# Classification of Herbicides

**1. Based on time of Application**

- **Pre-Plant Incorporation(PPI):** Such herbicides are applied before planting of crop in field. Example: Soil Applied - Fluchloralin, Alachlor, Foliage Applied - Glyphosate, Paraquat. EPTC.Monuron, Diuron, Fenuron, Sodium Chloride, Arsenic, Boron
- **Pre-emergence**- Application of herbicide after sowing of the crop but before the emergence of crop or weeds is called pre-emergence application generally selective herbicides Triazines,Atrazine, Pendimethalin, Butachlor, Thiobencarb, Pretilachlor. Simazine, Nitrofen, Alachlor,Butachlor
- **Post-Emergence Herbicides:** Applied after emergence of the crop and weeds. 2,4-D, Glyphosate, Paraquat, 2,4,5-T, MCPA, MCPB, Propanil, Dalapon,, Silvex, MSMA

**2. Based on Method of application**

- **Soil applied herbicides:** Herbicide act through root and other underground parts of weeds. Eg Fluchloralin
- **Foliage applied herbicides**: Herbicide primarily active on the plant foliage Eg. Glyphosate, Paraquat

**3. Based on Mode of action**

- **Selective herbicide:** A herbicide is considered as selective when in a mixed growth of plant species, it kills some species without injuring the others. Eg. Atrazine
- **Non-selective herbicide:** It destroys majority of treated vegetation Eg. Paraquat

**4. Based on mobility**

- **Contact herbicide:** A contact herbicide kills those plant parts with which it comes in direct contact. Eg Paraquat
- **Translocated herbicide**: Herbicide which tends to move from treated part to untreated are through xylem/phloem depending on the nature of its molecule. Eg Glyphosate

**5. Based on molecular structure**

- **Organic compounds**: This group is made from naturally occurring chemicals. Such as dinitrophenols chlorophenoxy compounds, carbamates, bipyridyl compounds and amide herbicides
- **Inorganic compounds**: Most herbicides are inorganic salts. Synthetically produced in labs

**6. Based on Toxicity**

- **Extremely Toxic**- Poison
- **Highly Toxic**-Poison
- **Moderately Toxic-** Danger
- **Slightly Toxic**- Cautious

## Formulations:

Herbicides in their natural state may be solid, liquid, volatile, non-volatile, soluble or insoluble

Hence these have to be made in forms suitable and safe for their field use.

**Types of formulation:**

- Emulsifiable concentrates (EC): A concentrated herbicide formulation containing organic solvent and adjuvant to facilitate emulsification with water eg Butachior
- Wettable powders (WP): A herbicide is absorbed by an inert carrier together with an added surface acting agent. The material is finely ground so that it may form a suspension when agitated with a required volume of water Eg. Atrazine
- Granules (G): The inert material (carrier) is given a granular shape and the herbicide (active ingredient) is mixed with sand, clay, vermiculite, finely ground plant parts (ground corn cobs) as carrier material. Eg Alachlor granules.
- Water soluble concentrates (WSC): eg. Paraquat

**Stale seed bed:**

Stale ('false') seed beds are sometimes used for vegetables when other selective weed control practices are limited or unavailable. Basically, this technique consists of the following

1. Preparation of a seedbed 2-3 weeks before planting to achieve maximum weed-seed germination near the soil surface
2. Planting the crop with minimum soil disturbance to avoid exposing new weed seed to favourable germination conditions.
3. Treating the field with a non-residual herbicide to kill all germinated weeds just before or after planting, but before crop emergence.



**Methods of Weed Control**

A. Preventive methods

B. Cultural methods

C. Mechanical methods

D. Chemical Method

E. Biological Methods

**1. Preventive Methods**

- Sowing of weed free seeds.
- Use of clean implements.
- Removal of weed along the canal and irrigation channel.
- Care in transplanting of seedling/plantlets
- Use of well rotten manure
- Avoiding passing of cattle from weed infested area.
- Crop management practices
- Enforcement of Weed Laws
- Quarantine methods and use of pre- emergence herbicides.

**2. Cropping or Cultural methods:**

- Crop Rotation
- Solarisation
- Use of Fertilizers or Selective Crop Stimulation
- Use of Fertilizers or Selective Crop Stimulation
- State Seed Bed
- Intercropping

**3. Mechanical methods**

- Hand Pulling or Hand Weeding
- Tillage
- Mowing and Sickling
- Flooding
- Burning
- Digging
- Mulching

**4. Biological control**

- **Lantana camara( Ghaneri):** It was controlled by using Crocidosema lantana. This bio-agent feeds on flowers and seeds. Lantana bug (Teleonemia scruplosa) was used in Australia for controlling Ghaneri.
- Alligator weed Altermathere philoxeroides ) in U.S.A has been effectively controlled with flea beetle (Agasicleshy grophyla)
- Water Fern (Salvinia molesta) in kerela (India) by using a beetle called Cytrobagoussaviniae.

**Allelopathy**

- It is the any direct or indirect harmful effect that one plant has on another through the production of chemical compounds that escape into the environment

**Types of Allelopathy:**

**A**. **True Allelopathy**: The direct or indirect harmful effect on the other crops through the release of toxic substance as such from the plant.

**B**. **Functional Allelopathy**. When precursor is released, which is converted into active substances some microorganisms, is categorized under functional allelopathy.

## Terminology

1. **Adjuant**: Chemicals employed to improve the herbicidal effects without being phytotoxic by themselves are called adjutants
2. **Band application of herbicides:** Application of herbicides in restricted area along the crop rows is called Band application of herbicides.
3. **Epinasty**: Increase growth on the upper surface of a plant organ or part causing it to bend downwards is called epinasty
4. **Flamming**: Momentary exposure of green weeds to as high as 10000C temperature from flame throwers resulting in coagulating their cell protoplasm is called flaming
5. **Humicant**: Chemicals which prevent rapid drying of herbicide sprays on the foliage thus providing an extended opportunity of herbicide absorption is called humicant
6. **Mowing**: Cutting of a uniform growth of weeds from an entire area at ground level is called mowing.
7. **Neutrophiles**: Weeds that grow well in neutral soils are called neutrophiles.
8. **Offset**: Runners of floating weeds are called offsets.
9. **Stolon**: A runner instead of trailing on the soil surface, rises in the form of an arc before hitting the soil surface is called stolen.