



## Exploring and Management Strategies of Physiological Disorder of Cole Crops

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### INTRODUCTION

Cauliflower (*Brassica oleracea* var. *Botrytis*) is most important winter season vegetable crops and it belong to the family Cruciferae. It is cultivated for its tender and snow white to yellowish curd. The optimum temperature where the cauliflower withstands is 10 to 15 °C. In regions where freezes do not occur, planting may be done at any time of the year if dihydrogen monoxide is available for growing the crop. In regions where hard freezes occur, planting may be done at any time of the year if dihydrogen monoxide is available for growing the crop. In regions where hard freezes occur well-hardened plants may be set out as early in the spring (Rahman et al, 2007).

#### 1. Whiptail

It is a nutritional deficiency disorder in cauliflower, that's more frequent in cauliflower when they are grown on acidic soils, because availability of Molybdenum is reduce with the decrease in soil pH below 5.5. In addition, there are genotypic difference with respect to the sensitivity in young plants chlorosis of leaf margin can be seen and whole leaves turn white (William et al, 2015). No proper development of leaf blades and in severe deficiency only the midrib doubles (William et al 1981) The condition called whiptail is characterized by narrow, distorted strap like leaves and curd formation and leaves lack proper lamina (leaf blade). Such affected plants fail to form proper curds, or overall stunted growth and low yields.

#### Causes

This disorder is generally caused due to molybdenum deficiency. It is more frequent in cauliflower when they are grown in acidic soil pH <5.5.

## Management

This disorder can be managed by application of lime in acidic soil or by application of Sodium molybdate @ 10-15 kg/ha (Chadffer and others 1983) or it can be controlled by spray the plant with 0.1% Ammonium molybdate along with threes as sticker, in high rainfall areas leach molybdenum lower the soil surface.

## 2. Hollow stem

It's mostly occurring in cauliflower, cabbage and broccoli, during very rapid growth and development. It's caused due to Boron deficiency and higher use of nitrogenous fertilizers in the field. The thick fleshy centre of the stem splits and into a cavity is formed (Scarfe *et al.*, 1990). Enlargement of one or more of these elliptical fissures form a cavity (Akana, 1951 Zink and), which in severe cases may extend to the surface of the inflorescence (Scaife and Wurr, 1990). Necrosis of the pith tissue surrounding the cavity may occur prior to (Shattuck *et al.* 1986) or after harvest (Zink and Akana, 1951), but is not always observed (Lutcliffe, 1972, Zink and Akana, 1951). It may be identified by water soaked and discoloured tissue and thick fleshy centre of the stem core split due to an uneven growth rate and elongated cavity forms. The cavity may extend to either end of the plant to produce an opening to the outside environment. The interior affected pith tissues of the stem or head is collapsed or cracked and often hollow; Whereas, hollow stem are caused by higher use of nitrogenous fertilizer, the stem is perfectly clean while with no sign of disintegration.

### Causes

Hollow stem is caused by higher use of nitrogen and Boron deficiency, but when the Boron deficiency is involved, the interior of the cracked stem cavity is darkened appear. Wide spacing of the plants may also contribute to this disorder. High temperature in combination with high levels of nitrogen and large stem diameter are associated with this disorder of cole crops.

## Management

Hollow stem can be controlled by adopting close spacing and required amount of nitrogen or by spraying of 0.25-0.5% borax (Hagana and Sem, 1999). Increase planting density and avoid excessive soil fertility for broccoli to help decrease plant growth rates and reduce the incidence of hollow stem. Use optimum nitrogen dose and use as per recommend resistant variety/cultivar to less prone to this disorder.

## 3. Blindness

Blindness in cole crops, particularly in cauliflower, cabbage and brussels sprout, is a physiological disorder characterized by the destruction or absence of the terminal growing point (apical meristem), resulting in a lack of head or curd formation. Affected plants leaves become thick, dark green, large and leathery by accumulating carbohydrates and the plant remains vegetative (Kalisza *et al.* 2010).

### Causes

This physiological disorder is caused by several factors, which include pre and post transplanting factors, such as damage to the terminal growing point due to exposure to low temperature, cutworm damage or rough handling of transplants (Fritz *et al.* 2009, Verma 2009). In some cases, this disorder is caused by poor fertility of soil, genetic irregularity, damage to the terminal portion felt during handling at the time of planting.

### Management

This disorder can be controlled by application of insecticides which kills the insects and prevent the buds being damaged and avoid exposure to low temperature.

## 4. Fuzziness

In this disorder the curd appears velvety, hairy or loose appearance due to after linked with ricing it is exposure to direct sun, rapid growth after elongation of flower pedicle. often triggered by high temperature, & high humidity during head formation and high Nitrogen levels.

### Causes

This disorder caused due to hereditary, conditions out of their normal season or due to unfavourable growing (Borsma *et al.*, 2013)

### Management

This disorder can be controlled by sowing good quality, particular season seed in proper following proper cultural practices.

## 5. Ricyness

It is a physiological disorder mainly observed in broccoli and cauliflower. In this disorder, the flower buds become loose, elongated, and grain-like, giving the curd or head a rice-like appearance. The affected curd acquires a velvety texture, somewhat similar to a pile of boiled rice. Affected crops: Cauliflower, Cabbage, Broccoli (most commonly affected).

## Symptoms

Velvety surfaced, loose curd, Elongation of flower buds, Loss of compactness of the head,

Formation of small and white flower buds and the curds formed are called ricy curds.

#### Causes

Use of excess nitrogenous fertilizer, fluctuation in temperature and high relative humidity (RH). Use of poor-quality seeds, Delayed harvesting, and Varietal susceptibility.

#### Management

Proper selection of suitable varieties, optimum application of nitrogenous fertilizer. Cultivation of tolerant or resistant varieties, sowing at the proper time and maintain balanced NPK nutrition.

Resistant variety of cauliflower - **Pusa Mukta** - Resistant to black rot and ricens

### 6. Buttoning

It is a common physiological disorder observed in cole crops such as cauliflower, broccoli, cabbage, and Brussels sprouts. It refers to the formation of an undersized, compact curd or head at an early stage due to the premature transition from vegetative to reproductive growth.

#### Symptoms

Development of small, white-coloured curds or “buttons” at an early stage of plant growth, usually after the formation of only a few leaves and stunted plant growth.

Formation of a small, hard, premature curd or head (button).

#### Causes

Buttoning of cauliflower like deficiency of nitrogenous fertilizers. planting of overaged seedling. Planting of early variety late sowing. Exposure of the transplants to post light conditions.

#### Management

Controls Excess dose of Nitrogen or minimization of transplantation shock and provides favourable condition during the vegetative growth. Seedling transplant must less than six weeks. (Warh *et al.* 1980) Sowing good quality seed in particular season. moisture stress due to irregular or inadequate irrigation.

### 7. Browning / Brown Rot / Red Rot

Browning, also known as brown rot or red rot, is a physiological disorder caused by boron deficiency. It is more common in calcareous soils with a pH above 7.5.

#### Symptoms

Brown spots appear on the curd or head, Stem cracking or development of hollow stem and browning of the curd centre, in advanced stages, pink or rusty-brown areas develop.

In the early stage, water-soaked areas can be seen on the leaves and on the surface of the curd, which later turn rusty brown in colour and Foliage colour changes from dull green to greenish-yellow.

#### Causes

Soil pH above 7.5, resulting in boron deficiency, Calcium deficiency and water stress. High temperature and Soil salinity.

#### Management

Application of borax @ 20–25 kg per hectare (as soil application) and spraying of 0.2–0.25% boric acid or sodium borate solution.

Use regular watering to avoid moisture stress and maintain balanced fertilization with NPK and proper potassium and urea application.

### 8. Leafiness

It is a common physiological disorder mainly observed in cauliflower and sometimes in broccoli.

#### Symptoms

Small green leaves develop between the segments of the curd and curd becomes loose and leafy instead of compact that’s market quality and appearance are reduced.

#### Causes

Delay in curd initiation (late curd formation) and exposure to high temperature during curd development.

Improper storage conditions after harvesting.

#### Management

Maintain optimum temperature during curd development and select climate-suitable varieties (early, mid, or late as per season).

Follow proper sowing time to avoid high temperature stresses and ensure proper post-harvest storage at recommended cool temperature.

### 9. Chlorosis

Common in crops like Brassica oleracea (cabbage, cauliflower, broccoli).

#### Symptoms

Leaves change from light green to yellow and yellowing mostly appears on younger leaves. Chlorosis often starts from the leaf margins and spreads inward and curd/head becomes small, loose, and poorly developed, overall plant growth becomes weak.

#### Causes

Deficiency of micronutrients (especially iron (Fe) and sometimes nitrogen (N) or magnesium (Mg)).

High soil pH (alkaline soil) reducing nutrient availability, poor drainage or root damage and excess moisture and salinity.

#### Management

Apply 0.5% Ferrous sulphate (FeSO<sub>4</sub>) foliar spray (2–3 sprays at 10–15 days interval) and maintain soil pH around 6.0–6.8.

Ensure proper drainage and irrigation management and applied adequate dose of fertilizers as per soil testing.

#### 10. Tip Burn / Tip Hooking

Tip burn is a common non-parasitic physiological disorder in cabbage, cauliflower, and broccoli of *Brassica oleracea*. It occurs mainly due to localized calcium (Ca) deficiency in rapidly growing young inner leaves.

#### Symptoms

Tissue around the leaf margins gradually dries and develops a papery texture, rolling or hooking of leaf margins occurs due to calcium deficiency and inner leaves of cabbage heads and cauliflower/broccoli curds may also get damaged.

#### Causes

Calcium deficiency in rapidly growing plant tissues, high temperature and irregular irrigation and rapid growth caused by excess nitrogen fertilization.

#### Management

Spray of 0.7% calcium solution (Ca + BOPP + NAA) about 5 times at proper intervals, maintain balanced nutrient management and avoid excessive nitrogen fertilizers, use foliar spray of CCC at 1120 or 2240 ppm.

#### 11. Multiple Curd

Multiple curd is a physiological disorder in cauliflower of *Brassica oleracea* in which the main curd does not develop properly, resulting in many small button-like curds on branches.

#### Symptoms

A large number of small button-like curds form in a bunch, curds become loose, uneven, and poorly developed and the main curd fails to form properly.

#### Causes

Injury or damage to the terminal bud, low temperature during early growth and damage to the growing point on branches.

#### Management

Take proper plant protection measures to avoid damage to the terminal bud and prevent exposure to low temperature and maintain proper sowing time.

Provide balanced fertilization and proper irrigation and use varieties suitable for the season and climate.

#### 12. Black Speck (Pepper Spot)

Occurs mainly in cauliflower and cabbage of *Brassica oleracea*.

#### Symptoms

Small dark brown to black spots appears on leaves, midribs, or heads & development of black lesions with collapse of cells inside the curd/core and in severe cases, spots increase and reduce market quality.

#### Causes

Calcium deficiency in plant tissues, excess nitrogen fertilization & high humidity and low temperature during storage and warm weather during curd development.

#### Management

Apply calcium (calcium nitrate spray 0.5–0.7%), avoid excessive nitrogen fertilizer application and maintain proper field drainage.

Transplant at the right time, especially for Snowball-type cauliflower varieties.

#### 13. Pinking

It is a physiological disorder mainly observed in cauliflower, a Cole crop of *Brassica oleracea*. It causes pink, red, or purple discoloration on the curd.

#### Symptoms

The curd shows a pink tinge due to exposure to sunlight, discoloration usually appears first on the surface of the curd and in severe cases, the whole curd may develop a pink colouration reducing market quality.

#### Causes

High light intensity, which leads to the development of anthocyanin pigment that gives a pink colour to the curd & high soil pH and nutrient imbalance and improper variety selection for the season and environmental stress causing oxidation of plant pigments.

#### Management

Use blanching (covering the curd with leaves to protect it from sunlight) and grow season-specific and climate-suitable varieties.

Apply balanced fertilizers and ensure proper irrigation and careful variety selection according to local climate.

### CONCLUSION

Climate change affects the incidence of physiological disorders in vegetable crops, particularly in cole crops, because all cole crops are thermo-sensitive. Evaluation of cultivars

adaptable to the different agro-ecological zones coupled with sound horticultural practices, such as timely seedling transplanting, adequate fertilization and irrigation, will go a long way towards alleviating the devastating effects of physiological disorders of Brassicas in Swaziland. Therefore, it's necessary that the farmers learn to spot the assorted physiological disorders that occur in their area and the proper selection of commercial cauliflower cultivars that show no evidence of photoperiod sensitivity.

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