

# MICHIGAN Potato Diseases



## Potato Seed Piece Health Management

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### Disease Complex

Fusarium dry rot (*Fusarium* spp.), soft rot (*Pectobacterium* spp.), late blight (*Phytophthora* spp.) and Pythium leak (*Pythium ultimum*)

### Introduction

Seed-borne diseases of potato represent a significant constraint to potato production in the United States. Pathogens such as *Phytophthora infestans* (late blight) and *Fusarium sambucinum* (Fusarium dry rot) are major pathogens of potato, affecting tubers in storage and seed tubers and sprouts after planting. In severe outbreaks, the pathogens may kill developing sprouts outright, resulting in delayed or non-emergence. Reduction in crop vigor then results from expenditure of seed energy used to produce secondary or tertiary sprouts to compensate for damage to primary sprouts. The use of an effective seed treatment in combination with good management practices during cutting and seed storage prior to planting is essential to reducing late blight and Fusarium dry rot, as well as secondary bacterial soft rot in cut seed prior to planting.

### Symptoms

The potato crop cycle offers two main opportunities to control seed-borne diseases such as tuber late blight and Fusarium dry rot. The first is the postharvest control of seed piece decay in the tuber crop in the fall. The second is the control of seed piece decay and sprout infection prior to planting the crop in the spring. The pathogens causing tuber rots and seed piece decay generally all infect tubers through wounds produced during harvest and transportation. Fungal pathogens such as *P. infestans* and *F. sambucinum* are usually the first pathogens to infect tubers. These are followed by the bacterial soft rots (*Pectobacterium* spp.). The first symptoms of Fusarium dry rot are usually dark depressions on the surface of the tuber. As lesions increase in size, the skin becomes wrinkled in concentric rings as the underlying dead tissue desiccates (Fig. 1). Clumps of fungal mycelium and white to pink pustules containing spores may emerge through the dead skin (Fig. 2).

Late blight infection of tubers is characterized by irregularly shaped, slightly depressed, brown to



Figure 1. External symptoms of Fusarium dry rot. Dark depressions form on the surface of the tuber, and the skin becomes wrinkled as the underlying tissue desiccates.

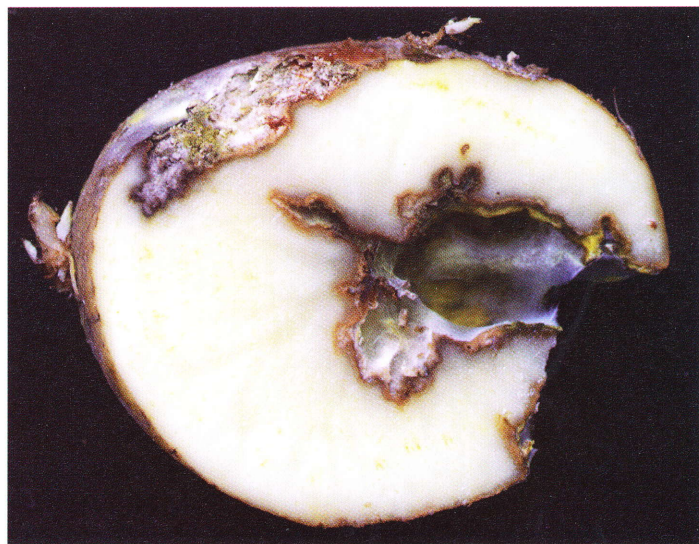
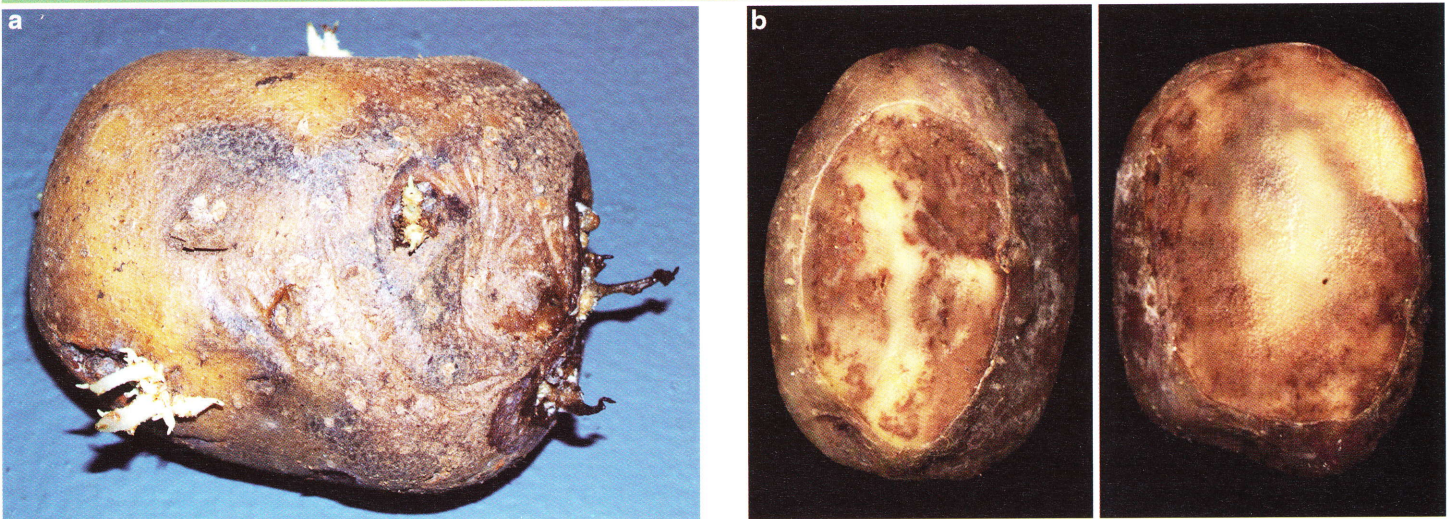


Figure 2. Internal dry rot symptoms. Clumps of mycelium line a dry necrotic cavity hollowed out from rotted tissue. White to pink spore masses form on the tuber surface.





**Figure 3.** Late blight infection of tubers is characterized by irregularly shaped, slightly depressed, brown to purplish areas on the skin (a). A tan to reddish brown, dry granular rot is found under the skin in the discolored area (b).

purplish areas on the skin (Fig. 3a). These symptoms may be less obvious on russet and red-skinned cultivars. A tan to reddish to brown, dry, granular rot is found under the skin in the discolored area, extending into the tuber usually less than 1/2 inch (Fig. 3b). The extent of rotting in a tuber depends on the susceptibility of the cultivar, temperature and length of time after the initial infection. The margin of diseased tissue is not distinct and is marked by brown, fingerlike extensions into the healthy tissue of the tuber. In time, the entire tuber becomes blighted and discolored. Late blight rot of tubers is often accompanied by soft rot (Fig. 4a), and in many cases more than one fungal pathogen may infect tubers at the same time (Fig. 4b).

### Current management problems

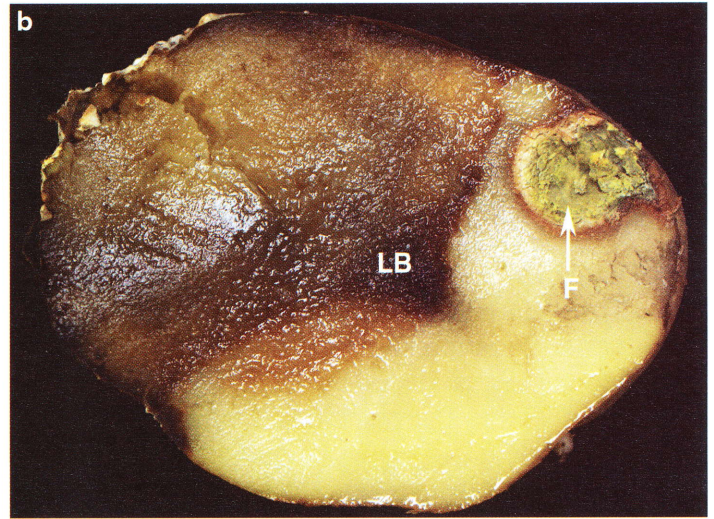
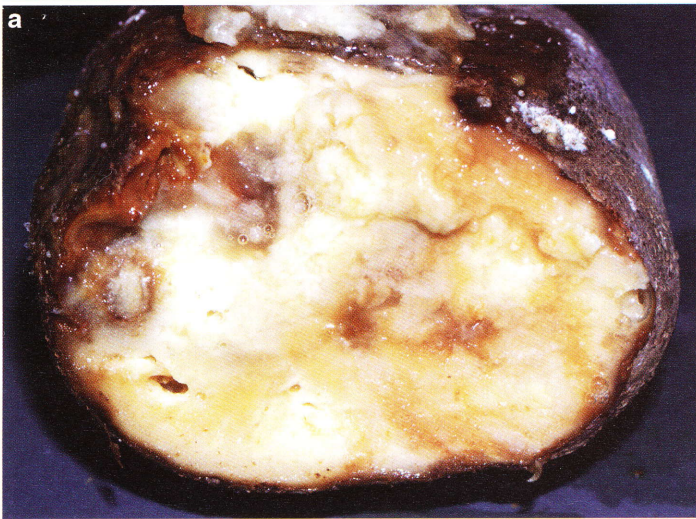
During recent growing seasons in Michigan, three factors have enhanced seed-borne disease problems: lack of information on effective fungicides for both postharvest and preplanting use against seed-borne disease-causing pathogens (e.g., *P. infestans* and *F. sambucinum*); an increase in the area of potatoes grown by fewer growers, leading to management issues such as timing of precutting of seed; and climatic factors such as increased frequency of rain events during planting. In combination, these factors can delay planting and increase the impact of seed-borne diseases during the early portion of the growing season, and subsequently may affect yield and quality of the crop.

Current recommendations for seed cutting describe some guidelines for the cutting process but do not indicate a time period or management strategy for storage of cut seed. Potato seed tubers are main-

tained in storage at 37°F, which is approximately the temperature at which *F. sambucinum* is dormant. Consequently, there is minimal development of dry rot in storage. However, some level of *Fusarium* dry rot is almost always present in commercially available seed. During the preplanting phase of potato production, seed tubers are warmed to about 54°F, then cut into seed pieces prior to planting. Tubers infected with *F. sambucinum* are particularly susceptible to the development of seed piece decay during this phase, and in cases of severe disease, seed pieces may rot completely before planting. Alternatively, after planting, over 50 percent of sprouts developing on infected tubers may become diseased and may be killed outright before emergence. Damage at this stage results in delayed or non-emergence and is usually expressed as poor and uneven stands with weakened plants. Reduction in crop vigor then results from expenditure of seed energy used to produce secondary or tertiary sprouts to compensate for damage to primary sprouts.

Studies at Michigan State University have shown that the effect of the timing of precutting potato seed and timing of application of seed piece fungicides prior to planting on seed piece decay, plant establishment, subsequent vigor and early crop development is complex and can be affected not just by the presence of inoculum but also by seed storage conditions after seed cutting and prior to planting. The most effective control of seed-borne fungal pathogens is achieved by the application of an effective seed treatment, such as fludioxinil (Maxim-based products) prior to planting. Thus, the use of an effective seed treatment in combination with good management practices during the cutting process and storage of cut seed





**Figure 4. (a) Late blight rot is often accompanied by bacterial soft rot, which makes the tissue mushy and slimy. (b) Tubers may be infected by multiple fungal pathogens, followed by soft rot. LB, late blight; F, Fusarium dry rot.**

prior to planting is essential to reducing Fusarium dry rot and secondary bacterial soft rot in cut seed prior to planting. Treatment of infected seed pieces with Maxim MZ at 10, 5 or 2 days before planting significantly reduced the percentage of diseased sprouts per tuber and significantly reduced seed piece decay in cultivars Pike and FL1879.

Some level of Fusarium dry rot is almost always present in commercially available seed. Even though it is not possible at present to be 100 percent sure that a seed lot is completely free of dry rot, it is sensible to plant seed that meets established seed certification standards. Although it may not seem cost-effective to apply seed treatments to healthy seed, these results suggest that applying a seed treatment up to 10 days prior to planting can provide effective control of dry rot and increase rate of emergence, rate of canopy closure and final plant stand. In addition, broad-spectrum seed treatments containing mancozeb may suppress other seed-borne diseases such as *Rhizoctonia* stem canker and black scurf, silver scurf, black dot and early blight.

### Management recommendations

The following practices to minimize seed piece decay and maximize early plant development and vigor have been compiled from recommendations developed at MSU, Cornell, North Dakota State University, and the universities of Minnesota, Idaho, Maine and Wisconsin.

#### Plant only certified seed

- Varietal purity and disease standards are regulated.
- Historical aspects of seed – such as generation

source, year, grow-out tests and field observations (e.g., late blight) – are recorded.

- Develop personal relationships between suppliers and customers:
  - Assurance about growing and storage conditions
  - e.g., fungicide programs, storage treatments.
  - Assurance about conditions after seed has been received.
- Home-saved, over- or undersized or generally non-certified seed will cause problems later in the season.

### Cultural practices

- Arrange a mutually acceptable delivery time, taking into account seasonal temperatures at both locations.
- Do not use a storage facility where sprout inhibitors have been used unless it has been thoroughly cleaned.
- Clean and disinfect seed storage facilities.
  - Clean ventilation system, plenums, ducts, etc.
  - Brush down walls and floors.
  - Wash walls and floors (detergent and high-pressure washer).
  - Recover surfaces with disinfectant (QA, bleach,  $\text{ClO}_2$ ,  $\text{H}_2\text{O}_2$ ) for at least 10 minutes.
  - Steam clean (in excess of 150°F).
  - Rinse and allow to dry (hot or cold water).
- Do not store seed near potential sources of inoculum (e.g., cull piles).
- Keep seed lots as separate as possible.
- On receipt, check certification documents.
- Check for signs of damage during transit (odors and liquefaction).
- After careful unloading, store seed at 40° to 42°F and 85 to 90 percent relative humidity and keep it well ventilated.



- Prior to cutting seed, slowly raise the storage temperature to 50° to 55°F.
- After cutting (and treating), seed should be piled no more than 6 feet high, stored at 50° to 55°F and ventilated to promote wound healing (REI after seed treatment is normally 24 hours).

### Seed cutting

- Clean and disinfect seed cutters regularly.
- Use water-impermeable seed cutters. Closed-cell sponge rollers are recommended.
- Keep the blades sharp and adjusted to deliver an average seed piece weight of about 2 ounces.
- Clean and disinfect cutting equipment, preferably each day and definitely between seed lots.
- Enforce sanitation practices for workers.

### Determining Potential for Dry Rot and Seed Piece Decay

- Seed lot should be visibly free of tubers with symptoms of *Fusarium* dry rot.
- Federal regulations allow 1 percent dry rot at shipping; by planting, 2 percent level may develop (reasonable).
- Determine *Fusarium* inoculum on tubers visibly and also cut symptom-free tubers (about 50) in half, place in a large paper bag and shake them for

about 2 minutes.

- Incubate at about 50°F in high humidity and examine for symptoms of seed piece decay after 10 to 14 days.
- If greater than 2 to 10 percent of seed pieces have symptoms of *Fusarium* seed piece decay, a seed treatment containing mancozeb, such as Maxim MZ or Moncoat MZ, should be used.
- If greater than 10 percent of pieces are showing symptoms, consider planting whole seed, removing clearly diseased seed tubers, applying a seed treatment or rejecting the seed lot.

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For more information, please visit: <http://www.potatodiseases.org>.

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