CLUB-ROOT OF CABBAGE

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Nearly all cultivated crops that belong to the crucifer family are susceptible to club-root. Common mustard and cabbage are susceptible to the disease, but winter cress is immune.

SYMPTOMS: The disease is caused by a fungus that gains entrance through root hairs and injured roots. After causing the roots to swell, the fungus transforms into a mass of spores which are released into the soil upon decay of the host tissue.

Infected plants have yellowish, sickly leaves or green leaves that wilt on hot days, and young plants may die and older ones fail to produce marketable heads. Roots of such plants are much enlarged and malformed. The malformations vary in size from very small swellings on smaller roots and rootlets to large club masses that later turn black, decay and give off disagreeable odors (Figure 1).

SURVIVAL AND SPREAD OF THE FUNGUS: The spores of the fungus are spread in infested soil or soil water. They are not, however, carried on or in the seed. The organism can remain viable in the soil for a period of at least seven years.

Wet, cool, and acid soils are favorable to club-root. The optimum temperature for germination of spores and disease development is between 64°F and 77°F. Infection can occur, however, when temperatures are as low as 54°F or as high as 81°F.

CONTROL: The eradication of weeds that belong to the mustard family is important. Other cultural factors that aid in control are providing and maintaining well-drained soil, long crop rotation, the application of lime to fields, and avoiding the use of club-root infested soil for plant beds.

The most important step is the location of the plant bed in an area where diseased cabbage has not been grown, and where infested soil cannot wash over it. The application of lime to an infected seed bed will hide the presence of the disease and

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infected plants will develop disease symptoms when they are set into an acid soil in the field. **DO NOT USE CABBAGE TRANSPLANTS CONTAINING ANY CLUB-ROOTED SEEDLINGS.**

**LIMING FIELDS:** If cabbage is to be planted in a field known to be infested with club-root, the soil should be limed to pH 7 to 7.2 at least 6 weeks prior to planting. Hydrated lime appears to be more effective in reducing the severity of club-root than is ground limestone. It has been suggested that fields should receive 1500 pounds per acre of hydrated lime. The correct amount of lime to use can only be determined by a soil test. This service is available from your county extension agent. If additional lime is required, finely ground limestone, which is usually cheaper than hydrated lime and is less caustic to the skin and eyes, should be used.

**ROTATION:** When the fungus is known to be present in the field, the rotations should be sufficiently long so that previously applied lime will have had time to dissipate before additional lime is applied. Each time cabbage is planted in the rotation, hydrated lime should be applied. Its application to previous crops is apparently not as effective in reducing the incidence of club-root in cabbage.

**FUNGICIDE:** The use of PCNB (Terraclor 75% WP) at the rate of 6 lbs in 100 gallons of water applied in the transplant water is recommended. Approximately 1/3 pint should be applied per plant. This treatment is not registered for use on turnips, collards and kale.

**RESISTANCE:** Resistant to club-root is important not only in the crucifers that are grown, but also in the non-cruciferous crops and weed hosts that might carry the fungus over indefinitely after it once is introduced into a field.

The host plants are divided roughly into the following four classes according to their susceptibility to club-root:

- **MOST SUSCEPTIBLE:** Cabbage, Chinese cabbage, brussell sprouts.
- **MEDIUM SUSCEPTIBLE:** Rape, black mustard, some turnip and radish varieties.
- **VERY RESISTANT:** Winter cress, horse-radish, shepherd's purse, garden cress, and some radishes.

**RESISTANT CABBAGE VARIETIES:** There are at least nine identified races of the club-root fungus. All races present in western Virginia have not been identified. It is possible that several different ones may exist in this area.