

# Plant hormones (Phyto-hormones)

Plant need water, oxygen, sunlight, minerals, etc, for their growth and development. These are external factors. Besides these, there are some internal factors, that regulate the growth and development of plants. These internal factors are called Plant hormones.

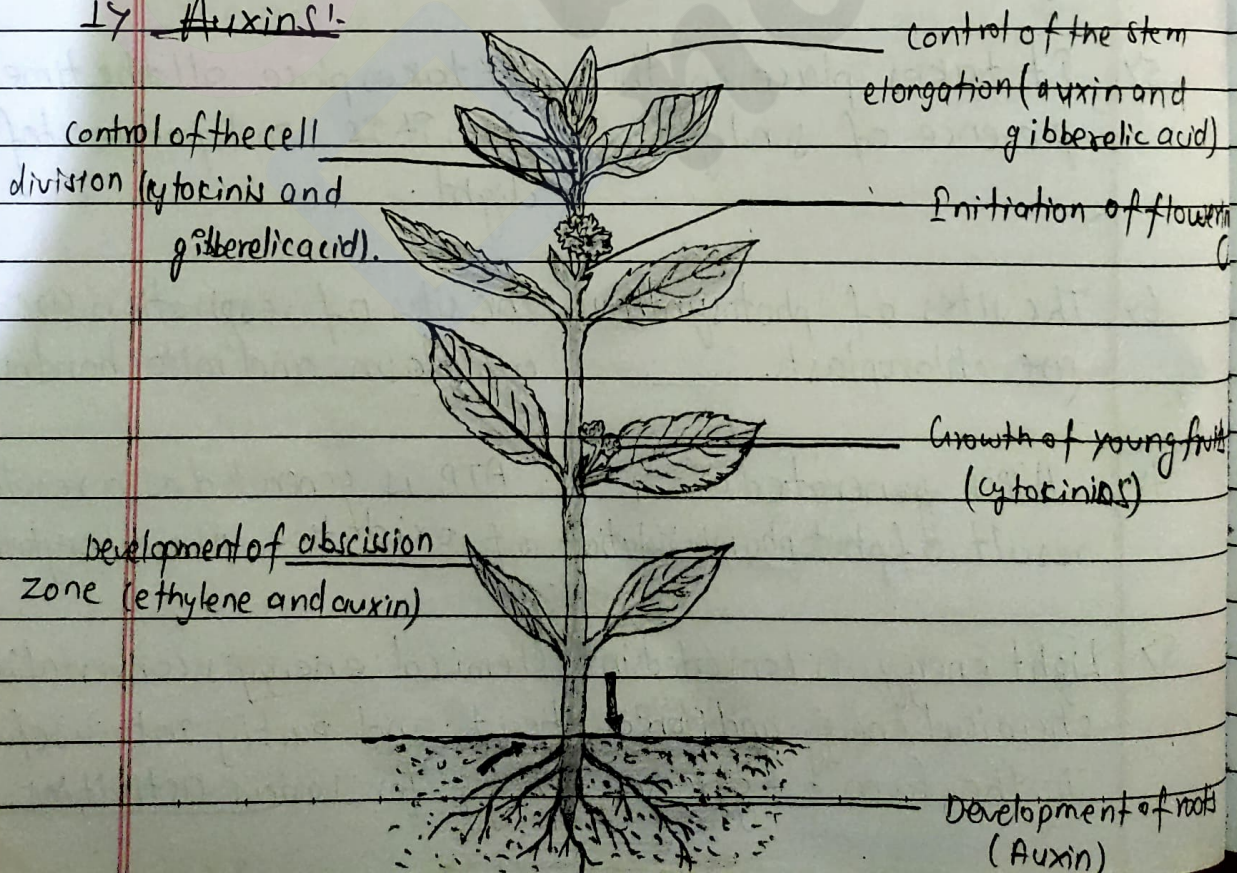
Plant hormones control the growth and the development activities like the cell division, enlargement, flowering, seed formation, dormancy and abscission.

Based on their action, plant hormones are grouped into two categories:-

- Plant growth inhibitors:- Abscissic acid and ethylene
- Plant growth promoters:-

There are 3 types of plant growth promoters. They are:-

## 1) Auxins:-





Auxin (Auxin means to grow) is defined as a plant growth hormone which is responsible for the elongation of the cells in the shoots. F. W. Went first isolated auxin from the Coleoptiles of oat seedlings.

### Site of auxin formation and its types:-

The auxin (IAA) is synthesized in the meristematic tissues and transported to the growth regions of the plants. IAA is the main natural hormone, found in the highest concentration at the tips of the stems and the roots, in the young growing leaves, and in the flowers and fruits.

There are two types of auxins:-

- Natural auxins:-

Indole-3-acetic acid (IAA), Indole butyric acid (IBA).

- Synthetic auxins:-

2,4-D (2,4-Dichlorophenoxyacetic acid), NAA (Naphthalene acetic acid).

### Functions of IAA (physiological effects).

Auxin perform many functions and physiological activities in the plants. Some of their important roles are:-

#### 1) Cell division or callus formation:-

Auxins initiate and promote the cell division in the tissues leading to the formation of

undifferentiated mass of the cells called the callus. This activity of auxin is used in tissue culture.

## 27 Cell elongation:-

Auxins brings about the enlargement of the shoot and the root tips especially behind the apical meristem. ~~Auxins in apical bud inhibit the development~~

## 37 Apical dominance:-

It is ~~orberse~~ observed in many plants that the removal of terminal buds ~~leads~~ to the growth of one or many lower buds.

## 47 Suppression of abscission layer:-

Another inhibitory effect of auxins is on the abscission of the leaves and the fruits. During abscission, an abscission zone present at the base of the leaves or fruits, cuts off the supply of nutrient and water.

## 57 Eradication of weeds:-

The roots are extremely sensitive to auxins. Application of the high concentration of 2,4-D stimulates the growth promoting activities of the cells of the root.

## 67 Root initiation:-

Applications of auxins activates the root initials. Rapid adventitious root formation is



absolutely essential of in cutting for their successful development into new plants in vegetative propagation.

### 7) Flower initiation:

At Normally auxins inhibit the flowering. However, in litchi and pineapple (*Ananas sativus*), auxins like 2, 4-D and NAA have been found to promote the uniform flowering.

### 2) Cytokinins

Cytokinins are defined as the plant hormones that influence the growth and stimulate the cell division. Cytokinins are the major growth promoters of the cell division (cytokinesis).

Cytokinin was first identified from young maize (*Zea mays*) in 1963. So it is also called zeatin. Auxins and cytokinins act antagonistically. Auxins are responsible for stimulating the growth of apical bud. On the other hand, cytokinins promote the growth of the lateral buds.

### Functions of cytokinin

#### 1) Cell division:-

Cytokinins promote the cell division in the apical meristem as well as in the non-meristematic tissues.

#### 2) Cell enlargement and differentiation

It plays a vital role in morphogenesis and differentiation of the shoot and the root meristems.

### 3) Initiation of Interfascicular cambium!

Cytokinins induce the formation of interfascicular cambium in the plants.

### 4) Counteraction of apical dominance!

Auxins and cytokinins act antagonistically in the control of apical dominance. Auxins are responsible for stimulating the growth of the apical bud.

### 5) Breaking of dormancy!

Cytokinins break the dormancy of many seeds and promote their germination.

### 6) Flowering!

Cytokinins induce flowering in certain species of the plants.

### 7) Delay of senescence!

Cut leaves dipped in cytokinins stay green longer. The effect of cytokinins in retarding the ageing is called the Richmond Lang Effect. Cytokinins slow down the process of senescence.



### 3) Gibberellins (GA)

Gibberellins are the plant hormones that regulate the various developmental process, including stem elongation, germination, dormancy, flowering, flower development as well as the leaf and the fruit senescence.

It was first detected in 1920s by Japanese plant pathologists Yabuta and Sumiki (1938) from a fungus (*Gibberella fujikuroi*).

It is also called as a fungal hormone.

#### Types of gibberellins (GA).

Following the extensive studies, it is noticed that there are at least six types of gibberellins which are called as GA<sub>1</sub>, GA<sub>2</sub>, GA<sub>3</sub>, GA<sub>4</sub>, GA<sub>7</sub>, GA<sub>9</sub>. Till now more than 100 different types of gibberellins have been isolated.

#### Functions:-

##### 1) Stem elongation:-

Gibberellins bring about the stem elongation by enlargement of the cells. They induce the rapid cell division and the cell elongation.

##### 2) Bolting in rosette plants:-

The plants like cabbages have a number of leaves around the shoot apex and reduced internodal length giving it a rosette appearance. When such plants are treated with gibberellins, dwarf stems are converted into the tall plants.



### 37 Leaf expansion:-

In many plants, the leaves become broader and elongated when treated with gibberellic acid. The expansion of the leaves increases the photosynthetic area.

### 47 Breaking of dormancy:-

Gibberellins break the dormancy of the buds and the seeds.

### 57 Parthenocarpy:-

Gibberellins have been considered to be more effective than auxins for inducing parthenocarpy in fruits like apple, tomato and pear.

### 67 Sex expression.

In plants like ~~cucurbit~~ cucurbits and Cannabis, gibberellin treatment induces the formation of male flowers ~~in~~ in more place of female flowers.

### 77 Reversal of dwarfism:-

Gibberellins also play a very important role in the elongation of the genetic dwarf (mutant) varieties of plants like corn and pea.

### 87 Flowering:-

Application of GA, to many non-vernalized ~~avette~~ plants cause bolting and subsequent flowering. Its application promotes the flowering in the long ~~it~~ day plants under the unfavorable short day conditions.







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