

Insect, Nematode, and Disease Control in Michigan Field Crops

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**This bulletin contains information on the management of field crops insects, nematodes, and diseases, including recommendations for pesticide use. Every attempt is made to verify product names, formulations, use rates, and other important information, but products and labels may change before the field season begins. Always read the label of a product to reconfirm rates, precautions, PPE, and other important information before use.

DRY BEAN DISEASES

Anthracnose

Cause: *Colletotrichum lindemuthianum* (fungus)

Symptoms: Symptoms can appear on any above ground part of the plant, including cotyledons, leaves, petioles, stems, and pods. The first symptoms are dark, water soaked lesions. Lesions are commonly found on the petioles and on lower surfaces of leaves and leaf veins as elongate, angular, brick red to purple spots, turning dark brown to black. They may also be found on the upper leaf surface. Pod infections are tan to rust- in color, becoming sunken cankers surrounded by a slightly raised black ring with a reddish brown border. Tan to salmon colored spores may form in the lesions.

Disease cycle: Between crops, the fungus survives in crop debris and can be spread in seed, air and water. Initial infection can take place anytime during the growing season during cool, wet weather; secondary infections can occur from spores forming on infected plants and spreading in wind and splashing rain, or being transported on equipment.

Conditions favoring the disease: The disease is favored by temperatures of 55–70° F with an optimum of 63° F and High humidity (more than 92%) or free moisture during all stages of disease development. The disease is most severe when there is frequent rainfall accompanied by wind and splashing rain. Seed treatment and certain copper fungicides are available for use. Look for resistant varieties and rotate every three years to reduce the buildup of disease inoculum.

Management: For the names of some cultivars with resistance to anthracnose, visit MSU's dry bean breeding website at: <http://www.css.msu.edu/bean/Variety.cfm>. Avoid introducing anthracnose into the fields by using certified anthracnose-free seeds. Avoid cultivating when the plant canopy is still wet. Work infected fields last and clean your equipment thoroughly before entering other fields. Plow under infected bean refuse, and clean your equipment afterwards. Use a three-year crop rotation with corn and small grains. Several fungicides are registered for use on dry beans.

See labels for specifics, including pre-harvest intervals, REIs and plant-back restrictions.

List of registered fungicides, rate per acre:

Amistar 2.5 oz.	Equus 500 Zn 2- 2.8 pints
Armcarb 100 2.5-5.0 lb.	Headline 5.5 -8 fl. oz.
Bravo Ultrex 1.25-1.8 lb.	Maneb 75 DF 1.5-2.0 lb
Bravo Weatherstik 1 3/8-2 pints	Maneb 80 WP 1.5-2.0 lb
Chlorothalonil 720 F 1.37-2 pints	Quadris F 6.2-15.4 fl. oz.
Echo 90 DF 1 1/8- 1 5/8 lb.	Quadris Opti 1.6- 2.4 pints
Echo 720 1 3/8 -2 pints	Thiophanate methyl 4.5 F AG 30-40 fl. oz.
Echo Zn 2-3 pints	Thiophanate methyl 70 W WSB 1-2 lb.
Echomate Armcarb "O" 2.5-5.0 lb.	

Fusarium Root Rot

Cause: *Fusarium solani* f.s. *phaseoli*(fungus)

Symptoms: The first symptoms are usually red to brown streaks or lesions on the roots and the portion of the stem below ground. These symptoms appear several weeks after seedlings emerge. Symptoms are rarely visible above ground. The primary root may be killed, and the lower stem may become pithy or hollow as the disease progresses. Infected plants can develop roots above the stem lesion, but may be stunted, exhibit yellowing leaves or leaf drop, and have poor pod fill. Later in the season, severely infected plants may show internal browning of the pith below the first node. The disease is distributed in circular to irregular patches in the field.

Disease cycle: The fungus survives in the soil as thick-walled resting spores (chlamydospores). The fungus is able to live indefinitely in infested fields by germinating and reproducing on organic matter, and roots and seeds of other plants in the soil until susceptible hosts become available. The spores germinate in response to nutrients exuded by germinating seeds and roots. Hyphae produced by the fungus penetrate the bean plant through wounds and natural openings.

Conditions favoring the disease: Low fertility, high plant density, hardpan, poor drainage or soil compaction; High amounts of decomposing organic matter at planting time.

Management: Use high-quality seed; selecting varieties with tolerance to *Fusarium*. Plant beans in warm, moist soil to encourage rapid germination and emergence. Cultivate soil to hill up around the stems to encourage the development of lateral roots. Avoid close cultivation that may trim lateral roots. Seed treatments must be systemic to be effective. Rotate to non-susceptible crops such as small grains or corn, with beans planted every third or fourth year.

Rhizoctonia Root Rot

Cause: *Rhizoctonia solani* (fungus)

Symptoms: The first symptoms are small, sunken reddish brown lesions on the roots and portion of the stem above the roots. These expand into cankers, become more sunken, and may girdle the stem. Small brown-black specks (sclerotia) may appear on the surface of cankers. Seedlings and young plants are most susceptible to infection. Seedlings may die. Older plants may appear stunted or die.

Disease cycle: The fungus survives as mycelium or sclerotia in the soil or on infested crop debris. It can survive in or on bean seed. Soil temperatures around 59 to 64°F are optimum for the fungus.

Conditions favoring the disease: Poor drainage, high levels of organic matter, high plant density, wounds on roots and stems caused by cultivation.

Management: Use high-quality certified seed. Plant beans in warm, moist soil to encourage rapid germination and emergence. Cultivate soil to hill up around the stems to encourage the development of lateral roots. Avoid close cultivation that may trim lateral roots. Seed treatments must be systemic to be effective. Rotate to non-susceptible crops such as small grains or corn, with beans planted every third or fourth year. Rotations with sugar beets, soybeans or potatoes are not recommended, as they are susceptible hosts for *Rhizoctonia*.

See labels for PHI, REI and plant-back restrictions.

List of registered fungicides (rate per acre):

Quadris F 0.40-0.80 fl. oz/ 100 0 ft. row as in furrow treatment Ridomil Gold PC GR 12 oz./1000 linear ft. (banded)

White Mold, Sclerotinia Stem Rot

Cause: *Sclerotinia sclerotiorum* (fungus)

Symptoms: Infected flowers look white and cottony. Lesions start as small water-soaked dark spots on pods, leaves, stems and petioles. Spots enlarge, and become slimy. Cottony patches of white mycelium appear on stems and other infected parts. Late season symptoms- bleached, papery and/or shredded lower stem; hard, black, irregularly-shaped pieces of dormant mycelium (sclerotia) develop on stems, in stem pith and (sometimes) in pods.

Disease cycle: Survives as sclerotia in crop residue, or combined with the seed. Burying sclerotia in soil increases their ability to survive. Sclerotia germinate in the spring and summer by forming mushroom-like fruiting bodies called apothecia. Apothecia produce large numbers of spores, which spread by wind and splashing rain. The spores germinate using dead and dying bean flowers as a food source to grow mycelium. The mycelium infects the stem near the node and spreads to other plant parts.

Conditions favoring the disease: Cool temperatures and high humidity in the crop canopy, particularly as plants are flowering. Cropping practices such as narrow rows, high planting rates irrigation, high soil fertility, and early planting increase risk.

Management: Use clean seed, free of sclerotia. There are several seed treatments that can be used to eradicate the fungus from seed to be planted (See section on dry bean seed treatments for these products).

Avoid rotation to susceptible crops-sunflower, dry beans or snap beans. Rotate with non-host crops such as sugar beets, corn, alfalfa, or small grains to reduce the number of sclerotia in fields. The fungus can survive for years in the absence of a susceptible host. Control broadleaf weeds during the non-host crop rotation- many broadleaf weeds are hosts for this disease. Plant partially resistant varieties. See MSU dry bean variety trials website: <http://www.css.msu.edu/varietytrials/soybean/whitemold.htm> Use planting rates and row widths that promote air circulation and rapid drying of plants and soil surface. Irrigate only as required for optimum plant growth.

See labels for specifics, including pre-harvest intervals, REIs and plant-back restrictions.

List of registered fungicides (rate per acre):

Contans WG 1-2 lbs. (biological, to reduce inoculum in soil)

Endura 8-11 oz.

Headline 5.5-8 fl. oz (White mold suppression)

Iprodione 4L 1.5-2.0 pints

Rovral 4F 1.5-2 pints

Rovral 75 WG 1.0-1.33 lb.

Thiophanate methyl 85 WDG 0.6- 0.8 lb.

Thiophanate methyl 70 W 1-2 lb.

Topsin 4.5 F 30-40 fl. oz. for single application; 20-30 fl. oz. for multiples

Topsin M 70 WP- 1 1/2-2 lb. single application; 1-1/2 lb. multiple applications.

Pythium root rot

Cause: *Pythium* spp. (Oomycete; “fungus-like” pathogen)

Symptoms: Seedlings die rapidly, leaving gaps in rows. Young plants turn yellow, collapse, and die, leaving gaps in row plantings. Infected seedlings develop a water-soaked lesion on the stem above the root (hypocotyl). Root systems are stunted and/or rotted. Mild infections stunt plant growth, but don’t kill the plant. During prolonged period of cool, wet weather, pods in contact with the soil may become infected- they can look water-soaked, and develop a fluffy white mold.

Disease cycle: Overwinters as resting spores (oospores) During periods of adequate soil moisture and temperature, oospores germinate to form structures called sporangia. In saturated soils, small swimming spores (called zoospores) are released. They swim to dry bean roots, where they attach, germinate, invade the root and grow.

Conditions favoring the disease: Wet soils favor damping off. Disease is more severe in poorly-drained or saturated soils, and where there is soil compaction. High amounts of organic matter, and high planting densities can contribute to more severe disease.

Management: Rotate with a non-legume crop for at least three years. Improve soil drainage. Manage irrigation runoff to restrict spread of root rots within and between fields. Avoid working or driving on wet soil; avoid tillage practices that contribute to soil compaction. Use systemic seed treatments or soil treatments. Apply fungicides to soil as broadcast, band, or in furrow treatment, depending on methods listed on label.

See labels for specifics, including pre-harvest intervals, REIs and plant-back restrictions.

List of registered fungicides (rate per acre or as noted):

Ridomil Gold EC 1/2 -1 pint as preplant incorporated

Ridomil Gold PC GR 12 oz./1000 linear ft. at planting

Ridomil Gold EC 1/2 -1 pint as banded surface application

Common Blight, Halo Blight

Cause: Common blight- *Xanthomonas phaseoli* (bacterium)

Halo blight- *Pseudomonas syringae* pv. *phaseolicola* (bacterium)

Symptoms: Common blight first appears as water-soaked spots on leaves. Spots are greasy, and green, with a small border of lemon yellow. Veins near the spots may turn dark. As the spots enlarge, the leaves take on a burned appearance. Dead leaves may remain attached to the plant. Lesions on pods are dark green with brick red margins, and may develop a yellow bacterial ooze in wet weather. Seeds may have areas discolored yellow or brown.. **Halo blight** appears first as small, greasy green spots on leaves. These spots turn into small dead areas (about ½ “), with light green halos. Veins near spots may turn dark. Pod lesions are similar to those on common blight but develop a white ooze instead of yellow ooze. Plants may be stunted.

Disease cycle: Both of these blights are seedborne, and planting contaminated seed is a major source of infection. Bacteria survive on crop residue at or near the soil surface.

Conditions favoring the disease: Splashing rain and humid weather, temperatures around 82 to 90 are favorable conditions for the pathogen. It can also spread on windblown soil, and can be spread from infected foliage to healthy plants by people and farm equipment.

Management: Plant high quality seed. Bactericides such as streptomycin can be applied to seed. Avoid working in wet fields. Plow down and bury bean refuse. Rotate crops with at least two years between bean crops. Copper compounds are registered for treating bacterial blights, but have had limited effectiveness at suppressing the disease in the field.

See labels for specifics, including pre-harvest intervals, REIs and plant-back restrictions.

List of registered bactericides (rate per acre or as noted):

Champ Dry Prill 2/3-2 lb.

Champ WP 1-3 lb.

Champ Formula 2 Flowable- 2/3-2 pints

Kocide 1-3 lbs.