

Pesticide Certification Information

9

**DISEASES
OF
SOYBEANS**

**WEST VIRGINIA UNIVERSITY
EXTENSION SERVICE
AN EQUAL OPPORTUNITY/
AFFIRMATIVE ACTION INSTITUTION**

DISEASES OF SOYBEANS

SEED QUALITY

Low seed quality can be caused by physical, physiological, or pathological factors, and can make the seed more susceptible to damage by damping-off fungi. (Damping-off is the rotting of seeds or seedlings shortly before or after germination.) The longer a soybean seed stays in the soil without germinating, the longer it is exposed to infection by damping-off fungi that will ultimately rot the seed.

Mechanical damage may fracture the seed coat, allowing penetration by soil or seedborne fungi. Then the seed decays in the soil, frequently before germination.

Seed size substantially below average for a variety can cause reduced stand and seedling performance. Small seeds tend to be hard to take up less water. Such seeds germinate more slowly than normal-sized seed and have reduced seedling growth.

Physiologically, seed quality may be lowered by storage conditions. Prolonged storage or storage of high-moisture seed at high temperatures can reduce seedling vigor as well as stand. Storage conditions have a greater effect on seed quality than does the storage time. Soybeans stored at more than 14 percent moisture content will deteriorate rapidly even under good storage conditions; soybeans containing 8 to 10 percent moisture will maintain quality under even less than ideal temperatures. The germination percentage of deteriorated soybeans may not decrease, even though the overall vigor of the seed may have dropped to an extent that would render it unsuitable for planting.

FUNGUS DISEASES

PYTHIUM ROT

Pythium rot is a fungus disease that may occur on soybeans at any time from seedling stage to end of flowering.

Symptoms: Seeds that do not germinate tend to be soft and overgrown with bacteria and fungi. Seedlings that emerge are blighted and often have well developed cotyledons but no plumule from which the main stem normally develops. This condition is called "baldhead". Often the cotyledons will have necrotic spots. Losses from these phases of pythium rot are greatest when seeds used for planting are weak or low in vigor.

In the early infection of older plants, the stem above the soil line has a water-soaked appearance. As the disease develops, this tissue becomes brown and sloughs off, giving the stem a shredded appearance. The outer tissues of the large roots are soft, brown, and moist, and also slough off easily. Roots are so badly rotted that most break off when pulled from the soil. Diseased plants stand singly or in small groups. The leaves have a wilted appearance, and eventually the whole plant dies.

Optimal Environmental Conditions: Pythium rot is favored by cold, wet soil early in the growing season or after a rainy period.

Control: Stand losses from seed rot and damping-off may be reduced by seed treatment with protectants, but in heavily infested soils, losses to older plants are likely to occur. The Pythium fungi attack many types of plants, making crop rotation of little value.

There is no resistant variety. Seed treatment protects against seed decay, particularly if the seed is at least 2 years old or if germination is less than 80 percent.

FUSARIUM ROOT ROT

Fusarium root rot is caused by a common soilborne fungus. Poor germination of infested plants results in either pre- or post-emergence damping-off or late emergence and stunted plants.

Symptoms: The fungus causes dark-brown lesions confined to roots and to the lower portions of stems. The latter symptom may be confused with Rhizoctonia root rot. Root systems of severely

infected plants may be completely destroyed. Wilting is more frequently observed on seedlings or young plants when roots are rotted and soil moisture is low. Older plants are seldom killed, but they wilt when soil moisture is low, and they recover turgidity at night or when moisture becomes adequate.

Optimal Environmental Conditions: Poor stands caused by the disease are usually associated with poor seed quality, heavy rains, soil compaction, or soil flooding after planting.

Control: Seedlings infected with the fungus and showing signs of wilting or death of lower leaves should not be cultivated, if possible, until adequate soil moisture is available. When plants are cultivated, soil should be ridged around the base of the plants. This will promote development of roots from the stem base above the diseased area. These roots are not as easily infected by the fungus, and they help the plants recover rapidly.

All varieties are susceptible, and rotation is of little value in disease control.

RHIZOCTONIA ROOT ROT

Rhizoctonia root rot of soybeans is caused by a soilborne fungus.

Symptoms: Wilting and dead plants are evidence of the disease. Typical symptoms are decay of lateral roots and localized reddish-brown lesions on the hypocotyl and lower stem. The lesions do not extend into the center of the root or stem. Infected stems remain firm and dry. The disease pattern may occur as dead individual plants or groups of plants in a row, or as circular areas distributed throughout a field.

Optimal Environmental Conditions: The disease infects young plants when the soil is wet early in the growing season. The first symptoms appear in the spring. Although the fungus usually becomes inactive after the middle of July, epidemics have occurred as late as September, especially during rainfall periods followed by cooling and subsequent warming. The wet, cool weather causes the fungus to become active, and the warm weather places a stress on the plant.

Control: Since root rot is caused by a common soil fungus capable of surviving in the absence of soybeans, rotation is of little value in controlling root rot. All presently grown varieties are susceptible.

PHYTOPHTHORA ROOT ROT

Phytophthora root rot is caused by a soilborne fungus that may attack the plant at any stage of development. It causes pre-emergence and post-emergence damping-off and also attacks older plants.

Symptoms: When older plants become diseased, the first symptoms are yellowing and wilting of leaves and a dark-brown discoloration of the stem that may extend from below the soil line up into the stem and branches. A common secondary fungus frequently invades Phytophthora-killed tissues and causes a white growth on the stem surface. The tap root of infected plants is usually dark brown, and the root system may be rotted. Even in the absence of obvious symptoms, plants may be reduced in vigor and become stunted, and yields may be reduced.

The disease pattern varies within a field. Frequently, it may be roughly circular, corresponding to the poorly drained areas, or it may occur as dead or dying individual plants or groups of plants in a row. Infected plants often may be found more easily in end rows than within a field.

Optimal Environmental Conditions: The disease is most common in low, poorly drained areas, but may appear on higher ground during wet seasons. Damage is usually more severe on heavy clay soils than on lighter soils. Older plants may become infected later in the growing season, even under dry conditions. Initial infection of lateral branches also may occur. In such cases, the fungus eventually grows into the stems and — since the roots may not be rotted — the disease may be confused with stem canker. The fungus survives from growing season to season in soil or

in crop refuse buried in soil.

Control: Several varieties are resistant to this disease.

BROWN STEM ROT

Brown stem rot is caused by a soilborne fungus. Infection of soybeans occurs through the roots and lower stem early in the growing season.

Symptoms: Since the diseased plant does not usually display outward symptoms, infection can be detected by splitting the lower six inches of the stem 10 to 30 days before the soybeans mature. Healthy stems have white tissue in the center; infected tissue is brown. The browning progresses upward in the stem during the growing season, moving most rapidly during cool weather. Warm weather suppresses the disease. Severely diseased plants may lodge.

Leaf symptoms are not ordinarily a reliable diagnostic tool, since they are uncommon and may be confused with other leaf disorders. Leaf symptoms develop when infected plants are subjected to high temperatures or drought stress following a period of cool weather. Tissue between the veins turns brown and dries rapidly, usually about 3 weeks before maturity, while tissue adjacent to the veins remains green a few days longer. Eventually the whole leaf dies.

Brown stem rot may cut yield by as much as 25 percent, if all plants in a field are infected.

Control: Growing soybeans following a crop of soybeans, alfalfa, or red clover may increase incidence of brown stem rot in a field.

The fungus survives from one growing season to the next in infected crop residue in the soil. With decomposition of infected residue the fungus cannot survive in the soil. Therefore, to control brown stem rot, soybeans should be rotated with crops other than alfalfa or red clover. Fields known to be infested with the fungus should not be planted to soybeans for at least three years. The end rows of corn fields should not be planted to soybeans.

STEM CANKER

Stem canker, caused by a fungus, usually appears after mid-July and continues until plant maturity.

Symptoms: An indication of the disease is the presence of dead plants with leaves still attached. Initially, the fungus causes a light brown, slightly sunken lesion at the base of a branch or leaf petiole on one side of a stem. The lesion eventually girdles the stem, and the upper part of the plant is killed. These lesions are usually found near the soil line, but they may occur higher on the stem. Symptoms of this disease may be confused with those associated with *Phytophthora* root rot.

Control: To control stem canker, plant seed from disease-free fields. Fall plowing of soybean fields to hasten decay of infested stubble is an effective disease-control practice, but it is not feasible because of severe soil erosion that may occur on land following soybeans.

POD AND STEM BLIGHT

Pod and stem blight is a fungus disease of stems and pods on plants nearing maturity.

Symptoms: Symptoms are small, black, fruiting fungus bodies on stems and pods. They are in rows on the stems, but are scattered on the pod. Frequently, seedlings grown from infected seed will damp-off soon after germination.

Optimal Environmental Conditions: Pod and stem blight is favored by periods of wet weather that enable the fungus spores to be produced and to spread infection to other plants. The disease is seedborne, and the fungus spores overwinter on infected refuse.

Control: Reasonable control can be achieved by plowing under crop refuse, planting seed from disease-free fields, and rotating crops.

BROWN SPOT

Brown spot is a fungus-caused disease which appears on the primary (first pair of) leaves in the spring.

Symptoms: Angular red to brown spots vary from the size of a pinpoint to 1/5 inch in diameter and are more pronounced on the under surface of leaves. Infected leaves become yellow and drop prematurely. As the plants grow, fungus spores produced on the primary leaves may spread and infect the trifoliolate leaves, stems, and pods. Defoliation of the plant occurs from the bottom-up, and the lower half of stems may be bare of leaves before the plants mature.

Optimal Environmental Conditions: Spores produced within the fruiting bodies of the fungus are discharged during warm, moist weather and start new infections on other plants. Areas with poor drainage favor spread of the disease.

Control: The fungus overwinters on infected crop residue in the field and is seedborne. Greatest disease incidence occurs when soybeans follow soybeans in the same field.

Control can be achieved by crop rotation and by keeping fields known to be infested with brown spot out of soybeans for at least a year. Soybeans from diseased fields should not be used for seed.

DOWNY MILDEW

Symptoms: Symptoms of the disease in the early stages are indefinite, yellow-green areas on the upper leaf. As infection progresses, the diseased areas become grayish brown to dark brown and are surrounded by yellow-green margins. Severely infected leaves fall prematurely. A gray fungus growth develops on the lower side of these diseased areas.

Fungus spores spread the disease from plant to plant. Spores develop within leaf tissue and overwinter in the fallen leaves, providing a source of infection for the next year's crop. The fungus also grows within the plant, invades the pods, and covers some seeds with a white crust of spores. When these seeds are planted, the seedlings become infected and provide centers of infection.

BACTERIAL DISEASES

BACTERIAL PUSTULE

Symptoms: First symptoms of this disease are small yellow-green spots with brown centers that appear on the leaves. These spots are most conspicuous on the upper surface of the leaf. A small blister-like pustule usually develops at the center of the lesion, especially on the lower leaf surface. Spots may merge, forming larger dead areas in which the tissue may fall out, giving the leaf a ragged appearance. The pustules eventually rupture and dry. At this stage, the disease may become confused with bacterial blight. The pustule and the absence of water-soaked appearance before the spot turns yellow distinguishes bacterial pustule from bacterial blight.

Optimal Environmental Conditions: Bacterial pustule is a warm weather disease, usually appearing about mid-July. Leaves of plants are infected by bacteria splashed from the soil or nearby diseased plants. The bacteria are carried over from year to year in infested residue and may be borne on seeds.

Some varieties are resistant.

BACTERIAL BLIGHT

Bacterial blight is one of the first leaf spot diseases to appear on young plants in the spring, and is one of the most widespread soybean diseases.

Symptoms: The causal bacteria are splashed from soil or nearby diseased plants to the lower leaves of healthy plants. Leaf symptoms start as small, angular, water-soaked spots that eventually turn yellow and then brown as the tissue dies. The brown central area of the spot is surrounded by a yellow border. As the spots increase in size, large areas of the leaf may fall out due to stress by wind, rain or insects, giving the leaf a ragged appearance. Leaves may drop from severely infected plants. The disease is most commonly found on leaves, but it can also infect stems, petioles, and pods.

Optimal Environmental Conditions: Bacterial blight develops most extensively during cool, wet weather, but appears to a limited extent throughout the summer.

Control: The causal bacteria are seedborne and also overwinter in dead leaves. One control method is to not plant seed harvested from infected fields.

VIRUS DISEASES

SOYBEAN MOSAIC

Soybean mosaic, probably the most common virus disease of soybeans, may reduce yields as much as 25 percent. Soybean varieties differ widely in their range of susceptibility to soybean mosaic. In general, commercial soybean varieties are less susceptible than large-seeded varieties, but no absolutely immune varieties are known.

Symptoms: When very susceptible varieties are infected, the first disease symptom is a yellowish vein clearing that develops in the small, branching veins of developing leaves. This symptom appears 6 to 14 days after infection. The third leaf formed after infection usually becomes crinkled.

Symptoms may vary from essentially normal-appearing leaves with deep-set veins to crinkled leaves in which portions of the upper surface have sunk to small, bladder-like sacs. Leaves become leathery, coarse, and brittle near maturity. Several infected leaves may be narrow. Seed discoloration may also be present.

Optimal Environmental Conditions: If infected plants are grown under cool conditions, the symptoms increase in severity on successive leaves, and the characteristic mosaic pattern of alternate light and dark-green patches of leaf tissue may appear. The mosaic symptom is more obvious on some varieties than on others.

Control: The virus is transmitted by aphids. There is no practical control measure for this disease.

BUD BLIGHT

Bud blight is caused by the tobacco ringspot virus and occurs mainly in the Midwest. The disease is sporadic; it does not appear every year. Losses of 25 to 100 percent have been reported. The disease is frequently more severe adjacent to legume-grass pastures or fence rows, where perennial plants act as virus reservoirs for transmission to soybeans. Grasshoppers, thrips and nematodes can transmit the virus.

Symptoms: Symptoms of bud blight vary with the stage of development at which plants become infected. When plants are infected before flowering, the apical bud and shoot turn brown, curve downward markedly, and become dry and brittle. The youngest leaf often develops a rusty flecking. The plant is dwarfed and produces virtually no seed. Sometimes the inside of the stem below the blighted terminal bud is discolored, most often at the nodes.

When infected during flowering, plants produce undeveloped pods. Infection after flowering results in poorly filled pods that have a conspicuous dark blotching. Many of these pods fall to the ground. Infected plants usually remain green after normal plants have matured, and thus are easily found in the fall. Many strains of the virus exist, and some cause severely dwarfed, barren plants.

Tobacco ringspot virus has a wide host range. Several legumes (alfalfa, red clover, sweet-clover) and common weeds (morning glory, pigweed, horseneetle, ragweed, and sunflower) may act as sources of inoculum.

Control: No bud blight-resistant varieties of soybeans are known. The most practical control measure is elimination of sources of the infection in nearby fence rows and of established perennial host plants in meadows and pastures. Volunteer soybeans should also be eliminated.

IRON CHLOROSIS

Iron chlorosis is a disorder that may occur in soybeans grown in soil with a pH of 7.8 or higher. Under these conditions, iron in the soil becomes unavailable to the plant.

Symptoms: The interveinal areas of leaves become yellow while the veins remain green. Eventually, the whole leaf becomes yellow and finally decayed. At this latter stage, the symptoms may be confused with damage caused by some herbicides.

Frequently, when iron chlorosis is not severe, the leaves at the top of the plant display typical iron chlorosis symptoms for awhile, then become a normal green. Iron chlorosis usually occurs in irregular areas throughout a field. Plants in the center of an affected area may be stunted or dead, and plants towards the periphery may be merely chlorotic.