

Potato Physiological Disorders – Internal Heat Necrosis¹

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Potatoes, a cool season crop, are planted in northeastern Florida's Tri-County Agricultural Area (TCAA; St. Johns, Putnam and Flagler counties) beginning in late December when day length is short and soil temperature is relatively cool. As the season progresses, daylight hours lengthen and soil and air temperatures increase as the potato plant reaches key developmental stages (emergence, tuber initiation, and full flower). Florida potatoes are grown in sandy, coarse-textured soils with low water holding capacity. Environmental factors, combined with heavy rainfall potential during the growing season, can cause leaching of mobile nutrients like nitrate-N, resulting in nutritional stress of the potato plant. Nutritional and environmental stress can initiate potato physiological defects such as brown center, hollow heart and internal heat necrosis.

Internal heat necrosis (IHN) is a physiological tuber disorder that causes an unacceptable browning of the tuber tissue and can increase economic loss to the grower (Stevenson et al., 2001). IHN is described in the Compendium of Potato Diseases, 2nd edition, as a physiological disorder caused by elevated soil temperatures during the latter stages of growth and

development of the tuber. If the vines and leaves are still actively growing and green during this period of elevated temperatures, water and nutrients are translocated from the tuber to supply the plant. The vascular system of the tuber is stressed and cannot sustain the evapotranspirational demands of the plant. Under these conditions, it is reported that the vascular ring deteriorates and becomes necrotic. The three suspected leading causes of IHN in tubers are temperature, soil moisture, and plant nutrition.

Necrotic areas are mostly found in and around the vascular ring usually coalescing and radiating to the center (pith). The symptoms are more prevalent at the bud (apical) end of the tuber than at the stem end (Figure 1). The exterior of the potato tuber does not show visible signs of IHN. IHN does not affect the nutritional value of the tuber, but the economic impact can be significant due to off-grade quality.

Internal necrosis has also been referred to as internal brown spot (IBS), chocolate and rust spot, internal browning and internal brown fleck (Sterrett and Henninger, 1997). Unlike IBS that is reported to occur throughout the growing season, IHN of

1. This document is HS1145, one of a series of the Horticultural Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date June 2008. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.

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'Atlantic' has been reported to occur during the mid to late bulking period of the tuber. Worthington et al. (2007) demonstrated that IHN in Florida production is triggered by rainfall and nutritional conditions that stress the plant early in the season combined with relatively high minimum daily temperatures late in the season (Yencho et al., 2008).

'Atlantic' is the prevalent chip potato variety planted in the TCAA encompassing 50 to 60% of the acreage (~9,600 acres) making it economically vital to the area. Major chipping processors request 'Atlantic' for its chipping quality. 'Atlantic' is noted for its light chip color, relatively high yield, and high specific gravity (Webb et al., 1978). However, 'Atlantic' is susceptible to internal heat necrosis (IHN).

In 2003, 'Harley Blackwell' was released by the USDA which may provide chip potato growers an alternative to 'Atlantic'. Over nine seasons of evaluation, marketable yield of 'Harley Blackwell' was 12% lower compared with 'Atlantic' (305 and 342 cwt acre⁻¹), respectively. Additionally, specific gravity of 'Harley Blackwell' (1.078) was slightly lower than 'Atlantic' (1.081), but acceptable according to chipping standards (Beltsville Agricultural Research Center Web site) (United States Standards for Grades of Potatoes for Chipping, 1978). However, 'Harley Blackwell' is resistant to IHN. Other IHN-resistant clones are currently being evaluated at the University of Florida's Partnership for Water Agriculture and Community Sustainability at Hastings farm.

Although adverse weather conditions during the growing season in the TCAA cannot be avoided, options for growers to help reduce the incidence of tubers with IHN are available. First, nutrient balance should be properly managed to reduce plant stress early in the season, particularly during rapid growth and development. Second, planting IHN resistant clones will, help reduce IHN incidence. 'Harley Blackwell' can be planted for late-season contracts when warmer, wetter weather conditions are prevalent and the development of IHN in 'Atlantic' is exacerbated.



Figure 1. Internal heat necrosis in 'Atlantic'. Top photo: Internal heat necrosis along the vascular ring at the bud (apical) end of 'Atlantic' cut into quarters. Lower photo: Internal heat necrosis along the vascular ring coalescing towards the center (pith) of a radially cut 'Atlantic' with the greatest severity at the bud (apical) end of the potato

Further Information

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