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Fruit Cracking in Subtropical Fruits: Causes and Remedies

Fruit cracking is a severe physiological condition that has a detrimental effect on fruit quality. Cracks on the fruit surface allow fungi to infect it, as well as promote rapid moisture loss and shriveling, lowering market quality and storage life. Fruit cracking happens when the plants have plenty of water after a prolonged drought, as well as when the temperature and humidity are high in the summer. In different fruit crops, different methods are used to regulate fruit cracking, such as drip irrigation, mulching, fertilizer management, resistant cultivars, bagging, different packaging materials, and timely harvesting, as well as spraying micronutrients and growth regulators.

INTRODUCTION

Fruit cracking is a physiological problem that affects many subtropical fruit crops around the world. The fruit's pericarp, or membrane, cracks mainly because the fruit's contents absorb water faster than the fruit wall expands. Varietal characteristics, environmental factors, orchard floor management, inconsistent water application at maturity level, and micronutrient deficiency can all be factors. Litchi, pomegranate, lemon, grape, bael, and fig are some examples. It occurs during fruit growth, development, and ripening. Cracked fruits are susceptible to storage disease and do not attain marketable quality and unable to fetch economic income from the market. Fruit cracking losses vary between 50 and 85 percent depending on the fruit harvest.

CRACKING PARTS ON FRUIT

1. Circular or semicircular cracking in the cavity and around the stem end.
2. Fruits have a similar fine crack at the apical end.
3. Lateral cracking refers to deep cracks on the side of the fruit.

FRUIT CRACKING TYPES

1. Radical cracking: It starts at the radical end of the stem and progresses to the fruit center. Fruits, such as nectarine, are damaged by radiation or sun rays, resulting in cracking.

2. Concentric cracking: The presence of a concentrated ring on fruit, such as cherries, induces cracking.

FACTORS THAT CAUSE FRUIT CRACKING

1. Environmental factors

- a. High temperature and low humidity
- b. Rainfall (low)
- c. Hot wind

2. Fruit Characteristics

- a. Maturity
- b. Fruit size
- c. Fruit firmness
- d. Osmotic concentration

3. Lack of orchard management

- a. Moisture stress
- b. Nutrient
- c. Insect-pest and disease

CAUSES OF FRUIT CRACKING IN SUBTROPICAL FRUITS

LITCHI

- During fruit growth, high temperatures, low humidity, and low soil moisture conditions encourage fruit cracking (Huang, 2005).
- A combination of temperature higher than 38 °C and relative humidity lower than 60 per cent is favorable condition for fruit cracking.
- Inadequate moisture during the early stages of skin development causes rough, non-elastic skin, which can crack when exposed to increased internal pressure due to rapid aril growth after irrigation or rain (Rab and Haq 2012).
- Cracking is more in the fruits which remained on the south west side of the tree than on the north east side.

POMEGRANATE

- Variation in soil moisture, day night temperature and atmospheric humidity (Khub 2014).
- Soil type and soil moisture status of orchard. Long periods of drought accompanied by heavy rains or irrigation are the main causes of pomegranate fruit cracking (Galindo *et al.*, 2014).
- Lack of appropriate orchard management.

- Peel hardening was exacerbated by a prolonged dry spell. The pulp expands and the peel cracks when dryness is followed by strong irrigation or rains.
- Fruits produced during *Mrig bahar* are more prone to cracking. It is due to variation in humidity during fruit growth and development.
- During fruit growth and development, there is an imbalanced fertilization and nutrient deficiencies, such as boron, calcium, and potash.
- Rind thickness and texture of fruits are related to their proneness to cracking depending varietal characters.

CITRUS

- It is common in acid limes and oranges and starts at the blossom end of the fruit.
- It's linked to abrupt changes in temperature, as well as heavy rainfall following a prolonged drought (Li, 2009).
- Fruit rinds become stiff and less elastic when the temperature rises during a drought. During the rainy season, growth processes are intensified, and the tissue within the fruit expands. Since the peel does not appear to expand as quickly as the pulp, cracking occurs. Infection with *Alternaria citri* and exanthema allows gummy substances to grow on the surface and within the body. Since the tissues containing these gummy substances retain too much water, the fruit splits.
- Fruit splitting is caused by hot winds and poor irrigation practices.
- Two kinds radial (longitudinal) and transverse splitting in which radial being more common.
- It varies seasonally and is usually greatest where crop load is heavy.

GRAPE

- Water on the surface of the stalk and berry is absorbed by the berry cells, resulting in a significant increase in water flowing through the berry, which increases the risk of cracking. Increased water content causes essential turgor strain, which causes berry cracking (Becker *et al.* 2012).
- The rate of berry cracking increases as the temperature rises from 10 to 40 degrees Celsius (Abd El-Rhman, 2010).
- Since high relative humidity reduces leaf transpiration, fruit water supply and turgor pressure can increase.

- Some grape disease retards the development of berries and causes berry cracking i.e. Powdery mildew.

BAEL

- It's linked to abrupt changes in weather conditions including temperature and humidity.
- In bael orchards, nitrogen and zinc deficiencies are common.

FIG

- Sudden change in atmospheric humidity or rain showers is responsible for fruit splitting. In cracked or split fruits, the pulp is exposed to insect and fungus attack.
- Extensive damage of fruits occurs if excessive rains prolonged in the region during April-May.

FRUIT CRACKING PREVENTION MEASURES

Selection of location: The most successful system for reducing rain runoff in a fruit orchard is site selection. Close to harvesting time, the orchard plants should be planted in a location with little or no rain. Fruit crop cultivars that show some resistance to rain-induced fruit crack should be chosen.

Rain cover protection: Fruit plants should only be covered on the top, allowing free airflow into the sides to prevent cracking at maturity, e.g. litchi netting and individual bunch bagging.

Moisture conservation: Moisture conservation is critical during the hot, dry months of May and June, since consistent moisture and sufficient humidity prevent fruits from cracking during their maturation time.

Irrigation management: At the time of fruit maturity, constant moisture and proper humidity are needed. Irrigation at 30-40% depletion of usable soil moisture is effective in reducing fruit cracking. Drip irrigation and fertigation can be used in hot and dry areas.

Nutrient management: In pomegranate, avoid *Mrig bahar* crop and instead use *Ambe bahar*. Cracking can be reduced by following the prescribed fertilizer schedule for fruit crops in each area.

Planting wind breaks: To shield the orchard from desiccating hot winds, suitable wind breaks should be planted along the orchard boundary at a right angle

to the prevailing wind. Mango and jamun trees, among others, are tall trees that serve as windbreaks.

Mulching: Organic mulches including leaves and straw help to conserve moisture by reducing evaporation, preventing weed growth, and adding humus to the soil as they decompose. Fruit tree cracking is reduced when soil moisture is maintained.

Varieties that are resistant: Growing highly resistant cultivars is the most efficient way to prevent fruit cracking. Crack tolerance is higher in pomegranate cultivars like Bedana Bosec, Khogand, and Jalore Seedless. Litchi cultivars with thin skin, few tubercles per unit area, and a rounded to flat form are less susceptible to cracking. The litchi cultivar Swarna Roopa is resistant to this disease.

Hormonal Spraying: Litchi fruit cracking is reduced by spraying 2, 4-D and NAA at concentrations of 20 ppm or 20 mg/litre. Fruit cracking in pomegranates can be reduced by spraying GA₃ (120 ppm) during maturity.

Chemical Spraying: From pea-size to fruit harvesting, spraying with ZnSO₄ (1.5 percent) weekly or CaNO₃ (1.5 percent) fortnightly is an efficient way to minimize cracking in litchi. Fruit cracking in pomegranates can be reduced by spraying calcium hydroxide (0.1 percent) and borax (0.1 percent) at 15-day intervals after the fruit has reached maturity. Fruit splitting in limes and lemons is reduced when K is applied.

Anti-transparent application: Anti-transparent application that prevents stomata from allowing water to pass through the leaf surface or plant surface. Spraying anti-transpirants including phenol (5%) and liquid paraffin (1%) on pomegranate fruit four to five weeks before harvesting reduces fruit cracking.

CONCLUSION

It has been concluded that proper orchard management at the appropriate time, as well as preharvest applications of mineral nutrients, plant growth regulators, and anti-transpirants at regular intervals during the early stages of fruit growth, may help reduce fruit cracking.

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