UNIT-V

plant Growth & development, stress physiology

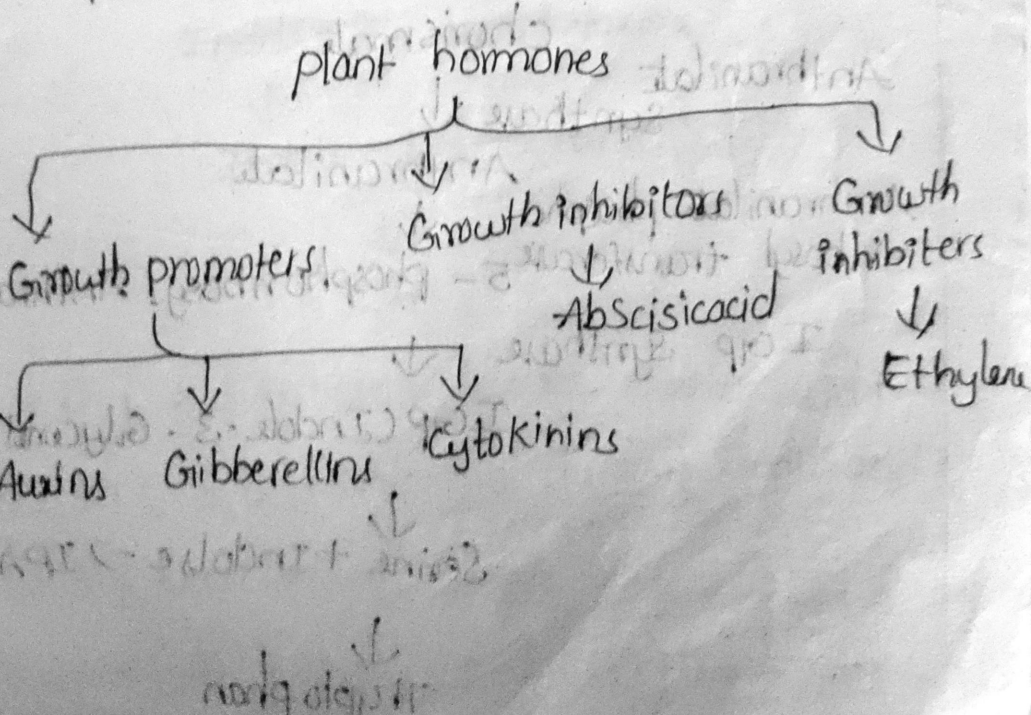
The plant homone auxin was first isolated as indole-3-acetic acid by F.W went (1926) as he studied the tropic response of Anena sativa [oat seedlings]

what is plant hormones?

plants need sunlight, water, oxygen minerals for their growth & development. These are external factors

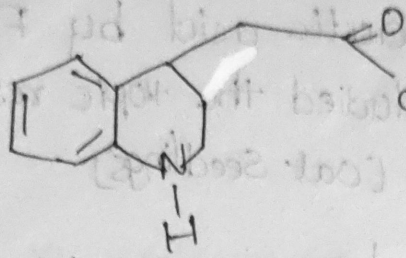
Based on their action plant hormones are categorised into two categories

plant Growth promoters
plant Growth inhibitors



Auxin means = To grow

They are widely used in Agricultural & horticultural practices. They are found in growing apices of roots & stems and then migrate to other parts to act



Molecular formula:- $C_{18}H_{32}O_5$

IAA – Indole-3-Acetic acid

↓

Most-Abundant Natural Auxin

Two types :- IIP
IDP

chorismate

Anthranilate Synthase ↓

Anthranilate

Anthranilate phospho-ribosyl transferase ↓ 5-phosphoribosyl Anthranilate

IGP synthase ↓

IGP (Indole-3-Glycerol phosphate)

↓

Serine + Indole → IPA → IAA

↓

Tryptophan

TDP well known in 4 different pathways

a) IPA (Indole-3-pyruvic acid)

b) TAM (Tryptamine pathway)

c) IAN (Indole's-3-Acetonitrile-pathway)

D) Bacterial pathway (or) IAM [Indole-3 Acetamide pathway]

-① equation

Tryptophan → TAM

↓ TIP TransAminase

IP A

↓ IPA decarboxylase

Indole-3-Acetaldehyde → TAM

(IAld)

↓ IAcetaldehyde dehydrogenase

IAA

-② equation

Tryptophan

↓

Indole-3-Acetaldoxime

↓

Indole-3-Acetonitrile [IAN]

↓

IAA

Agent orange herbaicide

- 2,4 D [2,4 Dichloro-phenoxy-Acetic acid]
- 2,4,5 T [2,4,5 Trichloro phenoxy Acetic acid]

NAA [Napthalene Acetic acid

Dicamba [2-methoxy, 3-6-dichloro benzoic acid]

Unit-IV

Nitrogen cycle

The Nitrogen cycle is the process by which nitrogen is ~~have~~ converted between its various chemical forms. This transformation can be carried out through both biological and physical processes

Forms of Nitrogen

Organic nitrogen as :-

Ammonium (NH_4^+)
nitrate (NO_3^-)
nitrite (NO_2^-)
nitrous oxide (N_2O_2)
nitric oxide (NO) or
inorganic nitrogen as nitrogen gas (N_2)

Nitrogen cycle consists of the following steps:-

1. Nitrogen fixation
2. Nitrogen assimilation
3. Ammonification
4. Nitrification &
5. Denitrification
6. Sedimentation

1. Nitrogen fixation:-

The conversion of free nitrogen of atmosphere into the biologically acceptable form or nitrogenous compounds

there are following ways to convert N_2 into more chemically reactive forms.

a) Biological Nitrogen fixation
b) physiocochemical nitrogen fixation
c) Industrial nitrogen fixation

a) Biological Nitrogen fixation:-

Some symbiotic bacteria, blue-green algae and some free-living bacteria are able to fix nitrogen as organic nitrogen

Ex:- symbiotic bacteria:- Rhizobium
symbiotic blue-green algae:- species of Nostoc, Anabaena
free living bacteria:- Azotobacter, clostridium Derma, Rhodospirillum etc-

b) physiocochemical (or) Non-biological nitrogen fixation

In this process, atmospheric nitrogen combines with oxygen (as ozone) during lightning or electrical discharges in the clouds and produces different nitrogen oxides

$$N_2 + 2(O) \xrightarrow{\text{Electric}} 2NO$$

$$2NO + 2(O) \xrightarrow{\text{Discharge}} 2NO_2$$

$$2NO_2 + (O) \longrightarrow N_2O_5$$

The nitrogen oxides get dissolved in rain water and on reaching earth surface they react with mineral compounds to form nitrates and other nitrogenous compounds:

$$N_2O_5 + H_2O \longrightarrow 2HNO_3$$

$$2HNO_3 + CaCO_3 \longrightarrow Ca(NO_3)_2 + CO_2 + H_2O$$

c) Industrial nitrogen fixation :-

under great pressure, at a temperature of 600°c and with the use of an iron catalyst hydrogen and atmospheric nitrogen can be combined to form ammonia (NH_3) in the Haber-Bosch process

2. Nitrogen assimilation :-

In this process, Inorganic nitrogen in the form of nitrates, nitrites, and ammonia is absorbed by the green plants via their roots and then it is converted into nitrogenous organic compounds

⇒ Nitrates are first converted into ammonia which combines with organic acids to form amino -acids. Aminoacids are used in the synthesis of proteins, enzymes, chlorophylls, nucleic acids, etc

3. Ammonification:-

It is the process of releasing ammonia by certain microorganisms utilizing organic compounds derived from the dead organic remains of plants and animals and excreata of animals

the microorganisms especially involved are:-
Actinomycetes, and bacilli

4. Nitrification:-

Nitrification is a process of enzymatic oxidation of ammonia to nitrate by certain microorganisms in soil and ocean

Nitrosomonas ammonia to nitrites (NO_2^-)
Nitrobacter oxidation of the nitrites into nitrates

In soil

$$2NH_4^+ + 2O_2 \longrightarrow NO_2^- + 2H_2O + \text{energy}$$

$$NO_2^- + 2O_2 \longrightarrow NO_3^- + \text{energy}$$

In Ocean,

$$2NO_2^- + O_2 \longrightarrow 2NO_3^- + \text{energy}$$

5. Denitrification:- Denitrification is the reduction of nitrates back into the largely inert nitrogen gas (N_2)

⇒ Some denitrifying bacteria are:-
Thiobacillus denitrificants
Micrococcus denitrificants
Pseudomonas aeruginosa

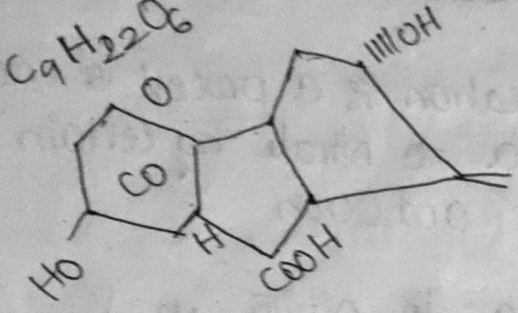
$$2NO_3^- \longrightarrow 2NO_2^- \longrightarrow 2NO \longrightarrow N_2O \longrightarrow N_2$$

6. Sedimentation:-

Sometimes, nitrates of soil are locked up in the rocks while they are washed down to the sea or leached deeply into the earth along with percolating water this phenomena is known as Sedimentation.

UNIT-V

Gibberlins



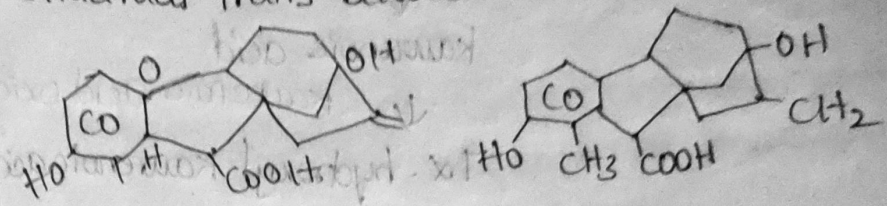
Gibberlin (GA) was first identified into pathogenic fungus gibberella fujikuroi, which causes a disease in rice called foolish seedling by producing large quantities of GA

GA was first identified in Japan in 1926 as a metal basic by-product of the plant pathogen gibberella fujikuroi.

The first in roads into the under-standing of gas were developments from the plant pathology field with studies on the bakanae or foolish seedling disease in rice foolish seedling disease causes a strong elongat of rice stems & leaves.

the Gibberellins

* The gibberellins are named GA, through GAn in order of discovery gibberellic acid which was the first gibberellin to be structurally characterised is GA_3. The bioactive GA, are GA_1, GA_3, GA_4 & GA_7 there are three common structrual traits between these GA_3



GA_1 GA_3

* The first definitive evidence for the occurence of gibberellins in plants was provided by "Jake macmilan" & P.J Suffer [1958]

* Gibberllins was discovered by E. kurosowain 1926 while investigating foolish seedling [bakanae] disease

Trans-geranyl-geranyl diphosphate

↓ copaly diphosphate synthase

Ent-kaurerene-copaly diphosphate

↓ kaurene synthase

kaurene

↓ kaurene oxidase

kaurenoic acid

↓ kauremic acid oxidase

7α-hydroxyl kaurenoic acid

↓ KAO

GA_{12}

20 oxidase ↙ ↘ 13 oxidase

GA_{15} GA_{53}

20 oxidase ↓ ↓ 20 oxidase

GA_{24} GA_{44}

20 oxidase ↓ ↓ 20 oxidase

GA_9 GA_{19}

3β oxidase ↓ ↓ 20 oxidase

GA_4 GA_{20}

C_{13} hydroxylation

2 oxidase ↘

30 oxidase ↓ GA_{29}

GA_1

20 oxidase ↓

GA_8

C_{13} hydroxylation