

Brassica Diseases
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There are several diseases that infect brassicas, including both foliar and soil borne pathogens. Foliar pathogens, especially fungi, were very prevalent this past summer as a result of the wet cool growing season.

Alternaria leafspot and headrot (*Alternaria brassicae* and *A. brassicicola*) is caused by fungi that like high humidity and wet foliage. The pathogens cause a target shaped spot with concentric rings on lower foliage first. The disease can spread by wind and splashing rain and cause defoliation and spotting on heads making them more vulnerable to further rot. The fungi can be seed borne but crops are usually infected from spores in crop debris. Best management options are 3 year rotations out of brassicas (and brassica weeds) and seed treatment with hot water. For cabbage and Brussels sprouts soak seeds for 25 minutes in 122 degrees F water. For Chinese cabbage, broccoli and cauliflower soak for 20 minutes. Exact time and temperature is essential. Cultivar differences also exist for susceptibility. Overhead irrigation should not be used. Current fungicide recommendations are in the NE Vegetable Management Guide. Copper compounds are labeled for organic production but have not been effective in recent studies.

Downy mildew (*Peronospora parasitica*) can infect most brassicas but is not the same downy mildew that infects cucurbits. The fungus is favored by cool moist conditions from rain, dews or fogs common in late summer and fall in NE. Infection can occur at any growth stage. Severe infections can kill seedlings but most losses occur from leaf and head infections that cause crop damage and loss at later stages. Symptoms appear as irregular angular yellow to brown spots on the top and undersides of the leaves. In broccoli infected areas on the leaves enlarge and turn tan and papery under moist conditions. The diagnostic feature of the disease for all brassicas is grayish white, fluffy growth on the undersides of leaves.

On the heads of broccoli or cauliflower, dark brown areas develop in flower buds of the head. Stems and stalks of the flower head may be darkened or have black streaks, and this may be the first sign of infection in broccoli. In cabbage, internal darkening and purplish spots appear in the inner layers of the head or move upward in the head from stem infections. Secondary infection with soft rot bacteria (causing major stink!) may follow the downy mildew. In cabbage, systemic invasion of the stem may occur after infection of the lower leaves. The fungus may then invade the head leaves and sporulate after the cabbage has been stored.

Spores overwinter in the soil and on infected crop debris. Three year rotation out of brassicas and brassica weeds is the best management. Till under crop debris and use adequate crop spacing to encourage drying of leaves to avoid downy mildew. Control in the seed-bed is very important and includes the use of clean growing medium, good drainage, and an avoidance of overhead irrigation. Resistant or tolerant varieties of broccoli have been developed. For current fungicide recommendations see the NE Vegetable Management Guide. Preventive spraying of protectant foliar fungicides may be necessary if environmental conditions favor disease development. For organic growers, potassium bicarbonate can be effective if applied at the first sign of disease and continue at 7-14 day intervals while conditions remain favorable for disease development. Copper hydroxide may be used for cabbage only.

Black rot (*Xanthomonas campestris* pv. *Campestris*) is the most destructive disease of brassicas. This disease is caused by a bacterium causing V shaped yellow or brown lesions or patches along the margins of leaves. As the lesions expand, the small veins become blackened. Infected plants may die prematurely, heads may remain small and quality may be reduced. Plants can become infected at any growth stage. If brassica seeds are infected with the disease, young seedlings become yellow, drop lower leaves and may die. These symptoms can look like nutritional deficiencies or root rots. The bacteria can also infect plants by entering leaves through the hydathodes (natural openings) on the leaf edges, resulting in the typical V shaped lesion on the leaf margin. Bacteria can also enter leaves through wounds caused by insect feeding. Black rot spreads rapidly during warm, humid weather with an optimal range of 80-86 degrees F and 80-100% humidity.

Managing this disease requires an integrated approach. Use hot water treated seed from your seed dealer or do it yourself by placing seed loosely in a cheesecloth bag, immersing and soaking in hot (122 degrees F) water for 20 minutes for broccoli and cauliflower and 25 minutes for cabbage and Brussels sprouts. Immediately immerse seed in cold water then spread in a thin layer to dry. Although this will not totally eliminate the bacteria, it will greatly reduce bacteria in seeds. Hot water treatment may affect vigor and viability of seed so test seed after treatment. Inspect brassica transplants and destroy any that have symptoms before moving to the field. Eliminate brassica weeds and volunteers. Avoid working in wet fields. Destroy crop debris after harvest, avoid overhead irrigation and use a 3 year rotation out of brassicas. Consult NE Vegetable Management Guide for spray recommendations.

Club root (*Plasmodiophora brassicae*) of cabbage is caused by a soil borne fungus. The first symptoms of the disease may appear as poor vigor in the stand, wilting during hot or dry weather or yellowing of foliage. When infection occurs at an early stage of growth, young plants are stunted and may die. Plants infected later in the season may fail to make marketable heads or growth. When entire plants are examined, the roots are swollen and distorted or “clubbed.” The clubbing reduces the plant's ability to take up water and can make the roots more susceptible to invasion by soft rotting bacteria. The pathogen can survive in soils for 7-10 years or longer. Infested soils with the resting spores of the fungus can be moved around the farm by machinery, people, infected transplants, water, tools and animals. The disease is restricted mainly to members of the mustard family, both cultivated and weeds, and to a few other plants. Although clubbing symptoms are unique to members of the Cruciferae, *P. brassicae* is capable of infecting the root hairs of the noncruciferous hosts including some grasses and other plant families. Because of the existence of races in this organism, plants can respond to attack on different levels. Preventing clubroot introduction into a field is the best management option. Inspect transplants before planting in the field. Maintain soil at pH of 6.8. Apply 1,500 lbs of hydrated lime 6 weeks before planting to raise pH to 7.2 or more. A 4 year rotation is recommended for brassicas. If clubroot is detected, increase to a 7 year rotation. Some resistant cultivars are available. For fungicide soil drench info, consult the NE Vegetable Management Guide.