

Mango Malformation: Understanding Causes, Symptoms, and Effective Control Methods

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Mango (*Mangifera indica* L.), often referred to as the "king of fruits," holds immense economic and cultural significance in many tropical and subtropical regions. However, one of the most detrimental issues faced by mango growers worldwide is mango malformation, a disease that can lead to significant yield losses and affect the quality and marketability of the fruits. This article delves into the intricacies of mango malformation, its types, causes, and effective management strategies to mitigate its impact.

Types of Mango Malformation

Mango malformation manifests in two primary forms: vegetative and floral. Each type has distinct symptoms and impacts, necessitating different approaches for management.

1. Vegetative Malformation: Vegetative malformation primarily affects the growth of vegetative parts of the mango tree.

The key symptoms include:

- **Abnormal Growth:** Affected shoots exhibit stunted growth and become densely clustered, creating a broom-like appearance often referred to as "witches' broom."
- **Leaf Deformities:** Leaves on malformed shoots are smaller than usual, with a thicker and leathery texture.
- **Impact on Tree Vigor:** The overall growth and vigour of the tree are compromised, leading to reduced fruit-bearing capacity.



2. Floral Malformation: Floral malformation directly impacts the reproductive parts of the mango tree, particularly the inflorescences (flower clusters).

The key symptoms include:

- **Distorted Panicles:** Inflorescences become compact, with a thickened rachis and shortened internodes, resulting in a dense cluster of flowers.
- **Reduced Fruit Set:** Malformed flowers often fail to develop into fruits, leading to significant yield reduction.
- **Delayed Flowering:** In some cases, flowering is delayed or completely inhibited, affecting the fruiting cycle of the tree.



Causes of Mango Malformation

Understanding the causes of mango malformation is crucial for devising effective management strategies. The primary causes include:

- 1. Fungal Infection:** The primary causative agent of mango malformation is the fungus *Fusarium mangiferae*. This pathogen infects the tree's growing tissues, leading to the characteristic malformation symptoms.
- 2. Genetic Factors:** Certain mango varieties are more susceptible to malformation than others. Genetic predisposition plays a significant role in the incidence and severity of the disease.
- 3. Environmental Stress:** Environmental factors such as high temperatures, water stress, and poor soil conditions can exacerbate the symptoms of malformation. Trees under stress are more vulnerable to infections and other diseases.
- 4. Nutritional Imbalances:** Deficiencies or excesses of specific nutrients, particularly nitrogen, can contribute to malformation. Proper nutrient management is essential to maintain tree health and reduce disease incidence.

Management and Control Strategies

Effective management of mango malformation requires an integrated approach that combines cultural, chemical, biological, and genetic strategies. Here are some key methods:

- 1. Cultural Practices:** Cultural practices form the backbone of malformation management. These practices aim to reduce the incidence of the disease by improving orchard hygiene and tree health.
 - **Pruning and Sanitation:** Regular pruning of infected shoots and branches helps in reducing the inoculum load. All pruned material should be destroyed to prevent the spread of the fungus.
 - **Proper Spacing:** Ensuring adequate spacing between trees promotes good air circulation, reducing humidity levels that favour fungal growth.
 - **Irrigation Management:** Proper irrigation practices that avoid water stress can help maintain tree vigour and reduce susceptibility to malformation.
- 2. Chemical Control:** Chemical control involves the use of fungicides to manage the disease. However, the effectiveness of fungicides can vary, and over-reliance on chemicals can lead to resistance development in pathogens.
 - **Fungicide Applications:** Fungicides such as carbendazim, mancozeb, and copper oxychloride have been used to manage mango malformation. Application timing and frequency are critical for effective control.
- 3. Biological Control:** Biological control is an emerging area of research aimed at developing sustainable management practices for mango malformation. Biological control involves using natural predators, parasites, or antagonists to suppress the disease-causing pathogen.
 - **Biological Agents:** Research is ongoing into identifying and utilizing beneficial microorganisms that can inhibit the growth of *Fusarium mangiferae*. For example, certain strains of *Trichoderma*, a soil-borne fungus, have shown promise in controlling *Fusarium* infections.
 - **Organic Amendments:** The use of organic matter and composts can improve soil health and microbial diversity, which in turn can enhance the natural resistance of mango trees to malformation.
- 4. Resistant Varieties:** Planting resistant or tolerant varieties is one of the most effective long-term strategies for managing mango malformation. Breeding programs focus on developing and promoting varieties that are less susceptible to the disease.

- **Variety Selection:** Farmers are encouraged to select and cultivate mango varieties known for their resistance to malformation. For instance, varieties like ‘Amrapali’ and ‘Mallika’ have shown some level of resistance.
- **Breeding Programs:** Ongoing breeding programs aim to develop new varieties with enhanced resistance to Fusarium and other biotic stresses, while also maintaining desirable horticultural traits.

Integrated Disease Management: An integrated disease management (IDM) approach combines multiple strategies to manage mango malformation effectively. This holistic approach not only targets the pathogen but also addresses the underlying factors that contribute to disease development.

1. Monitoring and Early Detection: Regular monitoring of mango orchards is crucial for the early detection of malformation symptoms. Early intervention can prevent the disease from spreading and becoming more severe.

- **Surveillance:** Farmers should conduct regular inspections of their orchards, particularly during the flowering and fruiting seasons, to identify any signs of malformation.
- **Diagnostic Tools:** The use of diagnostic tools and techniques, such as PCR-based assays, can help in the accurate identification of Fusarium species involved in malformation.

2. Integrated Pest and Disease Management: Combining pest and disease management practices can provide synergistic benefits and enhance the overall health of mango trees.

- **Pest Control:** Managing insect pests that may act as vectors for fungal spores is essential. For example, controlling mealybugs and scale insects can reduce the spread of Fusarium.
- **Soil Health Management:** Practices that improve soil health, such as crop rotation, cover cropping, and the use of organic amendments, can enhance the resilience of mango trees to malformation and other diseases.

3. Nutrient Management: Proper nutrient management is vital for maintaining tree health and reducing susceptibility to malformation. Balanced fertilization practices ensure that trees receive adequate nutrients without excesses that can predispose them to disease.

- **Soil Testing:** Regular soil testing helps in determining the nutrient status of the soil and guides the appropriate fertilization practices.
- **Foliar Applications:** In cases of nutrient deficiencies, foliar applications of micronutrients can provide a quick remedy and improve tree health.

4. Education and Extension Services: Educating farmers about the causes, symptoms, and management of mango malformation is crucial for effective disease control. Extension services play a key role in disseminating knowledge and promoting best practices.

- **Training Programs:** Workshops and training sessions for farmers on disease identification, management practices, and the use of diagnostic tools can enhance their capacity to manage malformation.
- **Information Dissemination:** Providing access to information through publications, online resources, and extension agents helps keep farmers updated on the latest research and management strategies.

Conclusion

Mango malformation remains a significant challenge for mango producers worldwide. However, through a combination of cultural practices, chemical and biological controls, resistant varieties, and integrated disease management approaches, it is possible to mitigate the impact of this disease. Continuous research, farmer education, and the implementation of sustainable management practices are essential to ensure the health and productivity of mango orchards. By adopting a proactive and integrated approach, farmers can protect their crops and continue to enjoy the economic and cultural benefits of this cherished fruit.

References

1. Ahlawat, T.R., Singh, A., Patel, C.R. & Rymbai, H. (2014). Management of physiological disorders in mango. *Indian Farmer*, 1(3), 185-197.
2. Avasthi, R. K., & Gupta, S. K. (2009). Management of mango malformation through an integrated approach. *Journal of Plant Pathology*, 91(3), 479-486. doi:10.4454/jpp.v91i3.1333
3. Kaur, A. & Kaur, N. (2018). Mango malformation: A fungal disease, physiological disorder or malady of stress. *Journal of Applied and Natural Science*, 10(1), 403-409.
4. Kumar, R., Misra, A.K. & Dwivedi, R. (2011). Mango malformation: One hundred years of research. *Annual Review of Phytopathology*, 49(1), 111-134. doi:10.1146/annurev-phyto-072910-095314
5. Ploetz, R.C. (2001). Malformation: A unique and important disease of mango, *Mangifera indica* L. APSnet Features. doi:10.1094/APSnetFeature-2001-0401
6. Sharma, K.K., & Misra, A.K. (2006). Fungal diseases of mango and their management. *Journal of Agricultural and Biological Science*, 1(3), 35-46. Retrieved from http://www.arpnjournals.com/jabs/research_papers/rp_2006/jabs_0906_07.pdf
7. Singh, P., Singh, S., Moharana, D. & Singh, A. (2017). A critical overview on various physiological disorders of mango (*Mangifera indica* L.). *Trends in Biosciences*, 10(28), 5913-5916.