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A review on physiological disorders in cauliflower: Causes and Management Approach

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Abstract

Apart from insects, pests and diseases, physiological disorders are one of the major which cause economic losses worldwide (Mishra et al, 2016). Physiological disorders can be termed as the abnormalities that can be seen in leaf, stem and fruit morphology, colour, or both which are not caused by infectious diseases or insects. These abnormalities occur due to adverse environment conditions and inadequate amount of nutrients in the plant. Brassica vegetables contain low fat, high vitamin, mineral and fibre as well as various phytochemicals (Sanlier N and Guler Saban M 2018). Among of all Cauliflower is one of the major cole crops grown in the world. As a vegetable it provides leaves, stem, flower and roots that are consumed freshly or by processing. It has high amount of nutrients and vitamins. This crop is grown in wide variety of soils and in all seasons. Cauliflower is sensitive to a number of disorders which reduce the quality and yield of the produce (Hazra and Som, 1999). Being a thermo-sensitive crop with the temperature fluctuation disorder will found in a crop and finally yield of the crop will reduces. The major disorder of cauliflower are riceyness, blindness, leafiness or bracting, pinking, multiple curds, browning, chlorosis, whip tail, tip burn, buttoning, hollow stem, fuzzy curd and black speck.

Keywords*: cauliflower, phytochemicals, thermo-sensitive, physiological disorders*

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Introduction

Cauliflower (*Brassica oleraceae* 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. It is utilized for pickles, soups and curries. It is opulent in carbohydrates, vitamins A, C and minerals. Cauliflower thrives best in a cool moist climate. It does not withstand very low temperature or an inordinate amount of heat. Cauliflower curd will not develop well in sultry weather, for this reason it is grown in winter. The optimum temperature where the cauliflower withstands is 10 to 15℃. In regions where freezes does 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 well-hardened plants may be set out as early in the spring (Rahman *et al*, 2007). The plants may fail to compose desirable curd in dry and sultry weather which causes the curd to develop prematurely and bolt or button. It requires moderately cool climates during the period of its magnification (Singh *et al*, 2019).

Physiological plant disorders caused by non-pathological disorders like poor light intensity, weather injury, water-logging or an absence of nutrients, and have an effect on the functioning of the system. Physiological disorder is distinguished from disease caused by microorganism, likea virulent disease or plant (Sharma, 2016). The symptoms of physiological disorders mightseem disease-like, they'llsometimes be prevented by sterilization environmental conditions. However, once a plant shows symptoms of nutrient deficiency it'sdoubtless that season’s yields are reduced. Any reasonably abnormality in economically necessarya part of vegetables or differentcomponents that contribute to yield and quality of vegetable is termed as physiological disorder.

Causes of physiological disorder: The causes of physiological disorders are

- Sudden fluctuation in temperature
- Deficiency of nutrient
- Improper moisture availability during cultivation

Riceyness:

During curdling stage, the velvety surfaced curd become loose and elongation of pedicle takes place which results in the formation of small white flower buds, thus formed curds are called ricey. Due to fluctuations in temperature and poor seed stock this disorder occurs (Grevsen *et al*, 2003). This can be controlled by proper selection of varieties, optimum application of nitrogen fertilizers and planting of tolerant and resistant varieties.

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Blindness:

Blind cauliflower are those lacking in terminal bud. In the earlier stages of plant growth the growing buds of cauliflower get affected due to which curd formation does not occur. The leaves become thick, dark green, large and leathery by accumulating carbohydrates and the plant remains vegetative (Kalisza *et al,* 2018). This is due to low temperature and insects such as cutworms. This can be controlled by application of insecticides which kills the insects and prevent the buds being damaged and avoid exposure to low temperature.

Leafiness or bracting:

Development of small green leaves between the sections of the curd can be seen. This is caused due to high temperature after curdling stage and delay in harvesting (Swati, 2015). This can be controlled by selection of varieties based on their adaptability.

Multiple curds:

This disorder is characterised by appearance of a number of small button like curds in the form of bunch. This is due to low temperature and damage to terminal bud resulting in branching and formation of small curds on each branch (Olesen, J. E., & Grevsen, K, 1993). This can be controlled by taking some plant protection measures which reduces the damage to terminal bud, prevent exposure to low temperature (Grevsen *et al*, 2003).

Pinking: The curd show pink tinge due to exposure of the curds to high light intensities. Under this condition, anthocyanin pigment develops which impart pink color to the curds (Hazra and Som, 1999).

Black speck: The development of black lesions with collapse of cells in interior of the curd of snowball type cauliflower. It is caused when snowball (late) cultivars are exposed to warm weather at curd development stages (Hazra and Som, 1999).

Browning: It is also called red rot or brown rot and it caused due to boron deficiency. The soil may be deficient in boron or it is not available to the plant due to unfavourable soil reaction and salinity. The deficiency of boron causes browning and acridness of curd with hollow stem. Similarly, poor root magnification, delayed crop maturity and curd quality deterioration are caused by phosphorus deficiency (Mitra 1990). Cauliflower is more

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sensitive to this boron deficiency. The symptoms can be seen after curd formation. In the early stages water soaked areas can be seen on the curd and stem surface. Leaf and on the surface of the curd which later turn into rusty brown in color. Later the stem becomes hallow with water soaked tissues covering internal walls of cavity (Vinod Kumar 2012). In case of severe deficiencies the curd appears brown or pink, so it is called red rot or brown rot or browning of cauliflower. Foliage colour changes from dull green to greenish yellow, leaves become small and undeveloped (Swati, 2015).This can be controlled by application of borax. Depending on the soil pH, type of soil and the extent of deficiency the quantity varies.in acidic soils it varies between 10-15 kg/ha while in alkaline soils quantity may increase (Rosen 1990). In acute deficiency, four spraying of 0.25 to 0.50% of borax solution @ of 1-2 kg/ha along with 0.1 % Teepol as sticker give satisfactory control. Spraying of 0.2 to 0.25 % boric acid or sodium borate is equally effective (Hazra and Som, 1999).

Whiptail:

This is generally caused due to molybdenum deficiency. It is 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 differences with respect to the sensitivity to molybdenum deficiency. In young plants chlorosis of leaf margins can be seen and whole leaves turns white (Swati, 2015). No proper development of leaf blades and in severe deficiency only the midrib develops (William Plant, 1951). This condition is called "whiptail". This can be controlled by application of lime in acidic soils or by application of sodium molybdate @ 10-15 kg/ha (Scheffer *et al,* 1987) or it can be controlled by spraying the plant with 0.1 % ammonium molybdate along with 0.1% Teepol as sticker thrice also gives good result.

Hollow stem:

This is mainly caused due to high nitrogen levels or boron deficiency. The symptoms can be seen in stem. The thick, fleshy centre of the stem splits and a cavity is formed (Scaife *et al,* 1990). This cavity extends to both the ends to form opening to the outside environment. This can be controlled by adopting close spacing and required amount of nitrogen or by spraying of 0.25 to 0.50% borax (Hazra and Som, 1999).

Buttoning:

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In the early stages of plant growth after formation of few number of leaves development of small white coloured buttons or curds can be seen. There are several factors causes buttoning of cauliflower like deficiency of nitrogenous fertilizers, planting of overaged seedlings because aged seedlings after establishment do not get sufficient time to initiate growth before curding, planting of early variety late and exposure of the transplants to poor light conditions. This disorder can be controlled by application of excess doses of nitrogen; minimization of transplantation shocks and provides favourable conditions during the vegetative growth of plant and the seedlings to be transplanted should not be more than six weeks (Wurr *et al*, 1984).

Fuzzy curd:

In this disorder the curd appears velvety due to elongation of flower pedicle. This is caused to hereditary or due to unfavourable conditions (Boersma *et al*, 2013). This can be controlled by sowing good quality seed in particular season and following proper cultural practices.

Bolting: Although cole crops are adapted to cool temperatures, prolonged periods below 50°F may induce bolting (flowering), particularly after broccoli and cauliflower have reached the five-leaf stage. The main causes of bolting in cauliflower found due to early sowing of seeds in hot weather, presence of warm winter, sudden and extreme changes in temperature during crop growth, failure of leaves to form solid heads, varietal characteristics, lack of pure seed, poor growth of seedlings due to inadequate nutrient supply, poor viability of seeds and attack of insect pests. Bolting in cauliflower can be overcome by growingcultivars which showing no evidence for photoperiod sensitivity (‘Plana’, ‘Kathmandu Local’ and ‘Snowball-16’) growing under different photoperiods (9, 12, 15, 18 h day-1) in the UK (Thapa 1994, Hadley and Pearson 1998), avoid the sowing in warm climate, supply adequate amount of nutrients and follow proper plant protection measures.

Other micronutrient deficiency symptoms found in cole crops:

Tip burn: Tissues around the leaf margin gradually dry and give a papery texture. In severe cases the leaves become necrotic and deformed. Tipburn incidence can be modified by several environmental factors including temperature, relative humidity, soil moisture and soil fertility (Nieuwhof, 1960). Increasing the air temperature, lack of soil moisture, or excessive soil moisture tend to enhance tipburn incidence. One common characteristic of tipburn is that occurrence is usually greatest in young, rapidly growing leaf tissue,

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particularly during curd enlargement. High rates of N fertilizer have been reported to increase incidence and or severity of tipburn in cauliflower (Jenkinson and Campbell, 1957).

Chlorosis due to magnesium:

This symptom can be seen first on older leaves. Chlorosis starts from the margin of the leaves and progresses towards the centre of the leaf. The veins become greenish white and in severe conditions necrotic spots can be seen (Barman & Sharma, 2016). This can be controlled by application of magnesium oxide @300kg/ha

Chlorosis due to boron:

The symptoms can be seen on younger leaves. The leaves are small, stiff and light green but the margins show reddish brown appearance. Older leaves are curled down and shows reddish discolouration. Curd development is reduced and appears brown in colour (Gupta, U. C., & Cutcliffe, J. A., 1975). This can be controlled by application of borax.

Chlorosis due to sulphur:

Symptoms first observed in younger leaves and then in older leaves. In case of severe deficiency all the leaves turn yellow or light green (Barman & Sharma, 2016). Formation of thin petioles takes place later on affected leaves weather and curl inward. This can be controlled by applying gypsum @ 50kg/ha.

Chlorosis due to manganese:

Interveinal spaces of younger leaves become dark but the veins remain green. With the increase in deficiency the leaves completely turn yellow. The affected leaves are smaller compared to normal leaves. This can be controlled by manganese sulphate in soil or as foliar application (Behboudian *et al*, 2016).

Chlorosis due to iron:

The symptoms include the chlorosis of leaf lamella while the veins remain green. In case of severe deficiency the root growth is supressed and leaves are deformed (Barman & Sharma, 2016). This can be controlled by application of iron sulphate.

Zinc deficiency:

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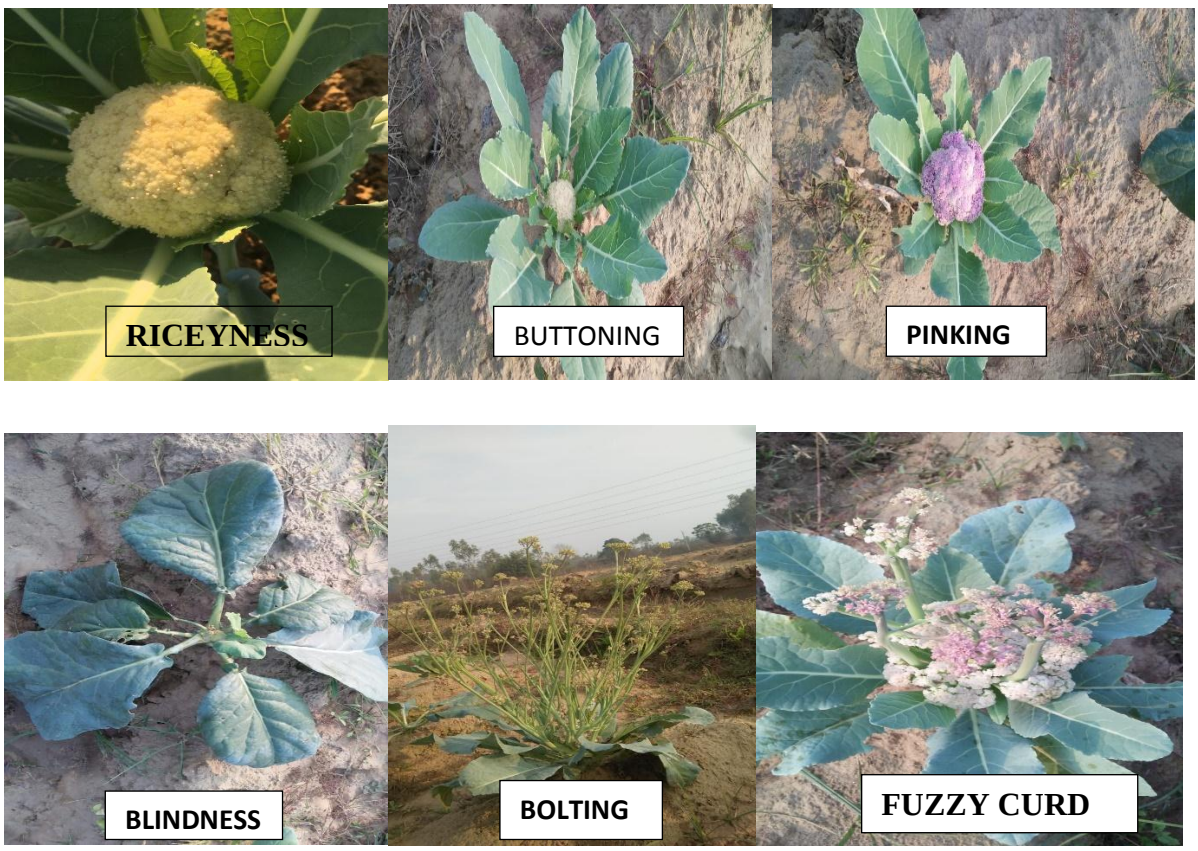
The symptoms can be seen on leaves and curd. The leaves become small and deformed. Improper development of curd and discolouration of curd can be seen (Sturikova *et al*, 2018). This disorder can be controlled by application of zinc sulphate @0.5%.

Few physiological disorder found in LPU farm:



Conclusion: The amendment in climate affects the incidence of physiological disorders in vegetable crops, particularly in cole crops because all cole crops are thermo-sensitive in nature. Insufficient quantity of micronutrient in the crop field might be considered as one of reason behind lower yield and disorder of cauliflower. Therefore, it's necessary that the farmers ought to learn to spotthe assorted physiological disorders that occur in their area and proper selection of commercial cauliflower cultivars which show no evidence for photoperiod sensitivity.

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