Diseases of Sugar beet

Fungal diseases	
Alternaria leaf spot	*Alternaria alternata* *Alternaria brassicae*
Anthracnose	*Colletotrichum dematium*
Aphanomyces root rot (black root)	*Aphanomyces cochlioides*
Cercospora leaf spot	*Cercospora beticola*
Damping-off, black leg, black root and seedling blight	*Aphanomyces cochlioides* *Fusarium* spp. *Phoma betae* *Pythium* spp. *Rhizoctonia solani*
Fusarium yellows and root rot	*Fusarium oxysporum* f.sp. *betae*
Phoma leaf spot and root rot	*Phoma betae*
Phytophthora root rot	*Phytophthora drechsleri*
Pythium root rot	*Pythium aphanidermatum*
Rhizoctonia foliar blight, crown and root rot	*Rhizoctonia solani*
Rust	*Uromyces betae*
Sclerotinia crown & root rot	*Sclerotinia sclerotiorum*
Southern blight (Sclerotium root rot and stem rot)	*Sclerotium rolfsii* *Athelia rolfsii* [teleomorph]
Bacterial diseases	
Bacteral blight	*Pseudomonas syringae* pv. *aptata*
Bacterial pocket	*Xanthomonas beticola*
Bacterial soft rot	*Erwinia carotovora* subsp. *carotovora*
Crown gall	*Agrobacterium tumefaciens*
Nemic diseases	
Lesion nematodes	*Pratylenchus spp.*
Root-knot	*Meloidogyne spp.*
Viral diseases	
Beet curly top	*Beet curly top virus* (BCTV)
Beet leaf curl	*Beet leaf curl virus* (BCLV)

Seedling Diseases:
The most common disease of sugar beet seedlings are caused by the fungi *Pythium*, *Fusarium*, *Phoma*, *Phytophthora*, *Rhizoctonia* and *Sclerotium* etc. Seedling diseases are worse during years when rain occurs shortly after planting, resulting in wet-soil conditions. Use of high quality seed, fungicide seed treatment with Apron® and Thiram®, and a high plant population (47,000 plants per acre is suggested) have reduced losses from seedling diseases.

Symptoms:
Symptoms consist of poor seedling emergence and/or death of emerged seedlings. Diseased seedlings that survive are usually stunted and unhealthy in appearance. Seedlings attacked by *Pythium* are usually killed prior to emergence. However, if environmental conditions are not favorable for these fungi until after seedlings have emerged, postemergence damping-off may occur. Seedlings infected with *Rhizoctonia* are pinched-off at or near the soil line with infected tissue turning black. Many of these seedlings can be broken off with wind. Seedlings infected with *Fusarium* usually turn chlorotic (yellow), while leaf tips turn brown and curl downward

Pathogen biology:
The genus and species of these fungi are *Rhizoctonia solani*, *Pythium ultimum*, *Fusarium oxysporium* f. sp. *betae*, *Phoma betae*, *Phytophthora drechsleri*, and *Aphanomyces cochlioides*. The organisms that cause seedling diseases are all fungi and survive in the soil for several years following the sugar beet crop. Each can be transmitted in soil peds (round balls of soil similar in size and weight to seed) which contaminate seed lots. *Phoma* and possibly *Fusarium* are transmitted by infected seed. *Fusarium* and *Rhizoctonia* both survive in the soil as dormant structures for several years, and they are able to grow saprophytically on organic debris. While all three may grow and infect seedlings under conditions in which the sugar beet will grow, *Pythium*, *Aphanomyces*, and *Phytophthora* all favor very wet conditions. All of these fungi can attack seedlings at soil temperatures above 68 degrees Fahrenheit. *Phoma* prefers the coolest conditions (61 to 68 degrees Fahrenheit), while *Phytophthora* and *Aphanomyces* prefer the warmest (83 to 88 degrees Fahrenheit).

Control
1. Use high-quality, fungicide-treated seed
2. Proper seeding depth. Fields should be worked in such a manner as to reduce the amount of large clods so seed can be planted shallow, ¾- to 1-inch deep.
3. Crop rotation and Resistance variety should be used.

Phoma Leaf Spot

Symptoms:
Phoma leaf spot causes large circular spots on leaves. Each spot has a concentric ring of dark brown to black spore bearing pycnidia. The outside of this ring is dark brown while the center is a lighter brown with a small central raised area.

Pathogen biology
Phoma leaf spot is caused by the fungus *Phoma betae*. The fungus is seed-borne. Infected seed may die prior to emergence or may emerge but remain stunted and unproductive. Spores, produced in round black pycnidia on these diseased seedlings, later infect leaves. A sexual spore stage (*Pleospora betae*) is formed in the autumn under spots on leaves. Spore-producing structures, called perithecia, contain ascospores which appear similar to the pycnidia on the upper leaf surface. Prior to harvest, spores from diseased leaves may infect the crown and upper root of the sugar beet plant and result in an upper root rot and storage rot of sugar beets after harvest. In field soil, the fungus can survive in infected plant debris for up to two years. The disease is most severe during periods of high humidity and temperature (range of 58 degrees Fahrenheit to 90 degrees Fahrenheit, optimum of 68 degrees Fahrenheit).

Control:
The disease has primarily been controlled by improved seed-cleaning methods and fungicide seed treatments. Crop rotation for two or more years is necessary to allow sufficient time for infected leaf debris to decompose. During years when the disease is severe, one application to the foliage with a systemic fungicide such as Benlate®, applied with a ground-operated sprayer, may be economical.

Root and Crown Rots:
The two most common fungal diseases of sugar beet roots and crowns are *Rhizoctonia* root and crown rot and *Phytophthora* root rot. While *Rhizoctonia* attacks the upper taproot, crown, and lower stems, *Phytophthora* primarily attacks the lower taproot. Both will attack seedlings. *Rhizoctonia* is by far the most widespread.

Symptoms:
Rhizoctonia causes the collapse and death of plants from shortly after seeding until harvest. Younger plants tend to dry up and collapse. Diseased plants have a dry, dark brown to black rot of the root with brown tufts of fungus sometimes present. After irrigation, the fungus infects the base of leaf petioles and eventually the crown, killing the plant. Rotted basal petioles and crown tissue are black in color. When removed, crowns and upper roots of older beets have a black rot and many diseased plants have a large crack in the upper root containing large amounts of brown fungal growth. Other plants may have only the root-rot phase of the disease, and above-ground portions of the plant may appear healthy. However, plants with severely rotted roots will show symptoms of wilting. Extensive plant mortality may occur. After plants are killed, leaves turn a light brown in color and dry up.

Pathogen biology:
Rhizoctonia is widespread in agricultural soils throughout the world, attacking many crops and weeds. It produces dry, hard, compacted masses of fungal mycelium called “sclerotia” which aid the fungus in survival and spread. *Rhizoctonia* can also survive as a saprophyte feeding on dead and decaying plant debris. *Rhizoctonia* is favored by warm temperatures (77 to 91 degrees Fahrenheit).

Control:
1. Rotation. Rotating out of sugar beets for five or more years will reduce damage from most soil-borne fungal disease, including *Rhizoctonia* root and crown rot.
2. Crop residue management. Incorporation of small grain residue in combination with liquid fertilizers, which speed up the breakdown of the straw, increases soil populations of microorganisms that are antagonistic to root-rotting fungi such as *Rhizoctonia* (Davey and Papvizas, 1960).
3. Weed control. Control of pigweed (susceptible to *Rhizoctonia*), particularly during rotation crops, should reduce soil population of *Rhizoctonia*.
4. Resistant variety. If *Rhizoctonia* is the dominant disease in a field, a variety with resistance to *Rhizoctonia* should be selected for planting.
5. Tillage practices. In fields with a history of *Rhizoctonia*, plow sweeps should be adjusted and tractor speeds reduced during the lay by tillage and ditching operations.
6. Fungicide treatment.

Phytophthora root rot

Symptoms:
Phytophthora causes a collapse and death of plants from shortly after seeding until harvest. Although root rot may encompass the majority of the root tissue of younger plants, it usually is confined to the lower portion of the tap root of older plants. When plants are removed, soil tends to adhere to the rotted portions of the root. In some cases, the bottom end of the rotted root appears frayed. If the root is cut open, rotted tissue is a brownish-orange in contrast to the white healthy tissue. Above-ground symptoms consist of midday wilting. Diseased plants are usually stunted with leaves turning either chlorotic or necrotic (brown), but many diseased plants remain alive until harvest. This disease is worse in fields having a high clay content of 25 percent or more, poor drainage, or a high water table.

Pathogen biology:
Phytophthora drechsleri is a water mold, producing the infective, mobile zoospores only when free water is present in the soil. Zoospores swim to the root surface and initiate infection. The fungus survives for several years as thick-walled, round oospores. Optimum temperature for growth of this fungus is 82 to 88 degrees Fahrenheit.

Control:
Once a field is infested, *Phytophthora* root rot is difficult to control. Losses can be reduced through practices that prevent prolonged exposure of the sugar beet crop to high levels of soil moisture such as providing adequate field drainage, preventing excessive seepage from irrigation pipes or ditches, subsoil plowing, sprinkler irrigation of problem fields, planting sugar beets in raised beds, and laser leveling of fields to remove low spots.

Fusarium yellows

Symptoms:
Plants can be affected from the seedling stage until harvest. The majority of plant death appears to occur when plants are in the seedling stage to the four-leaf stage of growth. Infected plants turn chlorotic and die rapidly. Dead plants are a light brown in color, and many remain visible until harvest. Although diseased plants may be scattered throughout a field, most occur in localized areas. If fields are visited in mid-season, plants with Fusarium yellows vary in size and stage of disease development. Many plants that are infected when young are usually stunted and show severe symptoms of interveinal chlorosis and marginal leaf browning. Plants infected later in the season will be larger in size and usually show very mild symptoms, consisting only of minor interveinal chlorosis. When plants are removed and roots are sliced in cross section, many show a yellow-brown to gray discoloration of the water-conducting, vascular tissues. Some severely diseased plants have a dry rot of the very lower portion of the tap root.

Pathogen biology:
The disease is caused by the fungus *Fusarium oxysporus* f. sp. *betae*. It is a soil inhabitant, surviving as microscopic chlamydospores which germinate and infect the sugar beet root under favorable conditions. It invades the water-conducting tissues of the root and grows upward into the leaf petioles. In seed production fields, this fungus may invade the seed stalks where it can become seed borne. Optimum conditions for infection are around 80 degrees Fahrenheit.

Control:
1. Rotation. Although crop rotation will not eliminate this disease, rotation for three to five years with other crops grown in the basin should reduce sugar beet loss from Fusarium yellows.
2. Early planting. Planting when soil temperatures are cool should reduce the severity of the disease.
3. Soil fumigation. Soil fumigation with Telone®II is effective in suppressing Fusarium yellows in sugar beets.
4. Resistant varieties. The use of host resistance may be the best means of managing Fusarium yellows.
5. Seed treatment. Current seed treatments offer only limited protection to sugar beet seedlings.
7. Weed control. Good weed control for alternate host plants of Fusarium yellows, such as pigweed, will aid in the overall control of the disease.

Beet Curly Top Virus

Symptoms

Depending on sugar beet leafhopper migration, sugar beet plants can be infected with the virus at all growth stages. Younger plants and seedlings are more susceptible than older plants. Early stages of the disease consist of plant exudates appearing on leaves and leaf petioles which eventually turn brown to black in color. Mild symptoms include stunted leaves which are smaller than normal, crinkled, and rolled upward and inward. Leaf veins are roughened on the underside of the leaf and often have small, spine-like protruding. Roots may be stunted and malformed. Proliferation of feeder roots, referred to as hairy root, may occur. When roots are cross sectioned, the vascular tissue is discolored showing yellow to brown concentric rings. More severe symptoms consist of chlorosis and necrosis of the plant crown and eventual death of the sugar beet plant.

Pathogen biology:

BCTV has an extensive host range of more than 300 plants species in 44 families. The virus can only be spread by the beet leafhopper. Beet leafhoppers are very active in the early season prior to canopy formation when overlapping leaves between rows occurs. Once the plant canopy has formed, hopper activity is reduced due to shading and increased humidity. In addition to the sugar beet plant, flax, tomato, and beans are also hosts. Several weeds serve as hosts for the virus as well.

Control:

Control of the BCTV consists of the combination of host resistance, controlling weed hosts, insect vector control, and cultural practices. Both early planting and protection of seedlings with soil-applied insecticides provide early season control when the sugar beet plant is the most susceptible.