

HEAT STRESS CAUSES POTATO TUBER SECOND GROWTH

Secondary growth often manifests as heat sprouts, tuber chaining and malformations

By Andy Robinson, associate professor and extension potato agronomist, North Dakota State University/University of Minnesota, and Eugenia Banks, potato specialist, Ontario Potato Board

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Potato tubers are the result of plant genetics and the environmental conditions in which they are grown.

Potato varieties are selected carefully for tubers that have desirable appearance to maximize sales and reduce waste.

However, some years can cause more environmental stress than others, resulting in tuber secondary growth. Secondary growth often manifests as heat sprouts, tuber chaining and tuber malformations.

This physiological disorder decreases



Figure 1. Pointy stem end tuber. (Andy Robinson, NDSU/UM)



Figure 2. Bottleneck-shaped tuber. (Andy Robinson, NDSU/UM)

yield and quality of the tubers in the field. The most common condition leading to secondary growth is heat stress, specifically soil temperatures.

Wisconsin's long dry spell and heat in late July through August of this past year caused some second growth problems on certain varieties.

Soil temperature as low as 75 degrees Fahrenheit can stimulate this disorder, while soil temperature held at 82 degrees for a month or 90 degrees for one week has resulted in consistent and significant second growth of tubers.

The development of second growth can also be attributed to other conditions that interrupt or temporarily halt growth, such as moisture stress or nutrient imbalance.

A combination of stresses, such as heat and moisture, will exacerbate plant stress and cause more pronounced second growth.



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STRESS INTENSITY

The size, shape and amount of second growth depend on the growth stage, variety, and the duration and intensity of the stress.

Second growth reduces tuber quality and marketable yield by consuming plant energy for heat sprouts, resulting in misshapen, unmarketable tubers, while not providing any benefit to the grower.

In a stressful period, normal potato tuber growth is interrupted or stopped, and then normal tuber growth resumes. This change in growth can affect how tubers develop.

Early bulking stress can constrict stem end growth, resulting in pointy stem end (Figure 1) or bottleneck tubers (Figure 2). Mid-bulking growth disruption leads to tubers that look like dumbbells (Figure 3), or those that are kidney-shaped (Figure 4) or

elongated (Figure 5).

Late-bulking growth disruption can cause pointy bud end tubers (Figure 6). Tubers with pointy ends, generally those receiving the early bulking stress, may develop jelly end rot (Figure 7) or an accumulation of sugars in the stem end, rather than starch, that appears translucent.

Jelly end rot results in soft, jellylike, slightly watery ends.

Fusarium can infect jelly ends and appear like dry rot. The affected area may extend up to an inch or more from the stem end.

As the tubers age or dry out, the affected tissue dehydrates, shrivels, and turns light brown and papery.

LATERAL BUDS

Heat stress can also stimulate growth of lateral buds, resulting in protruding eyes or knobs (Figure 8).



Figure 3. Dumbbell-shaped tuber. (Andy Robinson, NDSU/UM)



Figure 4. Kidney-shaped tuber with heat sprouts. (Andy Robinson, NDSU/UM)

Heat sprouts and chaining of tubers are an outcome of renewed growth

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following a stress period.

Heat sprouts (Figure 9) grow from stolons or tubers and will grow above ground into leafy stems (Figure 10) or below ground as stolons (Figure 11).

Tuber chaining (Figure 12) can occur when multiple tubers are set on one stolon. Varieties with short dormancy seem to be more prone to develop heat sprouts and chaining of tubers. This can result in dormancy being broken, causing tubers to sprout prior

to harvest.

Storing these potato tubers can be difficult because they are physiologically old and often will develop secondary tubers in storage (Figure 13).

Potato second growth is a difficult disorder to avoid because of the strong environmental influence on plant growth and development.

To minimize second growth, look for varieties that are less prone to having

second growth and try to maintain ideal conditions for uniform plant and tuber growth.

Cultural management practices may include promoting uniform stands, ensuring adequate plant nutrition, and promoting uniform soil moisture to meet crop demand.

Irrigation can be used to cool the soil, but do not overwater because this can lead to lenticel enlargement and pathogen entry into tubers. **BCT**



Figure 5. Elongated tuber. (Andy Robinson, NDSU/UM)



Figure 6. Pointy bud end tuber. (Andy Robinson, NDSU/UM)



Figure 7. Jelly end rot. (Andy Robinson, NDSU/UM)



Figure 8. Protruding eyes or knobs. (Andy Robinson, NDSU/UM)



Figure 9. Heat sprouts. (Andy Robinson, NDSU/UM)

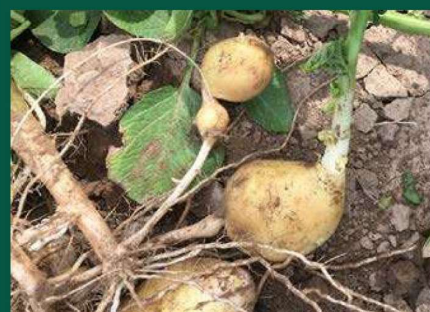


Figure 10. Heat sprouts with foliar growth. (Eugenia Banks, Ontario Potato Board)

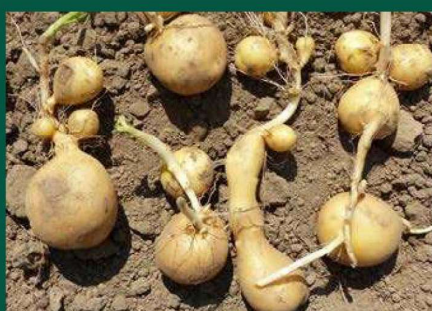


Figure 11. Heat sprouts with tuber chaining. (Eugenia Banks, Ontario Potato Board)

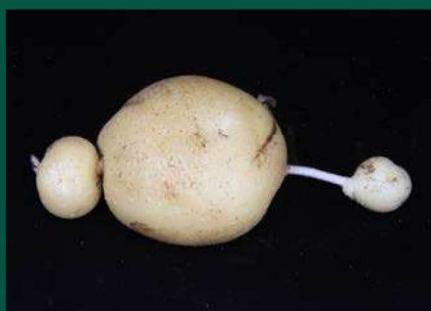


Figure 12. Tuber chaining. (Andy Robinson, NDSU/UM)



Figure 13. Second tubers. (Andy Robinson, NDSU/UM)