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Internal Brown Spot (IBS) "Internal Fleck", "Internal Rust Spot"

General

- It is not possible to detect and remove affected tubers and therefore the whole line becomes downgraded.
- The disorder seriously affects the quality of potatoes for the fresh- and processing market.
- Potato varieties show clear differences in their susceptibility to IBS.
- Some literature suggests that IBS can continue to intensify during storage at high temperatures.
- Immature tubers will have a higher incidence of the disorder.
- Symptoms of IBS can be confused with those of the virus disease corky ring spot (tobacco rattle virus).

Symptoms

- Small, round or irregularly shaped, light tan, reddish brown, or rust colored spots or blotches scattered throughout the tuber flesh.
- The brown spots consist of groups of dead suberised cells that are free of fungi and bacteria.
- The spots can be anywhere but are more commonly found inside the vascular ring and towards the apical end.
- There are no external symptoms except that larger and deformed tubers show a higher incidence of IBS.

Possible Cause

- Can develop just after tuber initiation or during bulking in periods of rapid or uneven growth of tubers.
- Re-absorption of water or other constituents from tubers to support vegetative development cause tuber cells to dye. This can occur during periods of plant stress normally on coarse textured soils with hot dry weather, high soil temperatures and low or fluctuating soil moisture.
- Calcium deficiency resulting from:
    - the poor transport of this element through rapidly growing tuber tissue,
    - low concentration of calcium in the soil-water-solution,
    - cat-ion competition with for example NH_4 and K,
    - soil pH below 5.

Heat Necrosis

Symptoms

- Lesions resemble those of IBS but are principally confined to the vascular ring tissue near the apical-end of the tuber.

Possible Cause

- Most common in tubers growing near the soil surface where exposed to higher soil temperatures especially after vine kill and during harvest and storage.

Brown Centre

General

- Brown Centre and Hollow Heart are considered to be different phases of the same disorder although Brown Centre do not have to precede Hollow Heart.
- Brown Centre is initiated when tubers are very small, the most susceptible period being from tuber initiation to the time when tubers weigh about 60 grams.
- If the tubers grow slowly and uniformly after the discoloration develops, the dead cells may be spread apart by the growth of living cells interspersed among them, and the brown colour may dissipate by the end of the growing season.

Symptoms

- Light brown pith tissue near the centre of the tuber.

Possible Cause

- Problems of calcium deficiency.
- Soil temperatures below 13ºC for 5 to 7 days during tuber initiation and early bulking.

Hollow Heart

General

- Can develop during tuber initiation called stem-end Hollow Heart and or later in the season called apical Hollow Heart.

Symptoms

- Star shaped or lens shaped, cork lined cavity in the pith of the tuber.
- Cavities can range from tiny openings to pockets nearly the size of the entire pith tissue.

Possible Cause

- Splitting of the central tissue during excessively rapid tuber growth.
- Breakdown of tissue in the centre of the tuber during early stages of growth due to potassium deficiency followed by rapid tuber growth.

- Stresses during or shortly after tuber initiation cause potato plants to take water minerals and carbohydrates from the young growing tubers, resulting in the death of some cells. When the stresses are relieved the return of favourable growing conditions result in rapid tuber enlargement, causing the injured cells to separate thus forming the Hollow Heart cavity.
- When conditions of rapid tuber growth succeed conditions such as drought and or cold weather which have caused cessation of growth.

Glassiness

General

- Glassiness is associated with second growth and are also called "translucent end", "sugar end", "incipient jelly end", or "jelly end rot".
- Deformed and pointed stem end tubers are normally associated with translucent end.
- The cells of the glassy part of the tuber contain a few or no starch particles and are filled with cell sap resulting in lower dry matter content and high reducing sugars in affected tissue.
- Severely affected tubers will be squashed during the first weeks of storage and, as a result, adjacent tubers will become damp and may start to rot.

Symptoms

- When elongated tubers show symptoms of glassiness at the stem end of tubers it is called "translucent end" etc. When such tubers are processed into french fries it will fry darker at the stem end due to an accumulation of reducing sugars there.
- Sometimes the entire tuber will become glassy or it may become spongy or, in severe cases develop cavities.
- When the tissue of the stem end of a long tuber appears water soaked or it may become rotten it is called "jelly end rot".

Possible Cause

- Second growth is characterised by the formation of new shoots and leaves and often also secondary flowering.
- Below ground second growth results in sprouts forming on tubers, knobs may also grow from one or more eyes, or chains of tubers may be formed on the same stolon.
- Second growth can occur when periods of low soil moisture and high ambient and soil temperatures (above 24ºC) causing stagnation of growth are followed by favourable growing conditions.
- Growth and starch synthesis resume only in certain areas of the tuber resulting in tuber malformation and glassiness.
- Glassiness can be the result of:
    - starch removed from the primary tuber to the secondary tuber where chains of tubers have formed on the same stolon. This normally happens after haulm destruction.
    - starch moving out of the stem end tissues and into the plant for renewed vegetative growth following a period of stress.

Integrated approach for the control of Internal Brown Spot, Heat Necrosis, Brown Centre, Hollow Heart and Glassiness

- Choose the date for planting susceptible varieties so as to avoid periods of high ambient and soil temperatures and other possible stresses during the period of tuber initiation and early bulking.
- Apply irrigation and fertilization practices that promote even growth without periods of stress on the plants especially during tuber initiation and thereafter.
- Ensure that all nutrients are available in adequate quantities.
- Spread nitrogen applications evenly over the growing season. Do not apply nitrogen at or just after tuber initiation.
- Avoid having excessive vegetative growth that will lead to plants being more susceptible to soil moisture and high temperature stress.
- Try to avoid the coarser soil textures.
- Apply cultural practices that tend to shift the size distribution to avoid having excessively large tubers. This would include:
    - Having good plant stands with few skips.
    - Having several stems per plant to ensure adequate plant competition.
- Harvest the crop as soon as possible after maturity or haulm destruction particularly in warmer times of the season.
- Keep tubers as cool as possible (13-20 ºC) from the time of haulm destruction till prosecing.
- Ensure that adequate levels of calcium are present for the plant and tubers. Much of the calcium in tubers are taken up directly from the soil-water-solution surrounding the tubers.
- Choose a planting date to avoid young tubers being exposed to soil temperatures below 13ºC for more than 5 days.
- Prevent soil temperatures reaching 24ºC and higher during and after tuber initiation. This can happen in situations where the canopy has not yet closed. Irrigation will cause the soil temperature to drop.
- Tubers with glassiness can be removed from the line with the aid of a salt bath with a specific gravity of 1.060-1.065, on which the affected tubers will float.

References

- "Physiological Disorders of Potatoes", Potato Short Course-Potato production in South Africa with the emphasis on KwaZulu-Natal, Agricultural Research Council, South Africa, Martin Steyn, pp. 143-145.
- "Internal Rust Spot“, "Hollow Heart" & "Second Growth", Potato Diseases, NIVAA, Holland, pp. 126, 140, 153, 161.
- “Controlling Internal Fleck in Potatoes”, Crop & Food Research, Pukekohe, New Zealand, J.A.D. Anderson.
- "Movement of Calcium and Potassium to the developing fruit and their Agricultural Importance", Sixth Meeting, Topics in Irrigation, Prof. Uzi Kafkafi, Haifa Chemicals, South Africa.
- "Brown Center and Hollow Heart" & "Internal Brown Spot and Heat Necrosis“, Potato Health Management, Randall C. Rowe, pp. 68, 89-91.
- “The Potato-Third Edition”, W.G. Burton,pp.195, 284-285.
- "6th August 2001: Brown Centre", Potatocrop.com, Agronomy notes, Denis C. Buckley.