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Physiological Disorders of Solanaceous Vegetables

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ARTICLE ID: 27

Introduction

A physiological disorder is a divergence from normal growth produced by abnormal, non-pathological changes in plant tissues as a result of non-living, abiotic factors or as a reaction to genotype-environment interactions. It can be reversible or irreversible depending on its severity and duration. In most cases, they cannot be reversed after they have occurred. Physiological disorders in wild species are rare, which may be due to natural selection, which eliminates genotypes that are poorly adapted to their environment. On the other hand, crop plants have been observed to exhibit a wide range of physiological disorders, showing that the mechanisms for physiological disorders were also selected for human needs during plant breeding.

POTATO

1. GREENING

Greening of the tissue immediately under the skin occurs, but the intensity may differ and may also be accompanied by sunburn. Generally, excessive application of fertilisers or exposure of tubers to sunlight leads to solanine production, which is slightly poisonous. This disorder can be controlled by proper earthing up of tubers as the tuberization takes place to protect them from direct sunlight and storing tubers in darkness after digging up. Avoid high nitrogen applications, especially with cultivars that are prone to forming long stolons.

2. INTERNAL BROWN ROT

Irregular, brown spots are scattered through the flesh of tubers due to moisture deficiency. Light sandy soils are not irrigated regularly, leading to irregular moisture supply and, ultimately, internal brown rot occurs. Regulate proper moisture supply to control this disorder.

3. BLACK HEART

Poor ventilation, characterised by blackening of tissues in the centre of potatoes, occurs due to poor ventilation which leads to sub-oxidation conditions under potato tuber storage in piles as

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the air does not get into the centre and also due to high temperatures due to high respiration. Provide proper ventilation and keep potato tubers in layers, not in the heap.

4. HOLLOW HEART

Tubers grow large and remain hollow inside, resulting in the death of pith cells and a cavity in the centre. The potato's centre expands as it grows, generating cracks and hollowness. The excessive use of nitrogenous fertilisers accelerates the development of this disorder. Maintain appropriate soil moisture and minimise excessive fertiliser, particularly nitrogen. Consider planting potatoes at a later date when temperatures are higher if early plants have a brown centre.

5. CHILLING INJURY

Chilling injury is not visible on the tuber surface but causes pinkish-red to reddish-brown or smoky grey discolouration in the vascular tissue of the tuber. It may occur due to low temperature (0–2.5 °C) exposure during heavy field frost, storage or transit. Use tolerant varieties, maintain proper ventilation, and set a temperature above 4 °C.

Freezing injury to potatoes can also occur due to low temperatures (-1 to -2 °C).

TOMATO

1. BLOSSOM END ROT

A brown water-soaked discolouration appears at the blossom end while the fruit is still green. The spots become larger and darker quickly, and the infected fruit turns sunken, leathery, and black. It occurs mainly due to calcium deficiency and is common in greenhouses. Balanced irrigation, staking, and foliar spray of 0.5% calcium chloride ($CaCl_2$) at the time of fruit development can treat this disorder.

2. FRUIT CRACKING

Radial and concentric cracks are formed on the tomato fruit due to boron deficiency, fluctuations in soil temperature, irrigation or rainfall after a long dry spell. Radial cracking is more common than concentric cracking. To control this, spray 0.3-0.4% borax solution on seedlings before transplanting or grow resistant varieties like Sioux, Roma, Punjab Chhuhara, Pusa Ruby, Arka Saurabh, etc.

3. BLOTCHY RIPENING

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Tomato fruits show irregular ripening and green blotches over the red skin due to severe water stress, poor potassium uptake, and distribution in plants. It can be managed by regulated water supply during fruit development and foliar sprays of 0.5% potassium chloride.

4. PUFFINESS

The outside wall of mature fruits continues to develop normally, but the growth of the remaining internal tissues, such as the placenta and mesocarp, is slowed down, resulting in a fruit that is only partially filled, light in weight, and lacks a solid texture. A cross-section of diseased fruit reveals voids or pockets. Low or high temperatures, as well as insufficient pollination, can cause tomatoes to be puffed up. It is manageable if over-irrigation and heavy nitrogen applications are avoided.

5. SUN SCALD

The exposed portion of either green or nearly ripe fruits gets blistered and water-soaked due to the extreme heat of scorching sunshine. Rapid desiccation in the blistered portion turns the sunken areas white or grey in green fruits and yellow in pink or red fruits. To avoid this disorder, protect plants from defoliation by diseases and insect pests. Training and pruning in the summer months should be avoided, and cultivars with heavy foliage cover should be used.

6. CATFACE

Unfavourable climatic (high or low temp at fruit set) conditions during flowering cause distortion of the blossom end, resulting in various ridges, furrows, and indentations in a localised area of the fruit. Tomatoes should be grown in areas with ample climatic conditions.

7. GOLDEN FLECK

Tiny yellow spots appear on the fruit surface around the calyx and fruit shoulder due to the high supply of calcium and phosphatic fertilizers. The primary causes of this disorder are the low K:Ca ratio and an excess of calcium oxalate. This disorder happens less often when the right amounts of calcium and potash fertilisers are used, and the plants are shaded in the summer.

8. UNFRUITFULNESS

Temperature, particularly night temperature, has a significant impact on fruit set in tomatoes. Both high (> 32°C) and low temperatures (at or below 13°C) have a negative impact on fruit set by decreasing pollen viability and pollen germination on the stigma. In eastern India, a low fruit set is an issue during summer cultivation. High temperature tolerant varieties, such as HS-

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102, Punjab Kesar, Punjab Chhuhara, Hot Set, etc., and low temperature tolerant varieties, such as Pusa Sheetal, Cold Set, etc., can be used to suppress this weed. This problem can be solved by applying growth factors like parachlorophenoxy acetic acid (PCPA) at 50 ppm during full bloom or 2,4-D at 1-2 ppm before anthesis.

BRINJAL AND CHILLI

Chillies and brinjal almost show the same disorders as potatoes and tomatoes, except a few. The main disorders of chilli include blossom end rot, sunscald, fruit or skin cracking, and fruit and flower drop. The last one is also common in brinjal. Brinjal also witnesses chilling and freezing injury and the main disorder is calyx withering in brinjal, in which fruits become reddish-brown in colour and lack normal lustre. Thus, the marketability of fruit is hampered. The calcium and nitrate content of the affected fruits is significantly higher than that of healthy fruits.

CONCLUSION

Physiological disorders lead to significant losses of vegetables, posing a serious threat to the grower. It must be diagnosed and treated properly. A number of measures can be performed to reduce the incidence of abiotic disorders. These include optimal sowing timing, homogeneous soil moisture control, and balanced fertiliser supply. In addition to proper post-harvest handling and storage conditions, the prevention of spoiling is largely dependent on these factors.