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Pest and Disease Control in the HOME GARDEN

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PEST AND DISEASE CONTROL

Garden pests when uncontrolled cause serious losses. Many control measures are preventatives rather than cures; therefore, you should become familiar with the major pests of each vegetable before you plant your garden. Control measures must be thorough and timely to be effective. *Do not delay treatment.*

Cultural Practices

Because many insects and diseases spend the winter in crop refuse and in other debris about the garden, you should collect and burn this material in late fall. Also burn infested and damaged vegetables to destroy many insects and diseases. Keep down weeds in and about your garden.

Types of Insects and Diseases

Insects may be divided into two classes according to their feeding habits: (1) *Chewing insects*. Grasshoppers and cabbage worms are good examples, for they eat part of the plant. Stomach poisons applied to the foliage as a spray or dust or around the plant as a bait control this type of insect. (2) *Sucking insects*. Aphids and leafhoppers are good examples; they insert their slender beaks into the plant tissue and take out the plant juices. Contact poisons as sprays or dusts are used mainly to control these insects. Some of the new insecticides such as DDT are both contact and stomach poisons.

Plant diseases may be divided into three groups: (1) *Parasitic*. They are usually caused by minute forms of plant life, living upon crop plants. (2) *Non-parasitic*. They are caused by poor soil, too much or too little water, or too much or too little plant food, etc. (3) *Virus diseases*. Produced by some little-known principle, they may be spread from plant to plant by insects or many times by diseased plants touching healthy ones.

Insecticides and Fungicides

There is an adequate supply of practically all insecticides and fungicides. Remember—good and timely cultural practices help reduce the need for chemical control.

Dusts. Certain insecticides and fungicides are diluted with carriers and applied as foliage dusts with a small hand duster. Others are applied as seed dusts. When you apply dusts to the foliage, they should form an even film on both sides of the leaves. Dust when the air is still, and if possible in the morning when plants are damp with dew. Apply nicotine or rotenone dusts when the weather is fair and temperatures are above 65° F.

Dusting materials usually are cheaper and easier to apply than sprays. You can buy many dusts already mixed; for others you can buy the ingredients and mix it yourself. You can also buy a small plunger-type duster at a reasonable cost. Usually you apply dusts at the rate of 20 to 40 pounds an acre ($\frac{1}{3}$ to $\frac{2}{3}$ pound per 100 linear feet of row).

Liquids. Some insecticides and fungicides are diluted with water and applied as sprays, drenches, or dips. Sprays are generally more difficult to use, because they require agitation and the water is heavy to carry. Spray equipment is usually more expensive than that required for dusting.

Where to Purchase Materials

Most hardware, feed, seed, and drug stores handle insecticides, fungicides, and equipment. These materials are cheaper in bulk form than in small containers (for example, 4-pound bags of DDT). Pool your needs with your neighbors.

Caution: Dusts, sprays, dips, and poison baits used for garden-pest control are practically all poisonous to warm-blooded animals. Be sure all such materials are labeled **Poison**, and keep them out of the reach of children, poultry, and pets. Follow the instructions on the label. Clean all containers after using, and wash your hands carefully. Burn empty containers.

DDT, chlordane, toxaphene, and calcium arsenate involve residue problems. Do not use them on edible leafy plants such as lettuce, spinach, collards, or on beet and turnip greens. And do not use these insecticides after the edible parts of such plants as broccoli, cauliflower, and brussel sprouts have formed. DDT is safe for potatoes, peas, and corn silks. You may use it on cabbage up to 30 days before harvest.

1. **DDT.** DDT is recommended to control many vegetable insects. You must, however, use it according to directions and handle it with care. Do not use DDT with lime or other alkaline materials or on most cucurbits (melons, cucumbers, squash, etc.). DDT on tomato plants may temporarily stunt their growth.

As a Dust: Use a prepared dust containing 5 per cent DDT. Commercially prepared dusts containing both DDT and sulfur or neutral copper also are available. These dusts act both as insecticides and fungicides for certain insects and diseases. Use at the rate of 20 to 40 pounds per acre (about $\frac{1}{3}$ to $\frac{2}{3}$ pound per 100 linear feet of row).

As a spray: Use 50 per cent wettable DDT powder at the rate of 4 level tablespoonfuls to 3 gallons of water.

2. **CHLORDANE.** Use a prepared dust containing 5 per cent chlordane. In most cases, it will control root maggots. Also recommended to control grasshoppers.

3. **ROTENONE.** Dusts and sprays containing rotenone are considered quite non-poisonous to warm-blooded animals at strengths used for insect control. Sunlight causes rotenone to deteriorate, so it becomes ineffective a few days after it has been applied.

As a Dust: Use a prepared dust containing 0.5 of 1 per cent ($\frac{1}{2}$ per cent) rotenone. Commercially prepared dusts which contain both rotenone and sulfur also are available. These dusts act both as insecticides and fungicides for certain insects and diseases. Use at the rate of 20 to 40 pounds per acre (about $\frac{1}{3}$ to $\frac{2}{3}$ pound per 100 linear feet of row).

As a Spray: Use the spray powders or liquids according to the manufacturer's directions.

4. **NICOTINE SULFATE.** You should use nicotine sulfate as a spray or dust immediately after mixing and when temperatures are above 65° F. Because this material kills by contact, you need a thorough coverage of the entire plant.

As a Dust: For garden insects a 4 per cent dust is satisfactory, and is made as follows: Place 1 quart of hydrated lime in a large can with a tight-fitting lid; then sprinkle 3 tablespoonfuls of nicotine sulfate (40 per cent nicotine) over the lime. Add a few gravel stones the size of walnuts and shake with a rolling motion for 4 or 5 minutes. After mixing, screen the dust through a window screen and crush any lumps. Mix only enough dust for one application.

As a Spray: Dissolve 2 tablespoonfuls of soap in 1 quart of warm water, and add 3 quarts of cold water. To this soapy water add $1\frac{1}{2}$ to 2 teaspoonfuls of nicotine sulfate (40 per cent nicotine).

5. **TETRAETHYL PYROPHOSPHATE.** Tetraethyl pyrophosphate is one of the newer insecticides effective in controlling spider mites and aphids. This material is prepared either as a dust or spray. Use according to the manufacturer's recommendations. Tetraethyl pyrophosphate is hazardous if absorbed through the skin by contact, by inhaling dusts or vapors, or by accidentally swallowing some of the insecticide. Read carefully all warnings and directions on the label.

6. **SABADILLA.** Sabadilla comes from the seed of the sabadilla plant. It is recommended to control the squash bug.

7. **CALOMEL (Mercurous Chloride).** Calomel is **poisonous** and must be handled with care.

As a Suspension: Mix 1 teaspoonful of calomel with 5 gallons of water. Calomel does not dissolve; therefore, you must stir it often to keep it from settling to the bottom of the container. With a dipper or watering can which has the nozzle removed, apply this suspension to the soil around cabbage plants at the rate of $\frac{1}{2}$ cup for each plant (2 gallons for 65 plants). For only one application, use 2 ounces of calomel to 5 gallons of water. On radishes, moisten soil along each side of the row at the rate of about 1 gallon to 40 linear feet of row.

As a Dust (Calomel-Hydrated Lime): Mix 1 tablespoonful of calomel with 1 pound of hydrated lime, using the method for mixing described under nicotine sulfate dust.

As a Seed Treatment for Maggots: Mix 2 parts of calomel with 1 part seed. Sow the mixture in the row, distributing the calomel evenly with the seed.

8. **SEMESAN.** This is a poisonous organic mercury compound and an important seed disinfecting dust. It is also effective as an agent for treating soil on small scale to prevent damping-off and root rot. Complete directions are contained with the product.

As a Seed Dust: Apply enough to coat the seed by shaking the seed and dust together in a tightly closed container. Screen or sift off any excess, and save for re-use. You may store the seed, or plant it at once. Semesan dust should not be inhaled; do the work in the open air.

As a Soil Disinfectant: Apply (sprinkling can recommended) 1-400 solution (1 level tablespoonful Semesan per gallon of water) at rate of 3 pints per 10 square feet soil.

9. **SPERGON.** This is a non-poisonous compound of rather recent appearance on the market. It has a similar purpose and use as Semesan, except it is not good for soil disinfection. It does not require extra graphite, so the treated seed can pass through the drill machines. Directions are supplied with product.

10. **ARASAN.** This is a new, non-poisonous compound. And has a similar purpose and use as Semesan and Spergon for treating seed. Directions are supplied with the product.

11. **SEMESAN BEL.** As a poisonous organic mercury compound to disinfect potato seed tubers, it controls only certain seedborne diseases such as Scab, Rhizoctonia, and Black Leg. Directions come with product.

12. **FORMALDEHYDE.** Fungicidal preparations of formaldehyde are all derived from the commercial 40 per cent water solution.

As a Soil Disinfectant: Dilute 1 gallon of the commercial product with water to make 50 gallons of solution. Add this solution to the prepared soil at the rate of $\frac{1}{2}$ gallon per square foot. Then cover the soil with canvas for 24 to 48 hours. Allow 7 to 10 days before seeding the treated soil.

As a Drip with Seeding of Onions: You may use the 1-50 dilutions as a drip along with the seeding of onions. Drip the formaldehyde into the rows just before you cover the seed. A medium-sized sprinkling can will deliver about the proper amount of formaldehyde when carried slowly down the rows.

13. **CORROSIVE SUBLIMATE.** Mercuric chloride or bichloride of mercury has been widely used to treat seeds.

As a Dip for Seed: To assure freedom from bacterial canker, dip tomato seed in corrosive sublimate solution, 1-3000, for 10 minutes. Rinse and dry the seed. Your druggist can make up a gallon of the solution or give you prepared tablets with directions for preparing the proper strength solution. The solution is deadly poisonous.

14. **BORDEAUX MIXTURE.**

As a Spray: This is a spray compound which has been used successfully for many years against certain insects and diseases. Its active ingredient is copper. The standard Bordeaux

mixture is said to be "4-4-50 Bordeaux," referring to 4 pounds of copper sulfate and 4 pounds of freshly hydrated lime to 50 gallons of water. The components should be prepared separately and mixed just before applying. Instant Bordeaux is available in package form, so all you need to do to prepare the spray is to add the water.

15. **COPPER LIME DUSTS.** These dusts are 10 to 25 per cent mono-hydrated copper sulfate and the rest hydrated lime. They are sold widely under a variety of names.

As Dusts: In general, copper lime dusts are intended to substitute for Bordeaux mixture, and their popularity is based on ease of application. You may add calcium arsenate as an insecticide (4).

Copper lime dusts are often used to control downey mildew, but are not so effective as Bordeaux mixture.

NOTE: Copper dusts containing lime should not be used with DDT.

16. **SULFUR.** Sulfur is a valuable fungicide and insecticide with many uses. It is cheap, effective, and easy to apply. You may use sulfur with calcium arsenate or rotenone to prepare a mixture which has both fungicidal and insecticidal properties.

As a Dust: Powdery mildew of many crop plants is readily controlled by using sulfur dusts. Sulfur for dusting purposes is sold as finely ground pure sulfur, 200 to 300 mesh. You can add sticking and conditioning agents.

As a Spray: Spray powders are also available as wettable sulfur.

17. **TAR PAPER DISKS.**

As a preventive: Cut tarred building paper into 5-inch squares. Make a cut from one side to the center. Cut several small slits radiating from the center to allow space for the disk to fit around the stem. Place the disk around the plant and press firmly to the ground. The disk must fit snugly to prevent flies from laying eggs in the soil near the stem.

18. **TOXAPHENE.**

Use a 5 per cent dust to control grasshoppers.

19. **METALDEHYDE BAIT.**

As Bait for Garden Slugs: Metaldehyde is effective to control slugs when mixed with bran and calcium arsenate and applied as a bait. Supplies of methaldehyde are not easily obtained; however, there are a number of commercially

prepared baits containing this chemical on the market. The bait should be broadcast or placed in heaps about the size of a dollar on moist soil near plants, rocks, or walls at intervals of about 3 feet. Apply bait at the rate of 1 pound for 4000 square feet.

20. POISONED CARROT BAIT.

As Bait for Pocket Gophers: Cut 1 quart of fresh carrots into pieces 1½ inches long and ½ inch square and dust over these with a shaker ¼ of a teaspoonful of powdered strychnine alkaloid. Insert pieces of bait at intervals along the main runway. This bait is extremely poisonous.

21. ETHYLENE DIBROMIDE. Ethylene dibromide is a heavy liquid which, when applied to the soil, gives off a gas. This gas goes through the soil and is highly poisonous to wireworms. The commercial product contains either 20 or 40 per cent of ethylene dibromide by weight.

For gardens, you may pour ethylene dibromide by hand from a can with a small hole directly along the plow sole or along a trench made by hand spading. Place the material at least 6 inches deep and cover immediately with the next furrow or spaded soil. Use the 40 per cent solution of

ethylene dibromide at the rate of 6 tablespoonfuls for each 50 feet of open furrow or spaded trench. The soil should be in good working condition. Do not apply ethylene dibromide when the soil is too wet to work properly. And do not plant seed or set plants for at least 2 weeks after treatment.

22. CALCIUM ARSENATE. This insecticide contains arsenic, which is poisonous and should not be used on foliage or fruit to be eaten unless the residue is removed at harvest time.

As a Dust: Place 1 pound of calcium arsenate and 3 pounds of hydrated lime in a large can and mix like nicotine sulfate dust.

As a Calcium Arsenate-Copper-Lime Dust: Add 1 pound calcium arsenate and 1 pound of mono-hydrated copper sulfate to 2 pounds of hydrated lime and mix like nicotine sulfate dust.

As a Spray: Place ½ teaspoonful of casein spreader or soap in 1 gallon of water and add 3 tablespoonfuls of calcium arsenate. Keep the mixture agitated while spraying. In western Washington, add a tablespoonful of hydrated lime.

Pest and Disease Control Chart

Crop	Pest	Description, Injury, and Control
General Feeders	Aphids	Green, black, or gray plant lice feeding on stalks and undersides of leaves. Spray or dust with nicotine sulfate (4*) or tetraethyl pyrophosphate (5) as soon as insects appear. A second application may be needed in 5 or 6 days.
	Blister Beetles	Long, narrow, shiny black or bluish-colored beetles appear in numbers and settle on vegetables in eastern Washington. Cause severe damage to foliage in short time. Dust with rotenone (3) or DDT (1) dusts immediately. Avoid DDT dust on edible portions of plants.
	Cutworms	Dark-colored worms about 1 inch long. Feed at night and lie curled up beneath lumps of earth or debris during the day. Feed on stems and foliage of many plants. Apply DDT (1) dust to seed bed before planting. If damage to plants occurs later, you may need to make another application of DDT dust. Avoid DDT on edible parts of plants.
	Earwigs	Dark brown-colored insects, bearing long forceps on the posterior end of the body. Insects feed at night and hide during the day. They hide in lettuce, sweet corn, and other vegetables. Dust entire yard and garden and especially along fences, walks, and buildings with a 5 per cent DDT (1). Avoid DDT dust on edible portions of plants. Do not sprinkle water on area treated for two nights.

* Figures in parentheses refer to insecticides and fungicides discussed on pages 3 to 5.

Crop	Pest	Description, Injury, and Control
General Feeders	Flea Beetles	Small, shiny, blue-black or black-colored beetles which feed on foliage of many plants, making small, round holes in the leaves. Grubs of beetles feed on roots. Apply DDT (1) or rotenone (3) as dust or spray. Repeat DDT applications every 10 days and rotenone applications every week until damage ceases.
	Grasshoppers	Feed on foliage of many plants, usually in late summer when fields next to gardens become dry. Dust toxaphene (18) or chlordane (2) on area surrounding your garden early in the morning before it becomes hot. Repeat every 15 days until damage is stopped.
	Garden Slugs	Soft, slimy slugs which hide under rocks, boards, debris, and plants in and about the garden during the day, come out at night, and eat large ragged holes in the leaves. Apply metaldehyde bait (19) to the seed bed and about fences and walls before planting. After plants are up, watch for injury and trails of slime and apply bait every few days until injury ceases.
	Sowbugs	These oval, gray-colored animals, that roll up into a ball when disturbed, are found in dark, damp places. They feed mostly on decaying organic matter but may also attack plants. Apply 5 per cent DDT (1) dust to infested area in the evening. Avoid DDT on edible portions of plants.
	Spider Mites	Spider mites can do great damage to many vegetable crops. They feed by withdrawing the contents of the leaf cells, causing whitening or mottling of the leaves. Some species spin webbing on the foliage. Spider mite populations often increase following DDT applications. Control with tetraethyl pyrophosphate (5) dust or liquid spray or with sulfur dust (16). Use ½ to 1 per cent tetraethyl pyrophosphate dust or dusting sulfur at the rate of 20 to 30 pounds per acre (about ⅓ to ½ pound per 100 linear feet of row). For spraying, use 1 teaspoonful of tetraethyl pyrophosphate to 1 gallon of water. Repeat applications every week as needed.
	Wireworms	Waxy, yellow-colored worms in the soil, feed on many plants causing damage to roots, tubers, or bulbs. Fumigating soil with ethylene dibromide (21) controls wireworms. See U.S.D.A. Circular EC-6, <i>Control of Wireworms in Irrigated Lands with Ethylene Dibromide</i> . A 50 per cent DDT (1) powder at the rate of ½ pound per 100 square feet of area evenly applied prior to plowing or spading also gives control, particularly after the first season. Mix thoroughly through soil.
	Seed Corn Maggots	Small, white maggots feed on decaying organic matter, seed potatoes, seeds of beans and corn, and in the crown of spinach. If troubled with this pest, do not plant on freshly plowed soil. Plant seed shallow so it will germinate quickly. Do not plant during cool, rainy periods. Do not plant warm season crops too early. Do not fertilize heavily with barnyard manure. Use mineral fertilizers. No satisfactory means of chemical control.
	Moles	These small animals feed mainly on earthworms and larval stages of insects but they may feed on many vegetables, causing damage to roots, tubers, or bulbs. Trapping is best method of control.

Crop	Pest	Description, Injury, and Control
General Feeders	Pocket-Gophers	These small animals feed on many plants, causing damage to roots, tubers, and bulbs. They may completely cut off roots of plants. Locate main runway, make openings, and insert pieces of poisoned carrot bait (20). Close holes.
Asparagus	Asparagus Beetles	Orange- and blue-colored beetles or orange-red with dark spots and dark olive-colored grubs feed on tips of cutting shoots or foliage. Dust cutting shoots once a week with rotenone-bearing dust (3) when beetles appear. After cutting season, apply 5 per cent DDT (1) dust. Repeat as necessary.
	Cutworms	Worms feed on sides and tips of cutting shoots. (See General Feeders.)
	Rust	Rusty or black pustules on stems and foliage. Eventually diseased plants show loss of vigor and poor growth. Destroy "escape" plants in the vicinity of the planting. Plant resistant varieties.
Beans	Bean Weevil	Small beetles which emerge from dry beans, leaving small, round holes. Fumigate beans with any grain fumigant immediately after harvest, and store in closed metal or glass container. Burn vines after harvest. Allow no weevils to escape from infested seed in the spring.
	Wireworms	See General Feeders.
	Aphids	See General Feeders.
	Seed Corn Maggots	See General Feeders.
	Spider Mites	See General Feeders.
	Bacterial Blight	Watersoaked lesions on leaf surrounded by a border or halo. Stem lesions sometimes occur and yellow spots may appear on the seeds. Occasionally wilt and stunt occur. May be controlled by rotation and the use of clean seed. Avoid cultivating plants while wet.
	Curly Top	Plants become yellowed and dwarfed with brittle, puckered leaves, and often die. No entirely satisfactory control for this disease is known. Remove and destroy affected plants as soon as noticed. Use resistant varieties.
	Rust	Rust-colored pustules on leaves, stems, and pods. Pustules become black late in the season. Plants show less vigor. Clean up and destroy old vines at end of season.
Seed Decay and Damping-Off	Rotting of seed during germination, especially in cold, wet soil; followed by sudden wilting of young seedlings shortly after emergence. Dust seed with Semesan (8), Spergon (9), or Arasan (10).	
Beets	Aphids	See General Feeders.
	Flea Beetles	See General Feeders.
	Curly Top and Mosaic	Virus diseases cause yellowing, stunting, irregular growth, and often death to affected plants. Good sanitary practices, insect control and roguing are helpful.
	Damping-Off and Root Rot	Rapid death of seedlings and root rot of older plants. Treat seed with Semesan (8), Spergon (9), or Arasan (10), and avoid overwatering. Keep soil well drained and aerated.
Broccoli		See Cabbage Insects.

Crop	Pest	Description, Injury, and Control
Cabbage Cauliflower	Aphids	See General Feeders.
	Cutworms	Worms feed on plants, often cutting them off at surface of soil. See General Feeders.
	Cabbage Worms Cabbage Looper Diamondback Moth	Greenish-colored worms feed on the foliage and developing heads. Dust or spray plants with DDT (1) at 10- to 15-day intervals up to 30 days of harvest, or use rotenone (3). Apply rotenone every week to 10 days.
	Cabbage Root Maggots	Small, white maggots tunnel in the roots, causing the plants to wilt. Either sprinkle 5 per cent chlordane dust (2) on soil around stem of plant immediately following transplanting, place tar paper disks (17) about plants, or sprinkle handful of calomel dust (7) on soil around stem of plants immediately following transplanting. You may also use calomel suspension (7).
	Club Root	With enlarged and malformed roots, the plants may become stunted and often wilt during the heat of the day. Some plants may die. Obtain plants from disease-free beds and do not replant in infested soil. Destroy cruciferous weeds, such as wild mustard. Apply 20 pounds calomel mixed in a ton of lime for each acre of area treated. For gardens 1 ounce of calomel in 16 pounds of lime to 350 sq. ft.
Ring Spot	Gray or black spots on the leaves and purplish-brown areas on stems, branches, and seed pods. Remove and destroy old plants at end of season. Rotate with unrelated crop.	
Carrots	Carrot Rust Fly	Yellowish-colored maggots tunnel in taproots in western Washington. Plant early carrots so they may be harvested by July 15. Do not plant late carrots before June 1. You can control rust fly by applying 5 per cent chlordane dust (2) in a 4-inch band as plants come through the soil.
	Wireworms	See General Feeders.
Sweet Corn	Corn Earworm	Plant recommended varieties. Use commercial corn earworm oil preparations according to directions furnished by manufacturers or apply 5 per cent DDT dust (1) to fresh silks. Several applications are necessary.
	Earwigs	They enter the end of the ear and feed on kernels and hide in the ear. See General Feeders.
	Seed Corn Maggot	See General Feeders.
	Spider Mites	See General Feeders.
	Wireworms	See General Feeders.
	Seedling Blight	Poor stand with numerous unthrifty seedlings. Plants may fail to grow normally and many may die. May be especially bad in cold, wet soil. Older plants may have ear rot. May be controlled by treating seed with Semesan (8), Spergon (9), or Arasan (10).
Smut	Swellings on stalks, leaves, tassels, or ears, become black powdery masses, partially covered with a silvery membrane. Remove and burn diseased plants.	

Crop	Pest	Description, Injury, and Control
Celery	Carrot Rust Fly	See Carrots.
	Damping-Off	See Beets.
Cucumbers		See insects under Squash.
	Spider Mites	See General Feeders.
	Mosaic	The growth is stunted, leaves mottled, fruits discolored, warty, and deformed. Control insect pests, get rid of weeds and diseased plants as soon as noticed.
	Powdery Mildew	Grayish powdery masses of the fungus on leaf surfaces. Leaves may eventually appear to be dusty from the large amount of fungous material present. Finely divided sulfur dust readily controls the disease (16).
	Curly Top	See Beans.
Horseradish	Diamondback Moth	See Cabbage.
Lettuce	Cabbage Looper	See Cabbage.
	Aphids	See General Feeders.
	Slugs	See General Feeders.
	Wireworms	See General Feeders.
	Damping-Off	See Beets.
	Downy Mildew	Yellowish spots on upper surface of leaves, grayish-white mildew on lower surface of same spots. Destroy old plants at end of season.
Muskmelon		See insects under Squash.
	Curly Top	See Beans.
	Powdery Mildew	See Cucumbers.
	Wilt	Damping-off and stunt of seedlings, and wilt of older plants. Use resistant varieties. Treat seed with Semesan (8), Spergon (9), and Arasan (10).
Onions	Onion Thrips	Small, slender insects feed on the leaves, causing silvery areas to appear and later wilting in case of heavy infestations. Apply nicotine dust or spray (4), or 10 per cent DDT dust (1) when injury first appears. Repeat as needed.
	Onion Maggot	Small, white maggots tunnel in bulbs or stems. Before planting, mix 1 part seed with 2 parts of calomel (7), or apply 5 per cent chlordane dust (2) over plants when they come through the ground or on soil immediately following transplanting.
	Wireworms	See General Feeders.
	Bulb Rot	Die-back or yellowing of leaves after midseason. Bulb rot and pink root are often additional symptoms. Mummification may finally occur. Control by rotation, insect control, and storage temperatures below 45° F. (33° to 35° F.).
	Downy Mildew	Purplish mildew on stems and leaves followed by yellowing of affected parts. Spray with Bordeaux and add sticking agent such as Penetrol at rate of 1 part to 300 parts Bordeaux solution.

Crop	Pest	Description, Injury, and Control
Onions	Neck Rot	Bulbs show water-soaked areas and gray fungous masses may appear. Small, hard, black resting bodies are often formed on badly decayed bulbs. Last stage is the production of a dry mummified bulb. Control by using colored varieties and thoroughly curing harvested bulbs. Store at about 33° to 35° F.
	Soft Rot	A slimy, soft rot of onions in the field and in storage. Get rid of diseased bulbs before storage. Avoid bruising during harvest and storage.
Parsnips	Carrot Rust Fly	See Carrots.
Peas	Pea Weevil	Small, grayish-colored beetles marked with black and white spots feed on the pollen of pea blossoms and deposit eggs on the developing pods. The eggs hatch into small worms, which bore through the pod and feed inside the pea seed. Worms change into adults when peas become mature. Emerging adults leave small, round holes in dry seed. Dust with rotenone dust (3) when peas come into bloom and repeat every 4 days until they go out of bloom. Use ½ pound of dust to each 100 linear feet of row. Use 5 per cent DDT dust (1) when first pods begin to form and repeat every week.
	Pea Aphid	Small, green insects cluster in tips of the plant. Feeding causes withering of the plants and deformity of pods. Apply nicotine dust (4) or tetraethyl pyrophosphate dust (5), ⅔ pound per 100 feet of row, if aphids appear before bloom; otherwise, pea weevil dusts hold infestation in check.
	Pea Moth	In some areas of N. W. Washington, a small, white worm feeds on the peas inside the pod. Peas should be planted early so they can be harvested by the last of June. Burn vines immediately after harvest. Apply 5 per cent DDT dust (1) when pods begin to form and repeat every week.
	Blight	Purplish-brown spots on leaves and stems, also basal stem rot. Plants eventually blighted. Use seed produced under semi-arid conditions and rotate crops.
	Downy Mildew	Mildew and yellowish spots on leaves and pods. Clean seed, sanitation, and Bordeaux mixture (14) are the best control measures.
	Mosaic	Leaves discolored and mottled. Control aphids. See General Feeders.
	Powdery Mildew	White powdery areas on leaves, stems, and pods, finally speckled with tiny black dots. Dust vines with fine dusting sulfur.
	Root Rot Damping-Off	Damping-off of seedlings and root rot of older plants. Treat seed with Semesan (8), Spergon (9), or Arasan (10).
	Wilt and Near Wilt	Yellowing of plants, growth stunted, leaf margins curve downward. Eventually rapid wilt occurs. Use resistant varieties.
Peppers	Flea Beetle	See General Feeders.
	Curly Top	See Tomatoes.
	Stem Rot	See Tomatoes.

Crop	Pest	Description, Injury, and Control
Potatoes	Potato Flea Beetle	Small, shiny, black-colored beetles feed on the foliage and deposit eggs in soil around base of plant. These eggs hatch into small, white worms which feed on the developing tubers, causing small black tunnels near the surface. On early potatoes, apply 5 per cent DDT dust (1) as soon as the beetles appear on the foliage. Repeat every 10 days until harvest. On late potatoes, apply dust when potatoes are 2 to 3 inches high and repeat every 10 days up to September 1. Use 5 per cent DDT neutral copper dust (1) for both potato flea beetle and late blight.
	Colorado Potato Beetle	Round-shaped beetles, with yellow and black stripes, and reddish-colored grubs feeding on the foliage. Apply 5 per cent DDT dust (1) when insects appear. Repeat as needed.
	Wireworms	Harvest early potatoes as soon as possible. Damage reduced if late potatoes are planted late in June. See General Feeders.
	Spider Mites	See General Feeders.
	Black Leg	Growth stunted, foliage somewhat yellowed, and branching poor. Leaf curl often noted and occasionally black stem rot may cause wilting and death. Use certified seed, treat seed (11-13), and plant soon after seed is cut. Get rid of diseased plants.
	Black Scurf (Rhizoctonia)	Symptoms variable, most important are hard, black fungous bodies on tubers, brown or black lesions on the below-ground stems, and the killing of the underground growing point. Use certified seed and rotate crops.
	Late Blight	Dark, purplish-black lesions on leaves and stems may spread to cause complete foliage blight. Mildew apparent on under surface of leaves during wet weather. Infected tubers become discolored and flesh next to the skin becomes brown. Soft rot of the tubers usually follows light blight infection. The systematic application of copper sprays (14) or copper lime dusts (15) controls this disease.
	Scab	Corky scabs on tubers. Best controlled by formaldehyde dip (12). Russet varieties are resistant. Long rotation with grains, grasses, or legumes recommended. Use certified seed.
Virus Diseases	Variable symptoms, including mottling, yellowing, and wrinkling of the leaves, and dwarfing of plants, are found. A number of viruses are involved. The best control is to use only certified seed. Insect control is helpful to reduce spread in field or garden.	
Radishes and Turnips	Cabbage Root Maggot	Small, white maggots tunnel into taproot. To prevent wormy radishes, plant in a 4 to 6 feet square, then place 10- or 12-inch boards on the end around the area and cover the top with cheese cloth as soon as plants come through the ground, or treat seed with calomel (7), or apply calomel dust (7) heavily along row as soon as plants come up. Calomel suspension (7) may be used.
	Flea Beetle	See General Feeders.
Spinach	Aphids, Cabbage Looper	See Cabbage.
	Seed Corn Maggot	See General Feeders.

Crop	Pest	Description, Injury, and Control
Squash	Aphids	See General Feeders.
	Cucumber Beetle	Use calcium arsenate dust (22). Repeat every 10 days.
	Squash Bug	Long, mottled, grayish-black colored insects attack plants soon after plants come up (in eastern Washington only.) Brown-colored eggs are deposited on undersides of leaves in clusters along veins and hatch into small green and later grayish-colored nymphs. Adults and nymphs suck juices from plants, causing them to wilt and die. No satisfactory control in heavily infested areas. Handpick eggs. Trap adults early in the season. Place shingles under plants and destroy bugs clustered under shingles each morning. When bugs appear, apply 20 per cent Sabadilla dust (6) to foliage or 5 per cent DDT dust (1) on soil around base of plants. Do not apply DDT to leaves.
	Seed Corn Maggot	See General Feeders.
	Storage Rot	Store in dry place. Keep dry. Store at temperature of 40° to 60° F.
	Curly Top	Vines stunted, leaves puckered, rough, brittle, especially at tip of vine. Remove diseased plants as soon as noticed.
Tomatoes	Tomato Hornworm	Large, green worms, with a horn on the tail end, feeding on the foliage. If these worms are present each year, dust plants early in July with arsenate dust (22). Repeat 1 or 2 times every 10 days. Handpicking the worms or cutting them with scissors may be practiced. Wash harvested fruit to remove any poisonous residue.
	Flea Beetles	Adults feed on foliage and larvae feed on roots, reducing vigor of plants. Use calcium arsenate dust (22) early in the season. Apply rotenone dust (3) late in season to avoid poison residue. See General Feeders.
	Bacterial Canker	Light-colored streaks on stems, stem cankers, stunt, wilt, deformed and cankered fruit. Rotate crops. Use seed collected from canker-free plants. Treat seed in corrosive sublimate 1-3000 solution (13) for 10 minutes.
	Blossom End Rot	A non-parasitic disease resulting from improper water relationships. A soft rot develops at the blossom end of the fruit which is often followed by a bacterial soft rot. Good soil drainage, uniform moisture supply, and cultural practice to keep fruit off the ground controls the disease.
	Curly Top (Yellow Blight)	Leaves become rolled, thickened, and brittle with a yellow blade and purple veins. Growth checked. Remove and destroy diseased plants as soon as noticed.
	Fruit Rot	Usually associated with growth cracks. Parasite enters through the cracks and causes a progressive rot. Black mold often on cracked surfaces. Non-cracking varieties and careful handling control.
	Late Blight	In western Washington, purplish-black mildewed areas on leaves and stems. Lesions spread and eventually foliage blight results. Fruit becomes discolored by the presence of yellowish-brown, water-soaked areas. Soft rot usually follows late blight. Regular applications of copper fungicides (14, 15, 22) afford satisfactory control.
	Wilt	Blanching or yellowing of the foliage from lower leaves upwards and often temporary or permanent wilting. Rotate with unrelated crop. Use resistant varieties.