions on the label. Follow all directions, precautions and restrictions that are listed. Do not use pesticides on plants that are not listed on the label. The pesticide rates in this table are recommended only if they are registered with the Environmental Protection Agency and the Alabama Department of Agriculture and Industries. If a registration is changed or cancelled, the rate listed here is no longer recommended. Information on label changes can be obtained by contacting your local county Extension office.

<sup>2</sup> Rate varies with insect species. For example, the rate recommended for control of flea beetles on cabbage with one brand of 22.5 % carbaryl liquid is 0.75 to 1.5 ounces per gallon of water while the rate recommended for armyworm on cabbage is 3 ounces per gallon. Check label for specific rate for each pest.

<sup>3</sup> RTU = Ready To Use

<sup>4</sup> Systemic insecticide. Apply as drench early after transplanting vegetables. Has excellent activity against soft bodied sucking pests. Do not use near bloom period.

<sup>5</sup> Read label directions to make sure dust is labeled for use on vegetable crop. Use an applicator to get the dust to penetrate crop canopy.

<sup>6</sup> For organic vegetable production. Products can be purchased online and may be expensive.

**Table 3. Insecticide Classification, Mode of Action, and Efficacy Chart for Controlling Major Insect Pests of Vegetables in the Home Garden**

IRAC Chemical Class and Mode of Action <sup>1</sup>	Active ingredient	Aphids, leaf-hoppers	Whiteflies	Thrips	Onion maggots (adult)	Flea beetles	Cutworms (in soil), armyworms (on foliage)	Fruitworm, hornworm, tomato pinworm (on foliage)	Colorado potato beetle	Stink bugs, Harlequin bugs	Squash vine borer	Spider mites
1A (contact/stomach)	Carbaryl					+	+					
1B (contact/stomach)	Malathion	+		+			+	+		+	+	
3 (contact)	Bifenthrin					+	+	+		+	+	+
3 (contact)	Cyfluthrin					+	+			+	+	
3 (contact)	Esfenvalerate					+	+	+		+	+	
3 (contact)	Gamma-cyhalothrin	+		+	+	+	+	+		+		
3 (contact)	Permethrin					+	+	+		+	+	
3 (contact)	Pyrethrin + synergist (PBO)		+				+					
4A (systemic and stomach)	Imidacloprid (NEW IN 2010)	+		+	Suppression only	+			+			
4A (systemic and stomach)	Acetamiprid	+	+	+			+			+		
5 (contact/stomach poison)	Spinosad						+	(target spray)	+		+	
11 (stomach)	<i>Bacillus thuringiensis</i>						+					
	Beauveria bassiana	+	+	+								
	Insecticidal soap	+	+	+								+
	Neem (with azadirachtin)	+	+	+			+					
	Paraffinic oil	+	+	+								+

<sup>1</sup> IRAC (Insecticide Resistance Action Committee) provides agricultural producers and crop protection professionals with information on resistance management.

**Table 4. Some Common Insect Predators Found Naturally in the Home Garden and Also Available Commercially**

Biological Control Agent	Predatory stages	Target Insect Pest
Lady beetles	Adult and larva	Soft-bodied insects (aphids, thrips) , caterpillars, mites
Lacewings	Adult and larva	Soft-bodied insects (aphids, thrips) , caterpillars, mites
Spined soldier bug	Adult and nymph	Small caterpillars and nymphs
Big-eyed bug	Adult and nymph	Eggs and caterpillars of many insects
Syrphid fly	Adult and maggot	Maggots feed actively on aphids and other soft-bodied insects
Minute pirate bug	Adult and nymph	Thrips, mites
Predacious damsel bug	Adult and nymph	Small caterpillars, leafhoppers, aphids
Assassin bug	Adult and nymph	Soft-bodied insects
Striped earwig	Adult and nymph	Egg and larvae of many insects
Ground beetles	Adult and larva	Egg and larvae of many insects, spiders, etc.
Insidious flower bug	Adult and nymph	Thrips
Nematode (NemaSeek)	Predatory nematode in soil	Soil pests like immature squash vine borer larvae and other grubs

**Table 5. Where to Buy Beneficial Insects**

Arbico Organics (Tucson, AZ): <http://www.arbico-organics.com/category/beneficial-insects-predators-parasites>

Gardens Alive

Extremely Green Gardening Company (Abington, MA): <http://www.extremelygreen.com/pestcontrolguide.cfm>

Syngenta Bioline Limited (UK): <http://www.syngenta-bioline.co.uk/products.htm>

Home Garden Vegetables: Insect Control revised by Ayanava Majumdar, Extension Entomologist, Alabama Cooperative Extension System, Alabama A&M University and Auburn University.

**For more information** on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:

**IPM 1293, "Safety."** Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides

**IPM 1294, "Submitting Samples."** Procedures for submitting samples for diagnosis, analysis, and identification

**IPM 1295, "General Pesticide Information."** Federal and state restricted use pesticide lists; pesticides and water quality



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**For more information**, contact your county Extension office. Visit [www.aces.edu/directory](http://www.aces.edu/directory).

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Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

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The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

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Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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