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# Oregon State Agricultural College Extension Service

Corvallis, Oregon

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## Vegetable-Crop Insect-Pest Control Program

By

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**T**HE successful grower of vegetable crops of high quality is burdened with many difficulties. The most exacting of the grower's troubles are the insect enemies of vegetable crops. Methods of combating these insect pests are briefly outlined in this bulletin.

**Insecticides** for controlling insects are applied by means of a liquid carrier or a dust carrier. Dusting the vegetable crops may prove for many the more acceptable form of application. The spray materials are, for the most part, available in dust form, and dusting outfits are comparatively inexpensive and handy. The insecticides and spray equipment may be obtained from your local dealer in spray materials.

Calcium arsenate, it is believed, is now so standardized that it may be substituted for lead arsenate in the control of vegetable insects. It is generally used at the rate of 2 pounds to 50 gallons of water, or 1 ounce (10 level teaspoonfuls) to 1 gallon of water. Casein spreader, skim milk or soap, 1 ounce dissolved to 1 gallon of spray, is usually added to make spray wet waxy leaves such as those of cabbage. For information on mixing sprays, send for Station Circular 68. Recently several new contact sprays for use against sucking insects, such as aphid or plant lice, as well as chewing insects, have appeared on the market under several different proprietary names. These are compounds containing pyrethrum, or derris. Directions for their use should be found on each container.

**CAUTION:** Recent investigation indicates that the lead in the lead arsenate combination is quite difficult to remove by the ordinary washing methods. Calcium arsenate is, therefore, less objectionable for use on vegetable

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crops. Great care, however, should be exercised in the use of any arsenical or other material that leaves a residue toxic to man on the edible parts of the vegetables. The treatment of vegetables should be so regulated that those parts to be eaten do not bear a poisonous residue. The application of these materials to leafy vegetables, spinach, asparagus, and the like that are to be eaten is not recommended.

**Bordeaux mixture** should be made fresh each time it is used. It is recommended for flea beetles and garden slugs. Commercial brands are available, or it may be made as follows:

Copper sulfate.....	1 pound
Quicklime.....	1 pound
Water.....	12½ gallons

Use only wooden or earthenware vessels in preparing bordeaux. In one vessel dissolve the copper sulfate in 2 gallons of water. In another vessel slake the lime and make up to 2 gallons. Pour the two solutions simultaneously through a strainer into a container holding 8½ gallons of water.

**Bordeaux oil emulsion**, recommended for onion maggot control, is made by adding 1½ gallons of a commercial oil emulsion stock to 50 gallons of bordeaux mixture. Agitate thoroughly before application. Use between 150 and 200 gallons per acre.

**Corrosive sublimate** is recommended against the cabbage maggot and onion maggot when used at a strength of 1 ounce to 12 gallons of water, applied at intervals of a week or ten days during the flight period of the fly. Drenching the soil with the solution of corrosive sublimate is of value in combating earthworms, slugs, larvae of fungous gnats, radish, onion and cabbage maggots. The preparation and handling of this chemical should be safeguarded as *it is a deadly poison*. As it corrodes metals, the solution should be prepared in a glass, glazed, or wooden vessel, which should be thoroughly cleaned or destroyed immediately after use. Use of hot water will hasten the solution of the corrosive sublimate.

**Poison bran mash** is the standard remedy for cutworms and grasshoppers. The following formula makes enough for a city garden or one-third of an acre:

Coarse wheat bran.....	5 pounds
White arsenic or paris green.....	3 ounces
(or Sodium fluoride.....)	5 ounces)
Molasses or sirup.....	1 pint
Water to make a crumbly mash.....	2 to 3 quarts

The dry ingredients are first thoroughly mixed and the water and molasses added. If too much water is used, the mash will be sloppy and hard to scatter; use just enough water so that it will be wet and still fall apart readily after being pressed together in the hands. The poison bait is broadcast over the area as soon as the first cutworm or grasshopper injury is noticed. As an insurance against cutworm injury, broadcast over the garden after soil is prepared, and just before garden is planted.

**Carbon bisulfide** is the most practical fumigant substance for the treatment of beans, peas, and other seeds for weevils. It can be used, when

properly applied, for the treatment of seeds intended for planting or for food. This material is inflammable. *Keep all lights, sparks, or flames away from it.* Do not use in a heated room. It is used at the rate of 10 to 30 pounds for every 1,000 cubic feet of space in an air-tight container. The liquid may be placed in very shallow pans on top of seed to be fumigated or dashed on gunny sacks previously spread over top of seed. For fumigating small amounts, place seed in a two-quart jar, pour 1 tablespoonful of carbon bisulfide over seed, and close the lid tightly. Allow gas to act for 48 hours before opening to air out. Keep seed in tight containers to prevent reinfestation. The gas is not effective if the temperature is much below 60° F. Warmer weather is more favorable.

**Three-in-One dust.** Repeated applications of a "Three-in-One" dust or "All-in-One" dust are of value in protecting the garden from insect attack. Begin dusting as soon as the plants appear above ground and repeat at intervals of 10 to 14 days and your insect troubles, it is believed, will be mostly prevented. It is not advisable to continue the applications of this dust on leafy or other vegetables soon to be consumed. Commercial brands of this dust are available, or it may be made as follows: Mix thoroughly 7½ pounds of calcium arsenate, 17½ pounds of sulfur, and 22½ pounds of good hydrated lime. Then add 2½ pounds of nicotine sulfate. To mix large quantities, place the mixture of lime, calcium arsenate, and sulfur in a keg (50 pounds can be mixed in a fifty-gallon keg), add the nicotine sulfate, and then add ½ pound of rocks or pebbles (about the size of a hen's egg) for each pound of dust to be mixed. The keg should then be closed tightly, and rotated for 10 minutes either by rolling the keg over the ground or by mounting it on a frame. In mounting the keg on a frame, spindles are placed on the ends of the keg and a hinged door fixed in the side. After mixing, the dust should either be used immediately or placed in air-tight containers, as the dust loses strength rapidly. To remove pebbles, pass the dust through a ⅜"-mesh wire screen. The nicotine sulfate in liquid form is poured into the dust after it has been thoroughly mixed. The mixing is then continued until the liquid has been thoroughly distributed.

**Spray equipment.** The type of sprayer to use is governed somewhat by the size of the area to be sprayed. For small areas, potted plants, etc., the ordinary hand atomizer as used for fly sprays is satisfactory. For the ordinary home garden, a knapsack sprayer is quite satisfactory. Several types of knapsack sprayers are on the market. These may be grouped under three heads as follows:

1. *Compressed air type:* This consists of an air-tight tank to which is attached an air pump. The tank is partly filled with the spray solution and pressure secured by pumping air into the tanks. A strongly constructed tank is necessary in this type because of the high pressure maintained in the tank.

2. *Bucket pump type:* This usually consists of a single cylinder pump with the handle extending under the right arm of the operator. The pump is operated with the right hand and the spray nozzle with the left. The operation of this type requires considerable labor.

3. *The slide-action pump:* The pump consists of two brass tubes, one working inside the other like a slide trombone. Considerable pressure can be maintained with this pump. It is also suitable for spraying trees up to 20 or 25 feet tall.

**Hand dusters.** Several types of hand dusters are suitable for dusting garden crops. There are three general types, the *bellows* type, where the air blast is generated by a bellows; the *cylinder* type, where a piston is utilized to make the air blast; and the *rotary* fan type, suitable for larger areas.

### CONTROL OF PESTS OF COMMON VEGETABLES

Crop	Insect	Control Program
ASPARAGUS	Common asparagus beetle	Cut crop clean to market size. Destroy all volunteer plants and crop remnant. Leave trap rows and spray or dust with calcium arsenate after larvae have hatched. Spray after crop is cut to destroy adults before cleaning patch for winter. Poultry of value in destroying beetle.
BEAN	Bean weevil	Fumigate seed immediately after harvest with carbon bisulfide and destroy all vines.
	Western 12-spotted cucumber beetle	Experiments indicate following to be of value: Leave trap rows. Drive beetles to trap rows by dusting with lime. Spray beetles on trap rows with pyrethrum spray. Most damage done by adults soon after emergence about time beans bloom. Control measures should be applied when first damage noticed.
	Aphis	Spray with nicotine sulfate $\frac{1}{2}$ pint, water 50 gallons. Add 4 pounds dissolved soap. Nicotine dust effective in warm weather. Aphids begin to appear before beans bloom. Control should be applied when first observed.
	Thrips	Spray at intervals with nicotine sulfate or nicotine dust. Thrips usually appear in numbers after beans bloom. Control measures should start with first appearance of thrips.
	Seed-corn maggot	No satisfactory control. Plant shallow in heavy, wet soil and in wet seasons. Avoid sod land or new land, especially in cold, wet seasons.

CONTROL OF PESTS OF COMMON VEGETABLES (*continued*)

Crop	Insect	Control Program
BEEET	Flea beetles Leaf beetles	Periodic applications of calcium arsenate spray or dust. First application to be made when injury first noticed. (If beet tops are to be used as food, try a pyrethrum spray.)
BRUSSELS SPROUTS	Aphis	Spraying or dusting with nicotine when aphids first appear.
CABBAGE CAULIFLOWER KALE	Cabbage worms Diamond-back moth	Usually present in early spring when plants are first set out. Dust with calcium arsenate dust at intervals of 2 weeks until plants begin to head.
	Cabbage root maggots	Wet soil around plants with corrosive sublimate solution at intervals of 10 days, beginning 3 days after transplanting. Make 4 applications. Screen late plants to exclude the flies which produce the maggots.
	Cabbage aphis	Appear soon after plants are set out. As soon as lice appear and before leaves curl, spray with nicotine sulfate $\frac{1}{2}$ pint, dissolved soap 4 pounds, and 50 gallons of water. Nicotine dust effective in warm weather.
CUCUMBER MUSKMELON SQUASH	Striped cucumber beetle 12-spotted cucumber beetle	Dust with mixture of calcium arsenate powder 1 pound, land plaster 20 pounds, when plants appear above ground. Repeat application every 4 days during fair weather and after each rain.
	Aphis	See Cabbage aphis.
	Seed-corn maggot	See Bean.
HORSERADISH	Diamond-back moth	Repeated applications calcium or lead arsenate dust.
ONION	Thrips Appear in early spring but usually not serious before early July.	Burn or plow under grassy or weedy borders near onion field in early winter to destroy thrips. When thrips appear in spring, spray with $\frac{1}{2}$ pint nicotine sulfate, 2 pounds dissolved soap, 50 gallons water, or 1 teaspoonful nicotine sulfate, 1 inch cube of soap to 1 gallon of water. Dust with nicotine dust when temperatures are above 60° F.

CONTROL OF PESTS OF COMMON VEGETABLES (*continued*)

Crop	Insect	Control Program
ONION ( <i>continued</i> )	Onion maggots	Spray soil around plants with corrosive sublimate solution or bordeaux oil emulsion, beginning when plants are 1 inch high. Five applications at weekly intervals are recommended.
PEA	Pea weevil	Fumigate seed with carbon bisulfide immediately after harvest and destroy all vines.
	Pea aphis	<i>See</i> Bean.
	Seed-corn maggot	<i>See</i> Bean.
POTATO	Grub worm and wireworms	These insects more prevalent in potatoes grown on new or sod land, or land not well drained.
	Flea beetles	Spray with bordeaux mixture to which is added arsenate of lead powder at rate of 1 ounce to 1 gallon of bordeaux mixture. Apply spray as soon as beetles appear.
	Colorado potato beetle	Dust or spray with lead or calcium arsenate at rate of 1½ pounds* to 50 gallons water. Make first application as soon as beetles appear on young plants and a second about 2 weeks later.
RADISH	Radish maggot or cabbage maggot	Exclude the egg-laying flies by planting radishes in rows. When second pair leaves appear, place 10 or 12 inch boards on edge along the row, join the ends by short boards, and cover top with mosquito bar or fly screen. <i>See</i> Cabbage.
SQUASH	Squash bug	Place small boards or old carpet near vines when they first come up. The bugs collect beneath these objects and may be destroyed. Try pyrethrum sprays.
	Western 12-spotted cucumber beetle	<i>See</i> Cucumber.

CONTROL OF PESTS OF COMMON VEGETABLES *(continued)*

Crop	Insect	Control Program
SWEET CORN	Corn earworm	Fall, winter or early spring plowing followed by frequent summer cultivation is said to be of value. Dust the silk at weekly intervals until silk shoots become dry. Use a calcium arsenate dust or fluosilicate dust.
	Seed-corn maggot	<i>See</i> Bean.
TOMATO	Green tomato horn worms	Pick off by hand or spray with calcium arsenate, 2 pounds to 50 gallons water, or dust with calcium arsenate dust mixture. If tomatoes have formed, use pyrethrum spray. Usually appear about time young fruit is forming.
	Tomato fruit worm	Spray before fruit is half grown with calcium arsenate 2 pounds to 50 gallons water, or dust with calcium arsenate dust mixture. Pyrethrum should be used in later applications.
	Flea beetle	<i>See</i> Potato.
VEGETABLES GENERALLY	Cutworms	Poison bran mash standard control. Many species of cutworms pass winter in larval stage and are present at time garden is planted. Poison bait applied just before planting is good insurance against these.
	Garden slug Present when garden is planted in early spring. Since slugs continue migrating into gardens, control measures should begin before planting and continue as long as slugs are present. Repeated applications of poison bran mash of value in combating the garden slug.	Clean up all trash, crop remnants, and debris about garden. A combination of a repellent spray such as bordeaux mixture applied to the plants and an attractive poison bait scattered on the soil is recommended. The poison bait for use in combination with spray consists of: Calcium arsenate.....1 ounce Chopped-up lettuce leaves or diced carrots.....1 pound Mix well and scatter about area to be protected. Lime, soot, powdered copper sulfate and lime, or dry bordeaux mixture periodically dusted on the soil about the plants and also lightly hoed in between the rows, gives temporary protection. Care should be exercised in application as some of these substances may burn the plants.

CONTROL OF PESTS OF COMMON VEGETABLES (*continued*)

Crop	Insect	Control Program
VEGETABLES GENERALLY ( <i>continued</i> )	Symphilids or garden centipeds	No effective control measures known.
	Grasshoppers	Spray or dust plants with calcium or lead arsenate. Spread poison bran bait as suggested for cutworms. Ap- pear in early summer; apply bait soon after appearance.
	Red spider-mites	Suggest spraying with summer oil emulsion $1\frac{1}{2}$ gallons to 100 gallons of water, or repeated applications of a sulfur-lime dust. ( <i>See</i> "Three-in- One" dust). Usually do not appear in serious numbers until weather becomes warm in June or July.
	Millipeds	Place diced vegetables (potato, ca- rot) dipped or dusted with paris green about their haunts. Sprinkle dry paris green 1 part and sugar 9 parts by weight, about infested places.
	Sow bugs	Sprinkle haunts with same materi- als suggested for millipeds, or with a poison bait made of paris green 1 part, white flour 2 parts, sugar 2 parts by weight.