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BIOCHEMICAL CONTROL OF GROWTH IN FRUIT CROPS

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The chemical substances (growth regulators) that affect growth and development have found increasing application in horticulture. Through chemical control, it becomes possible to affect not only growth, but the form and pattern of growth as well as differentiation in physiological processes as flowering and rooting.

The control of plant growth through the use of chemical substances is a modern development in horticulture. A number of substances are now known that have relatively broad spectrum of effects on growth and development of fruit crops (for example, indole butyric acid and the gibberellins). The chemicals used for controlling plant growth are known as Plant Growth Regulators. These are organic chemical compounds other than nutrients which in low concentration promote, inhibit or modify any physiological functions of the plant. Plant hormones have widely overlapping functions. These hormones are distinctive both in chemical characteristics and in their function but the behaviour and response of each crop are highly variable according to the composition and concentration of compounds. Some of the biochemical responses of plant to the chemical control of plant growth are as follows:

Rooting: The rooting of cuttings has been influenced by auxins. In a cutting, the auxin produced in young leaves and buds moves naturally down the stem and accumulates at the cut base along with sugars and other food materials. The formation of root is apparently triggered by the accumulation of an optimum auxin level in relation to these substances. Among various auxins, *Indole Butyric Acid* (IBA) found most effective in rooting of cuttings. *Indole Acetic Acid* (IAA) is ineffective, probably because it is readily destroyed by the plant.

Flower induction: It is assumed that, flowering mechanism is triggered by the photoperiodic stimulation from leaf to bud and across graft unions due to hormonal influence. It is demonstrated that the florigen is involved in the process. Auxins applied to plants after the initiation of flowering may effectively promote flowering. Flower induction in pineapple has been achieved with ethylene as well as auxins. Biennial flowering in mango can be controlled quite effectively with paclobutrazol, a growth retardant that suppresses gibberellin formation. This effect is achieved by the reduction of shoot growth that promotes flower formation in the following season.

Fruit set: The practice of chemically inducing fruit set has followed from studies of the relation of natural auxins to fruiting. The use of auxin derivatives to set fruit in the absence of pollination has had some commercial utilization in fig and grape production. The use of

auxins to ser fruit in Calimyrna fig eliminates the need for male trees and practices of caprification. The use of some auxin sprays to promote set fruit in grape has eliminated the need for girdling. This has become a widely adopted practice in 'Black Corinth' and 'Thompson Seedless' cultivars. The induction of parthenocarpy in grapes with gibberellins has made possible the commercial production of seedless grapes. Such clones receive two gibberellin treatments, the first to induce seedlessness, and the second to increase fruit size. Similar type of study was carried out by Manabu Watanabe (2008) on Apple.

Flower and fruit thinning:

The removal of flowers and fruits to reduce crop loads by chemical thinning has become a standard practice in fruit industry. The physiological action of these chemicals consists in preventing the completion of fertilization or to induce embryo abortion, both of result in natural abscission. Chemical thinning may be performed prior to fertilization (flower thinning) or after fertilization (fruit thinning).

All auxins are not necessarily effective in thinning; only NAA and its derivatives are effective in fruit thinning. This auxin is widely used in apples, pear, peaches, and grapes. The degree of thinning with auxins is greatly affected by the concentration used, the timing of application in relation to fruit development, and the species and cultivars, as well as by environmental factors as temperature and humidity.

Ripening:

Ethylene and acetylene stimulate fruit ripening. Ethylene gas applied in ripening rooms is standard practice to accelerate banana ripening. The discovery of ethylene generating material, Ethephon, stimulates fruit ripening has made the induction of the ripening process possible in the field. Application of Ethephon in pineapple makes complete mechanical harvesting a possibility by even ripening.

Preharvest fruit drop:

The effect of auxins in inhibiting abscission has found an important horticultural application in the control of Preharvest fruit drop. A natural auxin, which prevents abscission, decreases with fruit maturity. A exogenous application of synthetic auxins like NAA, 2, 4-D, 2, 4, 5-T are widely used in fruit industry for controlling fruit drop.

Dormancy:

The modification of seed and plant dormancy promises to be an important area for chemical control, because of extension of dormancy in woody plants to avoid damage by spring frost would provide great economic benefits. With the discovery of absicssic acid, the control of dormancy can be possible. High concentrations of auxins have been successful in prolonging dormancy. The use of growth inhibitor has been effective in inhibiting sprouting in storage and can be applied to the growing plant.

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