



Clubroot of Cabbage: *Plasmodiophora brassicae*

Introduction

Clubroot is a very serious disease of cabbage and closely related crops. The most susceptible crops include cabbage, Chinese cabbage, Brussels sprouts and some cultivars of turnip. Other related crops that may also be attacked include kohlrabi, kale, cauliflower, collards, broccoli, rutabaga, sea kale, all turnips, and radishes. Weeds in the mustard family may be infected and result in enhanced disease problems on the susceptible crops.



Figure 1: Clubroot symptom on cabbage.

Symptoms and Signs

The symptoms first noticed will be a decline of the plant including yellowing of leaves, and a tendency to wilt during hot days. Examination of the roots will reveal swollen, club-shaped roots instead of the normal fine network of roots (Fig. 1). In severe cases most roots will be affected (Fig. 2). The swollen roots will begin to decay and eventually disintegrate.

Slightly infected plants may show few symptoms above ground other than slow growth and will have very small knots on roots. Young infected plants may not show severe enough symptoms to be detected.



Figure 2: Close-up of the club shaped roots.

Disease Cycle

Clubroot is caused by the fungus *Plasmodiophora brassicae*. The important features of its life history include its longevity in soil, means of spread, and its reaction to soil pH. After the disease has occurred, the fungus can survive from seven to ten years without any susceptible plant ever being grown there. If any susceptible crops or weeds grow during this period, the fungus may become more prevalent.

Since the fungus survives in soil and in dead crop debris, any movement of these may result in transfer of the fungus to a new site. Therefore, usually all of a small garden will be affected once the disease has become noticeable. Resting spores of the fungus are produced in the swollen clubroots and released into the soil when these disintegrate.

Management Strategies

There are several approaches to managing clubroot, all of which may be used when appropriate. The first defense should be aimed at excluding the disease. Avoid purchasing infected transplants. Buy only from reputable garden store or grower as infected transplants cannot always be identified. It is safe to grow your own transplants because the fungus is not carried on the seed. If transplants are to be grown, care must be taken to use clean or sterile soil mixes for the seed bed.

Do not move plants or soil from one garden to another garden. This invites trouble unless it can be positively determined that no clubroot has occurred in a garden. Be sure to clean shoes and tools

thoroughly before working in a garden. Control weeds to avoid potential build-up of the disease on them.

If infected plants have occurred in a garden, liming may reduce or completely control the disease. The pH of the soil should be raised to 7.2 or higher with hydrated lime. TABLE 1 on the following page shows how much to use for measured pH levels. Soil pH testing is available at some local Cooperative Extension office and garden stores. Use at least 4 pounds per 100 square feet (9.3 square meter) of hydrated lime if the pH is below 8. The additional lime needed may be in the form of limestone or air slaked lime, but these alone will not completely eradicate the disease. Also liming will not be very effective on light sandy or muck soils, but will give excellent control on heavier soils. Some other crops will be injured if grown on soil with such a high pH. Adjustment may be necessary before another crop is grown. Do not grow cabbage for more that one year in a row where heavy liming is required; the accumulated lime will be difficult to counteract for other crops.

TABLE 1:

Amount of lime to apply for clubroot control.

pH	Amount of lime to apply:	
5.0	12 per 100 sq ft	1250 per 1/4 acre
5.5	10 per 100 sq ft	1000 per 1/4 acre
6.0	7 per 100 sq ft	750 per 1/4 acre
6.5	5 per 100 sq ft	500 per 1/4 acre
7.0	4 per 100 sq ft	375 per 1/4 acre
7.5	4 per 100 sq ft	375 per 1/4 acre
8.0	none	none

There are currently no home garden products registered in New York to help manage this disease. Although resistant cultivars of cabbage are not readily available there is at least one, Badger Shipper, that has a fair amount of resistance. In some situations this cultivar may solve the management problems. Resistant turnips, radish and rutabaga varieties are also available.

References:

Clubroot of Crucifers, T.A. Zitter, Vegetable MD Online. http://vegetablemdonline.ppath.cornell.edu/factsheets/Crucifers_Clubroot.htm.

Compendium of Brassica Diseases, APS Press.

Vegetable Diseases: A Colour Handbook, S.T. Koike, P. Gladders, and A.O. Paulus. Academic Press.

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READ THE LABEL BEFORE APPLYING ANY PESTICIDE! Changes in pesticide regulations occur constantly. All pesticides distributed, sold, and/or applied in New York State must be registered with the New York State Department of Environmental Conservation (DEC). Questions concerning the legality and/or registration status for pesticide use in New York State should be directed to the appropriate Cornell Cooperative Extension Specialist or your regional DEC office.

The Plant Disease Diagnostic Clinic

Phone: 607-255-7850

Fax: 607-255-4471

Email: kls13@cornell.edu or slj2@cornell.edu

Web: plantclinic.cornell.edu

