DISEASE MANAGEMENT

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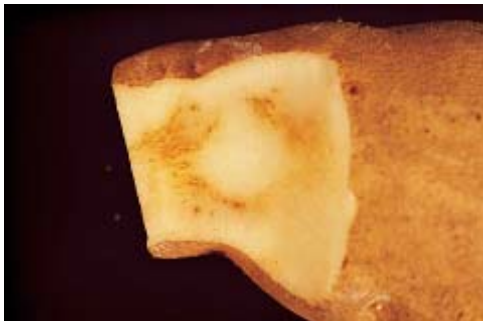
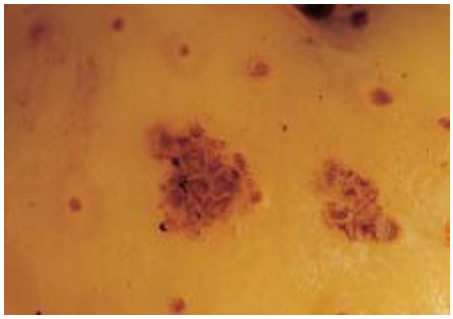
The following tables are provided as a brief overview of some common potato diseases and management options. More information is available in the Potato Production Systems book (Order Potato Production Systems).

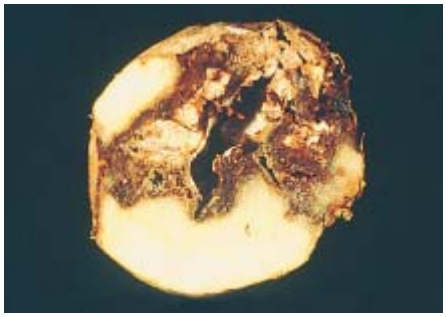
DISEASE AND SYMPTOMS	CAUSE	MANAGEMENT OPTIONS
Diseases Caused by Viruses		
Potato latent virus No symptoms or mild mosaic symptom.	Potato virus X (PVX)	Plant certified seed.
Potato mosaic PVY symptoms range from virtually none to noticeable stunting and mosaic to severe foliar damage and even death of the entire plant depending on variety.  *PVY-infected Russet Burbank plant.* PVA symptoms are very similar to PVY in structure and in behavior. Severe mosaic symptoms can occur, but this virus is often latent or shows only mild symptoms in the varieties grown in Idaho.	Potato viruses Y and A (PVY, PVA)	Plant certified seed.

Potato leaf roll Symptoms are rolling of leaves as well as chlorosis and stunting of potato plants.  *Rolled leaves and stunting are symptoms of a plant infected with PLRV.*	Potato leaf roll virus (PLRV)	Plant certified seed. Use a systemic insecticide at planting. Scout for aphids throughout the season and use late season aphicides.
Tuber net necrosis  *Tuber net necrosis caused by PLRV.*	Potato leaf roll virus (PLRV)	Plant certified seed. Use a systemic insecticide at planting. Scout for aphids throughout the season and use late season aphicides.
Corky ringspot Foliar symptoms have never been reported in Idaho. In other locations researchers reported symptoms that range from yellow-green mottling to foliar damage that resembles 2, 4-D injury.	Tobacco rattle virus (TRV)	Plant certified seed. Use soil fumigation to control stubby root nematodes.

Diseases Caused by Bacteria and Phytoplasmas		
Bacterial ring rot Foliar symptoms are first visible as “flagging,” which is sudden wilt in the upper leaves on one or more stems. More severe wilting of leaves on the symptomatic stems or on other stems of the infected plant may follow. In some varieties, such as Russet Burbank, a “dwarf rosette” symptom characterized by chlorosis, shortened internodes, and upright leaf growth may appear on some stems before the development of wilt symptoms.	*Clavibacter michiganensis* subsp. *sepedonicus*	Plant certified seed. If found, eliminate all potatoes on your farm. Thoroughly clean and disinfect all potato machinery and structures before bringing in new, clean, certified seed. Rotate to a different crop for at least 1 year. Leave infected crops in the field for 3 weeks or more after vine kill to allow severely infected tubers to completely deteriorate before harvest. Store potatoes as you would after a frost with high volumes of air and cool temperatures. Market as soon as possible.

Blackleg Blackleg is commonly associated with blackened hollow cavities in the stems that may extend nearly to the growing tips of roots and vines.  *Characteristic symptoms of blackleg.*	*Erwinia carotovora* subsp. *atroseptica*	Plant certified seed. Use limited generation certified seed sources. Do not wash seed potatoes. Routinely clean and disinfect seed potato cutting and transport equipment. Consider using whole seed or cut seed that has been properly healed (“precutting”). Use a fungicidal seed-piece treatment. Plant potato crops in well-drained soil and avoid irrigating non-emerged fields.
Bacterial soft rot Blackleg or soft rot infected tubers have no odor during the early stages of the disease.	*Erwinia carotovora* subsp. *carotovora*	Avoid bruising and mechanical damage to potatoes during harvest and transport. Properly heal stored potatoes before

Advanced stages of decay often develop a strong, foul odor, but this is due to the presence of other bacteria. Soft rot and blackleg infected tuber tissue usually has a thick consistency and readily flows under slight pressure.		lowering to the holding temperature. Store as cool as possible. Avoid moisture films on potatoes in bulk piles and dry potatoes as much as possible before placing them in fresh-pack containers. Use high volumes of air and a reduction in relative humidity in storages with badly infested tubers.
Common scab With first, small spots may become visible on the tubers After infection, a wound barrier may form a few cells below the surface. If bacterial penetration continues, a second or third barrier may be formed.  *Small spots that first appear on new tubes are classic sings of common scab.*	*Streptomyces scabies*	Avoid low soil moisture during tuber set and early bulking. On a silt loam soil, maintain soil above 75 percent available soil moisture. On fields where common scab is not a severe problem, high moisture alone may be sufficient control. No chemicals are effective against this disease.
Witches' broom Infected plants show a breakdown in apical dominance, and all or most of the buds on the plant will break dormancy. This leads to stunted, chlorotic plants that have a profusion of stems and shortened internodes, thus the namesake "witches' broom."	Phytoplasma (not named)	Separate potato fields from alternate hosts, such as alfalfa, or avoid drying down the alternate hosts late in the season.

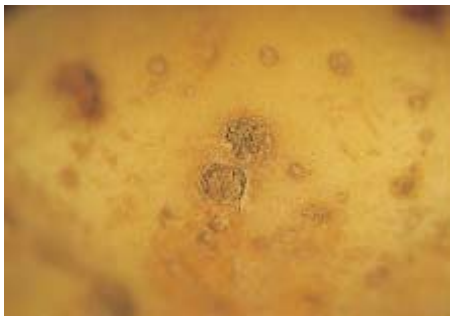
Diseases Caused by Fungi		
Dry rot Infected seed piece tissues often have a characteristic dark brown to fawn color. In storage, the lesions appear as small, brown areas around wounds. These lesions are dry and spongy in texture and tend to form hollow cavities. As the infection enlarges the tuber skin over the lesion collapses and wrinkles. Severely rotted tubers shrivel and become mummified.  *Tuber damage that is unique to Fusaruim dry rot include rotted tissues that are dry, crumbly, caracked, and brown in color.*	*Fusarium sambucinum* or *Fusarium coeruleum*	Harvest only mature potatoes with well-developed skin. Take steps to avoid mechanical damage or bruising during harvest and transport. Consider using thiabendazole (TBZ®, Mertect®) for treatment of potatoes during piling in storage or during packing for fresh shipment (although many isolates of *F. sambucinum* have been found to be resistant). Promote wound healing immediately after placement in storage by maintaining temperatures of 50° to 55°F and ventilation with high humidity. Clean and disinfect all potato handling, transfer, and cutting equipment. Provide good wound healing conditions when precutting seed before planting, or plant whole seed. Use a seed piece treatment that will effectively control *Fusarium* on potato seed pieces. Plant potato seed in warm (above 50°F), moist soil that promotes rapid plant emergence. Avoid irrigating non-emerged fields.
Potato early dying Foliar symptoms resemble a mature senescing potato plant and include uneven chlorosis, yellowing between leaf veins that may turn brown, and vascular discoloration of stem at the base. Symptoms will typically start on the lower leaves and may affect leaflets on only one side of the petiole	*Verticillium dahliae*	Plant certified seed and resistant varieties. Reduce soil populations by rotating crops and include potatoes every fourth or fifth year. Apply fumigants through sprinkler irrigation systems or by shank injection, and use fungicide seed treatments. Minimize plant stress and encourage uniform, continuous plant

or leaves on one side of the plant. As plant tissue dies the stem will often remain erect, a condition termed flagging.		growth with balanced fertility and optimum soil moisture levels.
Early blight Early blight is characterized by dark brown to black lesions on leaves and stems. Lesions usually appear on the lower or oldest leaves first. These lesions tend to be circular although they may take on an angular appearance when continued lesion expansion becomes impeded by leaf veins. Typical early blight lesions contain a series of concentric rings that give them a target or “bull’s-eye” appearance These lesions are often bordered by a chlorotic zone that fades into the normal green of the surrounding healthy tissue. As lesions expand in size, the entire leaf becomes chlorotic. The chlorotic tissue dies, turns brown, and dries out, but the leaves usually remain attached.	*Alternaria solani*	Provide proper plant nutrition and water management,proper pest management, and avoidance of other plant stresses. Several fungicides are available that control early blight on potato foliage during the growing season, the use of which also reduces production of spores that cause tuber lesions. If early blight moves into the canopy earlier than 3 weeks before intended vine kill, use one of the labeled and effective foliar fungicides. Prevent tuber infection through timely vine killing and harvesting of mature tubers. Avoid harvesting in wet conditions or when vines are green.

Late blight Leaf lesions may first appear as small pale to dark green spots that may rapidly enlarge under a favorable environment to become large, brown to purplish black necrotic lesions. Lesions tend to be circular in shape since leaf veins are not barriers to this fungus. A pale green to yellow halo may also be associated with these lesions. Under moist conditions (usually early in the morning), a white cottony growth may be present on the underside of late-blight infected leaves. Infection can spread to entire leaflets and move rapidly from the petioles to the stem, eventually killing the entire plant. A unique, diagnostic symptom of the disease is a dark, water-soaked-like lesion that begins at the apex and then moves down the stem. Stem lesions occur readily with the new strains and are cause for concern.	*Phytophthora infestans*	**Foliar:** Use only certified seed. If the seed is potentially infected, use a seed piece fungicide treatment that has activity against late blight (mancozeb, cymoxanil). Do not use heavily infected seed lots. Initiate protective spray programs at row closure and apply applications on a weekly basis for at least 4 weeks. Once new crop growth slows and there are no reports of late blight in the area, increase the interval between applications. Destroy cull and volunteer potatoes. **Storage:** Wash soil from suspect tubers, check tubers for late blight, and the storage for bad odors or wet spots. If late blight is detected, increase the air supply and shut down humidification until tubers are dry. Avoid conditions where free moisture is likely to develop. Do not store lots with more than 5 percent tuber blight. Hold temperatures at 38°F for seed and 42°F for fresh pack.
Rhizoctonia, Black scurf Stems and stolons have brown to black, sunken lesions. Sclerotia will form on the skin of tubers and will appear as dark, scurfy residues that growers term “dirt that won’t wash off.”	*Rhizoctonia solani*	Plant seed tubers that do not have sclerotia covering more than 20 percent of the tuber surface. Use fungicide seed treatments. Plant in warm soils to encourage rapid emergence and green tissue development.

 *Stems infected with Rhizoctonia solani.*		
White mold Infection causes water soaked lesions that soon produce a white, cottony, fungal growth. Initial infection sites usually occur where stems touch the soil. These lesions can girdle the stems of the potato plant causing the end of the vine to wilt.	*Sclerotinia sclerotiorum*	Implement long crop rotations to non-host plants (like grain). Maintain a good fertility program and avoid excessive vine growth. Avoid prolonged canopy wetness and excessive irrigation. Use available chemical control options with applications made before the disease has become well established in the field and before row closure. Ensure good coverage on the foliage and stems as necessary.
Pink rot, water rot Pink rot can is characterized by rotted tuber tissues that turn pink after a 20- to 30-minute exposure to air. The rot will usually appear to start from the stem end of the tuber and will progress through the tuber in a uniform manner, often with a nearly straight line between the healthy and the diseased portions of the tuber. In a tuber that is infected only with the pink rot fungus, the rotted tissues will still retain some structure and firmness but not nearly as much as the healthy portions of the tuber. The texture of the infected tuber	*Phytophthora erythroseptica*	Maintain good irrigation practices and avoid waterlogged soils. Avoid wounding tubers and high pulp temperatures during harvest. Consider treating with mefanoxam at planting or during the production season. Mefanoxam resistance has been reported in Idaho.

tissue is much like that of a boiled potato.  *Tubers infected with pink rot turn pink after 20 to 30 minutes (right tuber) exposure to air.*		
Pythium leak, watery wound rot Leak is characterized by a rot that starts from an infection site on the surface of the tuber and generally rots out the entire central portion of the tuber while leaving the portion of the tuber from the vascular ring out to the skin of the tuber intact. This results in a condition that is often described as “shell rot.” The rotted tissues are brown to black in color and may have cavities within them. The texture of the rotted tissues is soft and watery. When a diseased tuber is squeezed, a clear fluid exudes from the tuber. This property is the source of the name “watery wound rot,” which is another name for leak.	*Pythium* species	Avoid wounding during harvest and do not attempt to harvest when pulp temperatures are above 65°F, especially if environmental conditions are not conducive for removing field heat from stored tubers. If significant infection is found in storage, use high volumes of air and a rapid cool down. As with pink rot, consider treating with mefanoxam at planting or during the production season.
Silver scurf Lesions on infected tubers will have a smooth, gray to silvery sheen and are commonly found near the stem end. These lesions usually remain superficial with no internal damage to the tuber. However,	*Helminthosporium solani*	Plant disease-free tubers. Use fungicidal seed treatments. Keep storage temperatures and humidity as low as possible, and market infected potatoes as soon as possible after harvest. Disinfect storages before the next crop.

severe symptoms may occur where the infected cells of the periderm and underlying cortex collapse and allow moisture loss.  *Silver scurf symptoms on an infected tuber.*		
Powdery scab This disease causes scabby, warty lesions on the tuber surface, and the lesions fill with dark brown, powdery masses of spore balls. Tuber lesions can be confused with lesions of common scab, but powdery scab lesions are smaller and rounder and seldom as deep. The fungus also produces small, white masses of galls on roots.  *Scabby, warty skin lesions on a tuber infected with powdery scab.*	*Spongospora subterranea* subsp. *subterranea*	Plant certified seed. Follow 4-year crop rotations or longer. Do not plant in infested soil, and do not over irrigate. Use russet cultivars, which are more resistant to powdery scab than many white- and red-skinned varieties.

Powdery mildew Powdery mildew first appears as brown lesions that coalesce to form streaks or stipples on the stems and petioles. Leaf lesions may also show a superficial fungal growth that gives the lesion a powdery gray to brown color that may look, at first glance, like soil or spray residue. As the disease progresses the lower leaves will turn yellow and fall off while the rest of the plant remains erect.	*Erisyphe cichoracearum*	Sprinkle irrigate fields or spray fields with sulfur compounds before infections are established.
Black dot Foliar symptoms include wilting and yellowing that begin at plant apices first, and then develop later in mid to lower plant parts. Wilting symptoms are similar to those characteristic of potato early dying caused by *Verticillium* and *Fusarium* spp. Symptoms on roots include lesions on the main stem, which are similar to rhizoctonia lesions. The disease gets its name from the abundant, black sclerotia that form on the basal stem area. Sclerotia on tubers in storage may give the tuber a grayish cast, which can be confused with silver scurf.	*Colletotrichum coccodes*	Plant certified seed. Establish 4- to 5-year crop rotations. Maintain uniform and continuous growth by providing balanced nutrition and optimal soil moisture conditions. Consider using a strobilurin based fungicide.