Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 05 (SEP-OCT, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

The Impact of Plant Hormones on Fruit Ripening and Crop Yield

(*S. Prabakaran and R. Sowmyapriya)
ICAR-Indian Agricultural Research Institute, New Delhi 110012, India
*Corresponding Author's email: surendar.karan7@gmail.com

Plant hormones, or phytohormones, regulate plant growth, development, and environmental responses. They play a crucial role in agriculture, particularly in fruit ripening and crop yield. Key plant hormones include auxins, gibberellins, cytokinins, abscisic acid, jasmonic acid, and ethylene. Ethylene is a well-known fruit-ripening hormone that promotes cell wall collapse, color, flavor, aroma, and nutrition. Gibberellins affect crop yield by promoting stem elongation, promoting germination, and enhancing fruit set and blooming. Auxins help manage crops by promoting root growth, promoting cell division, and extending photosynthesis. Abscisic acid controls stress responses, making plants drought-tolerant and ensuring proper growth. Jasmonic acid controls chemical production and gene activation, affecting crop yield. Understanding these hormones can lead to more productive and sustainable farming methods, improving agricultural sustainability and global food security.

Introduction

Phytohormones, or plant hormones, regulate plant growth, development, and environmental responses. Plant hormones perform many functions, but fruit ripening and crop yield are vital to agriculture and food security. Understanding these factors can improve crop production and agricultural operations. Plant hormones impact crop yield and fruit ripening, and this article examines their effects and agricultural uses.

Uses of Plant Hormones

The main plant hormones have different activities. This includes:

- **Auxins**: It promote fruit development, root initiation, and cell elongation.
- **Gibberellins**: Promote fruit development, seed germination, and stem elongation.
- **Cytokinins**: It delays leaf senescence and regulate cell division and differentiation.
- **ABA**: It is needed for stress responses such seed dormancy and drought tolerance.
- **Ethylene**: famous for fruit ripening and senescence.
- **Jasmonic acid**: Plant defense and stress reactions use jasmonic acid.

Fruit and Ethylene Ripening

Probably the most well-known fruit-ripening hormone is ethylene. It signals fruit ripening in several fruits. Ripening functions of ethylene include:

- Ethylene promotes cell wall collapse, softening fruit. The process starts cellulase and pectinase.
- Ethylene synthesizes lycopene and carotenoids, which give ripening fruit its color.
- Flavor and Aroma: The hormone affects the production of volatile compounds that give ripe fruit its odors.
- Nutrition: As fruits age, some vitamins become more concentrated and others less concentrated. The process is somewhat regulated by ethylene.

- In agriculture, ethylene manipulation is beneficial. Ethylene inhibitors and controlled environment storage can delay ripening, extend shelf life, and reduce spoilage during transport and storage.

Gibberellin

Gibberellins alter crop yield by affecting growth parameters.

- Gibberellins cause stem elongation, which may increase plant height and productivity. Too much elongation can weaken plants and cause them to lodge or collapse over.
- These hormones help plants germinate after dormancy. By promoting germination, gibberellins can boost yields and crop uniformity.
- Gibberellins impact fruit set, blooming, and production. Gibberellin therapy can increase tomato and grape yield due to fruit size.
- Foliar sprays and seed treatments with gibberellin boost crop yield and performance. Gibberellin effects must be carefully managed to avoid excessive vegetative growth or declining disease resistance.

Auxins and Crop Management

Auxins help manage crops in several ways.

- Roots need auxins to grow. Rooting hormone treatments encourage cuttings to grow new roots, helping transplants succeed.
- Auxins affect fruit set and development by promoting cell elongation and division. They are often used on apples and grapes to reduce fruit thinning and improve quality.
- In plant tissue culture, auxins help tissue explants regenerate and create new plant species.
- Plant growth and development are optimized by auxins, improving crop quality and yields.

Cytokinins and Crop Yield

Cytokinins impact several plant growth components responsible for agricultural output, including:

- Cytokinins promote cell division in leaves and roots, increasing plant vigor and output.
- Delayed Senescence: Cytokinins delay leaf senescence and aging, extending photosynthesis and perhaps increasing agricultural yield.
- Root-to-Shoot Ratio: They determine how effectively roots and shoots develop in proportion, which affects nutrient absorption and plant health.
- Cytokinin-assisted agriculture increases crop productivity by extending plant life and improving plant health.

Abscisic acid and Stress Reactions

Abscisic acid (ABA) controls plant stress responses, which indirectly affects agricultural yield:

- ABA makes plants drought-tolerant by closing stomata and reducing transpiration. This is vital in drought-prone areas.
- Seed Dormancy: ABA regulates seed germination and dormancy to ensure proper growth. This helps establish crops.
- By controlling ABA levels, crops can tolerate environmental stress and become more reliable.

Jasmonic Acid and Defense

Plant defense mechanisms that use jasmonic acid affect crop yield.

- Jasmonic acid controls chemical production and gene activation to help plants combat pests and diseases.
- Trade-offs in growth despite stimulating protective systems, jasmonate can drain development resources. Controlling its levels is key to balancing defense and output.
- By regulating jasmonic acid levels, farmers can withstand biotic stresses and protect agricultural productivity.

Conclusion

Fruit ripening and agricultural yield are complex processes that are influenced by plant hormones. Auxins, cytokinins, ethylene, gibberellins, abscisic acid, jasmonic acid, and cytokinins all have specific roles in the growth and development of plants, which affects the amount and quality of agricultural products. Farmers and academics may create plans to accelerate fruit ripening, increase agricultural yields, and tackle issues like resource scarcity and climate change by utilizing our understanding of these hormones. Developments in this area might lead to more productive and sustainable farming methods, which would eventually improve agricultural sustainability and global food security.

References

1. Book – Fundamentals of Plant physiology by V.K Jain
2. Plant physiology by Pandey S.N and Sinha B.K