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Application of Plant Growth Regulators on Fruit Production

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Abstract:

Agrotechnical and horticultural fields are increasingly using growth-regulating agents to modify vegetative development, blooming, fruiting, and quality. These organic compounds are formed in higher plants spontaneously; they are active in minute amounts and regulate physiological functions at a location distant from their site of creation. Plant growth regulators, also known as bioinhibitors, function within plant cells to either stimulate or inhibit particular enzymes or enzyme systems, hence aiding in the regulation of tissue metabolism. For the purpose of distinguishing plant hormones from animal hormones, Thimann (1963) coined the term phytohormones. For phytohormones, both transcriptional and translational levels of control over genetic expression have been shown. Currently, exogenous application of plant growth regulators can reduce excessive fruit drop in fruit crops.

Keywords: Plant growth regulators, Flowering, Fruiting, Quality, Growth inhibitor.

Introduction:

The organic chemical substances known as plant regulators are those that, when applied at modest concentrations, alter or regulate physiological processes in a significant way within plants. Since they were a useful tool for improving crop growth and development both quantitatively and qualitatively, plant growth regulators have long been a crucial part of horticulture. Furthermore, it has been noted that additional plant growth regulators can be quite beneficial in this regard by modifying the growth and development of plants. Through their direct impact on fruit growth and development or their indirect influence on crop load, tree

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vigor, and canopy architecture, plant growth regulators are known to enhance fruit size, appearance, and aril quality. Promaline and CPPU, two synthetic cytokines, have been discovered to be particularly successful in promoting fruit growth in grapes, apples, and cranberries among other growth regulators. Hydrogen cyanamide has been proven to enhance horticultural crop blossoming in regions where the winter chilling requirement is not met.

Types of plant growth regulators:

• **Auxins:**	IAA, NAA, IBA, 2-4D, 4- CPA
• **Gibberellins:**	GA3
• **Cytokinins:**	Kinetin, Zeatin
• **Ethylene:**	Ethereal
• **Abscissic acid:**	Dormins, Phaseic Acid
• **Phenolic substances:**	Coumarin
• **Flowering hormones:**	Florigin, Anthesin, Vernalin
• **Natural substances:**	Vitamins, Phytochrome Tranmatic
• **Synthetic substances:**	Synthetic Auxins, Synthetic Cytokinins
• **Growth inhibitors:**	AMO-1618, Phosphon-D, Cycosel, B-999

Basic Role of Major Plant Growth Regulators in Plants:

a. Auxin:

i) Contributes to the root initiation process in stem cuttings.

ii) Less early-stage fruit and leaf falling.

iii) Control cell division and xylem differentiation.

iv) Apical dominance, in which the development of apical buds inhibits the growth of lateral buds, may transpire. The shot caps may be taken off in these circumstances.

b. Gibberellin:

i) Postpone fruits' aging process.

ii) End dormancy in seeds and buds.

iii) Help fruits like apples elongate and take on a better shape.

iv) Assists in raising crop productivity by lengthening the axis of plants like grape stems and increasing the height of plants like sugarcane.

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c. Cytokinin:

i. End seed and bud dormancy.
ii. Encourages the lateral bud to develop.
iii. They are employed to extend the vase life of flowers.
iv. Promote lateral shoot growth and adventitious shoot formation.
v. Encourage the mobilization of nutrients, which helps postpone the senescence of leaves.

d. Abscisic acid:

i. Promotes the growth and maturity of seeds.
ii. Prevents seed germination and plant metabolism.
iii. It has a role in controlling dormancy and abscission.
iv. It's frequently applied to trees as a spray to control fruit dropping.

e. Ethylene:

i. Dispels seeds' and buds' dormancy.
ii. Promotes faster breathing when fruits ripen.
iii. Promotes the senescence and abscission of leaves and flowers

Roles of PGRs in Fruit Crop Production:

1. **On Seed germination:** Gibberellins may be necessary for seed germination in order to initiate the embryo's vegetative growth. The administration of gibberellin also initiates the manufacture of alpha amylase in the aleurone layer, which transforms starch into sugar and transfers it to the developing embryo as a source of energy. effects of pre-sowing seed treatments on seedling growth and germination of various fruit crops. It was discovered that pre-sowing treatment with 200 ppm GA3 increased germination and prolonged seed longevity of ber cv. Gola.
2. **On Root initiation:** While undamaged roots develop more readily at lower auxin concentrations (10-10 to 10-9 M), roots grow less readily at higher auxin concentrations (10-6 M). Adventitious roots can originate from mature cell clusters that restart cell division in a range of tissue sites. These proliferating cells eventually form a root apical meristem, which is similar to how lateral roots form. Auxin's stimulatory action on adventitious root growth has proven to be highly beneficial in horticulture for plant vegetative proliferation by cuttings.

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3. **On Crop regulation:** It has been discovered that plant bio-regulators are particularly successful at controlling the cropping season and thinning flowers. For example, two sprays of 600–800 ppm NAA applied in April and May at 15-day intervals in Tarai conditions at 50% flowering are effective in controlling the crop in guava. Reducing the crop burden of the guava rainy season crop by applying several crop-regulating chemicals topically, such as urea, 2,4-D, potassium iodide, and NAA, has been effectively standardized for various agroclimatic zones, resulting in increased yield and quality of the winter crop.
4. **On Vegetative Growth:** When NAA was administered twice in the middle of August and October, the mango cultivar Himsagar produced the greatest number of new shoots at 200 to 400 ppm. In pear nursery plants, foliar treatment of GA3 at 200 or 600 ppm boosted vegetative development. Apple CV's leaf area rose when GA3 was treated at 10, 20, and 40 ppm during the silver tip to green stage. Intensely Flavorful. Plant height, leaf count, and number of runners per plant increased in strawberry cv. Chandler after 100 ppm GA3 was applied. Applying GA3 at 20 or 30 ppm either before or after bloom greatly improved the average leaf area in pears of the Flemish Beauty variety.
5. **On flower abscission - Chemical thinning period:** The application of caustic sprays and the usage of hormonal sprays are the two distinct strategies used in crop load reduction. This work gave rise to the chemical sodium dinitro-ortho cresylate (DNOC), which was used as an essential apple thinner in arid areas until its registration was revoked in 1990. Following DNOC's demise, there was a frenzy of activity that is still going on today. This volume contains background information and additional insights on pome fruit thinning using caustic agents. Auxins were linked to several early physiological reactions, including abscission retardation.
6. **On Flowering:** In some cherry cultivars, the application of paclobutrazol at a concentration of 100 ppm 40 days prior to blooming caused a two- to three-day delay in flowering. The application of paclobutrazol at 0.5, 1.0, 1.5, and 2 g/m2 to the soil stimulated mango flowering. The proportion of panicles and hermaphrodite flowers in the mango cultivar Dashehari was enhanced by applying paclobutrazol to the soil at a rate of 5 or 10 g a.i. per tree before flower bud differentiation.

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7. **On fruit retention/drop:** Reduced flower or fruit loss was seen in guava cv. Allahabad Safeda when a comparable spray of NAA (200 ppm) was applied. The lowest percentage of fruit drop (23.00%) was seen in 0.2 percent boron + NAA 150 ppm. When 2, 4-D, GA3, and other plant growth regulators were applied, the pre-harvest fruit loss in citrus species was greatly decreased. Applying 100 ppm NAA topically on fruit at 50% flowering and pea stage decreases flowers and fruit loss while boosting fruit set and retention.
8. **On Fruit ripening:** Banana fruits (Musa acuminata) treated with salicylic acid took longer to ripen, whereas bananas treated with calcium carbide took less days to ripen. Mango fruit ripening is accelerated and peel color is improved by ethephon treatment. Mangoes may be made to mature more quickly by applying ethylene to the fruit. Fruit given an ethrel-500 ppm treatment improves homogeneous ripening with somewhat more attractive color development and boosts the organoleptic properties of the fruits, making them more marketable by increasing customers' approval of the products overall.
9. **On Fruit storage:** When aonla fruits were treated with a combination of plant growth regulators and boron (i.e., NAA 40 mg/l + GA3 50 mg/l + Boron 0.50% at pin head and pea stage), the shelf life of the fruits was increased to 16 days at room temperature.
10. **On Seed treatment:** Studies on the effects of varying water and acid soaking times on seed germination in the guava cultivar Allahabad Safeda revealed that treatments of guava seeds with 5,000 ppm ethephon produced 72 percent germination and plants with longer shoots and more laterals. When compared to seeds soaking in H2SO4, HCl, and HNO3, seeds treated in water for 36 hours showed a higher percentage of germination (90%) and a shorter period for seedling emergence. The jackfruit seedlings treated with 100ppm GA3 exhibited the greatest germination percentage and the quickest rate of germination.
11. **On Fruit set and Yield:** Fruit set was increased in mango trees by applying cultar as a soil drench at a rate of 20–40 g per tree, just before flower bud differentiation in the first week of October. Similarly, in pomegranate cv. G-137, applying 100 and 200 ppm of NAA significantly increased fruit set, fruit yield, and fruit number per tree. The kiwifruit cultivar Allison showed improved fruit size, production, and number of fruits

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per vine under application of 50 and 100 ppm NAA. In sweet cherry, the application of 500 ppm paclobutrazol in mid-September greatly decreased fruit set. Apple fruit set and yield were enhanced by pre-bloom application of Paras at 0.6 ml/l concentration.

12. **On Fruit quality:** When GA3 was added to "Le Conte" pears at a concentration of 100 ppm during the petal fall stage, fruit output increased. Application of 200 ppm GA3 in strawberry cv. Camarosa resulted in higher fruit weight, TSS, and acidity. In an experiment on 8-year-old Younai plum trees, various treatments of paclobutrazol when applied through foliage or soil, one month before flowering and again at the end of physiological fruit drop and one month after harvest, increased the fruit yield. In Red Heaven peaches, etheral applied at a concentration of 200–300 ppm improved fruit skin color, reduced acidity, and increased fruit size, weight, TSS, and sugar content.
13. **On Canopy management:** Pomegranate cultivar Kandhari achieves maximum canopy volume with 75ppm GA3 application. The same results were noted for strawberries, mandarins, apples, and sweet oranges.

Conclusion:

Plant growth regulators are essential to the development of premium fruit and trees. Take all necessary safety measures and read the product label. In addition to promoting faster phenotypic changes, plant growth agents also enhance plant growth, facilitate nutrient transfer to profitable regions, and eventually raise crop output.

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