

2007 Florida Plant Disease Management Guide: Potato, Irish¹

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Specific Common Diseases

Management Strategies

Potato is vegetatively propagated by planting tubers which can carry many different pathogens. Therefore, it is especially important to include both preplant and post harvest strategies to control diseases in this crop. Many potato diseases during the cropping season and in the harvested crops are initiated as inoculum in seed tubers. For this reason utilization of certified inspected seed tubers is imperative for effective disease management in potatoes and a Florida Seed Law is in place to help ensure high quality seed tubers for Florida growers.

Bacterial Ring Rot (*Clavibacter michiganensis* subsp. *sepidonicus*)

Symptoms: Leaves and stems of affected plants can wilt anytime after midseason. At first, lower leaves wilt during the heat of the day and then recover at night. As symptoms progress, leaves first become pale green and roll slightly at the margins, followed by more severe wilting, intervenal

yellowing and necrosis of leaves. Often, one or two stems of a plant are severely diseased with the remainder remaining healthy. Stems cut and squeezed near the base often exude a milky white bacterial ooze.

Infection of tubers starts at the stem-end and proceeds through the vascular tissue. Tubers cut crosswise exhibit rings of a cheesy rot that can be gray, creamy yellow, or light to red-brown in the vascular tissue. Severely affected tubers may have dry, gray pockets of tissue around the vascular ring.

Control: Infected tubers are the most important source of inoculum. Seed certification is therefore the most effective means of controlling bacterial ring rot since there is a zero tolerance for the disease in all seed producing regions. Introduction of the bacterial ring rot pathogen into a field by using uncertified seed can result in severe crop losses. The disease can spread during the season and infected tubers are difficult to cull at harvest. The pathogen does not overseason in soil.

1. This document is PDMG-V3-46, one of a series of the Department of Plant Pathology, 2007 Florida Plant Disease Management Guide, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Revised December 2005. Reviewed January 2007. Please visit the EDIS Web site at <http://edis.ifas.ufl.edu>.

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Bacterial Soft Rot, Black Leg, and Aerial Stem Rot (Aerial Black Leg) (*Erwinia carotovora* pv. *carotovora* and *E. carotovora* pv. *atroseptica*)

Symptoms: These diseases are closely related. Soft rot affects the tubers as seed piece decay or as rots of daughter tubers. Black leg and aerial stem rot symptoms develop on potato stems during the season.

The causal bacteria are carried on and in tubers. Seed piece decay is favored by wet weather and temperatures exceeding 68°F. Rotting of seed tubers in Florida is especially severe in warm humid weather when condensation develops on cold seed tubers prior to or during cutting. Bacteria from rotting seed pieces infect daughter tubers by entering lenticels or wounds.

Black leg can develop at anytime during the season and stems may rot at any point from the seed piece to several inches above ground. During humid weather, affected stems are soft and water-soaked. Lesions shrivel and harden when dry weather prevails. The color of lesions varies from light brown to black. Often the pith above the lesions is decayed. Infected plants often are stunted and have rolled terminal leaflets which turn yellow and wilt. In advanced cases the entire plant dies.

Aerial stem rot is generally limited to above ground plant parts. It is distinguished from other rots as a soft rot of stems and petioles which does not start from the seed piece. Infection is often, but not always predisposed by plant injury. Symptoms start with a soft green decay which often turns brown in color.

Tuber rot symptoms vary from dark black decay emanating from the stolon end, to dark colored lesions at the lenticels. Rot can also initiate from wounds. Affected tissue is cream to tan in color and is soft and granular. Margins of decayed tissue often develop brown to black margins. Advanced stages of decay often become slimy and foul smelling due to secondary organisms. Some infections wall off and dry up as chalky white spots. See Plant Pathology Fact Sheet PP-12.

Cultural controls: Use certified seed derived from tissue culture or stem-cutting programs. Avoid

moisture condensation on seed tubers by air stacking and maintaining air movement through seed piles. Sanitize seed cutting equipment between seed lots. Plant in well-drained soil, but also avoid planting under excessively dry conditions. During the season avoid cultural practices which wound stems and when possible remain out of fields when plants are excessively wet. To avoid post harvest losses, follow appropriate vine-killing procedures. Do not harvest after a rain. Minimize bruising and wounding of tubers and avoid exposure to excessive heat. Tubers harvested when soil temperatures exceed 70°F are more susceptible to rot and the decay is speeded up when tubers are warmed in sunlight. Dry all tubers of free surface moisture after washing. Clean flumes as frequently as possible to avoid buildup of organic matter and soft rot bacterial inoculum. Avoid packing in film bags. Assure ventilation and air flow (forced air flow is best) around potatoes held for two days or longer. Cool internal tuber pulp temperature to 60°F. See Plant Pathology Fact Sheet PP-12.

Chemical Control: See PPP-6 for specific recommendations for seed piece treatments.

Bacterial Wilt and Tuber Brown Rot (*Ralstonia solanacearum*)

Symptoms: Symptoms resemble those of bacterial ring rot. Initially terminal leaflets wilt on hot days. Wilt progresses rapidly during hot weather and individual branches or entire plants wilt. Leaves often turn yellow and leaf margins roll. Stem cross sections exhibit vascular browning and as wilt advances illustrate bacterial oozing which is more viscous than that of ring rot. Cut stems suspended in water will usually exude bacterial streams from the vascular system. Tuber symptoms progress from the stolon end and consist initially of mild browning which progresses to distinct vascular discoloration coupled with bacterial oozing when tubers are cut in cross section. Soil often adheres to bacterial oozing from the eyes of severely affected tubers. Complete disintegration of tubers often results from secondary invaders. Tubers from a single plant can vary from asymptomatic to complete rot.

Cultural Control: Maintaining a dense cover crop of sorghum/sudan grass or corn which crowd out broad-leaved weeds can reduce incidence of

bacterial wilt. Avoid rotations with Solanaceous crops or planting highly susceptible cultivars such as Superior, Red LaSoda, LaRouge, or Pontiac. Do not move soil, water, or equipment from infested to non-infested fields. Incidence of tuber brown rot in the crop can be reduced by delaying harvest and allowing infected tubers to rot in the field.

Chemical controls: Incidence of bacterial wilt is reduced following control of root-knot nematodes with soil fumigants.

Soft rot caused by Clostridia (*Clostridia* spp.)

Symptoms: Clostridia were for many years considered to be solely secondary invaders of rotting tissue. Recent evidence, however, has shown some to be pathogens. Clostridial bacterial soft rots are slimy and have highly offensive odors which distinguishes them from other the bacterial soft rots of potato. Clostridial rots are favored by anaerobic conditions and relatively high (86 to 99°F) temperatures. These bacteria are present in most soils and rots caused by them are favored by water films on tuber surfaces. Even though Clostridia are pathogens, tuber decay is more rapid in presence of other soft rotting bacteria such as Erwinias.

Cultural controls: Strategies for managing Clostridial rots are the same as those for other bacterial soft rots of potato.

Scab (*Streptomyces* spp., principally *S. scabies*)

Symptoms: Scab is a disease of tubers. New lesions are brown and at maturity may be circular or irregular in shape, rough- textured, and dark brown in color. These lesions may be superficial on the tuber surface, raised, or pitted. The pathogen strain, variety, or soil environmental conditions affect lesion type or severity. The lesions may be few or many, often covering the entire tuber surface.

Common scab is normally a disease of alkaline soils of pH = 7 or higher. Some strains cause scab in soils with pH below 5.0, but these are less common.

Cultural Controls: Plant certified seed. Planting infested seed not only results in diseased tubers at harvest, but also can introduce new more aggressive

strains of the pathogen. When possible, increase the length of time between successive potato crops. Maintain optimum soil moisture levels during tuberization. Avoid soil treatments which raise pH. Seed treatments with fungicides can reduce incidence of the disease at harvest.

Powdery Scab (*Spongospora subterranea* f. *sp. subterranea*)

Symptoms: *Sponospora* is a cool weather pathogen and it was therefore long believed that powdery scab would not develop in Florida because of the subtropical conditions. The disease, however, has been observed during recent years in north Florida potatoes. Both tuber and root symptoms are seen. Initially symptoms on roots consist of light brown lesions that develop into wart-like galls. Without magnification early symptoms can be confused with galling caused by root-knot nematodes. The galls initially are white, but turn brown with age. Similar lesions and galls develop at tuber lenticels and eyes. As lesions mature, developing “spore balls” or cytosori develop in the tissue. Fully mature lesions filled with spore balls have not been observed in Florida, however, the pathogen has been shown to naturally survive for at least five years in north Florida commercial potato fields. This organism also carries and vectors the potato mop-top virus which has been recently (2001) found in potatoes shipped from north Florida.

Cultural Controls: Plant only certified seed tubers. Plant symptomless tubers to avoid introducing the disease to uninfested areas.

Rhizoctonia stem and stolon canker and tuber black scurf (*Rhizoctonia solani*)

Symptoms: Development of *Rhizoctonia* stem and stolon cankers is favored by cool, wet soil conditions between planting and emergence. Immature sprouts are more susceptible to attack than are green stems. Early season disease leads to increased tuber black scurf at harvest. Inoculum is tuber-borne, soilborne, or both. Amber brown to black lesions develop on stems, stolons, and roots. Severe cankers can girdle affected plant parts. Emergence can be delayed or reduced. In severe cases aerial plant symptoms develop including

reddening and rolling of terminal leaflets and formation of aerial tubers. Tuber symptoms include scurf and cracking, but conspicuous dark black sclerotia (“dirt which wont rub off”) on the tuber surface is the most recognized symptom.

Cultural controls: Rotate to other than crucifer or solanaceous crops for two to three years. Use certified, inspected seed to reduce levels of tuber-borne inoculum. *Rhizoctonia* is favored by heavy crop residue. Minimize amounts of cover crop residues by disking in cover crops several weeks before planting. Shallow planting can reduce stem cankering. Development of black scurf is enhanced by vine desiccation. Harvest as soon as possible after vine- killing or detach tubers from the mother plants.

Chemical controls: Treat cut seed with recommended fungicides. See PPP-6.

Early Dying or Verticillium Wilt (*Verticillium albo-atrum* and *V. dahliae*)

Symptoms: Early dying is difficult to distinguish from other causes including natural plant maturity. Symptoms can develop when plants are small, but usually occur after blossoming. Early season infection can result in stunting. Initially, lower leaves turn yellow and wilt, eventually becoming necrotic. Sometimes symptoms are confined to one side of a plant. Leaf yellowing and necrosis progress up the plant which dies and often remains erect. Vascular browning is observed in stems and at the stolon end of tubers, however, these symptoms may be due to other causes. Although severity of early dying is known to be enhanced by root lesion nematodes, the species reported are not found in Florida.

Cultural Controls: Plant only certified seed. Rotate and plant summer cover crops to nonhost plants. Incidence and severity of the disease are reduced following use of some nematicides.

Chemical Controls: See Nematode Management Guide for specific nematode controls.

Early Blight (*Alternaria solani*)

Symptoms: Early blight is a disease of senescence and is most severe following blossoming. Lesions fist appear as small dark brown spots, usually

on the older lower leaves of the plant. The spots enlarge rapidly in wet weather and develop a series of rings resulting in a “target board” appearance. Plants can be rapidly defoliated when conditions favor early blight development. Stems as well as leaves can be affected. Tuber infections occur and wounding of the periderm exacerbates infection. Small (1/16 to 1/8 inch), sunken round to irregular lesions develop on the tuber surface. Occurrence of tuber rot is not common in Florida. See Plant Pathology Fact Sheet PP-7.

Cultural controls: Employ adequate soil fertilization and moisture conditions. Utilize fungicides when disease occurs. After midseason consider using fungicides which prevent both early and late blight diseases.

Chemical controls: See PPP-6.

Brown Spot and Black Pit (*Alternaria alternata*)

Symptoms: Brown spot can appear on foliage at any time during the season and is easily confused with early blight. Initial lesions are dark brown circular necrotic spots up to 1/2 inch in diameter. Spots enlarge, can merge and have necrotic brown margins and concentric target board zonations similar to early blight lesions. Black pit symptoms on tubers are black sunken lesions with defined margins which can be 1/8 inch deep and up to 1/2 inch in diameter.

Cultural Controls: Provide adequate fertilization to the crop. Avoid bruising tuber at harvest.

Chemical Controls: Broad spectrum fungicides which control early blight are also effective for this disease. See PPP-6 for specific fungicides.

Late blight (*Phytophthora infestans*)

Symptoms: Lesions first appear as water-soaked spots on stems, petioles, or leaflets. The spots enlarge rapidly and on leaflets develop a brown center with a light green border or halo. When it is humid the fungus produces in the halo on the underside of the leaflet a white moldy growth that contains sporangia, spores or both. Frequently, elongate lesions that develop on stems under the crop canopy enable the disease to persist even during dry conditions.

Tuber rot first appears as a brown or purplish-black metallic discoloration of the skin. An amber brown discoloration of the flesh just below the skin develops, usually not penetrating more than 1/4 inch. Soft rots often follow late blight in tubers resulting in complete decay. See Plant Pathology Fact Sheet PPP-6.

Cultural Controls: Use certified seed. Plant tolerant cultivars. Avoid lifting tubers in wet weather which increases likelihood of tuber infection. If disease is severe, desiccate vines prior to harvest. Disease forecasts are available in the Hastings area.

Chemical Controls: FOR EFFECTIVE CONTROL OF LATE BLIGHT, ANY CURRENTLY REGISTERED FUNGICIDES MUST BE APPLIED BEFORE INFECTION OCCURS.

Use fungicides to control late blight. In south Florida, begin spraying after emergence and maintain a calendar schedule. Consult with local University of Florida, IFAS, extension personnel.

In the Hastings region spray advisories based on forecasting used to be available. Contact the University of Florida, IFAS, Hastings REC or area extension agents for additional information. If forecasting is not used, begin spraying before plants are six to eight inches tall if late blight fails to occur earlier. Follow a 5-7 day spray interval or an alternative more economical method of blight control by spraying plants following 8 consecutive days when the average daily temperatures range from 50 to 77°F and the 10 day rainfall total is 1.02 inches or greater. Weather data are available for the Hastings area by consulting the FAWN network. Intervals using this method may vary from 5-14 days or more. A MINIMUM OF A SEVEN DAY SPRAY SCHEDULE IS REQUIRED REGARDLESS OF WEATHER CONDITIONS ONCE LATE BLIGHT IS REPORTED IN THE REGION. More frequent sprays may be needed when weather conditions are favorable. Please consult PPP-6 for suggested fungicides.

White Mold (*Sclerotinia sclerotiorum*)

Symptoms: The disease is also known as *Sclerotinia* stalk rot. It is generally more severe in south Florida potatoes than in the north. Water-soaked lesions develop on the stems, beginning in the crotches or at points of injury. The spots enlarge and turn light to dark brown as they dry out. Infection can occur through old leaves, especially when in contact with the soil. Secondary infection often follows other diseases. Under favorable conditions, a white growth of mycelium may cover stems and foliage. Hard black resting bodies or sclerotia may form on the surface of infected stems or foliage, but are more common within the pith of the stems. The sclerotia are irregular in shape and range in size from 1/8 to 3/4 in. Aerial infections of leaves and stems may occur from ascospores produced from tiny mushroom-like structures emerging from soil-bore sclerotia during cool, moist weather. The ascospores may be dispersed some distance by wind.

Cultural Controls: Flooding of fields for several weeks has been suggested in the past, however, this is impractical in modern agriculture. Avoid injuring plant tissue when cultivating. Avoid irrigation practices such as overhead sprinkling which prolong wetting of foliage. Utilize cultural practices which enhance air flow within the canopy and speed up drying of the foliage. Avoid rotations with other susceptible crops such as snap beans or cole crops. Use crop rotation with grass crops and turn soil six inches to bury viable sclerotia. In fields with a history of white mold, application of protective fungicides may be advisable. See Plant Pathology Fact Sheet PP-22.

Chemical Controls: See PPP-6.

Southern Stem Rot or Southern Blight (*Sclerotium rolfsii*)

Symptoms: The disease generally occurs near harvest when higher soil temperatures prevail. Stem rot often appears rapidly near the end of the production season when rainy periods follow a prolonged period of drought. Most infections observed in the field are confined to the base and under ground portions of the stems and to tubers.

Initially, wet lesions develop at the soil line. As lesions age, white mycelial growth and numerous white to amber brown spherical sclerotia, resembling mustard seeds when mature, are visible on affected stems. Sclerotial development and growth of mycelium is usually more profuse on subterranean plant parts. Tuber infections usually start at the stolon end. Lesions are brown to dark brown in color and threads of mycelium and sclerotia develop on the tuber surface. Tuber flesh beneath the lesion can rot. Occasionally, dark brown to black circular lesions develop beneath tuber lenticels. See Plant Pathology Fact Sheet PP-4.

Cultural Controls: Bury plant debris by deep plowing. Attempt to complete harvest before hot weather prevails.

Virus Diseases (Various viruses)

Symptoms: A number of viral diseases affect potato. Field diagnosis is difficult because symptoms are often similar for different viruses. Mosaic symptoms are often associated with strains of *Potato Virus Y*, however, accurate diagnosis depends upon laboratory tests. Fortunately, incidence of these viruses has generally been low due to effective control through seed certification programs. A noted exception is tobacco rattle virus which is soilborne and common in the Hastings region. See the discussion on corky ringspot for details on this disease.

Cultural Controls: Plant only certified seed. Plant resistant cultivars when possible.

Corky Ringspot (*Tobacco rattle virus*)

Symptoms: Foliar symptoms usually do not occur in the field and symptoms are limited to the tubers. Although diagnostic symptoms of necrotic rings and arcs occur on the tuber surface of many smooth-skinned cultivars, the tubers of many cultivars do not have distinguishing external symptoms. Typical internal tuber symptoms in most susceptible cultivars are seen as arcs and rings of necrosis and can occur in tubers of any age depending upon the time of infection. *Tobacco rattle virus* is vectored to potato tubers by stubby root (trichodoriid) nematodes.

Cultural Controls: Plant resistant cultivars such as Superior. Crop rotations are generally ineffective, however, there is evidence from other regions of the U.S. that rotations with alfalfa provide effective control.

Chemical control: Consult the Nematode Control Guide for current suggestions.

Seed-Piece Rots (Various fungi and bacteria)

Symptoms: Symptoms are varied. Some pathogens such as *Fusarium* cause dry rot whereas other including soft rot bacteria result in soft, wet rots. Seed piece decay can result from the use of poor seed, improper handling and storing of seed prior to planting, or planting seed in an unfavorable environment.

Cultural Controls: Purchase only certified, low generation seed. For maximum protection, have seed inspected on arrival. Segregate truckloads or lots of seed. Avoid moisture condensation on incoming seed by air stacking (spacing) to maximize air flow around the tubers. Allow tubers to warm to 55 to 55°F before handling. Avoid bruising of seed tubers. Sanitize cutters between seed lots or at least daily. Wound healing is favored by fresh air, 95 to 99% relative humidities, and temperatures of 55 to 60°F. Lower humidity or a film of water interferes with normal healing. In Florida, the most favorable conditions for wound healing are often in the soil. Many seedborne pathogens can be controlled with seed treatments applied at the time of cutting.

Chemical Controls: See PPP-6 for specific seed-piece treatments.

Post-harvest tuber rots (Bacterial soft rots, *Pythium* spp, *Sclerotium rolfsii*, *Fusarium* spp., *Rhizoctonia solani*)

Symptoms: Bacterial soft rots, *Pythium* leak, *Sclerotium* rot, *Fusarium* rots, and *Rhizoctonia* black scurf, and occasionally charcoal rot (*Macrophomina phaseolina*) are the most frequently observed post harvest rots in Florida. The symptoms of these rots vary. *Pythium* leak and *Sclerotium* rot are often initiated at the stolon end of the tuber, but they can

also occur in wounds, or in the case of Sclerotium, at lenticels. Similarly, Fusarium can be associated with the stem end of tubers, but is also often seen emanating from wounds.

Cultural Controls: Although at harvest and post harvest handling of tubers can exacerbate soft post harvest rots, most of these diseases are most effectively managed through use of the previously described appropriate practices at planting and through the season coupled with practices which minimize tuber injury at harvest.

Chemical Controls: Pythium leak, Fusarium rots, and Rhizoctonia black scurf can be partially managed with appropriate fungicide programs. See PPP-6 for fungicide recommendations.