

b) Salts: Borax, copper sulphate, ammonium sulphate, Na chlorate, Na arsenite, copper nitrate.

ii) Organic Herbicides: Oils and non oils contain carbon and hydrogen in their molecules.

a) Oils: Diesel oil, standard solvent, xylene-type, aromatic oils, polycyclic, aromatic oils etc.

b) Aliphatics: Dalapon, TCA, Acrolein, Glyphosphate methyl bromide.

c) Amides: Propanil, butachlor, alachlor, CDAA, Diphenamide, Naptalam, Propachlor.

d) Benzoics: 2,3,6 TBA, Diacamba, tricamba, chloramben, Fenac.

e) Bipyridyliums: Paraquat, diquat.

f) Carbamates: Protham, chloropham, barban.

g) Thocarbamates: Butylate, dilate, triallate, EPTC, molinate, pebulate, vernolate, benthlocarb, aslum, cyclate.

h) Dithiocarbamates: CDEC, Metham.

i) Nitrilin (Benzonitrates): Dichlobenil, bromoxynil, ioxynil.

j) Ditroanilines (Toluidines) : Benefin, nitrilin, trifluralin, butralin, dinitramine, fluchlorine, oxyzalin, penoxalin.

k) Phenoxy: 2,4-D, 2,4, 5-T, MCPB, 2,4-DB, 2,4- DP, 2,4, 5-TP (silvex)

l) Triazines: Atrazine, simazine, ametryne, terbuteryne, cyprazinc, Metribuzin, prometryn, propazine.

m) Ureas: Monuron, diuron, fenuron, neburon, flumeturon, mothabenzathiazuron- buturon, chlorbromuron, chloroxuron, norea siduson, metoxuron.

n) Uracils: Bromacil, terbacil, lenacil.

o) Diphenyl Ethers: Nitrogen, flurodifen.

p) Organic Arsenicals: Cacodlic acid, MSMA, DSMA.

q) Others: Bentazon, Piclaram, Pyrazon, Pyrichlor, endothall, bensulphioe, MH, DCPA.

Classification of Herbicides According to Their Use or Mode of Action (Physiological)

I) Selective:

a. Foliage Application

1. Contact:DNBP, Propanil, EPTC, Nitroten,
2. Translocated: 2,4-D, 2,4,5-T, MCPB, MCPA, Silvex(2,4 ,5TP), Propanil, Monuron, MSMA

b) Soil-(Root) Application:

MCPA, TCA, Nitrofen, Dinitrophenols, Butachlor, Simazine, Atrazine

II) Non-Selective:

a) Foliage Application:

1. **Contact:**Paraquat, Sulphuric acid, Sodium arsenite, Ammate
2. **Translocated:**Dalapon, Acid Arsenical, Sodium chloride, Glyphosate

b) Soil Application (Root):

- **Soil Fumigants:** Cyanamide, Methyl bromide, Carbon disulphide, Trifluralin
- **Soil Sterillont:** TCA, Sodium Chloride, Boron, Dluron, Monuron, Atrazine, Fenac

Important Definition in Herbicides

1. **Selective Herbicides:**The chemicals which kills or retards the growth of some plants with little or no injury to other plants.
2. **Non-Selective Herbicides:**These chemicals are toxic to all the plants or kill all kinds of vegetation.
3. **Contact Herbicides:**A herbicides which kills only those plants or retards the growth of those plants which comes in direct contact.
4. **Translocated Herbicides:**The herbicides which are absorbed by the one part of the plants and exert a toxic action to other parts.These are also known as systemic herbicides. These absorbed chemicals upset the plant growth and metabolic processes.
5. **Soil Fumigants:**They usually function as a vapour or gas that diffuse through the soil and have relatively short life in the soil.
6. **Soil Sterilants:**Any chemical which prevent the growth of green plants when present in the soil is considered as soil Sterilants.

Classification of Herbicides Based on Time of Application

a) Pre-Planting/ Pre-Sowing: Trifluralin, fluchloralin

b) Per-Emergence: Simazine, Atrazine, Nitrofen, Alachlor, Butachlor

c) Post-Emergence: 2,4-D, 2,4,5-T, MCPA, MCPB, Propanil, Dalapon, Glyphosate, Silvex, Paraquat

Definition

a. Pre-Planting: These herbicides are applied before a crop is planted are called pre-planting herbicides. The herbicides is usually incorporated into the soil to reduce volatility and photo decomposition. e. g *Paraquat* , *Basalin*.

b. Pre- Emergence Herbicides: Pre-Emergence herbicides is most effective when applied *before the emergence of crop and weeds or the term may also refer to herbicides use after weed has emerged or established but before crop emerge* e.g Simazine, Atrazine.

c. Post-Emergence Herbicides: Post-Emergence herbicides are most effective applied after the emergence of crop and weeds or this term may also refer to herbicides use after crop has emerged but before weeds emerge. e. g 2,4-D , Dicamba (Banvel) etc.

Classification of Herbicides on the Basis of Residual Effect

a.) Short Persistent Herbicides: Residual effect remains in the soil upto a week.e. g Paraquat, diaquat, Amitrole, DSMA, DNBP.

b.) Medium Persistent Herbicides: Residual effect remains in the soil for upto 2 to 6 weeks.

c.) Very Long Persistent Herbicides: Residual effect remains in the soil for few months even years. E. g Prometon, Fenuron, Fenac, Silvex, Boron.

Classification of Herbicides on the Basis of Formulation

i) Wettable Powder (WP): Simaine, Atraine, 2,4-D, Sodium Salt, Diuron, Linuron.

ii) Liquid Water Soluble (Concentrates) (WSC): Diaquat, Paraquat, Bromacil.

iii) Water Soluble Powder: 2,4-D, Sodium Salt, TCA.

iv) Granule: Butachlor, Bromacil, Calcium cyanamide, 2,4-D ester salt, Nitrofen , Benthioncarb.

v) Dusts: 2,4-D, Ester salt.

vi) Emulsifiable Concentrates (EC): Propanil, Alachlor, Barban, Eptam.

vii) Pellet: Arsenic Compounds.

Advantages and Limitation of Herbicides or Chemical Method of Weed Control

Advantages of Herbicides or Chemical Method of Weed Control

- 1) The use of herbicides as pre-plant and pre-emergence treatment can control weeds, before their emergence from the soil so that crop can germinate and grow in weed free environment or with minimum competition during their tender and seedling stage. This is not possible with other methods of weed control.
- 2) In broadcast sown and narrow spaced crops herbicides prove very effective in reaching every weed. Mechanical methods are not so effective in such crops.
- 3) In wide spaced crops mechanical methods are effective for controlling weeds in rows but it leaves the intra-row weeds. Herbicides reach to all places and control the weeds i.e inter row and intra-row weeds.
- 4) Weeds with similar morphological characters like crop are escaped from mechanical method. But now herbicides are available which can kill such weeds without damaging the crop.
- 5) Herbicides withhold the weeds for considerable period after their application. In mechanical methods weeds tend to grow back soon.
- 6) Deep rooted, vegetatively propagated weeds can be controlled by using translocated herbicides. The mechanical methods like weeding or hoeing are not so effective for their control. Sometimes the suitable combination of mechanical methods (deep ploughing or digging) and chemical methods is more effective for controlling such weeds.

Limitation of Herbicides (Chemical Method):

- 1) The use of herbicides requires technical knowhow regarding choice of particular herbicide, time of application safe dose method of application etc in the particular crop.
- 2) Over and under-dose of herbicides can make a market difference between the success or failure of weed control.
- 3) Certain herbicides because of their long residual effect limit the choice of next crop in the crop rotation.
- 4) Herbicides drifts may harm the neighbouring crops. E.g Ester form of 2,4,-D may harm the neighbouring crop of cotton, soybean, okra, etc.
- 5) Herbicides use may cause environment pollution.