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Controlling Plant Diseases in the Home Garden

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Plant diseases caused by fungi, bacteria and viruses take a heavy toll in the vegetable gardens each year. They attack plants at various stages of growth and may be responsible for poor stands in seed beds, damping-off of seedlings, wilts, root rots, stem rots. leaf spots, fruit spots and rots, early defoliation and death, reduced yields, and poor quality. Although complete control of all diseases is not practicable there are simple, inexpensive methods that will prevent much of the damage caused by these plant parasites. The symptoms of the diseases of each crop cannot be described in sufficient detail in a brief circular to enable gardeners to identify all of them with certainty. Some diseases have very characteristic symptoms and cannot be mistaken, while others require more careful examination. The proper diagnosis of the disease and some knowledge of the behavior of the causal agent is necessary for the intelligent use of control measures. For example, the spraying of plants attacked by wilt fungi is useless and wasteful, since the fungi occur in the soil, enter the plants through the roots, and remain inside the plant in the water vessels. Gardeners who are interested in securing diagnoses of diseased plants and further information on disease prevention are asked to send specimens to the Plant Pathologist, Missouri Agricultural Experiment Station, Columbia, Missouri.

Rotation

Most home gardens are maintained year after year in the same location. In spite of heavy manuring the gardener often finds it more and more difficult to secure satisfactory results through the summer, principally because of the gradual accumulation in the soil of disease organisms and insects that attack the plants, killing them or shortening their periods of production. Wherever possible new garden plots should be prepared; a rotation plan should be adopted which will permit each plot to remain in other crops, preferably grasses or cereals, for two years. This practice will build up the organic matter in the soil and reduce many of the parasites that attack garden crops.

Rotation of crops cannot be relied upon, however, to rid the soil of some of the most destructive fungi, particularly those which cause cabbage yellows, and the wilts of tomato, watermelon and potato. The fungi which cause these diseases have been shown to remain in the soil for ten years or longer, even when no susceptible plants are grown. It is advisable, therefore, when using a new plot of land for the garden, to avoid bringing plants from an old garden into it, since this would almost certainly cause a new infestation.

Seedling plants for transplanting are also frequent means of introducing diseases. The plants are grown to transplanting size in cold frames or greenhouses at fairly low temperatures. Under these conditions the wilt fungi, if present in the soil, may enter the roots but the symptoms of the disease do not develop until after transplanting when warmer weather occurs. There is definite danger, therefore, in using apparently healthy plants from unknown sources.

Almost all gardens become infested, to some extent, after a few years. The planting of resistant varieties is helpful in preventing the spread of the wilt fungi. Although some infection may occur the fungi do not develop rapidly in these varieties, and the build-up of infestation is much slower than when susceptible varieties are grown.

Sanitation

The parasites that cause disease are often carried over the winter in refuse from the previous summer. As diseased plants appear during the summer they should be removed from the garden and burned. A diseased plant left standing in the garden is of no value and may serve as a source of spread of disease to the healthy plants. In the fall the garden refuse should be raked up and burned before the garden is plowed. The practice of leaving diseased, rotting vegetables in piles in the garden is especially dangerous.

Seed Treatment

The treatment of vegetable seed with chemicals serves two purposes; it disinfects the seed by destroying parasites that may be on the seed; it protects the seed and young seedlings against decay organisms that may be present in the soil. The protective action of seed treatments is especially valuable when cold, wet weather follows planting; under such conditions treatment often results in good stands when untreated seed produces poor, irregular stands.

Seed treatments are very cheap and easily applied. The chemicals may be purchased in any seed store. The treatment may be applied whenever convenient, since it does not injure the seed, and the seed may be stored several weeks between treatment and planting. Since different crops and parasites respond in various ways to chemicals it is not yet possible to recommend a single chemical treatment which may be used safely and effectively on all seed. The parasites that occur on the seed vary with the locality in which the seed was grown, and seed grown in certain areas is more likely to be free from seed-borne diseases.

Some of the chemicals which have proved effective for seed treatment are (1) Cuprocide; (2) zinc oxide; (3) Spergon; (4) New Improved Semesan, New Improved Semesan Jr., and Semesan Bel. In treating seed with Cuprocide and zinc oxide the seed may be shaken with the dust in a fruit jar; the excess dust should then be removed by shaking the seed gently on a screen. Plant the seed with as much dust as will stick to it. The other materials, Spergon, New Improved Semesan, Semesan Jr., and Semesan Bel, should be used according to the directions printed on the container.

In the following table the desirable treatments for vegetable seed are listed:

Bean (snap and dry). None.
Bean (Lima). Spergon.
Beet. Cuprocide or Semesan.
Cabbage, cauliflower, kohl rabi and **Brussels sprouts. Do not use Cuprocide.** Treat with Semesan or zinc oxide.
Cantaloupe. Cuprocide.
Carrot. Cuprocide.
Cucumber. Cuprocide.
Eggplant. Cuprocide.
Lettuce. Cuprocide.
Onion. None.
Parsnip. None.
Pea. Cuprocide or Spergon.
Pepper. Cuprocide.
Potato. Semesan Bel.
Radish. None.
Spinach. Cuprocide or zinc oxide.
Squash. Cuprocide.
Sweet Corn. Use New Improved Semesan, Jr., in accordance with directions on the package.
Tomato. Cuprocide or (better) soak in a soultion of 1 part Semesan in 1200 parts water for 10 minutes. Dry before planting.
Turnip. None.
Watermelon. Cuprocide.

Cultural Practices

Damping-off of seedlings is encouraged by high humidity, dark weather, and crowding of seedlings. Plants in cold frames and hotbeds are specially subject to damping-off. Raising the covers whenever possible is helpful by preventing excessive air humidity. Frequent watering encourages the development of damping-off. The plants should be watered thoroughly at infrequent intervals rather than lightly at frequent intervals. Watering in the morning and leaving the beds open during the day is desirable. Do not give the plants more water than necessary to maintain normal growth.

If damping-off appears, sprinkle the seed bed with Bordeaux Mixture (3 ounces copper sulphate and 1½ ounces hydrated lime in 5 gallons of water), or Cuprocide (1 ounce in 3 gallons of water). The solutions leave a deposit of copper compounds in the surface layer of soil that prevents the growth of the damping-off fungi through the soil.

Many leaf and fruit diseases are spread by cultivation early in the morning when the plants are wet with dew. It is advisable to keep out of the garden when the leaves are wet. Leaf spots and blights are often caused by bacteria which develop in the discolored areas in enormous numbers, finally breaking through the surface of the leaf and oozing out to form a small crust on the surface. This bacterial slime contains millions of microscopic bacteria. When wet the bacteria are easily carried through the garden with the drops of water from diseased leaves that adhere to the tools used in cultivation.

In general, plants well supplied with plant food, kept well cultivated and free from weeds are more resistant to many diseases than neglected plants. The roots of many plants are attacked by soil fungi, and the welfare of the plants may be dependent on their ability to produce new roots to replace those injured or destroyed by parasites. Plants handicapped by weed competition and neglect lack the ability to maintain root growth.

Resistant Varieties

Considerable progress has been made in breeding varieties of vegetable crops with resistance to some of the more serious diseases. In many instances the use of these resistant varieties is the only practicable method of combatting certain diseases, especially in gardens in which the parasites have become established in the soil. The source of seed may be important in determining the diseases carried by the seed.

The following table lists resistant varieties and some information regarding seed sources and diseases:

Asparagus.—Mary Washington and Martha Washington are rust-resistant. Plants and seeds from reliable dealers will prove true to type and resistant to this very serious disease which has almost eliminated susceptible varieties.

Bean (snap and dry).—Do not use home-grown seed. Western-grown seed is much freer from disease. (1) Dry beans: Michigan Robust and University of Idaho Great Northern varieties are immune to common mosaic. This disease is caused by a virus which is transmitted from diseased to healthy plants by insects, particularly aphids. Infection is carried, to some extent, internally in the seed. Symptoms of infection include the appearance of mottled light and dark green areas in the leaflets, crinkling and distortion of the leaf tissue and cupping or slight rolling of the margins of the leaflets. Infected plants are stunted and the yield is small. The removal of infected plants as early as possible is advisable to prevent the spread of virus by insects moving from diseased to healthy plants. (2) Midseason garden and canning types: Giant Stringless, Tendergreen, Asgrow Stringless, Improved Kidney Wax, Round Pod Kidney Wax are tolerant to bacterial blight and mosaic. (3) Late garden and canning types: Idaho Refugee, Sensation Refugee 1066, Sensation Refugee 1071, U. S. No. 5 Refugee and Wisconsin Refugee are immune to common mosaic and highly resistant to bacterial blight, a disease which causes large, irregular, brown, brittle spots on the leaves and reddish cankers on the stems. On the pods the disease causes irregular, rusty blotches. The bacteria are carried in the seed, and home-grown seed is almost always infected. Seed from Western sources is nearly free from infection and should produce crops fairly free from blight. (4) Pole beans: Kentucky Wonder U. S. No. 3 and No. 4 are resistant to rust. The ordinary Kentucky Wonder strains are highly susceptible to rust, which appears on the leaves as small brown pustules, which later become black. Infected leaves turn yellow and fall.

Powdery mildew often attacks beans. It appears as a white, powdery growth covering the leaflets and causing curling or cupping. As soon as the mildew appears the plants should be dusted with sulphur, using a finely ground type of sulphur especially prepared for dusting. The dusting should be repeated at intervals of 7-10 days.

Bean (Lima).—California-grown seed is usually free from bacterial spot.

Cabbage.—Use Puget Sound grown seed if available. The following varieties are resistant to yellows, our most serious cabbage disease. No other varieties should be planted. Cabbage yellows is caused by a fungus that lives in the soil, invades the roots and grows up the stem through the water vessels, causing a brown discoloration which may be seen as a brown ring when a diseased stem is cut. The plants are stunted, the leaves turn a yellowish green and the lower leaves fall off. Diseased plants seldom produce heads of useful size or quality. Most gardens are more or less severely infested with the yellows fungus. Since resistant varieties are available in a wide range of types one of these should be selected for the home garden. All are satisfactory under Missouri conditions. (1) Wisconsin Golden Acre—earliest (50 days)—round head. (Available in 1943). (2) Jersey Queen—50-55 days—pointed.

(3) Racine Market—60 days—round. (4) Marion Market—70 days—round. (5) Globe—75 days—round.

Cantaloupe.—California No. 45 is resistant to one form of the powdery mildew fungus. It may become infected in some localities. The cantaloupe is attacked by bacterial wilt which also attacks the cucumber, and can be controlled only by controlling the cucumber beetle.

Carrot.—The Chantenay is moderately tolerant to leaf blight.

Celery.—Self-blanching varieties: Michigan Golden and Florida Golden are highly resistant to yellows. Very resistant green varieties are Paragon, Earligreen and Sweetheart. (Celery is not well-adapted to Missouri conditions).

Cucumber.—The Shamrock cucumber is resistant to mosaic. The most serious disease, wilt, can be controlled only by controlling the cucumber beetle. The bacteria that cause the disease are carried over winter in the adults of the striped cucumber beetle which fed, during the previous summer, on diseased cucumbers, cantaloupes or squashes. The beetles transmit the disease to young cucumber plants, which wilt, dry up and die very quickly. Dead or wilted vines should be pulled out and destroyed early in the season.

Onion.—Sweet Spanish is resistant to pink root and yellow dwarf. Red and yellow varieties are very resistant to smudge and neck-rot; white varieties are very susceptible. Smudge causes dark green or black blotches on the bulbs, usually on the top or side. Neck-rot is caused by a fungus which infects the bulbs at harvest and develops in storage, appearing as a grayish mold or as black, crust-like growths. Much of the damage may be avoided by drying the onions thoroughly before they are placed in storage. All immature, thick-necked onions should be graded out.

Pea.—Use Western-grown seed of early maturing varieties. The pea season in Missouri is usually short. In rainy seasons powdery mildew may become prevalent; it develops as a white, powdery coating of the leaves, pods and stems; diseased plants turn yellow and die prematurely. If the plants are watched closely and dusted with dusting sulphur as soon as the mildew appears, the spread of the disease can be halted. Dusting should be done at weekly intervals.

Potato.—Use certified seed.—There is no other control for some of the most destructive potato diseases. Treat seed with Semesan Bel and plant in soil free from scab or scurf. Scab is caused by a fungus which lives in the soil from year to year, causing rough, pitted, scabby spots on the tubers. The use of lime, fresh stable manure or wood ashes on infested soil increases the severity of the disease. Badly scabbed seed potatoes should not be planted. Avoid soil known to be heavily infested.

Wilt causes a sudden wilting and death, with browning of the water vessels in the base of the stem, and in the stem-end of the tubers. The causal fungus lives in the soil. Avoid introduction of the fungus by using certified seed, and rotate to avoid planting potatoes in the same area more often than once in five years.

Rhubarb.—Crown rot is very destructive. The fungus invades the plant at the crown, causing a rot which results in wilting of the leaves and death.

of the entire plant. Roots from old plantings are likely to transmit the disease to new areas; new plantings should not be made where old plants have died. Heavy, poorly drained soils favor crown rot devlopment and should be avoided in choosing a location for rhubarb.

Sweet Corn.—Bacterial wilt is very prevalent in the common yellow early varieties. The bacteria overwinter in adult flea beetles, and the severity of the disease varies from year to year, since the number of infected beetles that survive the winter varies with climatic conditions. In Missouri the disease is usually quite abundant and planting susceptible varieties frequently results in almost complete failure. Some excellent resistant varieties have been developed. Golden Cross Bantam is especially recommended for Missouri gardens. Other good resistant varieties are Marcross, Spancross and Whipcross.

Sweet Potato.—The sweet potato is subject to several serious diseases. Stem rot causes wilting and yellowing and reduced yields. Stems of infected plants are black inside, and the roots have a black ring under the surface.

Black rot occurs widely. Infected sweet potatoes have round or irregular sunken, black spots. The rot spreads rapidly in storage and infected sweet potatoes have a bitter taste when cooked. Both stem rot and black rot are transmitted from diseased seed potatoes to the slips. In growing slips only potatoes from healthy plants should be selected for bedding. The soil in the hot bed should be renewed each season. When plants are bought they should be examined carefully. The stems and roots should be clean, white and healthy. The plants should not be planted where sweet potatoes grew the previous year.

When certified plants are available, the small extra cost is a good investment. Certified plants are grown from healthy roots and the state inspection service permits certification of healthy plants only.

Tomato.—Use certified seed if possible. Wilt is probably the most destructive disease in home gardens. Rutgers, Marglobe, and Prichard are resistant. The fungus that causes wilt lives from year to year in the soil. The disease usually appears when the first fruits are nearly ripe and causes premature death of the plant. Rotation is helpful but not entirely effective in controlling the disease. In most gardens resistant varieties only should be planted.

Leaf spots and fruit spots may be reduced in severity by rotation, by removing and burning all old plants after harvest, and by seed treatment.

Watermelon.—Wilt is very common and destructive. Resistant varieties are Hawkesbury (not recommended for large-scale commercial planting), Leesburg, Improved Kleckley No. 6 and Improved Stone Mountain No. 5. If susceptible varieties are grown they should be planted each year where watermelons have not grown previously.

Seed should be purchased only from the most reliable producers. This is especially important when securing seed of improved varieties resistant to disease. The most careful planning and attention given the garden may result only in disappointment if inferior seed is planted.

Home-grown plants produced by the gardener or secured from a reliable local grower generally prove more satisfactory, from the standpoint of freedom from diseases, than plants shipped in from other areas.

Summary

The control of plant diseases in the garden involves some planning and forethought. Success in avoiding diseases depends, to a considerable degree, on prevention rather than on attempts to stop an epidemic after it is well established.

1. Select adapted varieties, disease-resistant when available, for the home garden.

2. Purchase seeds and plants from reliable growers. The origin of the seed is often important.

3. Treat seed of most vegetable crops, using the proper material for the particular kind of seed.

4. Destroy old plants in the garden before plowing.

5. Plan the garden plot to permit rotation, especially for the crops subject to the wilt diseases.

6. Insect control aids plant disease control; in some instances diseases are spread mainly by insects.

7. Maintain good fertility and keep weed competition down.

8. Do not cultivate when the plants are wet.

9. Destroy plants affected by mosaic and wilt. Use sulphur dust if powdery mildew appears.