



# Extension FactSheet

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## Clubroot of Crucifers

Sally A. Miller, Randall C. Rowe, and Richard M. Riedel  
Department of Plant Pathology  
The Ohio State University

Clubroot is a world-wide problem in temperate climates in the production of cruciferous vegetables such as cabbage, broccoli, cauliflower, radishes, and turnips; and field crops such as mustard and rape. The disease was known as early as the 13th century in England where it was called “finger and toe” disease because of the shape of infected roots.

### Symptoms

The most striking symptom of clubroot is an abnormal enlargement of the root system with clubs often thickest at the center, tapering spindle-like towards the ends (Figure 1). In radishes, clubroot causes distorted swellings on the base of the bulb and along the tap root (Figure 2). In severe cases, entire plantings are destroyed. Clubroot-infected plants often wilt on sunny days and permanent wilting may accompany advanced decay of infected roots. Severe stunting may be evident if infection occurs early and the disease progresses rapidly. The malformed and greatly enlarged roots are the key symptom of this disease.

### Causal Organism

Clubroot is caused by the soil-borne fungus, *Plasmodiophora brassicae*, which only infects plants in the crucifer family (Figure 3). It infects susceptible host plants through root hairs. Once in the tissue, it stimulates abnormal growth of affected parts,

resulting in a swollen club. Infection is favored by excess soil moisture and low pH, although it can occur over a wide range of conditions. Once a plant is infected, numerous resistant spores of the fungus are produced in the “clubbed” tissues. As these tissues decay, spores are released into the soil where they can remain infectious for at least 10 years. Contaminated soil moved by wind or water can serve as a source of infestation of nearby fields causing outbreaks of disease in areas where susceptible crops are planted for the first time. Numerous races of the pathogen have been identified.

### Management

Clubroot is a very difficult disease to manage, and heavily infested areas may have to be abandoned for crucifer production. Some control may be achieved with the following measures:

1. A good crop rotation program, growing crucifers on the same soil no more than every third or fourth year, is essential to retard development of a large population of spores on land not already heavily infested.
2. Since clubroot is favored by a low pH, liming soil to pH 7.2 or above may be helpful. Raising soil pH too high, however, may interfere with the growth of succeeding crops other than crucifers. Calcitic lime is usually preferable to dolomitic lime, except for soils low in magnesium, where dolomitic lime is



Figure 1. Clubroot symptoms on mustard.

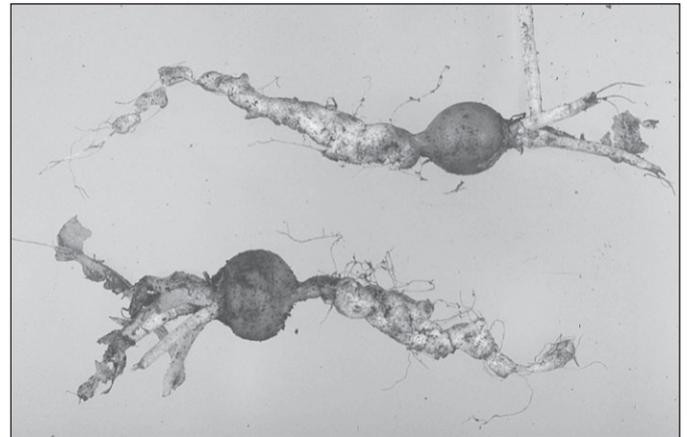
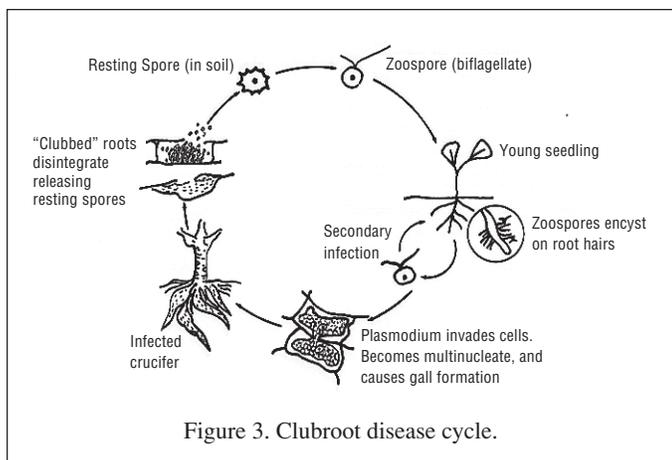


Figure 2. Clubroot symptoms on radish.



- more effective. In course-textured soils, increasing the pH can result in boron deficiency. This may be alleviated by application of boron in transplant water or as a foliar spray.
3. With transplanted crops, the use of pathogen-free seedbeds and uninfected plants is essential to prevent introduction of the disease.
  4. Application of a fungicide in transplant water or rototilled in a band prior to planting may help to reduce disease development. See the Ohio Vegetable Production Guide (OSU Extension Bulletin 672) for current fungicide recommendations.
  5. Clean and disinfect all machinery before moving it from infested to non-infested land.
  6. Some resistant cultivars are available. However, plant resistance has not been very useful in clubroot control because of rapid development of new races of the fungus.

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Keith L. Smith, Associate Vice President for Ag. Adm. and Director, OSU Extension

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