

ROLE OF PLANT GROWTH REGULATORS IN AGRICULTURE

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Plant growth regulators are organic compounds other than nutrients that promote, inhibit or modify any physiological process in plants. The plant growth regulators can be naturally occurring growth substances or synthetic compounds. The plant growth regulators have successfully been used in Horticulture for controlling various developmental processes starting from seed germination till the post harvest preservation.

The plant growth regulators are distributed in five major categories, viz., auxins, gibberellins, cytokinins, abscisic acid and ethylene. Lately some new compounds have also been used as plant growth regulators, which include polyamines and brassinosteroids. The synthetic compounds that are being used for plant growth promotion processes are Indole Butyric acid (IBA), Naphthyl acetic acid (NAA), 2,4-Dichlorophenoxy acetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), Benzyl adenine and thiadiazuron.

In some of the horticultural crops there is need for inhibition of plant growth. In such cases, the growth inhibitors like Maleic hydrazide, cycocel, mepaquat chloride and a few others are used on need basis. The synthetic auxins like 2,4-D and 2,4,5-T have herbicidal and weedcidal properties in addition to growth promoting activity depending upon the concentration in which they are applied. The optimum stage of plant growth, method and the dose of application of growth regulators play a crucial role in obtaining the desired results.

Auxins : The primary auxin in plants is Indole Acetic acid (IAA). Others are IBA, phenyl acetic acid and 4-chloro IAA. These first get converted into IAA for their action. All parts of roots can synthesize IAA. The physiological role of auxins is cell elongation, phototropism, geotropism, apical dominance, root initiation, ethylene production and fruit development. Few important applications of auxins include :

- Induces rooting in stem cutting
- Promotes morphogenesis of roots in tissue culture
- Promotes uniform flowering in pineapple
- Inhibits flower drop in pineapple
- Increases fruit growth in banana
- Controls fruit drop in citrus, plum, mango and lychee
- Induces parthenocarpy in multi seeded fruits.
- Reduces fruit set in apple and citrus
- Controls mango malformation

Cytokinins : Cytokinins that occur in plants are N⁶ substituted adenine derivatives. Two major kinds of cytokinins found in plants are free form and conjugated form. The free cytokinins are zeatin and isopentenyl adenine. The conjugated cytokinins are produced as glucosides and alanine conjugates. Cytokinins are biosynthesized in the roots and transported via xylem to shoots, where they exert a major influence on growth and photosynthesis. The cytokinins can promote or inhibit root initiation and development depending upon the concentration used. Kinetin can stimulate dry weight and elongation of roots, photosynthesis and growth in very low concentrations, whereas, the higher concentration and prolonged exposure to kinetin inhibits the same functions. Kinetin also controls the timing of senescence. A few major functions are :

- Delays leaf senescence
- Promotes morphogenesis of shoots in tissue culture
- Increases post harvest life of some fruits
- Increases sink capacity of fruits

Gibberellic acid: Gibberellins are terpenoids and built from five carbon isoprene units. The young leaves are the main sites of biosynthesis of gibberellic acid. Roots are the site of interconversion of gibberellins produced in the shoots. Seeds also produce gibberellic acid but are not able to transport it. The main function of gibberellins is to regulate starch accumulation and utilization inside and outside the roots by stimulating the hydrolytic enzymes that promote the conversion of starch to sugars. The main functions controlled by gibberellins are :

- Promote fruit growth
- Increase bunch weight and berry size in grapes
- Increase fruit growth
- Promotes internodal elongation in sugarcane (elongation of shoots)
- Breaks dormancy of buds in temperate fruit crops.
- Controls the fruit development of the parthenocarpic fruits
- Play important role in thinning of stone fruits
- Inhibits flower bud differentiation in deciduous fruits

Abscisic acid : It is a sesquiterpene compound. It consists of three isoprene units and it is synthesized in roots of

Contd.... p. 77