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CONTROL INSECTS

Of Flowers, Shrubs, and Shade Trees

Bulletin A-18

Cooperative Extension Service
and The Agricultural Experiment Station, University of Arizona
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CONTROL
INSECTS
Of Flowers, Shrubs, and Shade Trees

By
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Aphids or Plant Lice

Aphids or plant lice are small, globular shaped, soft-bodied sucking insects of about every color of the rainbow. The aphid sticks its beak into the stems or leaves and sucks out the sap of such plants as arborvitae, oleander, elm, ash, privet, photinia — and almost all annual-blooming flowers such as stocks, marigolds, calendulas, snapdragons, etc. The plant may be killed if the insects are not controlled.

Sometimes aphids are controlled by predators (lady bugs, lace wing flies, syrphis flies) and parasites (small minute wasps). The latter turn the aphids brown and emerge through exit holes in the body wall.
Aphids have the power of producing winged individuals when the wingless females become crowded. The winged forms develop very quickly for the purpose of flying to another plant or part of a plant to start a new infestation. When the winged female settles down on its new host, it starts giving birth to another colony.

Aphids reproduce very rapidly; for example, with one female today if conditions are good, there could be well over a million aphids within 30 days. Due to this fact, a thorough coverage of the plant with an insecticide is important for control.

Control

Aphids are killed only by the insecticide coming in contact with the insect or by fuming or complete fumigation. Best results have been secured with a 57 percent emulsion concentrate of malathion at the rate of 1 1/2 to 2 teaspoonfuls per one gallon of water or a 5 percent malathion dust.

A spray mixture of diazinon also has been very effective. Follow directions on the container since it comes in two different strengths.

A 40 percent nicotine sulfate solution, used at the rate of 1 1/4 to 1 1/2 teaspoonfuls plus the same amount of household ammonia in one gallon of water, is an effective control.

Pyrethrum and rotenone sprays also are effective. Follow directions on the container.

Parathion is never recommended to be used by the home gardener. DDT, chlordane and toxaphene do not kill aphids effectively.

Lindane, a pure form of benzene hexachloride, may be used. Be sure to follow directions on the container for dilutions to use.

Caterpillars or Worms

Western grape leaf skeletonizers, loopers, tent caterpillars, leaf rollers, bagworms, webworms, woolly worms (salt marsh caterpillars), large hornworms, and other insects may be classed together. These insects have chewing mouth parts and destroy the portion of the plants that they feed upon.

Some of the worms feed only on the lower surfaces of the leaves. Others feed within a web. Still others are leaf "miners."

Some of these worms form the pupal stage on the plant. Others crawl into the soil for pupation.

These insects are the larval stages of moths or butterflies.

Control

Control measures for caterpillars vary considerably since there is no one insecticide that will control all species. Generally speaking, these
insects are not controlled in the adult moth or butterfly stages, but as worms or larvae. Either a spray or a dust is applied to the plants and the caterpillar or worm in turn feeds upon the plant tissues and gets the poison into its stomach.

A 5 percent malathion dust or a spray of 1 to 2 teaspoonfuls of 57 percent malathion to a gallon of water is effective on the western grape-leaf skeletonizer and some loopers. A 10 percent DDT dust also is effective on several species of worms. Arsenical dusts are effective, as are 10 or 20 percent toxaphene dusts. Sprays of a wettable powder of toxaphene are also effective.

Other insecticides also are effective. Rotenone if available is good. For control of various webworms in the soil use a 2 percent dieldrin dust or 6 percent dieldrin granules.

Woolly worms or salt marsh caterpillars in some areas of Arizona cause serious injury to shrubs and lawns. In some instances a spray of malathion using 3 teaspoonfuls per gallon of water is effective when sprayed directly on worms.

In areas where worms are migrating from fields, a barrier of 7 inch aluminum foil has been very effective. If they are very abundant, post holes sometimes are dug every 3 feet to capture the worms piling up behind the barrier. It is wise to place water or oil in the bottom of the hole.

Where moths lay eggs on shrubs and in home yards, control with malathion as listed earlier is effective against the newly hatched caterpillars.

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**BEETLES**

Generally speaking, beetles cause injury in both adult and larval slug or grub stages by chewing on or in the plant. The adults and larval slugs or grubs may feed on the leaves, stems or roots, or as borers in the limbs and trunks.

In many cases only the adults are involved in causing the injury to the tops of the plants. In other cases, both the adults and larvae feed on the leaves and stems.

**Flea Beetles**

Several different species of flea beetles feed on flowers and shrubs. Some are steel blue, black, green, striped, and of various other colors. They eat small holes in the leaves and jump like fleas when you approach the plants.

**Control**

A 10 percent DDT dust will give excellent control. Also 5 percent malathion, 10 percent chlordane, 2 percent dieldrin dust, or diazinon sprays are effective.
Elm Leaf Beetles

During the past few years, the elm leaf beetle has become very injurious to elms in central Arizona and in parts of Apache county. They are now appearing in Yavapai county.

The adult beetle feeds and deposits her eggs on leaves. From these eggs hatch small yellow larvae or slugs that feed very ravenously on the leaves. There may be several generations a year if the insects are not controlled.

Control

Use 1.5 to 2 teaspoonfuls of 57 percent malathion emulsion in one gallon of water. For larger amounts, use 1.5 pints of malathion emulsion in 100 gallons of water. A diazinon spray is also effective. Follow directions since there are two strengths offered for sale.

Fruit Bud Beetles

These small black beetles, looking something like thrips but larger, cause great concern to many gardeners. They frequently appear in roses in great numbers, and sometimes infest other flowers.

Control

These insects can be controlled by dusting with 10 percent DDT before the flower opens. A 5 percent malathion dust is very effective after flowers open. Or use a spray of malathion, 1.5 teaspoonfuls per gallon of water.

Other Beetles

Another beetle found feeding on roses is a medium sized beetle known as the Rose Chafer. The same dusts mentioned for the fruit bud beetle will control this beetle.

The Chrysanthemum Borer that often destroys chrysanthemums is rather difficult to control. In transplanting these flowers, never include any of the old crown. This will reduce chances of infestations in other areas. When separating young plants always destroy the old crowns.

There are several beetles injuring shrubs in the state. In some areas June Bugs range in color from brown to green. Some are quite large. There is no control for the adults. The larvae, commonly known as white grubs, may be controlled if they become too numerous. Work 10 percent chlor dane into the soil. A 2 percent dieldrin dust worked into the soil is also effective, as are 6 percent dieldrin granules.

The Cottonwood Beetle may become numerous on cottonwood trees and may be controlled with a spray of 3 pounds of 50 percent wettable DDT to 100 gallons of water.

Some beetles deposit their eggs in bark, from which borers hatch. There are several borers that feed on roses. One is the Flat-Headed Apple-Tree Borer. Another is a round-headed borer, known as the Rose Borer.

Whenever you are pruning roses, be certain to paint the wound with some paint or tree seal. This operation will greatly reduce the possibility of borer injury.

A large, long prionid beetle is 2 to 5 inches in length. It usually is found at lights. The larva of this beetle will destroy palo verde, carrots, elms and poplar trees, as well as shrubs. The larva will feed on the tap root and, if it girdles the
root, the tree will die. To control, use 10-percent chlordane dust or 2 percent dieldrin dust or 6 percent dieldrin granules worked in the soil.

Leafhoppers
Leafhoppers are sucking-type insects that cause considerable damage to many flowers, shrubs and shade trees. These small, varied colored insects fold their wings in the adult stage in a triangular shape on their back. The small ones, commonly called nymphs, do not have well-developed wings, but remain on plants all of the time.

Leafhoppers suck juices from the plants, and in many instances they are vectors of plant virus diseases. Aster yellows, curly top of sugar beets, and other plant diseases are spread by these little leafhoppers.

Control
Leafhoppers, which as previously stated, have a sucking type of feeding structure in the form of a hair-like beak, are controlled with contact insecticides. Dusting sulfur, 5 percent malathion dust, DDT, chlordane, lindane, toxaphene, rotenone and pyrethrum dusts are very effective for their control. A 57 percent malathion emulsion, 1.5 teaspoonfuls to 1 gallon of water, or a spray of diazinone used according to directions is effective.

A 5 percent DDT-dusting sulfur dust mixture may be used. A 5 percent chlordane dust also is effective.

In sprays, a combination spray of pyrethrum-rotenone is very effective. Follow directions on the package. Toxaphene and lindane also are used by following directions on the container. Insecticides applied as sprays through garden hose attachments are very effective when used correctly.

CUTWORMS, CRICKETS, & DARKLING BEETLES
Cutworms, crickets and darkling beetles cause serious loss to transplanted annuals and many bedding plants and flowers. They are chewing insects that feed on the small, tender plants, usually at night. They can be easily controlled with baits of various kinds, as well as some insecticides.

Cutworms
There are several different species of cutworms to be found around the yard or lawn. They feed mostly at night. The worms are usually a dirty dull to shiny grayish-black color. They stay in the soil during the day and come out and feed at night.
If you find plants that have been cut off, dig in the soil at the base of the plant and you may locate the worms. The adults of these worms are a grayish-brown to black moth.

**Control**

Cutworms may be controlled with a 10 percent DDT dust, 10 percent chlordane, 5 percent heptachlor, 10 percent toxaphene, or a 2 percent dieldrin dust. Place the dust on the soil near the plants for best results. Apple peel baits as well as metaldehyde baits are also effective.

Where only a few transplanted plants are involved, use protectors made of small strips of cardboard. The strips should be about 2 inches wide and 3 or 4 inches long. Place the piece of cardboard around the stem of the plant with about 1.5 inches above the soil and the rest beneath the soil. Leave this until the plant has taken root, usually about one week.

**Crickets**

There are several species of crickets that may be present in the flower gardens or in the home.

A 10 percent chlordane dust, 10 percent toxaphene dust, or 2 percent dieldrin dust is a very effective control. Some prepared poison baits also are effective.

**Darkling Ground Beetles**

Darkling ground beetles are small, dark brown to black beetles that feed on tender plants in a manner similar to cutworms. They also annoy homemakers by crawling inside the house. They do not cause injury to rugs or furniture.

**Control**

Darkling ground beetles in flower beds and lawns are controlled with 10 percent chlordane dust, 2 percent dieldrin dust, or 10 percent toxaphene dust. Keeping them out of the house is difficult. However, wide bands of 2 percent dieldrin next to the house or porch are usu-
ally effective, as is spraying the door opening with 2 percent dieldrin in oil spray.

**Spider Mites or Red Spiders**

Spider mites or red spiders are serious pests of many shrubs, flowers and shade trees in Arizona. Mites are very small, practically microscopic in size, and make a web when present in great numbers. They are of many colors.

These mites are not true insects, since they have eight legs. They cause injury to the foliage of arborvitae, junipers, ash trees, elm trees, privets, zinnias, calendulas, pansies, violets, snapdragons, stocks and almost all other annual flowers. If not controlled, they can damage many of your shrubs, trees or flowers.

**Control**

Spider mites and red spiders can be controlled on most shrubs, trees, and flowers with dusting sulfur.

Where plants are susceptible to sulfur burn, you may wish to use one of the organic insecticides. Recent work has shown that a 3 percent aramite dust, a 3 percent kethane dust, or a spray of either to be very effective.

Be certain to follow directions as given on the container at all times when using these materials.

**Grasshoppers**

Arizona has several species of grasshoppers that infest shrubs, small trees and flowers. They are chewing insects that feed on the foliage in either the young or adult stage.

**Control**

Grasshoppers now are controlled by sprays or dusts, and very little poisoned bait is used. Recent research has found that chlordane, dieldrin, and toxaphene sprays or dusts are very effective.

Aldrin in the spray form is often the cheapest and best to use to control grasshoppers. It comes in an emulsion form. On large areas use 0.5 pint per 3 to 10 gallons of water per acre. (See the chart on page 16 of this circular for smaller dilutions). The material, when sprayed on the plants, will give good control of the grasshoppers.

If aldrin is not available, use a 5 percent chlordane or 10 percent toxaphene dust, or an emulsion of either material according to directions. You may also use 2 percent dieldrin.

You may still use poisoned baits if they are commercially available.

**Thrips**

Thrips are common on many Arizona shrubs and flowers. Thrips are very small, slender insects which attack the blooms of many flowers and also feed on gladiolus...
bulbs and other bulbs. They have rasping mouth parts and can be very injurious if not controlled.

**Control**

Thrips are controlled with several of the new insecticides. Best results have been secured with 2 percent dieldrin, 10 percent chlordane, 5 percent heptachlor, 10 percent toxaphene, or 5 percent malathion dusts.

Emulsion sprays of these materials, used according to directions, also give good results. A diazinon spray is also effective. Follow directions since it is packaged in two strengths. Several applications may be necessary.

**Snails and Sowbugs**

Snails or slugs, and sowbugs or pill bugs, are not true insects. Yet they are often confused with crickets and cutworms since their injury resembles that of the cricket and cutworm.

These two pests cause their worst injury in shady and overplanted beds. The snail is easily recognized, while the sowbug or pill bug is grayish in color and rolls up into a "pill" when disturbed. Not all snails have a shell.

**Control**

Control of snails or slugs and sowbugs or pill bugs may be secured with poisoned baits. A good bait contains metaldehyde. It may be purchased from seed and feed houses or nurseries. A 10 percent chlordane or 2 percent toxaphene dust sometimes is very effective.

**Boxelder Bugs**

Boxelder bugs are very pretty true bugs about 0.5 inch long and slate black, with three red lines on the back. As indicated by the name, they feed on box elder trees. They also like to crawl into the house and annoy homemakers. Some years they are very prevalent in the higher elevations.

**Control**

Control for boxelder bugs has been accomplished with chlordane emulsion sprays. In some instances 5 percent chlordane dust has given good results.

Since these are sucking insects, the insecticide must come in contact with them.

**Earwigs**

These pestiferous insects range from small to medium sized. They have biting mouth parts. The insect is elongated, rather flattened, with a very prominent head and antennae. It is rather glossy looking and very easily identified by the two movable forceps on the
posterior end of the abdomen. The forceps are harmless to humans. This insect is found here in our lawns where it feeds on grass cuttings and other plant debris. It may also feed on living plant material. Some species also feed on other insects. The insect comes into the home but does not harm anything. If it is mashed a terrible odor is forthcoming.

**Control**

Control may be secured with a 2 percent dieldrin or 10 percent chlordane dust or a spray of dieldrin or chlordane. The insecticides may be applied in the lawn or around the outside of the house.

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**Leafcutter Bee**

The leafcutter bee causes injury to many shrubs and flowers. It is the small insect that cuts perfect circles out of the leaves and petals of shrubs and flowers.

This is a small bee that is very difficult to control. The bee cuts out the leaf or flower petal to make a nest for its young. The bees may find a hole in the ground that something has already made, or they will find a hole in a wall or under the eaves of a house.

In the hole, the bee will place several cells made of the leaves and petals. Each cell contains a larva and pollen and nectar to raise the insect to a full grown bee.

**Control**

There is no control other than destroying the nests which discourages the insects. Incidentally these bees are very excellent pollinators of alfalfa and clover blooms.

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**SCALE INSECTS**

**Cottony Cushion Scale**

This soft bodied scale insect feeds on lemons, oranges, grapefruit, cape jasmine, pittosporum, and similar plants. The insect covers its abdomen with a cottony egg sack with which it protects the young crawlers. This sack protects the insects from insecticides.

**Control**

There is no good control by insecticides. The best control is with the Vedalia ladybug. A strong malathion spray (2 to 4 teaspoonfuls of concentrate per gallon of water) is rather effective if insects are thoroughly covered.

**Elm Scale**

The insect known as the elm scale has become very prevalent in Yavapai and Coconino counties on shade elm trees. In some instances the scale has practically killed the trees. The mature scale can be rather pretty when in great numbers, yet it can kill the tree.

Scale insects are sucking insects. When grown, they usually develop a cover, called a scale, as protection.

The adult female gives birth to the young, which are called crawlers, since they are equipped with legs. They crawl around for a while, stick their beaks in the limb or twig and start feeding. At this time they lose their legs and form a scale covering.

**Control**

The control of elm scale and scale insects of this kind is accomplished by dormant and summer-spray oils. Best results are secured with a
good dormant oil spray. In some instances nicotine sulfate is added to the spray mixture.

Mealy Bugs

Mealy bugs are flattened, elongated oval-bodied insects that are covered with a white, powdery wax which extends from the sides in a series of short filaments, with usually longer ones on the back end. This insect belongs to the same order as scale insects and aphids, and is very closely related to scale insects. You will find them on some indoor plants and on poinsettias and other plants around the garden.

Control

They can be controlled with a spray of malathion at the rate of 1.5 teaspoonfuls per gallon of water. At times the insects, if present in small numbers, may be picked off by hand or washed off with a stream of water.

Whiteflies

Whiteflies are very small insects with wings like a tennis racquet and covered with a fine, snow-white waxy powder. The adult fly deposits very small eggs which hatch small insects that resemble scale insects. In Arizona they do not cause too much damage to plants.

Control

At times we have requests for control. Spraying with a malathion spray of 1.5 to 2 teaspoonfuls per gallon of water usually gives control.

Bagworms

In some parts of Arizona we have considerable injury from feeding of bagworms. Bagworms are ravenous feeders on arborvitae and other ornamental shrubs, and sometimes we notice them on some forest plants.

The adult moth deposits eggs which hatch into small dark worms that immediately start feeding on the plant, at the same time forming a case or bag. The bag becomes large enough to house the worm and it hides here, when not feeding. It protrudes from the case to feed.

Control

Some people clip off the bags and destroy them, while others spray the shrub with arsenate of lead, DDT or malathion as a means of control.

White Lined Sphinx

This large worm with a horn on its abdominal end quite often becomes a nuisance to homes on the edge of the desert. It does not destroy too many plants, but gets into swimming pools, etc. The adult of this worm is the white lined sphinx moth and sometimes is called the humming bird moth. There is no economical control.

Spittlebugs

Spittlebugs, sometimes called froghoppers, are so called because the small young or nymphs are usually surrounded or covered with a mass of white froth or cottony-like material. The small insects live in this froth and also feed on that portion of the plant so infested.

The insects closely resemble leafhoppers and differ in that they are usually rather squatty and give a froglike appearance. In Arizona
spittlebugs are found on walnuts, many annual plants, and shrubs.

**Control**

Control of spittlebugs is obtained with malathion. Malathion at the rate of 1 or 2 teaspoonfuls per gallon of water sprayed on the froth usually gives good control.

**Other Insects**

Cypress Bark Beetles cause injury to Arizona cypress trees. Injury is less to trees that have been well watered or fertilized. There is no insecticidal control.

Termites injure palms as well as many shrubs. When they appear, dust 10 percent chlordane or 2 percent dieldrin around the base after cleaning away the loose material.

Twig Girdlers are also numerous. The only control is to burn the girdled twigs.

**INSECTICIDES**

Some insecticides are very poisonous to warm-blooded animals, while others are not so toxic.

When using any insecticide, always follow directions. Be certain to use the correct insecticide for the insect being controlled.

**Aldrin**

Uses: Soil insects including white grubs, cutworms, mole-cricket, wireworms, and grasshoppers. Kills by contact and stomach poisoning, some vapor action.

**Formulations:** 25% wettable powders, 2½% and 5% dusts, 5 and 10% granules, emulsifiable concentrates containing 2 lbs. active ingredient per gallon (about 23%).

**Chlordane**

Uses: Grasshoppers, soil insects including ants, white grubs, cutworms, wireworms, sowbugs, pillbugs, etc.; used for plant bugs; used in snail baits; used extensively in household pest control; lice, ticks, hornflies and mange mites of livestock; chiggers and termites.

Kills by contact, stomach poison and some vapor action.

**Formulations:** 2 to 3% kerosene solutions for household pests; emulsifiable concentrates ranging from about 44% to 78% by weight; 40% and 50% wettable powders; 5% and 10% dusts; 5% and 25% granules.

**Diazinon**

Diazinon is an organic phosphorous insecticide and is considered a poisonous insecticide so should be handled according to directions. It has been very effective for control of Bermudagrass insects and mites, aphids, leafhoppers, flies, and household insects. It is sold as a 12.5 and 25 percent emulsifiable concentrate, a 25 percent wettable powder and a 4 percent dust.

**DDT**

Uses: One of most widely used insecticides on vegetables, forage and cover crops, livestock, ornamentals, lawn and turf insects including chinch bugs, sod webworms, armyworms, leafhoppers.
Kills by contact and stomach poison; no vapor action.

**Formulations:** 5, 10 and 15% dusts; 25% emulsifiable concentrate (2 lbs. actual per gallon); 50% and 75% wettable powders; aerosols, smokes; 5% kerosene solutions for household use.

**Dieldrin**

**Uses:** Excellent for grasshoppers and thrips control on ornamental plants like chrysanthemums, gladiolus, thrips on subtropical fruits; soil inhabiting insects like ants and cutworms. Used in mosquito control work and for household pests including termites. Kills by contact and stomach poison.

**Formulations:** 25 and 50% wettable powders; emulsifiable concentrate containing 1.5 lbs. per gallon (about 18.5%); 1.5% dust concentrate; 1.5% to 2.5% dusts; 2% and 5% granules.

**Heptachlor**

**Uses:** A chlorinated insecticide related to chlordane. Used against soil insects including wireworms; grasshoppers; mosquitoes; and thrips on onions.

**Formulations:** 25% wettable powder; 2½% dust; 2½% and 25% granules; 25% granules; 25% emulsifiable concentrate (contains 2 lbs. actual per gallon).

**Malathion**

Malathion is a phosphate insecticide related to parathion, but less toxic to humans.

**Uses:** Aphids, thrips, scales, whiteflies, mealybugs, house flies, fleas, Mexican bean beetles. Widely used on ornamentals. Kills mites but not their eggs. Kills by contact, stomach poison, and some vapor action.

**Formulations:** 4%, 5%, and 10% dusts; 25% wettable powders; 57% emulsifiable concentrate (5 lbs. actual per gallon).

**Metaldehyde**

**Uses:** Control of slugs and snails; combined with chlordane, as 10% metaldehyde and 5% chlordane, or used alone as 15% dust; used in baits as attractant with calcium arsenate.

**Formulations:** 15% dust; in baits with other toxicants.

**Nicotine Sulfate**

Nicotine sulfate is one of the insecticides for control of aphids around the home. It is usually purchased in a 40 percent strength and used as a spray. Dusts must be mixed fresh and are too difficult to mix by an amateur.

Use 1.25 teaspoonfuls of nicotine sulfate plus the same amount of household ammonia to a gallon of water. If your water is very hard, add a teaspoonful of soap flakes to each gallon.

Nicotine sulfate is a contact insecticide and must come in contact with the insects if good controls are to be secured.

**Parathion**

Parathion is a phosphate insecticide that should be applied only by licensed commercial applicators. The home gardener should not use this material.

**Uses:** Aphids, thrips, scales, mealy-bugs, peach insects. Widely used on ornamentals, citrus, vege-
tables, sub-tropical fruits. Kills mites but not their eggs. Used in combination with DDT on numerous crops against a very wide range of insects. Kills by contact, vapor and stomach poison.

**Formulations:** 15% and 25% wettable powders; 1% and 2% dusts; 25% emulsifiable concentrate (2 lbs. actual per gallon) and 42% emulsifiable (4 lbs. actual per gallon); granules.

**Piperonyl Cyclonene**

Piperonyl Cyclonene is a synergist or activator for pyrethrins. It is not considered poisonous and seems to increase the killing power of pyrethrum many times.

**Poisoned Baits**

Poisoned baits may be purchased for control of slugs or snails and sowbugs. These are prepared baits that are much cheaper to purchase than to make at home.

**Pyrethrum**

Made by the grinding or extraction of the dried flowers of Chrysanthemum cinerarifolium. Extracts have largely replaced the ground flowers. Gives quick knock-down and breaks down rapidly.

Uses: Primarily in stored grain sprays and dusts, household sprays and aerosols, and for livestock pests. Often mixed with other insecticides to give quick knock-down. Used to some extent in ornamental and vegetable garden dusts and sprays. Also an ingredient in many flea and lice powders. Pyrethrum is of very low toxicity to humans.

Formulations: Dusts, aerosols, sprays.

**Rotenone**

Rotenone is a botanical insecticide derived from the roots of derris, cube and timbo. Has low order of toxicity to humans.

Uses: For many garden and flower pests, but has been largely replaced on commercial crops by newer organic insecticides. Used widely for cattle grubs and Mexican bean beetles and in backyard vegetable gardens.

Formulations: 4% and 5% wettable powders: 75% to 1.5% dusts.

**Sulfur**

Sulfur is a well known fungicide and miticide with a low order of toxicity to humans but irritating to the eyes.

Uses: Control of citrus rust mite on citrus. Also effective against a few other mites and insects. Largely being replaced for mite control on ornamentals and other crops by newer organic materials.

**Toxaphene**

Toxaphene is chlorinated camphene.

Uses: Widely used against grasshoppers, armyworms, sod webworms, cutworms, stink bugs. Also used on many vegetables. It is generally good for use on caterpillars. Kills by contact, vapor, and stomach poison.

Formulations: 25% and 40% wettable powders—40% most common; 5%, 10% and 20% dusts; emulsifiable concentrates containing 2, 4, 6 or 8 lbs. toxaphene per gallon. Probably most common is emulsifiable concentrate containing 6 lbs. toxaphene per gallon (about 60%); 2 to 2½% baits; 10% and 20% granules.
DUSTERS AND SPRAYERS

If emulsion materials are used, the ordinary 3 gallon compressed air sprayer will be satisfactory. Some of the sprayer attachments for use with a garden hose also do a good job. However, it is a little difficult at times to regulate the amount of insecticide used. Always use insecticides according to directions.

If dusts are used, always apply with a plunger-type duster. Don’t apply with a shaker or cloth if you desire good results. On very small plants, cover with cloth when applying dust.

When using a wettable powder, be certain to keep the contents of the sprayer well agitated, since the materials are insoluble in water. However, if they are agitated they will stay in suspension until applied.

Remember that if you are to control the insects, you must apply the insecticides thoroughly and not in a haphazard way.

DILUTION SPRAY CHARTS

Liquid Measure

<table>
<thead>
<tr>
<th>If dilution for 1 gallon is:</th>
<th>Then dilution for 5 gallons is:</th>
<th>And dilution for 100 gallons is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 tspnful</td>
<td>1 1/5 tspnful</td>
<td>1/2 pint</td>
</tr>
<tr>
<td>1 tspnful</td>
<td>1 3/5 Tbspnful</td>
<td>1 pint</td>
</tr>
<tr>
<td>2 tspnful</td>
<td>3 1/6 Tbspnful</td>
<td>1 quart</td>
</tr>
<tr>
<td>4 tspnful</td>
<td>6 1/3 Tbspnful</td>
<td>1/4 gallon</td>
</tr>
<tr>
<td>2 1/2 Tbspnful</td>
<td>2 3/4 pint</td>
<td>1 gallon</td>
</tr>
<tr>
<td>5 Tbspnful</td>
<td>4 3/5 pint</td>
<td>2 gallons</td>
</tr>
<tr>
<td>1/3 pint</td>
<td>1 3/5 pint</td>
<td>4 gallons</td>
</tr>
<tr>
<td>4 3/5 pint</td>
<td>4 pints</td>
<td>10 gallons</td>
</tr>
</tbody>
</table>

Dry Weight

Wettable Powder

<table>
<thead>
<tr>
<th>If dilution for 1 gallon is:</th>
<th>Then dilution for 5 gallons is:</th>
<th>And dilution for 100 gallons is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/6 ounce</td>
<td>3/4 ounce</td>
<td>1 pound</td>
</tr>
<tr>
<td>1/3 ounce</td>
<td>1 3/5 ounces</td>
<td>2 pounds</td>
</tr>
<tr>
<td>1/2 ounce</td>
<td>2 1/2 ounces</td>
<td>3 pounds</td>
</tr>
<tr>
<td>2/3 ounce</td>
<td>3 1/2 ounces</td>
<td>4 pounds</td>
</tr>
<tr>
<td>4/5 ounce</td>
<td>4 ounces</td>
<td>5 pounds</td>
</tr>
<tr>
<td>1 3/5 ounces</td>
<td>8 ounces</td>
<td>10 pounds</td>
</tr>
<tr>
<td>3 1/5 ounces</td>
<td>16 ounces</td>
<td>20 pounds</td>
</tr>
</tbody>
</table>