

Agricultural Experiment Station

NEW HAVEN



Vegetable Pest Control Schedule

A. A. DUNLAP and NEELY TURNER

THIS publication is issued as a summary of the available practical information on control of insects and diseases attacking vegetable crops. Only those methods and materials believed to be practical for use by growers have been included. It is expected that further research may provide more effective materials, particularly in controlling plant diseases. Accordingly this schedule will be revised from time to time.

CONTENTS

Insect and Disease Pests, Control

Beans.....	29
Beets.....	31
Cucumber, melon, squash.....	31
Eggplant.....	33
Lettuce, endive.....	33
Carrots.....	33
Cabbage, cauliflower, broccoli, Brussels sprouts.....	35
Celery.....	37
Corn.....	37
Onions.....	39
Peas.....	39

Insect and Disease Pests, Control

Potatoes.....	41
Irish Cobbler Potatoes.....	41
Green Mountain Potatoes.....	41
Tomatoes.....	43

Supplementary Material

Equipment.....	45
Insecticides.....	46
Fungicides.....	47
Prevention of Damping-off.....	48
Cutworms.....	49
Page for Notes.....	50

## BEANS

**Anthracnose** appears as sunken brownish spots or lesions on stems, leaves, leaf veins underneath, pods and seed. Young seedlings are often attacked through seed infection and are frequently killed. The disease weakens the affected plants, and pod lesions reduce the value of the crop.

**Bacterial blight** causes large, irregular brownish areas on leaves, and discolored, water-soaked lesions on the pods and stems. Diseased areas are usually larger and tend to run together more than do spots made by anthracnose.

**Mosaic.** Leaves become crinkled and puckered with development of light- and dark-green areas. The disease is caused by a virus which is seed borne. Spread in the field may be due to insects or to mechanical transfer of leaf sap from infected to healthy plants.

**Mexican bean beetle.** A ladybeetle about one-fourth of an inch long, oval in shape, and varying from light yellow to pale brown in color, depending on the age. Eight small black spots on each wing cover. Larvae light yellow, about one-sixteenth of an inch long, growing to one-third of an inch long, with several rows of conspicuous spines. Both larvae and adults feed on the lower surfaces of the leaves.

[28]

## SPRAY AND DUST SCHEDULE

INSECT OR DISEASE <sup>1</sup>	WHAT TO USE	WHEN TO APPLY	TREATMENT
<b>BEANS</b>			
<b>Mexican bean beetle</b>	Rotenone dust	Early beans up June 1 —about June 7 and 21  Beans up between June 20 and July 1— about July 29  Beans up July 1 to 10 —about July 29 and August 9  Beans up between July 10 and August 1 —about August 9 and 20	Rotenone dust containing at least .5 percent rotenone. About 25 lbs. to the acre on the underside of the leaves.
	Or cubé spray	Same as above	Three lbs. pure ground cubé root (4 percent rotenone) in 100 gals. of water.  Select resistant varieties. Plant western-grown seed. Rotate crop.
<b>Anthracnose</b> <b>Bacterial blight</b> <b>Mosaic</b>			

<sup>1</sup>See preceding page for descriptions of diseases and insect pests.

[29]

## BEETS

**Leaf spot** appears as small, round, grayish spots with red borders. The spots become larger and may fall out, leaving holes in the leaf.

**Scab.** Resembles the symptoms on potatoes, due to the same organism, but the lesions on beets are frequently more bulging.

## CUCUMBER, MELON and SQUASH

**Bacterial wilt** first attacks a few leaves shortly followed by wilting and death of the entire plant. Cut fibres in the stem show a whitish ooze upon pressing between the fingers. The disease is spread in the field by striped cucumber beetles. Even a few beetles can cause much infection.

**Downy mildew** is the most destructive disease of cucurbits in Connecticut. It appears during practically every season but some years earlier (August 1) than others (August 15 to September 5). First symptoms are yellowish spots on the leaves, usually showing a purplish, downy growth on the under side. The disease spreads rapidly under certain conditions and an entire field may present a dull gray appearance as if stricken by a frost. Growth of the vines is stopped by the fungus, and melons picked from blighted vines are worthless.

**Mosaic** produces mottled foliage, usually showing on the younger leaves. The leaves appear yellowish with darker green areas. Cucumbers become distorted and covered with green lumps—a condition commonly known as "white pickle". Mosaic is a virus disease that is spread by insects.

**Striped cucumber beetle.** Small beetles about one-fourth of an inch long, yellow with three longitudinal black stripes and a black head. Larvae feed on roots of host plants. The beetles carry wilt from one plant to another.

[30]

INSECT OR DISEASE <sup>1</sup>	WHAT TO USE	WHEN TO APPLY	TREATMENT
<b>BEETS</b>			
<b>Leaf spot</b>	Bordeaux mixture 4-4-50	When spots first appear	Allow two or three year rotations between crops. Spray every 10 days.
<b>Scab</b>			Avoid planting on land that has produced scabby potatoes. Use lime on soil only when necessary for good growth.
<b>CUCUMBER, MELON AND SQUASH</b>			
<b>Striped cucumber beetle</b>	Rotenone dust	First day beetles appear on seedlings	.6 or .75 percent rotenone dust, about 15 lbs. per acre. Repeat once a week for 2 or 3 weeks.
<b>Bacterial wilt</b>			Control striped cucumber beetles.
<b>Downy mildew of cucumbers and melons</b> (use one of these three treatments)	2-2-50 Bordeaux mixture or Copper oxychloride (2 lbs.-100 gals.) or Coposil (3 lbs. -100 gals.)	August 15  July 20	Spray vines thoroughly every 10 days until half of crop is harvested.  Spray vines thoroughly every week or 10 days until half of crop is harvested.
<b>Mosaic</b>			Pull up and destroy milkweed, ground cherry and pokeweed growing in or around fields.

<sup>1</sup>See preceding page for descriptions of diseases and insect pests.

## EGGPLANT

**Blight** attacks the leaves, stems and fruits. Spots on the leaves are circular and brownish in color. On the fruit, the fungus develops rapidly, causing rotting and shriveling. Infected areas on fruits are usually slightly roughened and black due to fruiting bodies of the fungus.

**Wilt** causes a stunting of the plant and wilting of the lower leaves. These leaves die first, followed by the death of the entire plant in severe cases. On cutting across the stem, darkened areas in the woody part may be seen. This disease is almost certain to appear if eggplants are grown on the same land without rotation.

**Potato flea beetle.** A small, shining, black beetle about one-sixteenth of an inch long. Jumps off leaf when disturbed. Eats out small round holes on under sides of leaves of young plants.

## LETTUCE

**Bottom rot and drop** present somewhat similar symptoms in the field, especially in the later stages of the diseases. The plants become decayed in contact with the soil and finally the stem and head are affected with a soft rot. Wilting is a common symptom in the case of drop.

## CARROTS

**Leaf blight** appears as dark colored spots on leaves. If severe, the entire leaf becomes yellowish and may fall off. Affected tops reduce the value of bunched carrots.

**Soft rot** frequently occurs in the field during prolonged wet periods. Decay of the entire carrot follows infection around rootlets, growth cracks, or insect injuries.

[32]

INSECT OR DISEASE <sup>1</sup>	WHAT TO USE	WHEN TO APPLY	TREATMENT
<b>EGGPLANT</b>			
<b>Blight</b>	Bordeaux mixture 4-4-50	When first fruits are set	Rotate crop. Spray every 10 days until fruit is nearly mature.
<b>Wilt</b>			Plant on new land—old sod land preferable. Treat seed with hot water 122° F. for 30 minutes.
<b>Flea beetles</b>	Rotenone dust	When beetles appear soon after plants are set	.75 percent rotenone dust about 20 lbs. per acre. Second treatment may be necessary.
<b>LETTUCE and ENDIVE</b>			
<b>Bottom rot drop</b>	Organic mercury dust	Two or three weeks before harvest	Rotate crops. Plant on ridges instead of in furrows. Use well-drained land. Dust underneath plants—one application.
<b>CARROTS</b>			
<b>Leaf blight</b>	Bordeaux mixture 4-4-50	Two months after sowing	Rotate crop. Spray with Bordeaux mixture, making 3 to 5 applications at 10-day intervals.
<b>Soft rot</b> (in field)			Plant on new land when possible or use long rotation.

<sup>1</sup> See preceding page for descriptions of diseases and insect pests.

[33]

## CABBAGE, CAULIFLOWER, BROCCOLI and BRUSSELS SPROUTS

**Club root** may be recognized by the large, irregular swellings on the roots; frequently called "finger and toe disease". Plants lightly infected show a tendency to wilt on bright days. Badly infected ones soon die. The causal fungus overwinters in the soil.

**Yellows.** Infected plants drop the lower leaves, which frequently become one-sided through death of half of the leaf. Entire plant becomes yellowish green in color. The fungus lives in the soil.

**Black leg** forms cankers on the stem just above the ground, causing the plant to wilt and die. Also causes leaf spots. Lesions are frequently covered with minute black dots.

**Black rot** first shows in blackened veins and triangular yellowish areas near margins of the larger leaves. Later results in a soft rot of the head and stem.

**Cabbage maggot.** Small white maggots on tap root just below surface of ground. Eggs are laid on ground near the stem.

**Cabbage worms.** Imported cabbage worm is a green larva covered with closely set, short hairs. Adult is a white or sulfur-yellow butterfly. Cabbage looper is a light green caterpillar striped lengthwise with light and darker green, and loops when it crawls. Adult is a grayish brown moth marked with white. Diamond-back moth is a small gray moth with light yellow rear margins on the front wings. Larvae pale green and about one-fourth of an inch long when full grown.

**Cabbage aphid.** A whitish, powdery or mealy aphid occurring in colonies on the leaves. Heavily infested leaves curl.

[34]

INSECT OR DISEASE	WHAT TO USE	WHEN TO APPLY	TREATMENT
<b>CABBAGE, CAULIFLOWER, BROCCOLI and BRUSSELS SPROUTS</b>			
<b>Cabbage maggot</b> (early crop)	Calomel-gypsum dust	When plants are set  or Dusted on after setting	8 percent calomel with 92 percent gypsum or talc applied freely on roots and stems of plants before setting. About 75 lbs. per acre.  4 percent calomel dust applied freely on ground around stems 3 days after setting. Repeat 10 days later. About 75 lbs. per acre for each application.
<b>Cabbage worms</b>	Rotenone dust	When young worms appear	.75 percent rotenone dust when larvae first hatch and again 10 days later. About 20 lbs. per acre.
<b>Cabbage aphids</b>	Nicotine sulfate	On plants in seedbed when aphids appear	½ pint of 40 percent nicotine sulfate in 50 gals. of water with 1½ qt. liquid spray soap.
<b>Club root</b>	Hydrated lime in soil	Six weeks before planting	Plant on same land only one year and use 4- to 6-year rotation. Test soil for acidity. Add enough lime to make soil reaction 7.0 to 7.5 pH. Do not use plants from seedbed in which disease appears.
<b>Yellows (cabbage)</b>			Plant resistant varieties.
<b>Black leg</b>			Treat seed with hot water 122° F. (cabbage, 25 minutes—all others 15 minutes). Practice 4-year rotation.
<b>Black rot</b>			Treat seed as for black leg, or with corrosive sublimate 1-1000 for 25 minutes, rinse and dry. Practice 4-year rotation.

<sup>1</sup> See preceding page for descriptions of diseases and insect pests.

## CELERY

**Early blight** makes large, irregular, light-brown areas on leaves and leaf-stalks. Infected leaves may be entirely killed. Commonly appears in late July or early August.

**Late blight** produces a smaller and more circular spot than early blight. The spots often appear black owing to the spore bodies of the fungus. Usually appears a little later than the above form. The entire leaf may also be killed.

## CORN

**Bacterial wilt.** The entire plant becomes wilted and dies, especially if infected when small. First symptoms may consist of discolored streaks in leaves. In resistant strains of corn, the disease sometimes appears only in the form of these streaks. To diagnose the disease: Cut off stalk and squeeze cut end; look for yellowish ooze from the cut fibres. Wilt is introduced into new localities by planting infected seed. Corn flea beetles spread the disease in the field.

**Smut** first appears as whitish "boils" on any part of the plant; these later become large, black, smutty masses.

**European corn borer.** A dirty-white caterpillar about three-fourths of an inch long when full grown, with rows of black spots. Tunnels in stalks and ears. Moths have a wing-spread of a little more than one inch; female pale buff and male brown, both with contrasting brown markings. Fly late in evening.

**Corn ear worm.** A large caterpillar, about two inches long when fully grown. Varies from light-green to purplish in color. Usually found only in silk end of ear in this State. Moth, light tan with darker wing margins, about one and a half inch wing-spread.

[36]

INSECT OR DISEASE <sup>1</sup>	WHAT TO USE	WHEN TO APPLY	TREATMENT
<b>CELERY</b>			
<b>Early and late blights</b>	Bordeaux mixture 4-4-50	Start with plants in seedbed	Spray or dust thoroughly every week or 10 days, making from 8 to 12 applications. Secure good coverage over entire plant. Use new soil in seedbed. Rotate crops. Destroy old leaves removed at harvest.
	Copper-lime dust 20-80	Same as above	
<b>CORN</b>			
<b>European corn borer</b>	Spray—1 lb. pure ground cubé root with spreader in 25 gals. water	Early corn—about June 5, 10, 15 and 20	Spray developing whorls of main stalks and tillers. Last application to developing ears. About 100 gals. per acre per application.
		Late corn (no tassels on August 1)—about August 2, 7, 13 and 19	Spray developing whorls until tassels form, then apply to ears.
	Dust—dual-fixed nicotine dust	As above	As above. About 30 lbs. per acre per application.
<b>Corn ear worm</b>			No practical treatment available.
<b>Smut</b>			Rotate crop. Destroy smutted masses or "boils" as early as possible. Avoid use of manure containing corn smut from previous season.

<sup>1</sup> See preceding page for descriptions of diseases and insect pests.

[37]

## ONIONS

**Smut** causes grayish streaks in the leaves or bulbs that later break open to expose a black smutty mass. The disease attacks seedling onions and may destroy part of the stand of plants. Diseased plants also have curled or twisted leaves.

**Onion maggot.** Small maggots feeding in the stem or bulb below the ground.

**Onion thrips.** Very small yellow insects which feed on the leaves, leaving a whitish, chain-like mark on the surface. Hide in the leaf sheaths during the day.

## PEAS

**Pod spot.** The fungus causing this disease attacks the stem, leaf and pod. The sunken, grayish spots are most clearly seen on the pods. Peas become infected in the pod and upon germinating the seedling may be killed by the fungus. Stem infections later in the season may girdle the vine. Spots on the pods either prevent them from filling, or reduce their value through damaged appearance.

**Root rot** causes a browning or even complete decay of nearly the entire root system. The diseased plants are yellowish in color and are likely to die soon after the leaves show the yellow discoloration. Plants affected with root rot rarely yield any marketable pods.

**Pea aphid.** A large green aphid on the stems and undersides of the younger leaves. Heavy infestations stunt the plants.

[38]

INSECT OR DISEASE <sup>1</sup>	WHAT TO USE	WHEN TO APPLY	TREATMENT
<b>ONIONS</b>			
<b>Onion maggot</b>	Pure calomel	Treat seed	2 lbs. calomel to 1 lb. moistened seed. Plant immediately.
<b>Thrips</b>	Pure ground cubé root	When thrips appear in June (sets) or July (seed)	1 lb. cubé root with spreader in 25 gals. water every 10 days until tops fall over. (Experimental control).
<b>Smut</b>	Formaldehyde	At time of planting	Use onion sets. When seeds are planted, sprinkle formaldehyde 1-50 in furrow. In dry soil, apply 50 gals. per acre and 75 gals. per acre in wet, heavy soil.
<b>PEAS</b>			
<b>Pod spot</b>			Obtain disease-free seed. Rotate crop.
<b>Root rot</b>			Plant in well-drained soil. Use 3- to 5-year rotation. Do not plant following alfalfa or clover. Plant on grass sod if possible.
<b>Pea aphid</b>	Pure ground cubé root	When aphids are abundant	1 lb. pure ground cubé root with spreader in 25 gals. water. One application under ordinary conditions.

<sup>1</sup> See preceding page for descriptions of diseases and insect pests.

[39]

## POTATOES

**Scab** is too well-known to require a detailed description. The rough, broken-open areas on the surface of the tuber readily identify this disease.

**Rhizoctonia** causes hard black specks or small lumps on the surface of the tuber—frequently called “black scurf” or “dirt that does not wash off”. At times, plants in the field may show brown canker-like spots on the stem beneath the soil surface, and frequently young sprouts may be killed by this type of infection. Affected hills are usually stunted and produce small yields.

**Mosaic, leaf roll and spindle tuber** are all virus diseases commonly known as “degeneration diseases”. They are most likely to appear in fields that are planted from home-grown or commercial stock potatoes. The names are derived from the outstanding symptoms in each case. The plants are usually dwarfed and have an abnormal appearance.

**Tip burn**, as the name suggests, consists of a curling and dying of the leaf margin, especially towards the tip of the leaf. Unfavorable growing conditions are supposed to be the cause. A similar trouble, called “hopper-burn”, is caused by the feeding punctures of leafhoppers on the larger veins.

**Early blight** causes irregular or roundish brown spots on the leaves. The spots are somewhat sunken with a rather definite margin and are often marked by faint concentric rings. This fungus is frequently serious enough in Connecticut to cause reduced yields on unsprayed plants. The tubers are not affected by early blight.

**Late blight** is occasionally destructive under Connecticut conditions. It sometimes shows up in July and disappears without causing much damage. Late season infections are the most destructive, since the fungus at this stage attacks the tubers, causing a dry rot. (Wet rot soon follows in the field.) Field symptoms consist of large, dark, watersoaked areas on leaves and stems. During damp weather a whitish downy growth of the fungus can be readily seen on the more recently infected areas.

**Potato flea beetle.** A small, shining, black beetle about one-sixteenth of an inch long. Eats out round holes in under surface of the leaves. Larvae feed on roots and occasionally on tubers.

**Potato leafhoppers.** Pale green with transparent wings, about one-eighth of an inch long. Nymphs are tiny green insects found on under surfaces of leaves. Leafhopper feeding causes tip-burn.

**Colorado potato beetle.** A large beetle, almost half an inch long, yellow with longitudinal black stripes. The larvae are red with a black head and four rows of black spots, being about half an inch long when full grown. Both larvae and adults feed on potato foliage.

[40]

INSECT OR DISEASE <sup>1</sup>	WHAT TO USE	WHEN TO APPLY	TREATMENT
<b>POTATOES</b>			
<b>Rhizoctonia</b> <b>Scab</b>	Corrosive sublimate 1-1000 or Yellow oxide of mercury 2 lbs.—30 gals.	Soak seed just before planting	Rotate crop. Use certified seed. Maintain soil around 5.4 pH. Soak uncut tubers in: Corrosive sublimate—90 minutes; or yellow oxide of mercury—1 minute. Renew solution after every three lots of tubers.
<b>Mosaic</b> <b>Leaf roll</b> <b>Spindle tuber</b>			Plant certified seed. Control aphids.
<b>Irish Cobbler</b>			
<b>Potato flea beetle</b> <sup>2</sup> <b>Colorado potato beetle</b> <sup>2</sup> <b>Leafhoppers</b> <b>Tip burn</b> <b>Early blight</b>	Spray—4-4-50 Bordeaux mixture plus calcium arsenate 1½ lb.—50 gals.	When beetles appear	Two or three applications starting when plants are about 6 inches high. (Bordeaux increases yield over dust but delays maturity.)
<b>Green Mountain</b>			
<b>Potato flea beetle</b> <sup>3</sup> <b>Colorado potato beetle</b> <sup>3</sup> <b>Leafhoppers</b> <b>Tip burn</b> <b>Early and late blights</b>	8-8-50 Bordeaux mixture	Start about July 1	Spray every 10 to 14 days until plants stop growing. Apply 200 gals. per acre to full-grown plants using from 300 to 400 lbs. pressure.

<sup>1</sup> See preceding page for descriptions of diseases and insect pests.

<sup>2</sup> If dust is to be used, these insects can be controlled by 1 lb. barium fluosilicate, 3 lbs. clay or talc. Two or three applications, one early in June, others early in July.

<sup>3</sup> Add calcium arsenate, 1½ lb. - 50 gals., in the first spray.

[41]

## TOMATOES

**Early blight** on tomato is very similar to the same disease on potato.

**Late blight** produces the same type of leaf injury as on potato. It also attacks the tomato fruit at any stage of maturity, causing rough, sunken, brownish areas that soon develop a soft-rot condition. The white, downy fungus is frequently seen on the infected tomatoes in wet weather. This disease was bad in Connecticut in 1932, 1933 and 1934. Since that epidemic, however, no appreciable losses have been caused by late blight.

**Leaf spot** consists of small, circular spots usually thickly occurring and frequently showing small black dots in the brown areas. If serious, this disease may cause defoliation of the lower leaves or of nearly the entire plant. Occasionally the spots may occur on the stems or even on the tomato fruit.

**Bacterial canker** attacks the stem of the tomato plant, eventually causing the plant to wilt. The stem cracks open lengthwise in affected areas and even the interior of the fruit may be discolored. This disease occurs only occasionally in Connecticut.

**Mosaic** of tomato, as in the case of other vegetable plants mentioned here, is recognized by the crinkled foliage with its light and dark-green areas. Sometimes the leaflets may be greatly distorted and malformed. Late infections frequently appear to affect only the uppermost leaves. The mosaic plants are stunted and poor yields are usually obtained.

**Blossom-end rot** consists of a circular, dead, brown or black area centered on the tomato fruit at the point where the blossom was attached. This disease has been shown to be due to an interrupted water supply for the plant. Soil moisture and fertilizer concentration have been found to be contributing factors of blossom-end rot. Secondary infections may cause a soft rot of the tomato.

**Potato flea beetle.** A small, shining, black beetle about one-sixteenth of an inch long. Eats out round holes in the under surface of the leaves of young plants.

[42]

INSECT OR DISEASE <sup>1</sup>	WHAT TO USE	WHEN TO APPLY	TREATMENT
<b>TOMATOES</b>			
<b>Early blight</b> } <b>Leaf spot</b> } <b>Late blight</b> }	2-2-50 Bordeaux or Red copper oxide <sup>2</sup> or Copper oxychloride <sup>2</sup>	Apply a few days before transplanting and repeat every 10 to 14 days	Rotate crop. Red copper oxide and copper oxychloride are less injurious to the setting fruit and less conspicuous than Bordeaux mixture.
<b>Michigan canker</b>	Corrosive sublimate 1-3000	Whenever convenient	Use seed from healthy plants. Treat seed in corrosive sublimate for 5 minutes, rinse thoroughly and dry. Use 3-year rotation.
<b>Mosaic</b>			Destroy all ground cherry, nightshade, pokeweed and bittersweet growing in or around field. Destroy infected plants if there are only a few. Prevent aphid infestation while plants are growing.
<b>Blossom-end rot</b>			Maintain high organic-matter content of soil. Apply fertilizer broadcast. Do not stake plants.
<b>Potato flea beetle</b>	Rotenone dust	When beetles appear on newly-set early plants	.75 percent rotenone dust. One application about 20 lbs. per acre.

<sup>1</sup> See preceding page for descriptions of diseases and insect pests.

<sup>2</sup> Two lbs. to 100 gals.

[43]

## EQUIPMENT

**For mixing dusts:** Individuals or groups of growers can mix dusts by use of comparatively inexpensive equipment. Small amounts of dust, 25 pounds or less, can be mixed in a large milk or cream can which should be used only for this purpose. The ingredients should be weighed out carefully, a few small stones or a short length of chain added to facilitate mixing, the cover placed on tightly and the can rolled on the ground until a suitable mixture is obtained. Larger quantities may be mixed in a barrel mixer such as an old-fashioned barrel churn.

**Dusters:** Hand-operated dusters are satisfactory for small acreages of vegetables. The bellows type has been more satisfactory in actual practice than the rotary fan type. Either of these types costs less than \$25 and will last for years if properly cared for. Growers should have enough of these dusters to dust the crops needing treatment within two days. Usually dusting is most effective early in the morning before winds interfere. Not more than four hours of suitable weather per day should be expected. A few crops are dusted at night.

Beans or potatoes may be dusted with horse- or tractor-drawn traction or power dusters. These types are most suitable for large acreages. There are available small, self-propelled power dusters suitable for many vegetables. These may replace other types for use on the average truck farm.

**Sprayers:** As a rule sprayers are more expensive than dusters, and for many vegetable crops dusting is more effective in controlling insects than spraying. However, in controlling vegetable diseases, sprays are usually more satisfactory than dusts. Brass knapsack sprayers are suitable for small acreages and are inexpensive. Wheel-barrow sprayers having a pressure tank are satisfactory for larger acreages. Power sprayers covering from 4 to 12 rows are best adapted to potatoes and large acreages of beans. At present there is no small power sprayer adaptable to use on truck farms.

**Maintenance:** Both sprayers and dusters should be thoroughly cleaned before storing, and overhauled and tested well in advance of the growing season. Clogging of spray nozzles can be prevented by keeping the sprayer clean and by straining all material and water into the spray tank through a 30-mesh screen or cheese cloth.

## INSECTICIDES

The following insecticides are those suggested for use in this Circular:

**Poisoned bran mash:** (Preferably home-made.) Composed of 20 pounds of wheat bran and one pound of Paris green mixed dry and then moistened just enough so that the finished bait will not drip when squeezed in the hand. Do not breathe the Paris green during mixing and wash hands thoroughly after handling the bait. Apply broadcast 20 pounds to the acre before plants are set, or apply one pinch to a hill after setting.

**Calomel-gypsum dust:** Mix thoroughly one pound calomel and 24 pounds gypsum, clay or talc. If the roots and stems are to be dipped in the dust before setting, use one pound calomel and 12 pounds gypsum, clay or talc. Can be purchased mixed ready for use.

**Rotenone dust:** For controlling striped cucumber beetles and Mexican bean beetles, a dust containing .5 to .6 percent rotenone is satisfactory. For cabbage worms and flea beetles, a .75 percent dust is preferable. Unless large acreages are involved the growers will probably prefer to purchase only the .75 percent strength, using it for all insects. Can be mixed on the farm, using 19 pounds pure ground cubé root (4 percent rotenone), and 81 pounds talc or clay carrier. Mix in a tightly covered barrel, using a short length of chain to insure mixing.

**Pure ground cubé root:** Used in sprays (with a suitable spreader) at the rate of one pound of root (4 percent rotenone content) in 25 gallons of water. Two ounces of *Ultravet* or 1½ ounces of *Areskap* are needed for each pound of cubé root to act as a spreader. Some dealers are handling the root to which a spreader is added. It is preferable to purchase this product rather than trying to weigh out small quantities of spreader on the farm.

**Dual-fixed nicotine dust:** A proprietary product mixed ready for use and containing 4 percent nicotine. Cannot be used to control aphids.

**Nicotine sulfate:** The commercial product containing 40 percent nicotine sulfate. For aphid control use one pint in 100 gallons of water with 3 quarts of liquid spray soap.

[46]

## FUNGICIDES

**Bordeaux mixture:** The standard spray for foliage diseases such as blights and leaf-spots. Best made by adding dilute copper sulfate (bluestone or blue vitriol) solution to a concentrated suspension of lime. Used in various strengths such as 2-2-50 (meaning 2 pounds copper sulfate, 2 pounds lime, 50 gallons water), 4-4-50, 8-8-50, etc. Either quicklime or fresh hydrated lime should be used. If old hydrated lime is used, add one pound extra to each four pounds of copper sulfate. When mixed in tank of power sprayer, keep agitator running while mixing.

When needed in only small amounts, a gallon of Bordeaux mixture may be made as follows: Dissolve 3 teaspoonfuls of copper sulfate in 2 quarts of water in wooden, earthenware, or glass vessel. In another container add 5 teaspoonfuls of hydrated lime (or one ounce unslaked quicklime) to 2 quarts of water. Pour together with rapid stirring. Use immediately. All Bordeaux mixtures deteriorate upon standing.

**Copper-lime dust:** Used in place of Bordeaux mixture when dusting is preferred to spraying. Made by mixing thoroughly one pound monohydrated copper sulfate (snow) with 4 pounds hydrated lime. Apply while foliage is wet.

**Insoluble copper compounds:** Recently several new copper compounds have been placed upon the market as substitutes for Bordeaux mixtures. Many of these appear promising as desirable and effective fungicides for vegetables. They are in general less injurious to sensitive foliage than is Bordeaux mixture. Since these materials have not as yet been thoroughly tested under Connecticut conditions, they should not be wholly relied upon by the grower, except in cases where specific directions are given in this circular. Information concerning the use of these materials may be obtained through the County Agents, Vegetable Extension Specialist, or the Experiment Station. Among these materials are: Red copper oxide, copper oxychloride, copper hydroxide, copper phosphate, copper ammonium silicate, basic copper sulfate and copper zeolite.

[47]

## PREVENTION OF DAMPING-OFF

**In the greenhouse:** Use one of the following—

- A. Sand culture: Sow seeds in clean, fresh sand in clean flats or benches. Keep sand moist. After seedlings emerge feed twice a week (just after a heavy watering) with a solution of 5-8-7 fertilizer, 4 teaspoonfuls to a gallon. Keep sand moist with plain water between feedings.
- B. Steam: Treat soil with steam long enough to cook a medium-sized potato buried in soil.
- C. Formaldehyde dust: Treat soil with 6 percent formaldehyde dust,  $\frac{1}{2}$  pound of dust to a bushel of soil.
- D. Use one of the dust-seed treatments listed below under treatment for field-sown seeds.

**In cold-frames and hot-beds:**

- A. Use steam as under "B" above.
- B. Dust seed with preventive materials listed below. Use care in watering. Do not drench soil. Ventilate freely.

**In the field:**

The stand of plants frequently can be improved by seed treatment. Dust seed with red copper oxide, zinc oxide or Semesan. Follow directions of manufacturer when these are given. Certain seedsmen treat their seed before selling, thereby making this step unnecessary for the grower. Place seed in tight container about half-full and add approximate amount of dust as directed; shake thoroughly; screen off excess dust and plant. The following treatments are suggested:

### Red copper oxide

Use amount of dust equal to  $\frac{1}{25}$  of the weight of seed to be treated

For:

Beet	Muskmelon
Carrot	Pea
Celery	Pepper
Cucumber	Spinach
Eggplant	Squash
Lettuce	Tomato

### Zinc oxide

Use in same amount as red copper oxide

For:

Broccoli
Brussels sprouts
Cabbage
Cauliflower
Onion

### Semesan

Follow directions on container

For:

Bean (snap)
Cabbage
Cauliflower
Pea

[48]

## CUTWORMS

Cutworms are most destructive on fields which have been in grass or clover for a number of years. When these fields are planted to vegetables, the cutworms become a serious pest. Usually they cause most trouble in such places, but occasionally they are destructive in soils that have been cultivated for years. They may migrate from one infested field to another.

Cutworms feed at night; some of them cut stems below ground and others climb up the plant and feed on buds and leaves.

**Control:** If cutworms have caused trouble in fields in former years, it may be assumed that control measures are necessary. The bait is prepared by dry-mixing 20 pounds of wheat bran and one pound of Paris green, and then moistening with water so that the finished bait is damp but will not drip when squeezed in the hand. Paris green is poisonous and care should be taken not to breathe it during the mixing process. The hands should be washed thoroughly after handling the bait. Apply broadcast, 20 pounds to the acre, before plants are set, or use one pinch to a hill after setting.

Many formulas include molasses and orange or lemon juice to attract the cutworms. These additions appear to be unnecessary.

[49]