



AGRI MAGAZINE

(International E-Magazine for Agricultural Articles)

Volume: 02, Issue: 12 (December, 2025)

Available online at <http://www.agrimagazine.in>

© Agri Magazine, ISSN: 3048-8656

Clubroot Disease of Cabbage

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Clubroot is a serious soil-borne disease that affects cabbage and other cruciferous (Brassicaceae) crops such as cauliflower, broccoli, kale and radish. It is caused by the obligate parasite *Plasmodiophora brassicae*, which belongs to a group of organisms known as protists, not true fungi. The pathogen invades the root system of the host plant, causing the formation of swollen, deformed roots known as “clubs.” It causes significant yield losses by affecting root development, resulting in stunted and unmarketable plants. One of the major challenges with clubroot is its long persistence in soil—the resting spores can survive in the soil for up to 20 years, making the disease very difficult to eradicate once introduced.

Disease Symptoms

(1) Above-ground symptoms

- Infected plants are shorter and less vigorous than healthy plants.
- Leaves may droop and wilt during hot, dry periods, only to recover when the conditions become wetter.
- Leaves may turn yellowish due to the plant's inability to absorb nutrients and water.
- In some cases, the leaves may also turn purple or reddish.
- Plants may recover partially at night but deteriorate over time.
- Premature plant death in severe cases.



Cabbage plants wilting from infection by club root



Galls on the roots typical of infection by club root

(2) Below-ground symptoms

- The most distinctive symptom is the formation of small, spindle-like swellings to larger, more distorted structures.
- The disease also leads to the loss of smaller roots and root hairs, which are essential for water and nutrient uptake.
- The presence of the galls blocks the normal absorption of water and essential nutrients from the soil, severely impacting the plant's health and productivity.
- Root galls vary in size and become brown and rotten as they age.

Favorable Environmental Conditions

- **Soil pH:** Acidic soils (pH below 6.5) significantly favor the disease.
- High soil moisture and poor drainage promote the infection.
- **Soil temperature:** Warm temperatures (18°C to 25°C) are ideal for disease development.

Disease Cycle

- The pathogen survives in soil as resting spores for many years.
- Germinate the resting spores in moist soil and release zoospores.
- Zoospores infect root hairs, where the pathogen multiplies.
- Secondary infection: The pathogen invades cortical tissues and leading to gall formation.
- Reproduction: Inside the galls, new resting spores are formed and released into the soil as galls decay.

Disease Management

(1) Cultural Practices

- **Crop rotation:** Rotate with non-host crops (e.g., cereals, legumes) for 5–7 years.
- **Soil liming:** Raise soil pH to above 7.2 using lime (calcium carbonate) to inhibit spore germination.
- Providing improved drainage conditions can protect crops from disease up to certain extent.
- **Sanitation:** Remove and destroy infected plant material.

(2) Biological Control

- Biocontrol agents like *Trichoderma spp.* and *Bacillus spp.* may help suppress the pathogen, but efficacy in the field is variable.

(3) Chemical Control

- **Soil treatment:** Application of fungicides like fluazinam or cyazofamid.