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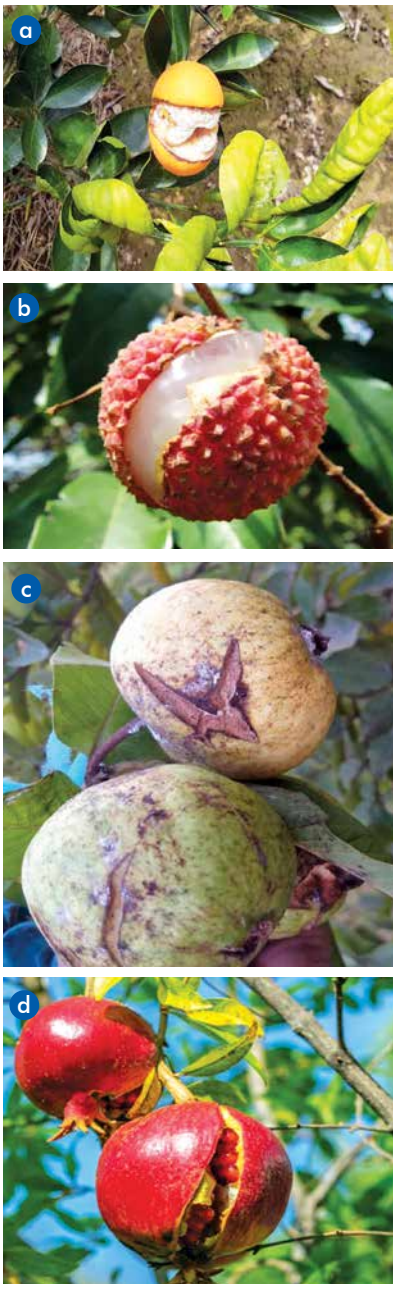
Management of fruit cracking

Cracking is a major physiological disorder of horticultural crops. It is mostly observed at the middle and final stage of fruit growth. There are many reasons that lead to fruit cracking such as abiotic factors, nutrient deficiencies, growth regulators imbalance, poor cultural practices, rootstock type and tree age and fruit peel thickness. The main reasons that are responsible for fruit cracking and its management strategies are highlighted in this article.

FRUIT cultivation contributes towards nutritional and economic security of a country. India's diverse climate favours the cultivation of all the fruits with high production. Still, there are many hindrances in fruit production that affect the supply of fruits to consumers. The foremost limitations for fruit production is the occurrence of physiological disorders. The physiological disorders are the result of malfunction and dysfunction of the physiological processes of the fruit tissues. Fruit cracking is the major pre-harvest physiological disorder of most of horticultural crops, mainly occurring due to sudden changes in the temperature as well as due to moisture stress conditions. Fruit crops like litchi, pomegranate, guava, daisy tangerine and lemon cv. Baramasi are highly susceptible to fruit cracking incidence that deteriorate their market acceptability. The average loss due to fruit cracking ranges from 50-85%.

Fruit cracking may occur during fruit growth, development and ripening stage. Fruit cracking may be radial or transverse in nature. Basically there are three different types of cracking in fruit crops which included circular or semi-circular, around the stem and in the cavity, at the apical end of the fruits. This disorder affects the appearance of fruits, increase water loss and susceptability to infection by pathogens such as *Aspergillus, Pencillium,* etc. Cracked fruits are also susceptible to mechanical injury.



Cracked fruits: a) Daisy, b) Litchi, c) Guava, d) Pomegranate

Factors responsible for cracking

It is believed that the problem is caused by a combination of various factors rather than a single factor. There may be following reasons for fruit cracking:

Environmental factors: Fluctuations in temperature, light and humidity play an important role in fruit cracking. In case of semi arid and arid zones, low relative humidity and more temperature are the major environmental factors that are responsible for fruit cracking eg. Litchi. In general, there is linear increase in fruit cracking with the increase in temperature from 10 to 40°C. However, temperature also influenced many other factors like permeability of the cell wall and biochemical processes of the cell. For example, litchi, sweet cherry and citrus.

Mineral nutrients: Deficiency of calcium and boron is responsible for fruit cracking in pomegranate, litchi and cherry. In addition, the nutritional imbalances, low K and Ca and high P leads to fruit cracking incidence in some citrus fruits. Imbalances of P and K application cause weak or thin rind. The nutrients both in deficient or excessive range indirectly lead to increased chances of fruit cracking.

Hormonal imbalances: Fruit growth and development mainly depend upon the hormonal content of fruit. Fruit cultivars with low natural endogenous level of hormones are more prone to cracking disorder. GA mainly influences the fruit cracking percentage in fruit crops based on application time. At the time of flowering, application of GA_3 increases the fruit cracking in citrus. At the fruit development stage, pollinated seeds serve as source of hormones. However, in case of split prone cultivars of mandarins such as 'Nova' and Ellendale' are weakly parthenocarpic in nature, leading to decreasing the rind thickness and

increasing the fruit cracking. The rind thickness is directly proportional to endogenous level of gibberellin and cytokinin content, which leads to more rind thickness and reduces the chances of fruit cracking.

Tree age: Fruits of young tress are susceptible to cracking as compared to older ones. Because at the young stage, deficiency of boron leads to cracking. As in case of older tress, fruit cracking occurrs due to imbalance of moisture, rains, erratic irrigations and due to extreme fluctuations in day and night temperature.

Fruit characteristics: Overmaturity of the fruits also lead to fruit cracking. Size and shape of the fruits also affects the fruit cracking rate. Larger is the fruit, more will be fruit cracking as compared to smaller ones (Pomegranate, cherry, etc). The fruits that show higher growth rate have lower tensile strength which initially causes minute cracks in flavedo, which later develop into visible cracks. Fruits having firm flesh are more susceptible to cracking as compared to soft fleshed such as cherry, litchi.

Others: Due to heavy irrigation or rains after long dry spell, cracks develop at the surface of the fruit. Generally, fruit cracking occurs due to the physical failure of the cuticle or skin as a result of tension and heavy rains. Genetically, those fruits having skin thinner as compared to others are susceptible to this disorder. In cool areas, fruit cracking is less compared to hot areas.

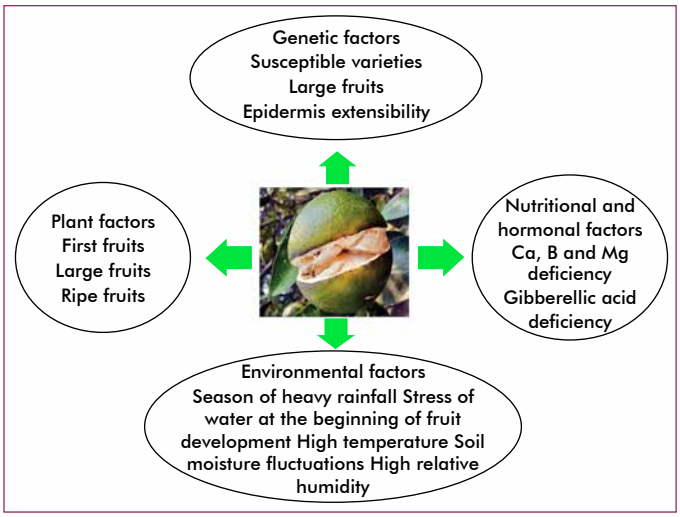
Fruit cracking problem is highly dependent upon number of flowers, fruit set percentage as well as final crop load of the tree. Higher amount of fruit cracking occurs in case of tree having high crop loads and less or no cracking in low crop loads.

Control measures

There are various horticultural practices currently employed to reduce the fruit cracking in different species which include manipulation of crop load by thinning, GA_3 application, as well as sufficient application of Ca, K and P nutrition. Not a single practice can reduce the fruit splitting in case of cracking prone cultivar in orchard. The major practices that are followed to control fruit cracking are given here.

Nutrient applications: Spraying of KNO_3 (2%) + 2,4-D (100 mg/L) at the end of full bloom stage is recommended for reducing fruit splitting in mandarin cv. 'Page'. Spray of borax (0.4%) twice at interval during fruit development and colour turning stage, helps to maintain atmospheric humidity to 70-75% and soil moisture level 60-70% that helps to minimizes the fruit cracking in litchi. In case of pomegranate, adequate and regular irrigation, through drip irrigation, as well as application of boron (0.2%) are the measures to control fruit cracking incidence. The chemicals lead to increase in peel thickness, mechanical resistance to the peel against cracking and thus reducing the cracking.

Plant growth regulator applications: Foliar application of plant hormones in definite concentrations may be helpful in reducing the fruit cracking in susceptible cultivars. In case of citrus, combination of different types of growth regulators like GA_3, NAA and Salicylic acid and nutrients like potassium nitrate, boric acid are helpful in



Factors responsible for fruit cracking

reducing the problem of fruit cracking. In case of litchi, application of GA_3 at 40 ppm or NAA (20 mg/L) and 2,4 D (10 mg/L,) Ethephon 10 (mg/L) have been reported to reduce the incidence of fruit cracking percentage. In case of pomegranate, pre harvest application of GA_3 150 ppm significantly reduces the fruit cracking percentage. In litchi, spraying of NAA at 50 ppm and NAA 20 and 40 ppm in case of lemon resulted in lower fruit cracking incidence.

Management of plant water relations: Mulching and compost maintain the degree of moisture in the soil, while the application of slow release fertilizers is enough to help provide food intake evenly. During hot dry months of May and June, conservation of moisture is necessary. Maintenance of soil moisture reduces the cracking percentage of fruit crops. Use of black polythene mulch in lemon was helpful in minimizing the fruit cracking.

Others: To protect fruit cracking at maturity stage, some other practices are also necessary like protection of the fruits from direct sunlight and solar radiations by bagging of the fruits, by providing shade nets as well as the use of antitranspirants based on 'Kaolin' are also the possible measures to control the fruit cracking incidence. The bagging of the litchi fruit bunches with white and pink polypropylene non-woven bags at 25-30 days after the fruit set can enhance the quality and improve the colour of the fruits as well as provide protection against sun burning and cracking of the fruits. Selection of resistant varieties is the most effective way to reduce fruit cracking in most of the fruit crops for e.g pomegerante cv. Jyoti which is less susceptible to fruit cracking.

The optimal growing conditions including reasonable cultural practices, sufficient water supply with mineral nutrition and mulching which can significantly reduce the occurrence of splitting. To reduce the fruit cracking incidence, there should be proper orchard management practices that minimize the water stress.

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