Internal Physiological Disorders:

Internal Heat Necrosis and Blackheart

Heat Necrosis

Internal physiological disorders reduce the quality and marketability of potatoes. Every few years, a plethora of potatoes exhibit internal heat necrosis and blackheart in the Red River Valley.

Internal heat necrosis can be described as tan to brown spots in the parenchyma tissues of harvested tubers. The spots first appear near the apical end of the tuber (Figure 1). This disorder also has been referred to as internal browning, physiological internal necrosis, internal brown fleck and chocolate spot.

This is a physiological disorder that likely is caused by several environmental stimuli: high day and night temperatures, high soil temperatures and low soil moisture.

Symptoms generally are not observed on tubers or foliage, except some cultivars may express blackened eyes, tuber distortions and depressed skin or shrunken legions on the tuber surface.

Reports indicate that tubers with internal heat necrosis often have firm tissue, and tissue remains firm even after cooking. The color, intensity and...
area affected will increase through time and can intensify in storage.

Cultivar susceptibility will influence internal heat necrosis. The cultivar Atlantic is well-known for being highly susceptible to heat necrosis. Other cultivars known to be susceptible to internal heat necrosis are Chieftan, Yukon Gold and Russet Burbank. Harley Blackwell is resistant to internal heat necrosis, and other new cultivars are being developed that express resistance to internal heat necrosis.

**Managing Heat Necrosis**

Heat necrosis is a disorder that involves heat and moisture, thus it is physiological and not a biological organism causing this problem.

**Practices to help mitigate heat necrosis that growers can control include:**

- Plant and hill in a timely manner to avoid heat stress.
- Plant cultivars known to be less susceptible to stress.
- Reduced in-row spacing.
- Apply proper nutrients to promote vine and tuber growth.
- Maintain a healthy canopy to shade hills and reduce soil temperature.
- Avoid harvesting when soil temperatures are high.
- Transport and store tubers in ideal conditions, and avoid too much heat.

**Blackheart**

Blackheart is a physiological disorder caused by lack of oxygen, leading to dark, necrotic cavities. The symptoms are an irregular-shaped area that turns black to blue-black with a distinct border (Figure 2).

This disorder can occur during tuber development, before harvesting or in storage. During tuber development and harvest, conditions that favor low-oxygen availability such as compacted soils can lead to the development of blackheart. A water film surrounding the tuber (oxygen diffuses slowly through water) and water-logged soils also will favor blackheart development.

Blackheart development is intensified when the temperature is high because respiration rates of potato tubers are greater in high temperatures, while lower temperatures need a longer period of time for symptoms to develop. Thus, when vines are removed or desiccated to allow potatoes to set skin, this period of time can be critical in blackheart development if soil temperatures are hot and the soil becomes waterlogged.

Potatoes in storage can develop blackheart when bins are closed, piles are deep with poor ventilation, tubers are harvested when they are muddy or an excess of soil is in the storage facility, or when a water film covers the potato.

**Managing Blackheart**

Here are some ways to reduce opportunities for blackheart to develop:

- Use fields with good drainage.
- Avoid excessive irrigation.
- Encourage good soil porosity through tillage, organic matter and other means to boost air exchange.
- Avoid high respiration rates, especially water condensation on tubers.
- Do not apply water to potatoes going into storage.
- Maintain good aeration in storage with plenty of fresh air.
Internal heat necrosis and blackheart can be found in tubers subjected to the previously mentioned conditions for both disorders (Figure 3). Internal physiological disorders make tubers unmarketable, and they are more susceptible to secondary fungi and bacteria.

Seed potatoes with these internal disorders are weakened and will not favor a vigorous plant or uniform stand. These disorders are not seed transmitted.

Although we cannot prevent these disorders, careful management of the potato crop in the field and in storage can reduce the severity of these internal physiological disorders.

Figure 3. Effects of internal heat necrosis and blackheart from potatoes stored for seven months.

Selected References


