

PGRs and their Working Manner

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Abstract

The plant hormones or regulators are the organic chemical compounds, which modify or regulate physiological processes in an appreciable measure in the plant when used in a small concentration. In other words, plant growth regulators are organic substances (other than nutrients), which in small amounts promote, inhibit or otherwise modify any physiological process in plants. Thus, the use of plant growth regulators has resulted in some outstanding achievements in several fruit crops with respect to growth, yield and quality.

Introduction

Phytohormones are organic substances produced naturally in higher plants, controlling growth or other physiological functions at a site remote from its place of production and active in minute amounts. But plant growth regulators include naturally occurring phytohormones, their chemical analogs, hormone releasing agents, hormone sensitivity altering agents and hormone synthesis inhibitors (Hajam *et al.*, 2017). Thimmann (1948) proposed the term phytohormone as these hormones are synthesized in plants. Plant growth regulators include auxins, gibberellins, cytokinins, ethylene, growth retardants and growth inhibitors.

“hormone” is a Greek word derived from “hormao”, which means to stimulate. Auxin was the first hormone to be discovered in plants and at one time considered to be the only naturally occurring plant growth hormone. Plant growth regulators considered as a new generation of agrichemicals when added in small amounts, modify the growth of plants usually by stimulating or modifying one part of the natural growth regulatory system, thereby the yield is affected as well.

Table 1. Class of Plant Growth Regulators

Auxins	IAA, NAA, IBA, IPA, 2-4D,4-CPA,2,4,5-T
Gibberellins	GA ₃ (most commonly occurring)
Cytokinins	Kinetin, Zeatin, Benzyladenine
Ethylene	Ethereal
Abscisic acid	Dormins, PhaseicAcid
Phenolic substances	Coumarin
Flowering hormones	Florigen, Anthesin, Vernalin
Natural substances	Vitamins, Phytochrome
Synthetic substances	Synthetic Auxins, Synthetic Cytokinins
Growth inhibitors	AMO-1618, Phosphon-D, CycocoeI, B-999

Commercial Utility of PGRsin Fruit crops

Auxins

Optimum concentration and combination of IBA and NAA on rooting potential. The treatment of IBA (7500 ppm) gave a maximum rooting percentage (96.67%). Application of 2,4-D spray (20 ppm) at or shortly after bloom effectively thins the number of mandarin fruits without affecting total yield. Effect of NAA on fruit set and fruit retention percentage of mango was found as a positive effect.

Gibberellic Acid

The promotive effect of GA₃ on seed germination is due to the role of GA₃ inactivating alpha amylase enzyme which converts starch into simple carbohydrate and liberates chemical energy which is used in the activation of the embryo.

Cytokinins

The promoting effect of Cytokinin on fruit set and fruit retention is achieved by reducing abscisic acid content. It also affects the rate of somaclonal variation indirectly by increasing multiplication rate and inducing adventitious shoot proliferation.

Ethylene

Increasing the higher accumulation of metabolites and quick conversion of starch into soluble sugars during the fruit development in response to growth regulators due to the effect of different concentrations of ethrel (2-Chloroethyl phosphonic acid) also shown on ripening and colour development of the fruits.

Abscisic Acid

ABA treatment enhanced anthocyanin accumulation under high night temperatures to almost the same level as under low night temperatures. The mechanism for the increase of anthocyanin accumulation in grape skin by ABA treatment seems to involve the induction of *vmyb1*, a putative regulatory gene of anthocyanin biosynthesis.

Table 2. Plant growth regulators and their associated functions

Plant Growth Regulators	Associated functions
Auxins	Promote stem elongation, stimulates cell elongation, inhibit the growth of lateral buds (maintains apical dominance), promote root initiation, control fruits drop,
Gibberellins (GAs)	Regulate various developmental processes, including stem elongation, germination, flowering, flower development. GAs are one of the longest-known classes of plant hormones.
Cytokinins (CK)	Promote cell division, or cytokinesis, in plant roots and shoots. They are involved primarily in cell growth and differentiation.
Ethylene	Regulating the ripening of fruit, the opening of flowers, the abscission (or shedding) of leaves.
Abscisic acid	Acts as a plant stress hormone, seed and bud dormancy, the control of organ size and stomata closure. It is especially important for plants in the response to environmental stresses.

Conclusion

Plant growth regulators considered as a new generation of agrichemicals when added in small amounts, modify the growth of plants or regulate physiological processes in an appreciable measure in the plant when used in small concentration.

References

- Hajam, M. A., Hassan, G. I., Bhat, T. A., Bhat, I. A., Rather, A. M., Parray, E. A., Wani, M. A., and Khan, I. F. 2017. Understanding plant growth regulators, their interplay: For nursery establishment in fruits. *International Journal of Chemical Studies*, 5(5): 905-910.