

Physiological Disorders of Mango Trees and Their Management

Dr. R.P. Singh, Dr. R.M. Ram, Dr. Abhik Patra, Dr. B.K. Singh, Dr. Himanshu Singh and
Dr. Ashutosh Kumar

Introduction:

Mango (*Mangifera indica*) is one of the most important fruit crops in India and is called the "King of Fruits." It is rich in Vitamins A, C, and D, along with its taste, aroma, and attractive appearance making it special. Mango fruit is low in calories, making it an excellent fruit for reducing calorie intake. Mango trees can be grown in various types of soils and are hardy by nature. Their care is possible even with relatively low management. Both raw and ripe mango fruits are used at all stages of their development. Mango kernels also contain 8-10% high-quality fat, which can be used in soap manufacturing. In India, mango cultivation is carried out in many states including Uttar Pradesh, Andhra Pradesh, Karnataka, Gujarat, Tamil Nadu, and Bihar. There are many reasons behind the decline in mango production, among which physiological disorders are a serious problem affecting fruit quality and storage capacity. This article discusses the major physiological disorders of mango and their management measures, which will help farmers deal with these problems in a timely manner and obtain better profitable prices from mango cultivation.

Causes of Physiological Disorders

- ☞ Deficiency of micronutrients and sudden changes in temperature
- ☞ Poor soil condition
- ☞ Inadequate moisture availability during cultivation

Definition of Physiological Disorder:

A physiological disorder is a condition in which abnormality occurs in the economically important part of the fruit or other parts of the plant, affecting production and quality. Details and management of major physiological disorders are given here.

Mango Malformation (Gumma Disorder):

Causal Agent: Infection by fungus *Fusarium moniliformae* var. *subglutinans*

Due to this, production loss ranges from 50 to 80%. Its cause is very complex and is seen more in 8 to 10-year-old trees. There are two types of malformation: vegetative malformation and floral malformation.

Vegetative Malformation: Vegetative malformation mostly occurs in young plants. In affected plants, vegetative growth becomes distorted, internodes swell, and nodes remain

**Dr. R.P. Singh, Dr. R.M. Ram, Dr. Abhik Patra, Dr. B.K. Singh, Dr. Himanshu Singh and
Dr. Ashutosh Kumar**

Krishi Vigyan Kendra, Narkatiaganj, West Champaran (Dr. RPCAU, Pusa)

short. In such distorted vegetative malformation, leaves are small and thin and form a cluster shape at the upper part of the plant. This symptom is called "**Bunchy Top**". Similar symptoms are also seen in larger plants, but these are found much less compared to young plants.

Floral Malformation: In floral malformation, the main nodes of the inflorescence (boor) remain short, and the length of secondary branches of the flower cluster also decreases, causing flowers to appear in clusters. Flower buds convert into vegetative buds, and thin, small leaves emerge, making the inflorescence appear very dense. In such inflorescences, very few flower buds open and remain green. Some floral malformations are not dense; instead, the nodes are long. Hence, they are longer than normal inflorescences, and flowers are spaced apart. Generally, fruits do not set on such inflorescences.

Management:

1. Prune and burn affected inflorescences, shoots, or branches to prevent the disease from spreading.
2. Spraying Naphthalene Acetic Acid (NAA) 200 ppm (1 ml per 5 liters of water) in the first week of October and removing (deblossoming) and destroying new distorted buds/flowers/inflorescences emerging

in the last week of December or January/February helps reduce this disease.

3. Apply two sprays of Zinc (100 ppm), Copper (40 ppm), and fungicide Carbendazim (0.1%) during November-December. Balanced use of nitrogen, phosphorus, and potassium fertilizers along with micronutrients, removing malformed inflorescences every year, and not using diseased plants for raising saplings are effective steps.
4. Use of Cycloheximide and Cultar (Paclobutrazol) can also control malformation.

Irregular Bearing (Alternate Bearing) in Mango

This disorder is effective in reducing mango productivity. Most commercial varieties of mango suffer from irregular or alternate bearing, resulting in fruiting one year and no fruiting the next year. This disorder is also called "**Biennial Bearing**". Varieties grown in North India, especially Dashehari, Langra, and Chausa, are affected by irregular bearing, while South Indian varieties like Neelum, Totapuri, etc., bear regularly. It is understood that when a tree bears heavily for one year, it develops a deficiency of nutrients, primarily affecting the carbohydrate:nitrogen balance, and consequently, the tree becomes

incapable of producing new flushes. As a result, fruiting is low or absent in the second year. The causes of this disorder are considered to be genetic (hereditary factors), plant physiology, environmental factors, agronomic practices, varietal differences, nutritional deficiency, excessive fruit load, and imbalance of growth regulators. Excessive rainfall, high humidity, low temperature, and prolonged fog during flowering can turn a bearing year into a non-bearing year.

Management:

1. In the bearing year ('On' year), late-emerging inflorescences (March-April) should be removed i.e., prune flowers (deblossoming) to reduce fruit load, so that balance is maintained in the 'Off' year.
 2. Cultar (Paclobutrazol), which is a systemic vegetative plant growth regulator. Apply it at the rate of 3.2 ml per tree per meter of canopy spread (mixed in 10-15 liters of water) in a trench (30 cm wide and 20 cm deep) made at a distance of 1.5 to 2 meters from the trunk, 90 to 100 days before flower bud emergence or during September.
 3. If the tree age is more than 25 years, dissolve the recommended dose of Cultar (Paclobutrazol) in water, divide it into two parts; apply one part in the
- trench near the fertilizer trench and the remaining part in a circular trench made 25-30 cm inside the canopy area.
4. After applying Cultar (Paclobutrazol), maintain adequate moisture around the tree for at least 25-30 days for maximum absorption.
 5. Extensively cultivate regular bearing varieties (Amrapali, Neelum).
 6. Increasing the recommended dose of fertilizers by 25-50% during July or 1-2 months before Cultar application can maintain additional growth and plant health after Cultar application.
 7. Ethephon 200 ppm concentration along with 0.1% urea was found effective in inducing regular flowering throughout the year.
 8. In sandy soil, only 50% of the recommended dose of Cultar should be given.

Flower and Fruit Drop

Mango fruits drop at various stages of their life, causing economic loss to growers. The proportion of fruit set compared to the number of flowers on the tree and inflorescences is very low. Most fruits drop soon after setting. Mango fruits drop at very small stage (pinhead), after fruit set, and at fully developed stage (during May). Dropping of developed fruits causes more economic loss. The rate of fruit drop varies among different

varieties. The Langra variety shows higher fruit drop. There are many reasons for fruit drop, including embryo abortion, deficiency of water and nutrition, and hormonal imbalance being the main ones.

Management:

1. Apply light irrigation in the field during fruit set.
2. To prevent fruit drop, spraying Alar (B-nine) @ 100 ppm or NAA or Planofix (200 ppm) @ 90 ml dissolved in one drum of water i.e., 200 liters, at the pea-sized stage of mango fruits has been found beneficial. Adding Teepal or (soap solution 2-3 ml) is advantageous.
3. Spray NAA (Naphthalene Acetic Acid) or 2,4-D at concentrations ranging from 20 to 50 mg/liter on half-mature fruits.
4. Treatment with auxins in combination with urea or nutrient mixture (KNO₃, micronutrient complex) has also been recommended.
5. Among commercial varieties, 'Langra' is more susceptible to fruit drop, while 'Dashehari' is the least.

Internal Necrosis (Internal Fruit Decay)

Initially, water-soaked, grey-colored spots develop on the lower part of the fruits; later, these spots enlarge and turn dark brown. The process of tissue disintegration starts, exposing the pulp. The fruit cracks, revealing the internal tissues which appear rotten.

Simultaneously, yellowish droplets start oozing from the cracked portion. The stone also appears brown, and the fruits drop from the tree.

Management:

1. To keep this disorder under control, soil application of Borax @ 500 grams per tree in the basin or foliar spray of Borax (1%) is beneficial. The first spray should be done when fruits are pea-sized, followed by a second spray after 15 days.

Black Tip Disorder

This disorder has been observed in orchards located near brick kilns (due to gases emitted from kilns such as carbon monoxide, sulfur dioxide, ethylene). Symptoms appear as soon as the mango grows slightly. A mark first appears on the distal end of the fruit, which gradually enlarges, turns black, and spreads over the lower part of the fruit. This part of the fruit becomes hard, and fruit growth stops. In some varieties like Dashehari, the distal end of the fruit becomes pointed and appears greener. Fruit growth also stops. A specific symptom is the appearance of etiolation (pale yellowish discoloration) at two, three, or more places on the sinus of the distal end.

Management:

1. For prevention of this disorder, spray 1% Borax solution (2 kg Borax mixed in 200 liters of water) three times

(before flowering, during flowering stage, and at fruit set). Apply when fruits are pea-sized, followed by two more sprays at 15-day intervals. Be sure to add Teepal or soap solution to the spray mixture.

2. Planting mango orchards 5 to 6 kilometers away from brick kilns in a north-south direction can significantly reduce the disorder.
3. Spray Bordeaux mixture 2:2:250 at pea size and repeat every 20 days until fruit maturity.
4. Increase chimney height to 15-18 meters.
5. Spraying a mixture of washing soda (0.5%) or caustic soda (0.8%) has also been found beneficial.

Clustered Fruiting / Jhumka Disorder

In this disorder, several small mango fruits (four to five) develop at the tip of the inflorescence, resembling an earring (jhunka). The color of such fruits is somewhat darker than normal fruits, and the shape of these fruits is also slightly curved downwards. Such fruits remain attached to the tip of the inflorescence for many days. Their prolonged attachment to the inflorescence gives the impression of a good crop, but their growth stops, and after a few days, these fruits drop. Seeds also do not develop in such fruits. The main causes of this disorder are considered to be excessive use of

insecticides, sudden fluctuations in temperature, and lack of cross-pollination.

Management:

1. When flowers are in bloom, no insecticides or fungicides should be sprayed. To attract pollinators, 10% jaggery (gur) solution can be sprayed at full bloom stage.
2. Spraying 100 ppm NAA during October and November will take care of inflorescence development.
3. Efforts should be made to maintain a high population of pollinator insects during the flowering stage.
4. Spraying Naphthalene Acetic Acid 300 ppm can also reduce this disorder.
5. In old orchards, some branches should be top-worked with pollinizer varieties like Bombay Green.

6. Establish honeybee boxes in the orchard during flowering time.

Spongy Tissue

This is an internal physiological disorder in which the fruit pulp does not ripen properly, and the taste deteriorates. Externally, the fruit looks normal, but the problem appears upon cutting. It is mainly found in the Alphonso variety. The main causes are inactivation of ripening enzymes due to high temperature and prolonged exposure of fruits to sunlight after harvest.

Management:

1. Harvest fruits at 3/4th maturity stage.
2. Storing fruits at 10-15°C for 10-18 hours after harvest reduces the problem.
3. Use of black polyethylene mulch.
4. Grow resistant varieties like Ratna, Arka Puneet, and Arka Aruna.
5. Adopting sod culture in orchards, growing legumes as cover crops, mulching basins, and maintaining soil moisture near field capacity during fruit development reduces the incidence of spongy tissue development in mango fruits.

Frost Damage

Bark cracking, which is not initially visible but becomes apparent when the tree starts dying or drying. Oozing of gum from cracked bark, dieback of new shoots, burnt appearance of leaves, young buds, and inflorescences, and ultimately complete drying of the tree are specific symptoms.

Management:

1. To protect young mango plants from frost, cover them with dry grass in such a way that sunlight and wind from the east continue to reach them. Young plants should be covered with straw or dry grass during the winter months.
2. If irrigation is done during frost, plants can be saved. Sprinkler irrigation and

overhead irrigation on plants are beneficial during extreme cold.

3. Apply a paste of cow dung and copper sulfate (tutia) on the main trunk.

Chloride Toxicity

The main symptom is drying of mango leaves starting from the tip and progressing to the margins. It appears as if the leaf tips are scorched. The dried parts appear brick-red in color. This disorder can be identified from a distance.

Management:

1. Do not use fertilizers containing chloride; instead, use potassium sulfate.
2. Do not spray fungicides like Copper Oxychloride on such plants.
3. Fallen leaves should be collected and removed from the field.
4. Do not allow waterlogging around the plant; ensure proper drainage management.
5. Apply gypsum to help mitigate soil salinity issues, including those related to sodium chloride.

Fruit Cracking Disorder

Peel Cracking

The physical weakening and cracking of the fruit peel, i.e., breakage of the cuticle, is called peel cracking. This is mainly found in the Langra (Malda) variety of mango.

Pulp Cracking

In this type of cracking, the fruit pulp also cracks, and the entire fruit opens up. Simultaneously, pulp starts oozing out from the cracked upper part, and the stone becomes visible externally. This cracking has become a major problem in the Dashehari variety.

Star-shaped Cracking

Fruits affected by this crack in a star-like pattern. Cracking mainly starts from the central part and deepens inward, and this part turns black due to the entry of various microorganisms. This type of cracking is very rare in mango but has been found occasionally in Amrapali and Dashehari varieties.

Pulp cracking in mango is mainly caused by internal factors such as low water availability during fruiting, excessive moisture due to heavy rainfall, and high water absorption leading to peel cracking. Deficiency of nutrients (calcium and boron) also plays a significant role in fruit cracking. Safeda and Ramkela are tolerant to fruit cracking.

Management:

1. Controlled and regular irrigation during fruit growth and development is very important in mango orchards. Generally, drought after heavy rain or heavy rain after drought is the main cause of fruit cracking.

2. Provide regular irrigation at 15-day intervals during May-June.
3. Ensure proper drainage in areas with heavy rainfall and clayey soils.
4. Adequate supply of boron is essential, especially in Langra variety orchards.
5. Definitely carry out soil treatment with Borax @ 500 grams per tree in Dashehari mango orchards.
6. Apply two or three sprays of Borax @ 8-10 grams per liter of water at 15-day intervals from the pea-sized fruit stage, especially in light and sandy soils.
7. To prevent fruit cracking in mango, two foliar sprays of Gibberellic Acid @ 150-200 mg per liter of water at 15-day intervals can also be done.

Gumad Disorder (Burr Disorder)

This is a new disorder of mango. Under this, in trees aged 15-20 years, an abnormal type of growth starts occurring on the main trunk and primary branches, which later takes an uncontrolled form, transforms into a woody disorder, and appears as a burr (gumad). These burrs keep increasing in size and can affect the entire tree. The Langra (Malda) variety is more affected by this disorder, while the Chausa variety is less affected. Compared to healthy trees, the yield of trees affected by this disease decreases, causing losses to growers. Other commercial varieties of mango such as

Dashehari, Bombay Green, Amrapali, Mallika, etc., have been found free from this disorder.

Management:

1. Since the actual cause of this disorder is not yet known, integrated management is required.
2. During pruning in the first fortnight of October, first cut off the affected parts of the trunk with the help of a saw. Apply Chaubatia Paste (Copper Carbonate: 1 part + Red Lead: 1 part + 1.25 parts: Raw Linseed Oil) or Copper Oxychloride paste (or 1 kg Copper Oxychloride in 250 ml Castor oil and required amount of water) on the cut portion.
3. A compatible insecticide can also be used with this paste.

Mistletoe (Loranthus) Infestation on Trees

It grows on mango trees; wherever it attaches to the tree, a knot forms. Its leaves are oval, and flowers are yellow-red. The parasite's haustoria penetrate the host tissue, through which it derives its nutrition.

Management:

Infested branches should be cut from below, and Copper Oxychloride paste should be applied to the cut portion.