

Vegetable-Disease Control

Celery, Onions, Carrots, Lettuce, Etc.

By controlling plant diseases,
you can improve the quality
and increase production of the
the food you grow.

Vegetable-Disease Control

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Diseases of Celery

Early blight usually occurs after the plants are 6 to 8 weeks old. The name is somewhat misleading since the disease may appear at any time throughout the growing season.

The symptoms are characterized by more or less circular, grayish-green spots on the leaves and stalks. Later the spots become brown, with ashen-gray centers and well-defined borders. When numerous, the spots run together making diseased patches.

Late blight may occur at any time after the seeds germinate. The spots on leaves and stems are irregular and brown, with black fruiting bodies of the causal mold over their surfaces.

Late blight is often referred to by growers as a rust. In storage, trenches, and transit, secondary soft-rot organisms often enter the stems through the late-blight spots and cause serious losses.

Bacterial-blight infection is manifested by irregular, rusty-brown spots, which are often confused with the late-blight spots. However, the bacterial spots do not have the black fruiting bodies, and the spots rarely occur on the stems.

Fortunately all of these blights may be controlled by the same methods, which are as follows: (1) Treat the seed with either semesan at the rate of $\frac{1}{4}$ teaspoonful per pound of seed, or cuprocide at the rate of $1\frac{1}{2}$ teaspoonfuls per pound. (2) Remove celery plant refuse from fields and destroy it. (3) Disinfect soils of hotbeds with steam, formaldehyde, or chloropicrin (tear gas), as recommended in Colorado Extension Bulletin D-8, on Control of Damping-off. (4) Spray seedlings in hotbeds and the plants in the field with yellow cuprocide, $1\frac{1}{2}$ lb. of the yellow cuprocide, with $\frac{1}{3}$ pt. emulsifier B-1956 spreader, per 100 gal. of water.

For those who prefer dusting, use either cuprocide dust or copper oxychloride dust. Cuprocide dust is made by thoroughly mixing 5 lb. of yellow cuprocide with either 5 lb. of vatsol K, or 1 lb. vatsol OS sticker and brought to 100 lb. with cherokee clay.

The copper oxychloride dust is made by adding 12 lb. of copper oxychloride either with 5 lb. of vatsol K, or 1 lb. vatsol OS sticker, and brought to 100 lb. with cherokee clay. Use 25 or 30 lb. of either dust per acre.

The plants should be sprayed or dusted in the field when

they have become well established, after transplanting, and applications made at 12-day intervals, throughout the growing season. The plants should be well coated either in spraying or dusting.

Damping-off of celery seedlings is quite common in hotbeds, and may cause rotting of seeds in the soil, death of the seedlings before they emerge from the soil, and a watery soft-rot at the base of the stems of seedlings causing them to fall over and die.

Treat the seeds either with semesan, at the rate of $\frac{1}{4}$ teaspoonful per pound, or $1\frac{1}{2}$ teaspoonfuls of cuproside per pound of seed.

Disinfect the soil of hotbeds, greenhouse benches, and flats with steam, formaldehyde or chloropicrin (tear gas) as given in Colorado Extension Circular No. D-8, on Control of Damping-off.

Pink-rot of celery is a disease that causes considerable losses to celery growers in the State. It may develop serious trouble after wrapping, in the trenches, and often causes much damage in storage and in transit. The pink-rot mold may also cause damping-off of seedlings in the hotbeds.

The symptoms of pink-rot are manifested by small, slightly pinkish to gray or brown areas, which usually appear about the small growth-cracks, insect wounds or blight spots on the stems. In the advanced stages, which occur after wrapping, in trenches, and in storage, a watery soft-rot develops that spreads quite rapidly throughout individual bunches, and to any bunches packed against them.

The control for pink-rot incorporates the control of early, late, and bacterial blights, previously given in this circular, insect control, and prevention of mechanical injury of stems. Wrapping the celery bunches individually with wax-coated paper will greatly help in preventing the spread of pink-rot from infected bunches to healthy ones in storage and in transit.

Yellows is a disease which at first causes an off-colored condition of the plants. Later the infected plants become yellow, brittle, stunted, and somewhat bitter to taste. Young infected plants may soon die, but older plants live as long as the healthy ones. The vascular tissue becomes yellowish to brown from rootcrown to leafveins. The roots and crown develop a brownish dry-rot, which is often invaded with secondary organisms that cause a watery soft-rot.

The only satisfactory control is the use of yellows-resistant varieties, of which none are adaptable to Colorado conditions. Work is now being conducted at the Colorado Agricultural Experiment Station on the development of resistant varieties for Colorado growers.

Diseases of Asparagus

Rust is the only disease of asparagus of any consequence in Colorado. The reddish or black lesions (pustules), which are filled with rust spores (seeds), are easily detected. In the advanced stage of the disease the plants turn yellow and die early.

Grow the Mary Washington rust-resistant variety of asparagus and the rust problem will be solved. However, when rust appears in susceptible varieties, dust the plants with sulphur, 3 weeks after the cutting season. Make two additional applications at 18-day intervals. Dusting when the plants are damp will give the best results.

Diseases of Carrot

Damping-off quite commonly causes poor stands of carrots. As in the case of damping-off of all other kinds of vegetables, the seeds may rot in the soil, seedlings may die before they emerge from the soil, or seedlings may develop a watery soft-rot just above the groundline, then fall over and die.

To control damping-off, treat the seeds, disinfect the soil, and spray as outlined for control of damping-off in Colorado Extension Circular D-8, on Control of Damping-off.

Macrosporium leaf-blight often causes severe losses to carrot crops. At first the affected leaves and stems turn yellow, then they become brown, so that in the advanced stage of the disease the entire top may be killed.

At the first signs of macrosporium leaf-blight, growers should spray with yellow cuprocide, or dust with cuprocide dust or copper oxychloride dust. The method for making cuprocide dust is given under control for the blights of celery in this circular. Two or three applications at 10-day intervals should control the disease.

Diseases of Lettuce

Lettuce-drop causes a watery soft-rot of the stems, outer-leaf bases, inner leaves, and roots. The outer leaves often die, wither, and droop until the tips rest upon the ground. The disease advances from outer leaves toward the heart of the plant until it has progressively killed all of the leaves. At this stage of the disease the entire plant has the appearance of having been crushed, or having dropped. Under moist conditions the white mold which causes the disease may grow over the entire plant and produce numerous black fruiting-bodies called sclerotia. The presence of these black fruiting-bodies is an important characteristic for diagnosing the disease.

Lettuce-drop is difficult to control in the field; however, certain precautions can be adopted that will be very beneficial. (1) Practice a 4-year crop rotation, using such crops as sweet corn, tomatoes, potatoes, cucumbers, radishes, beets, onions, and spinach. Avoid celery and cabbage in the crop rotation.

Bottom-rot of lettuce can be detected by the rust-colored, slightly sunken lesions on the leafstems and midribs, and the slimy, dark-brown rot on the leafblade. The midrib does not disintegrate, but remains whole even after the leafblade has rotted away. After the lower leaves are infected, the decay usually spreads to the adjoining leaves in succession until the entire head has been changed to a dark, slimy mass. Later the invaded leaves often dry, leaving an erect, black, mummified plant. The brownish-colored mold, which causes the disease, can be seen over the surface of the infected plants and often extends over the soil at the base of the stems. Brown, crust-like, fruiting bodies, such as are found on rhizoctonia-infected potato tubers, may be found on the diseased lettuce leaves. As a matter of fact, bottom-rot of lettuce and rhizoctonia of potato are caused by the same mold.

Where highly resistant varieties of lettuce, such as the iceberg, can be profitably grown, the disease can be satisfactorily controlled. However, in areas where the resistant varieties are not adaptable, use a 4-year crop rotation with such crops as sweet corn, tomatoes, cucumbers, radishes, beets, onions, and spinach. Unharvested lettuce plants should be removed from the field either by grazing sheep, or hauling them to compost heaps. Dusting the soil underneath the plants with semesan jr. has been found to give satisfactory control in some states.

Damping-off.—The symptoms are rotting of seed in the soil, death of seedlings before they emerge, or a watery soft-rot girdles the seedling just above the groundline, causing the plants to fall over and die.

Treat all seeds with $1\frac{1}{2}$ ounces of cuprocide per pound, and disinfect soil of hotbeds with steam, formaldehyde, or chloropicrin (tear gas) as given in Colorado Extension Circular No. D-8 for Control of Damping-off.

Tipburn is a disease of lettuce believed to be caused by a combination of climatic conditions resulting in a too rapid loss of water in the leaves. It usually appears after 2 or 3 days of rainy weather, or after heavy irrigation, followed by a few hot days when growth is rapid and much water has been given off by the plants. It has been reported in other states that applications of fertilizers low in potash and relatively high in phosphate will help to prevent tipburn.

Dr. A. A. Goodman, County Extension Agent in Rio Grande County, conducted field tests for 2 years, where phosphate was applied at different rates. The fertilizers used in these tests failed to control the tipburn disease. There seems to be no satisfactory control for the disease at present; however, work is being conducted by the Colorado Agricultural Experiment Station in developing tipburn-resistant varieties of lettuce.

Diseases of Onion

Downy mildew on onions occurs rather late in the growing season and during damp, rainy weather. Normally it does not cause serious losses in Colorado. It usually spreads rapidly from a few isolated spots in the field. At first purplish, mold-spots appear on the surface of the leaves. As the spots enlarge, the whole leaf appears water-soaked, later turns yellowish, and may turn whitish after drying. In the advanced stages the leaves usually wither and fall over.

This disease is difficult to control; however, there are certain practices which will prevent it from causing serious losses. (1) Use a 3 to 4-year crop rotation. (2) The soil should be well-drained. (3) Burn all infected onion refuse from infected crops. (4) In seasons when there is considerable rain and high humidity, the plants should be sprayed either with yellow cuprocide, to which has been added $\frac{1}{3}$ pt. emulsified B 1956 spreader and sticker, or with rosin in 2 percent lime-sulphur.

Fusarium bulb-rot may affect onion bulbs at any stage of their growth, and in storage. Distinct yellow to brown streaks may extend on one side for the full length of the leaves. A few or all of the leaves on an infected plant may show the yellow streaks, lop-over to the ground and die. The roots become thin, discolored and die; however, a few new roots continue to develop and in turn become infected, until the tops die.

The first symptom on the bulbs is a short, narrow crack which appears at the base of the fleshy leaves. This short, narrow, crack develops into a semi-dry-rot, crescent-shaped lesion that may continue to invade the bulb until nothing remains but a dried, mummified bulb. In most instances, secondary organisms gain an entrance through the wound and cause a watery soft-rot which gives off a pungent odor.

The mold organisms which cause bulb-rot may live in the soil for several years, and for that reason, it is difficult to control. However, by following certain practices the losses can be greatly reduced. (1) Remove and destroy onion refuse of diseased crops from fields. (2) Practice long crop rotations. (3) Prevent mechanical and insect injury of bulbs. (4) Practice

careful sorting and handling of bulbs before storing. (5) Proper ventilation of storage houses, and good aeration around bulbs while in storage crates, will help.

Neck-rot is caused by a mold that gains entrance into the onion bulbs through wounds. It rarely is of any importance in the field, but has been known to damage 20 to 30 percent of the bulbs in many storage houses of the State.

At harvest time the bulbs appear to be normal, but after they have been stored for 2 or 3 weeks, the neck-rot disease develops. The neck becomes soft, and discolored, and when a slight pressure is applied to it a watery liquid oozes out. The tissue at the base of the neck becomes sunken and spongy and the underlying tissue becomes invaded and breaks down. Often there is a brownish-black mold growth over the surface of the diseased area. In most instances the outer three scales are infected, but frequently the middle scales and hearts of the bulbs become affected. The latter condition is the least common. The mold which causes the disease may live for years in the soil.

The methods for control are relatively simple, and if followed, they are effective. (1) Proper drying of the bulbs before storing hinders the growth of the mold. Onions should be dried for a week or 10 days in the field prior to storage, if weather conditions permit. (2) All splits, scallions, doubles, and mechanically injured bulbs are especially susceptible and should be carefully sorted out before storing. (3) Storage houses should be opened during the dryer part of the day, to get rid of the moisture given off by the bulbs. The storage houses should be well supplied with ventilators in the roof and doors. The mold which causes neck-rot makes little or no growth at temperatures of 34 to 36 degrees Fahrenheit, therefore, the temperature of the storage house should be kept as nearly as possible within that temperature range to avoid neck-rot. Care should be taken when ventilating, that the temperature of the storage house is not raised too high. (4) All the diseased onions which have been sorted out should be removed from the storage house, because they only serve as a source of infection.

Purple-blotch shows at first as a small, gray, sunken spot on the leaves. These spots enlarge into purplish areas that may girdle and kill the leaves. On the bulbs, the purplish spots are dark, sunken, and appear on or near the neck. When infected bulbs are cut open, the fleshy scales near the neck are discolored, become sunken, and form a cavity. This disease becomes serious only when moisture and temperature conditions are high.

The control of purple-blotch involves the following methods:
(1) Sort out all infected bulbs before storing, and it is best not

to store bulbs from badly infected crops. (2) Thorough curing in the field after harvesting the bulbs is necessary. (3) Hold the storage rooms between the temperature range of 34 to 36 degrees Fahrenheit. (4) Spray the plants with 4-4-50 Bordeaux Mixture, to which has been added 1 pound of caso sticker per 100 gallons of the spray. The spray should be applied every 10 days until the disease has been brought under control. Either yellow cuprocide dust, or copper oxychloride dust may be substituted for the spray. Use the dust mixtures as given for control of the blights of celery.

Pink-rot of onions is quite generally distributed throughout Colorado onion-growing districts. At first the roots are slightly lead-colored but later become pink to red in alkaline soils, and brown in acid soils. Infected roots die and dry-up, and often new roots develop which in turn become infected and die. The outer scale-leaves of white bulbs show a reddish discoloration, while those of the colored bulbs appear water-soaked. In severe cases the bulbs are stunted. The tops of infected plants are stunted, and there is considerable tipburning. Infected seedlings may die.

Pink-rot is very difficult to control, when once the causal mold becomes established in the soil. However, there are certain practices which will help to prevent losses. (1) Employ long crop rotations. (2) Treat seeds with semesan. (3) Plant the seeds when the soil is cool. (4) Where the crops are to be planted with either sets, or seedlings, use only healthy stock. (5) Grow the crops for sets in pink-rot-free soil. (6) Quickly available nitrogenous fertilizer will help.

Bacterial soft-rot may attack nearly all kinds of vegetables. Frequently it causes heavy losses in fields and in storage. The disease develops rapidly when temperature and humidity conditions are high. The bacteria overwinters on plant-refuse, on floors and walls of storage-bins, and on used crates. It may be transmitted by tools and insects, and enters the host tissue through wounds. The disease results in a wet, mushy, soft-rot, which produces a disagreeable odor.

The control methods are: (1) Spray the walls and floors of storage bins either with tri-basic copper sulphate, or yellow cuprocide. (2) Avoid mechanical injury. (3) Control insects. (4) Sort carefully before storing. (5) Store onions at low humidity, and a temperature from 32 to 34 degrees Fahrenheit.

Published and distributed in furtherance of the Acts of May 8 and June 30, 1914, by the Colorado State College, Extension Service, F. A. Anderson, Director, and U. S. Department of Agriculture cooperating.