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Role of Plant Growth Hormones: An Overview

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INTRODUCTION

PHYTOHORMONES

The Greek word "Hormoa," which meaning "to stimulate," is where the word "hormone" originates (Beylis & Starling, 1902).Hardy and Thiemann (1948) coined the term "hormone" and recommended calling plant hormones "phytohormones."Phytohormones are naturally occurring organic chemicals that, depending on their minute or low concentration, either increase or decrease and alter a plant's growth and development.The place of action and the site of synthesis are distinct.

PLANT GROWTH REGULATORS

Plant Growth Regulators (PGRs) are synthetic or natural chemicals that affect how crops grow and develop.While all PGRs are not plant hormones, all plant hormones are plant growth regulators.For example, IBA (Auxin) is always synthetic, although IAA (Auxin) can be both natural and synthetic.Known by another name, "plant growth regulators," phytohormones are organic substances that are found in higher plants naturally and have trace amounts of activity. They control physiological processes such as growth at a site remote from their site of synthesis. The discovery of plant hormones and their ability to regulate every aspect of plant growth and development changed the course of horticultural history. Plant Growth Regulators (PGRs) were quickly found to have the potential to improve postharvest life, quality, and productivity. The development of tree fruits is the most notable example of their proven influence. Tree fruit is considered a high-value commodity, and little changes to enhance the product's quality, production efficiency, or visual appeal can have a significant effect on its value.

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NAA was found to be beneficial in addressing biennial bearing and preharvest drop, two of the main problems facing apple production, following the discovery of auxins. Even now, the NAA is a big PBR. The discovery of gibberellins and cytokinins has enabled the commercial applications of commodities in these hormone groups, such as improved fruit form, greater market value by eliminating blemishes, and optimal tree architecture that may be obtained by opposing apical dominance. Subsequent research revealed that PBRs might extend postharvest life or quicken ripening, extending the period of time when excellent fruit could be gathered and sold. Among other areas of fruit development, PBRs are very beneficial in avoiding preharvest fruit drop, managing fruit ripening, regulating vegetative growth, and promoting the formation of flower buds. Other PBRs, such Prohaxadione calcium, slow down the growth of new shoots and alter a plant's metabolism to make it more resistant to pests and diseases. Prohaxadione calcium also inhibits the production of gibberellin. A naturally occurring hormone called abscisic acid has demonstrated potential in reducing plant stress and encouraging early fruit drop. Recently, pome fruit storage has undergone a radical transformation thanks to 1-MCP, a competitive ethylene inhibitor that extends the fruit's postharvest life and improves its quality over time. Fruit thinning and preharvest drop retardation are the two areas where PBR use has made the most progress lately. In these areas, a better understanding of the underlying mechanisms, the application of molecular biology techniques, and further empirical research have led to improved regulation of these important processes in tree fruit development.

Major classes of PGR's

1. **Auxins**
2. **Gibberellins**
3. **Cytokinins**
4. **Ethylene**
5. **Abscisic acid**

Auxins

The word **Auxin** has been derived from a Greek word **Auxein** which means "to grow / to increase".

It was originally discovered in human urine.

antecedent: tryptophan

Location of production: Young, growing leaves, seeds, and the tips of shoots and roots

Types of Auxins:

Natural - IAA (Indole-3-Acetic acid), PAA (Phenyl Acetic Acid)

Synthetic - IBA (Indole-3-Butyric Acid), 2,4-D, 2,4,5-T, NAA

Functions of Auxins

- ✓ encourages apical domination.
- ✓ encourages the beginning and growth of roots, such as IAA, IBA, and NAA.
- ✓ Encourages elongation of cells – IAA.
- ✓ Encourages Parthenocarpy: IAA, NAA, IBA, and so on.
- ✓ stops foliage, flowers, and immature fruits from being abscissed.
- ✓ Employed as herbicides: 2,4-D and 2,4,5-T
- ✓ Encourages Blooming: IAA, NAA, etc.
- ✓ Premature fruit drop prevention. For instance, tomatoes and capsicum.

Gibberellins

The fungus Gibberella fujikuroi, which causes rice plants to grow unnaturally tall due to Bakane stupid seedling sickness, is the source of the word Gibberellins (Kurosawa and Hori). The compounds known as GA1, GA2, GA3, and so forth are known as precursors. Terpenoids (terpenes, diterpenes, and sesquiterpenes) are produced in embryos, roots, and young leaves. Nonetheless, GA3 has been the subject of the greatest research.

Functions of Gibberellins

encourages cell division and elongation.

enhances the growth of seedlings and the germination of seeds.

a seed's dormancy ending.

encourages long-day plants to bloom.
controls the expression of sex in certain plants, such as cucurbits.
Allowance for coldness.

Cytokinins

- ✓ Initially, they were separated from coconut milk.
- ✓ Cytokinins are the growth factors that Miller, Skoog, and their colleagues identified from a DNA preparation as being responsible for cellular division.
- ✓ 5-AMP (adenosine monophosphate) is a precursor.
- ✓ Production sites: Young fruits, seed endosperm, and tips of roots.

Functions of Cytokinins

- ✓ encourages the growth, division, and differentiation of cells (used in tissue culture).
- ✓ stops plants from aging (senescence).
- ✓ Because they prevent apical dominance and promote the development of lateral buds, they are often referred to as anti-auxins.
- ✓ encourages short-day plants to bloom.
- ✓ lengthens the vegetables' storage life.
- ✓ increases vegetable output and quality.

Ethylene (c_2 H_4)

The hormone ethylene is a colorless gas.
Another name for it is Ripening Hormone.
Oxygen is necessary for ethylene synthesis since carbon dioxide inhibits it.
Precursor: Methionine
Site of production: Ripe flowers, fruits, leaves, and stem nodes.

Functions of Ethylene

- ✓ Encourages the growth and differentiation of roots and shoots (Triple response).
- ✓ causes fruits to ripen. For instance, tomato.
- ✓ encourages the senescence and abscission of leaves, flowers, etc.
- ✓ breaks the dormancy of seeds and buds in several species.

Abscisic Acid

It functions as an anti-Gibberellin and is also referred to as stress hormone or dormin.
Hormone found in plants naturally.
The Mevalonic Acid Precursor
Site of production: every organ.In times of drought, it is in charge of shutting stomata, making it a plant stress hormone.

Functions of Abscisic Acid

- ✓ causes seeds and buds to become dormant.
- ✓ engaged in fruit and leaf abscission (fall).
- ✓ prevents the germination and growth of seeds.
- ✓ has a significant impact on the regulation of stomata opening and shutting.
- ✓ keeps cells from becoming dehydrated.
- ✓ increases resistance to cold.
- ✓ prevents the spread of infections.

CONCLUSION

- ✓ PGRs have an instant impact.
- ✓ Suitable for enhancing quality.
- ✓ Useful for producing hybrid seeds.
- ✓ Suitable for prolonged crop storage.