

POTATO EYES



Vol. 9, Issue 5, November 1997 • Alexander D. Pavlista, Extension Potato Specialist

UPDATES

MAXIM

Full registration, Section 3, has been approved for MAXIM, fludioxonil. Tolerance was set this month on potatoes at 0.02 ppm. Harvests from seed-pieces that were treated at planting this spring may be commercially sold now. Tablestock and process growers can apply Maxim to seed-pieces to be planted next year. Note, seed producers still can't treat seed with Maxim; but, we are trying to change that. Maxim is a seed dust for the control of silver scurf and other tuber-borne diseases. More on the label will be outlined in Spring.

SuperTin

A Section 24c is being prepared on SuperTin used for controlling early and late blights. The Special Local Needs registration will shorten the pre-harvest interval from 21 to 7 days. Submission and approval is expected this winter or early spring.

Late Blight Systemics

A new Section 18 is being prepared for the late blight systemics - Acrobat MZ, Tattoo C, Manex C-8, and Curzate M-8. Submission is expected in January with approval by April.

Desicate II

Desicate II, a newer version of Des-I-Cate, received full registration, Section 3, late this summer. The product used as a vine desiccant is a more concentrated, water-soluble formulation of endothall. The label indicates that it can be applied by ground or air, and to vines 10 to 14 days before harvest.

Culls for Cattle

After last issue, Ray Cory of Countrywide Seed, Alliance, made some additional comments on using cull potatoes for cattle based on his experience in Maine. Ray suggests mixing hay with potatoes only at feeding time and store them separately if being stored through winter. If the potatoes are stored through winter, he indicated that there was no need to crush or disc potatoes. Potatoes should be allowed to freeze and thaw during the winter. This also will keep any greening, late blight or rot from developing. Ray also indicated that soil-grade calcium may be added since phosphorus can be high. The calcium content should be about equal to the phosphorus content. Ray reported noticing that, when there is too much phosphorus in the feed, arched back and curled toes are possible.

Tuber Diseases in Storage

Pythium - *Phytophthora(s)* - *Alternaria(s)* - *Helminthosporium* - *Colletotrichum* - *Streptomyces*

Several growers this fall asked me how I distinguish between the various tuber rots. What do I look for and how are they different? The following are rough personalized descriptions for the identification of major tuber rots occurring periodically - *Pythium* spp. (leak), *Phytophthora erythroseptica* (pink rot), *Phytophthora infestans* (late blight), *Alternaria solani* (early blight), *Alternaria alternata* (black pit),

A copy of the "Compendium of Potato Diseases" (\$35) published by the American Phytopathological Society is helpful; call 1-800-328-7560 to order.

These are the symptoms that I look for on tubers at harvest and in storage.

LEAK

Pythium spp. (2 main species), fungus; no foliar disease

- **Infection:** Tubers get infected only from infested soil. It is primarily seen at harvest and during early storage. Infection commonly occurs at harvest through wounds or bruises during hot and/or wet harvest conditions. The disease decays tubers but is not transmitted between tubers in storage.

- **Early Symptoms:** Very moist, gray or brown lesions form around wounds or near stem end. Internal starch is breaking down thus cutting the tuber shows a grayish creamy inside which darkens to black upon exposure to air. [note - the blackened tissue looks like blackheart, a physiological disorder, but leak is watery.] A noticeable vinegar-like smell develops; for me this is a really distinguishing symptom.

- **Later Symptoms:** A liquidizing of the tuber's inside is very noticeable and cavities may form. The skin will remain intact, a papery shell, unless ruptured ("shell rot"). Also very noticeable is a strong stench much like rotting fish. No mold is usually seen unlike *Fusarium* rots. [note - The black-bordered creamy cavities are similar to bacterial soft rot (blackleg), but leak is not slimy and it has that smell. In many cases, leak and bacterial soft rot will occur together since both are favored by the same conditions.]

- **Control Practices:** Avoid injury during harvest; avoid harvest when air temperature is much above 70 F and/or soil is wet; allow skin set. (Entire tubers may rot in two days at 75-80 F. In storage, keep cool, keep dry and keep well-aerated, just as recommended for bacterial soft rot. Two applications of metalaxyl in the field when tubers are at "marble" and "golfball" sizes has shown to be effective.

Bacterial Soft Rot or slimy soft rot (bacteria) was covered in last July's issue. The keys to control are cool, dry and aerated.

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Alexander D. Pavlista

Tuber Diseases in Storage

PINK ROT

Phytophthora erythroseptica, fungus; no foliar disease

– **Infection:** Tubers get infected only from infested soil. Like leak, it commonly appears at harvest and early storage. Pink rot will spread from tuber to tuber in storage if tubers are wet. Infection usually starts at the stem end but the pathogen can enter through lenticels and eyes.

– **Symptoms:** The tuber surface shows dark lesions delineated from healthy tissue by a blackish band. Tubers tend to be flaccid and may give off a small amount of liquid when squeezed. The key symptom, which also gives the disease its name, is a pink coloring inside the tuber that develops in 10-20 minutes after cutting. The discolored area is not mushy or slimy, and is not well delineated as with leak or bacterial soft rot. In time, the pink will change to brown and then black. A slight pungent odor similar to formaldehyde may occur. Cavities do not develop as with leak.

– **Control Practices:** Avoid planting in poorly-drained soils. As with leak and bacterial soft rot, pink rot develops when harvest conditions are warm (> 70 F) and wet. Avoid over-irrigating during senescence near the end of the season. Two applications of metalaxyl in the field when tubers are at "marble" and "golfball" sizes has shown to be effective.

– **Vine Symptoms:** Pink rot may cause a wilt at the end of the growing season. The wilt starts from infecting the base of the stem and working up causing leaf yellowing, drying and loss. Aerial tubers may appear. However, pink rot is considered more of a tuber problem than a wilt.

LATE BLIGHT

Phytophthora infestans, fungus; foliar = late blight

– **Infection:** Late blight has changed dramatically in recent years. Symptom descriptions are based on US strain 1, an A1 mating type, which has been the only strain in the US for over a century until the 1990s. This strain has been nearly totally replaced since 1993 by US strain 8, an A2 mating type. This new strain is much more virulent and in many ways acts quite differently from the old strain #1. US-8's vine attack is beginning to be understood, but even less is understood about its soil leaching or tuber behavior. The tuber symptoms described here are still largely based on US-1.

Tuber infection occurs by spores leaching through the soil after being washed off infected foliage. Some infection may occur during harvest (lifting) by direct exposure to infected, still living vines. Late blight needs living tissue to survive (unless/until A1 and A2 type strains meet and mate). Currently, it is presumed that late blight can spread in storage.

– **Early Symptoms:** The tuber's skin has patchy and irregular, brown to purple areas. When cutting through these patches, the inside is a mahogany (reddish brown), firm rot progressing to a quarter to a half-inch deep. This rot is brown with a very irregular border "spiky" or "toothy."

– **Later Symptoms:** Skin patches darken and sink into the tuber. The below skin rot is granular and may have dark projections

going deeper into the tuber. Late blight may be confused with pink eye. Tuber breakdown is due to secondary, saprophytic bacterial infections, "wet rot phase." Bacterial soft rot and *Fusarium* rot can also invade.

True identification of late blight on tubers requires **laboratory testing**.

– **Control Practices:** Treat foliar late blight with registered fungicides in a treatment program. Delay harvest until vine kill is complete. There is current research which suggests that soil treatment with fixed coppers or chlorothalonil may kill spores in and on soil. Sulfuric acid may kill spores at the surface if ground isn't too wet or spores aren't covered by soil, debris or vine. Keep cull piles well away from storage facilities. A lot of research is needed to deal with this new threat.

ALTERNARIA TUBER ROT

Alternaria solani, fungus; foliar = early blight or target spot

– **Infection:** Tubers get infected by early blight only by direct contact with spores during harvest (lifting). Early blight will spread in storage.

– **Symptoms:** The skin surface has brownish-black, circular or oblong patches that are slightly sunken. The patches are well demarcated by a raised margin separating it from healthy skin. Cutting through a lesion (patch or spot), a shallow, dry, brown rot will appear. The rot is sharply delineated from healthy tissue by a corky margin. In advanced stages, it can become watery and the tuber shrivels up. Secondary infections are not a factor as with late blight.

– **Control Practices:** Control foliar development of early blight. Harvest after complete vine kill and allow for skin set. Keeping tubers cool will halt decay and keeping them aerated will inhibit spread in storage.

BLACK PIT

Alternaria alternata, fungus; foliar = brown spot or alternata blight

– **Infection:** Because historically *A. alternata* has been considered a minor problem, there is little known about this disease in potatoes. However, in recent years, *alternata* blight and now black pit has been reported to be a problem more and more in several States from Texas to North Dakota. Because of early blight, it has largely been ignored. The only information available describing the foliar and tuber symptoms come from research done in Israel in the 1980s. Infection of foliage is much like early blight. How tubers get infected is not quite known. Recent observations in Nebraska suggest leaching through the soil much as late blight. Pathologists in Colorado have suggested that the fungus can live in the soil as well. Direct contact with infected vines remains a possibility.

– **Symptoms:** Black pits appear on tuber. These are similar to pits by common scab but are deeper, narrower and blacker. Skin patches nearly identical to early blight can also be clearly seen after tubers are washed.

True identification of late blight on tubers requires **laboratory testing**.

- **Control Practices:** The vine disease is favored by high temperatures, long dew periods and sandblasting. I usually detected on vines several days before early blight, but, once early blight is present, early blight takes over. Alternata blight has been reported to be sensitive to EBDCs. Canadian research has suggested that a single, August application of metalaxyl plus mancozeb may reduce the tuber disease but control of black pit is unknown. Whether black pit will spread in storage is unreported.

SILVER SCURF

***Helminthosporium solani*, fungus; no foliar disease**

- **Infection:** The principle method of infection is believed to be through infected seed. Infected seed release silver scurf into the soil where it can survive for up to six months and infect new tubers. Silver scurf may spread in storage when temperature is above 40 F and humidity is 90-95%. Reports have indicated that silver scurf can spread in storage through the ventilation system. Silver scurf has also been reported to be able to survive in storage facilities on wood, sheet metal and insulation. Spread is minimal but progresses severely on an infected tuber in storage.

- **Symptoms:** Tubers need to be washed to observe symptoms of silver scurf. When tubers are slightly or initially infected, small, round, shiny, light brown spots appear at the stem end. With greater infection or as disease spreads on tuber, the skin has large areas with a shiny silvery appearance. This can be difficult to detect on white-skinned and easily detected on red-skinned varieties. A fluorescence may appear under a black light. With storage, the blotches may wrinkle. No rot is associated with silver scurf; there is no internal symptoms. Silver scurf can readily be confused with black dot and laboratory observations are needed.

- **Control Practices:** Don't let tubers over-mature before harvest. Don't harvest under wet conditions. Keep tubers dry, cool and well ventilated. Silver scurf does not like humidity below 90%. Thiabendazole applied to tubers going into storage is reported to inhibit silver scurf, but resistance has been widely reported. EBDC seed treatments applied to tubers in storage has been reported to be effective. Fludioxonil has this month been registered as a seed treatment for controlling silver scurf (see Updates on page 1).

BLACK DOT

***Colletotrichum coccodes*, fungus; foliar = black dot blight**

- **Infection:** Black dot is introduced into the soil through seed; once introduced, black dot, unlike silver scurf, will survive for years. Many plants, crops and weeds, in the same family as potato serve as hosts to black dot. Thin skinned potato varieties are the more susceptible than thicker skinned ones. The disease infects tubers by entry through stolons.

- **Symptoms:** Stolons, if still attached, will have a reddish (amethyst) coloration and the epidermis, skin, can slough off easily. Under magnification, small, black, spiny dots, looking like tiny black sea urchins, can be observed on the stolon and sometimes on the skin. Tubers skins have large, grayish areas. These areas when wet are nearly indistinguishable from silver scurf; they are a shiny brown. During storage, infected tubers shrink. No rot occurs. To clearly distinguish from silver scurf, laboratory observation is needed. Often both diseases occur together on tubers. Black dot-infected tubers may also be more susceptible to bacterial soft rot.

- **Control Practices:** Tubers should be stored at a humidity above 90% to minimize spread of black dot in storage, just the opposite of silver scurf. Black dot spreads well in storage above 50 F. Avoid skinning at harvest. Rotate crops with grains. Control nightshades and stay away from fields in which nightshade was poorly controlled in previous years. Clear debris from fields after harvest since black dot can over-winter in debris. Black dot is often associated with sandy soils, low nitrogen, high temperatures and poor soil drainage.

COMMON SCAB

***Streptomyces scabies*, bacteria; no foliar disease**

- **Infection:** Tubers get infected during early bulking by attack from the bacteria in the soil. After attack, the wound heals and a repeated attack is possible. There is disagreement on how well soil can be infested by seed-borne scab and how important is seed-borne scab.

- **Symptoms:** Light infection causes a rough (corky), circular, tan to brown surface blemish. With mild infection, blemishes may be raised. Severe infection causes dark brown pits to form which are wider, shallower and lighter than those of black pit. No rot occurs.

- **Control Practices:** Grow scab-resistant varieties on scabby ground. Irrigate to maintain soil moisture above 90% 2-3 weeks after tuber initiation and maintain this soil moisture level until mid to late bulking. Application of ammonium sulfate in-furrow or just before tuber initiation has been reported to reduce scab by half. In acid soil, acidify further by adding sulfur to below pH 5.4. Recent research suggests that a few insecticides have lessened scab infection by affecting soil insects that may play a role. Avoid manure. The similarity of potato common scab and the common scab infecting sugar beets and beans is not clear. Avoid growing potatoes the year after these crops.

Others

Bacterial soft rot (blackleg), dry rot (*Fusarium* wilt), black scurf (stem canker), and vascular discoloration by *Verticillium* wilt (early dying) were covered in the July (9-3) issue of Nebraska Potato Eyes and, therefore, not repeated here. Their tuber symptoms are included in the Table on page 4.





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Primary Symptoms of Tuber Diseases

	External Symptoms	Internal Symptoms	Spread in Storage	Main Source
Leak	dark, large areas; smell; papery shell	liquidized, cavities rancid smell	NO	Soil
Pink Rot	dark areas near stem end, around eyes and pores	pink area after cutting; slight odor	Yes	Soil
Late Blight	brown areas turning black and sinking (depressions)	reddish brown below discolored areas	?	Leaching
Early Blight	brownish-black, irregular sunken areas	shallow, dry and brown below sunken areas	Yes	Lifting
Black Pit	narrow, deep, black pits	pits extend into tuber	?	?
Silver Scurf	shiny, silvery areas	none	Yes	Seed
Black Dot	shiny, brownish areas reddish on attached stolon	none	Yes	Seed, Debris
Common Scab	rough, round surface areas to brown pits	pits extend into tuber	No	Soil, Seed?
Bacterial Soft Rot	slimy, tan spots around wounds or at stem end	slimy, soft rot with dark borders	Yes	Vine, Soil
Dry Rot	dry decay around wounds fungal growth possibly seen	dry cavity from wounds possible ring discoloration	No	Vine, Soil
Black Scurf	black, hard, small spots	none	No	Soil
Early Dying	none; pink eye may occur	vascular discoloration	No	Vine, Soil

