

29.1 NOVEL PLANT GROWTH REGULATORS

A) JASMONATES: Jasmonic acid (JA) and its methyl ester (MEJA) occur in several plants and also in the oil of jasmine.

- a) JA and MeJA inhibit the germination of non dormant seeds and stimulate the germination of dormant seeds.
- b) JA plays a role in the formation of flowers, fruit and seed. It is suggested by the relatively high levels of this compound in developing plant reproductive tissues.
- c) Reported a role in insect and disease resistance of plant.
- d) JA stimulates tomato and apple fruit ripening.

B) BRASSINO STEROIDS (BRs) : Brassinolide, a potent plant growth stimulator, was the first BR isolated; it was discovered in rape (*Brassica napus*) pollen in 1979. So far, more than 40 brassinolide analogues, collectively known as brassinosteroids, have been identified and characterized from many different plant species.

- Immature seeds and pollen contain the highest concentrations of brassinosteroids.
- When applied exogenously to intact plants at micromolar or nanomolar concentrations BRs can induce a variety of physiological responses, including seed germination, pollen tube growth, stem elongation, leaf unrolling and bending, vascular differentiation, induction of ethylene biosynthesis, altered gene expression, and stress response modulation.
- They help to increase flowering fruit set and yield
- Foliar spray of 0.3 ppm BR at panicle initiation and flowering stage increases yield in rice

C. SALICYLIC ACID: Salicylic or ortho hydroxy benzoic acid belongs to a diverse group of plant phenolics. The interest in salicylic acid began with the discovery that this compound is a natural trigger for the metabolic explosion which raises the temperature of the thermogenic inflorescences of Arum Lillie.

- SA increase flower longevity by inhibiting ethylene biosynthesis by blocking the conversion of ACC to ethylene.
- SA regulates some aspects of disease resistance.

D. TRIACONTANOL: Saturated primary alcohol isolated from shoots of alfalfa. Response is very rapid in increasing growth. Enhanced growth in rice and maize is reported.

29.2 GROWTH RETARDANTS

The term growth retardant refer to the chemicals that slow down cell division and cell elongation of shoot tissue and regulate plant height physiologically without formative effects. They do not occur naturally in plants.

Examples:

- AMO 1618 ,
- CCC (Chloro choline chloride) (2-Chloroethyl – trimethyl ammonium chloride)
- Chlormequat chloride (Cycocel)
- Alar or B9
- paclobutrazol
- Mepiquat chloride,

29.3 GROWTH INHIBITORS

Growth inhibitors suppress the growth of plants. ABA and ethylene are called as natural growth inhibitors. They bring about certain formative changes in plants. There are synthetic growth inhibitors also.

Examples:

- Malichydrazide (MH)
- 2,3,5-T or Triiodo benzoic acid (TIBA)

29.4 COMMERCIAL APPLICATION OF PLANT GROWTH REGULATORS IN AGRICULTURE AND HORTICULTURE:

A) AUXINS

- a) IBA (@250 ppm) and NAA were found to increase root development in the propagation of stem cuttings.
- b) 2,4-dichlorophenoxy acetic acid (2,4-D) stimulates excessive uncontrolled growth in broad leaf plants for which it is used as a herbicide.
- c) Application of NAA (Naphthalene Acetic Acid) reduces flower and fruit drop in Mango.
- d) NAA application brings uniform flowering and fruit set by inducing ethylene formation in Pineapple.
- e) NAA application @ 10-100 ppm during fruit setting period controls boll shedding in cotton crop.

B.GIBBERELLINS:

- a) GA is used extensively on seedless grape varieties to increase the size and quality of the fruit. Pre- bloom spray of 20 ppm induces rachis of the fruit cluster to elongate. This creates looser clusters that are less susceptible to disease during the growing season.
- b) GA is used to increase the yield of barley malt and to decrease the time required for this process to occur. Application of GA to germinating barley supplements the endogenous content of this hormone and accelerates the production and release of hydrolytic enzymes. They can easily degrade the stored carbohydrates.
- c) Foliar spray of GA₃, at 100 ppm during panicle initiation stage enhances the panicle exertion and increases seed weight and yield in hybrid rice.
- d) GA has also has been used to control flower sex expression in cucumbers and squash. GA application tends to promote maleness in these plants.
- e) Gibberellic acid is also applied to citrus crops, though the actual use depends on the particular crop. For example GA₃ is sprayed onto oranges and tangerines to delay or prevent rind-aging, so that fruit can be harvested later without adverse effects on rind quality and appearance. For lemons and limes, GA₃ synchronizes ripening and enhances fruit size.
- f) Gibberellic acid is used extensively to increase the sucrose yield of sugarcane. Sugarcane, a normally fast-growing C₄ member of the Poaceae (grass) family, is sensitive to cooler winter temperatures, which reduce internode elongation and subsequent sucrose yield. The adverse effects of cooler temperatures can be counteracted by the application of GA₃.

C.ETHYLENE:

- a) Because ethylene regulates so many physiological processes in the plant development it is the most widely used plant hormones in agriculture. Auxins and ACC can trigger the natural biosynthesis of ethylene and in several cases are used in agricultural practice.
- b) Because of its high diffusion rate, ethylene is very difficult to apply in the field as a gas, but this limitation can be over come if an ethylene releasing compound is used. The most widely used such compound is ethephon or 2-chloro ethyl phosphonic acid (**CEPA**)(trade name: **ethrel**).

- c) Ethrel @ 100-250 ppm sprayed at 2-3 leaf stage induce femaleness in cucumber and melons.
- d) It helps in degreening of citrus and banana which increases its market acceptability.
- e) Storage facilities developed to inhibit the ethylene production and promote preservation of fruits have a controlled atmosphere of low O₂ concentration and low temperature that inhibits ethylene biosynthesis. A relatively concentration of CO₂ (3-5%) prevents ethylene action as a ripening promoter.

D) OTHER GROWTH REGULATORS:

- AMO 1618 (a quaternary ammonium salt) is used in the cultivation of ornamental plants and causes a bushy shape and a sturdy growth of the treated plants.
- paclobutrazol : Reduces the problem of biennial bearing in Mango
- Mepiquat chloride, Chlormequat chloride (Cycocel) : used in ornamental plants for shorter internodes and thicker stems (used in poinsettias), it also prevents lodging and increases tillering in cereals.
- Malichydrazide (MH): prevents premature sprouting of onion and potato
- 2,3,5-T or Triiodo benzoic acid (TIBA): Increases flowering in chrysanthemum
