

MAGR
GOVS
MN 2000 FSPP-28 (1976)

UNIVERSITY OF MINNESOTA
DOCUMENTS

MAR 11 1976

ST. PAUL CAMPUS LIBRARIES

Diseases of Cole Crops

PLANT PATHOLOGY NO. 28-1976

F.L. PFLEGER

Cabbage, cauliflower, Brussels sprouts, broccoli, kale, kohlrabi, and turnip are commonly referred to as cole crops. They are susceptible to a number of serious diseases that must be controlled to obtain desired quality and good yields. The diseases and control measures discussed affect both the home gardener and the commercial producer. However, emphasis will be on disease control in commercial cole crop production. Before using any of the fungicides listed for control of various cole crop diseases, always read and follow label instructions.

BLACK ROT—This is a very serious disease on cole crops, especially cabbage, cauliflower, broccoli, turnip, and Brussels sprouts. Other hosts include kohlrabi, collard, rutabaga, and radish. It is caused by the bacterium called *Xanthomonas campestris*.

Symptoms. Plants may be affected at any stage of growth. The bacterium usually enters through the water pores around the leaf margins. Once the bacterium has entered the leaf, the tissue turns yellow toward the center of the leaf forming a V-shaped pattern. The veins within the yellow-colored tissue turn black. The bacterium moves down the leaf and is distributed throughout the entire plant. Infected leaves turn yellow and eventually drop off; some plants may be almost completely defoliated. The affected stem, when cut crosswise, reveals a black ring where infection has followed the water conduction tissue (Fig. 1). The bacterium is carried on and in the seed. When infected seed is planted, the bacteria pass from seed parts into the leaves of the small seedling and symptoms develop as previously described.

Disease cycle. The pathogen overwinters in and on the seed and in plant debris left in the field. The bacterium may become established in a field by planting infected seed, planting infected transplants, or planting in fields where the disease was a problem the previous year. The bacteria are spread by splashing or running water, insects, and infected transplants.

Control. Control of black rot includes 1) planting western-grown seed, 2) hot water seed treatment, 3) fungicide seed treatment, 4) plant bed sanitation, 5) inspection and careful plant handling, and 6) crop rotation.

Plant only western-grown seed. Seed grown in the western United States is usually free of the pathogen while seed grown in Europe and the eastern United States usually has a low percentage of infected seeds.

Hot water seed treatment. This disease control practice is very necessary on cole crop seed to eradicate the black rot bacterium from the seed. Prior to hot water seed treatment, a seed germination test should be conducted since this treatment may reduce germination, especially if the seed is old. Fill cotton bags half full with seed to be treated, squeeze all the air from the bags to assure that all the seeds are wet, and place the bags in a water bath at a constant 122°F. for 25 minutes. Several bags of seed may be treated at once, but the water volume should be five times the total seed volume.

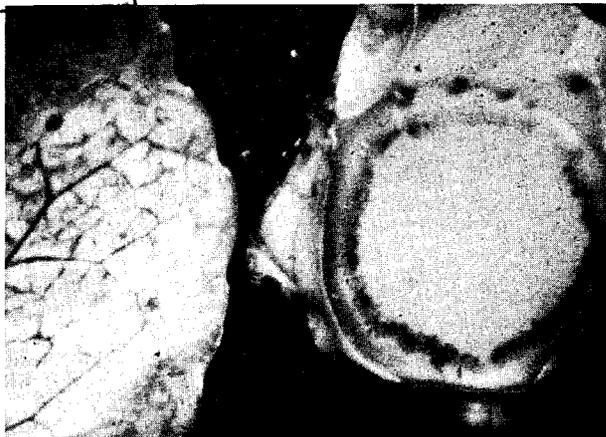


Fig. 1. Note the dark ring in the conductive tissue of the stem. This symptom is commonly associated with bacterial black rot disease of cole crops.

The temperature and length of time for seed treatment must be followed exactly. An automatic thermometer of a floating type can be used to control water temperature accurately. Additional steam can be introduced from a steam line as required to maintain a constant temperature. Brussels sprouts, cabbage, broccoli, cauliflower, Chinese cabbage, collard, kale, kohlrabi, and turnip should be hot water treated.

After the seeds have been hot water treated, place them immediately in cold water. When the seeds have cooled, spread them on racks and maintain good air circulation and warm temperatures. The dried seeds then should be treated with captan or thiram for protection against soil-borne pathogens.

Plant bed sanitation. Take care to avoid planting beds that have been used for cole crop production i.e. cabbage, cauliflower, etc. Wait at least 3 years. Drainage water from old compost heaps and from old cabbage fields also can contaminate the soil. If disease-free soil is not available, fumigate with Vapam, Vorlex, methyl bromide or chloropicrin.

Plant inspection and handling of plants. Inspect the plants thoroughly and look for disease symptoms described earlier. Handle plants carefully to avoid injury.

Crop rotation. A 3 year crop rotation with unrelated crops is required since the bacterium can overwinter in the soil for 2 years.

SEED ROT and DAMPING OFF—As mentioned earlier, careful choice of seedbeds and a strict sanitation program are necessary for control of black rot. In addition, PCNB (Terraclor) is effective against wire-stem (*Rhizoctonia*) while *Pythium* damping off can be controlled by seed fungicides and soil treatment. The soil can be treated with PCNB plus captan 10-10 dust; or PCNB 20 percent mixed with captan 7½ percent dust. These fungicides must be mixed with the top 3 to 4 inches of soil using a Rototiller or rake.



Fig. 2. A cabbage plant infected with *Phoma lingam*. Note the dark canker on the stem and the small dark dots above the canker. The small dark dots are fungal structures and indicate presence of the pathogens.

BLACK LEG—This disease, caused by the fungus *Phoma lingam*, is a major concern in areas involved with cole crop production because the pathogen can infect a variety of cole crops.

Symptoms. Plants may become infected in the seedbed or in the field anytime during the growing season. Usually the first symptom is a circular depressed canker that develops at the base of the stem, enlarging and eventually surrounding the entire stem (Fig. 2). Yellow spots with gray centers appear on the foliage. The infected tissue on both stem and leaves is marked with small dots. These black dots are fungal structures and indicate the presence of the pathogen. Severely infected plants usually topple over as the pathogen destroys the supportive stem tissue.

Disease cycle. The fungus overwinters in the soil on old infected plant debris for at least three seasons. When infected seed is planted, the fungus infects the seedling and produces spores which, in turn, are disseminated to other plants. Rain and surface drainage water spread the pathogen. The disease can spread very rapidly even though only a few plants may be infected.

Control. The methods needed to control black leg (fungus) are the same as those described for black rot (bacteria) control. These control measures include (1) planting western-grown seed, (2) hot water seed treatment, (3) fungicide seed treatment, (4) seedbed sanitation, (5) plant inspection, and (6) crop rotation for at least 3 to 4 years.

CLUB ROOT—This important cole crop disease is caused by the fungus *Plasmodiophora brassicae*.

Symptoms. Often disease development on the roots of affected plants can be extensive before above-ground portions show any symptoms. Leaves on infected plants turn yellow, wilt, and die. Plants infected later in the growing season usually fail to produce a marketable product. Infected roots enlarge, become distorted, and resemble clubs, hence the name.

Disease cycle. The fungus gains entrance into the plant by attaching to the root hairs. As the fungus begins to develop in the roots, it produces spores. These spores are released and can be disseminated by drainage water, infested soil, etc. Acid soils and cool wet weather favor pathogen development. The disease is not seed borne.

Control. Location of the seedbed is very important in club root control. To avoid local and wide-spread distribution of the pathogen, plant in disease-free soil or where no disease has been found. Hydrated lime incorporated into the soil to raise the pH to 7.2 reduces club root. The application of lime on muck soils is of little value because of the high buffering capacity. Club root can be reduced by adding Terraclor 75 WP to the transplant water, used at 1/2 or 3/4 pint per plant. These control programs should be coupled with a long crop rotation.

ALTERNARIA—It is caused by the fungus *Alternaria brassicae*. This disease is widespread and affects all cole crops.

Symptoms. On seedlings, symptoms appear as small dark spots on the stems which eventually cause the seedling to topple over. Symptoms on the foliage also appear as small dark spots which enlarge rapidly. Within these infected areas, large masses of dark spores are produced. The pathogen also may attack the heads of cauliflower and broccoli rendering them nonmarketable. The disease is also a problem in storage of cole crops.

Disease cycle. The pathogen can overwinter on old infected plant debris and also can be carried in the seed. The fungus produces masses of spores which are easily disseminated by wind, rain, equipment, etc. Warm moist weather conditions favor disease development.

Control. Since the pathogen is carried in the seed, hot water seed treatment (see Black Rot section) is an effective control measure. Application of fungicides such as Maneb (80 percent WP) or Bravo 6F will help control this disease. Begin fungicide application at the first sign of disease and repeat every 7-10 days.

DOWNY MILDEW—This disease, which affects all cole crops, is caused by the fungus *Peronospora parasitica*. Plants may become infected during any stage of growth, but usually the disease is more of a problem on early-seeded plant beds or on late-maturing crops.

Symptoms. Infection usually takes place on the under side of lower leaves where the fungus produces a white fluffy growth which indicates the presence of the pathogen. As disease development progresses, yellow spots which later turn to tan develop on the upper leaf surface.

When the pathogen attacks cabbage heads, symptoms appear as small dark sunken spots. Similar symptoms can be observed on curds of cauliflower and broccoli.

Disease cycle. The fungus overwinters on old crop debris. The pathogen produces masses of spores which can be disseminated by wind, rain, etc. Cool moist weather conditions favor disease development.

Control. Bravo 6F or Maneb 80 percent WP plus a spreader-sticker will provide good control of downy mildew. Begin application at the first signs of disease and repeat every 7 days.

The information given in this publication is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Minnesota Agricultural Extension Service is implied.