

Ministry of Higher Education
Salahaddin University
College of Agricultural Engineering Sciences
Plant Protection Department



Weeds and Weed Control
Fourth Grade
Spring Semester (2022-2023)
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Lecture 4

1

Introduction to Herbicides



Herbicide:

Defined as any chemical agent that kills or greatly inhibits plant growth. They are made to specifically and mainly kill plants.

Literally means "**plant killer**".



2



History of Herbicides

- **1890 to 1900 - sodium arsenite to control aquatic plants in waterways in the USA.**
- **1925 - sodium chlorate (direct soil application) was first used for killing weeds.**
- **1934 - sodium nitroresylate, as the first selective weed killer in France.**

3



History of Herbicides

- 1940s – first organic herbicide 2,4-D was commercialized providing selective control of certain **broadleaf** weeds in grass crops.
- 1960's – pre-emergence herbicides trifluralin and atrazine introduced.
- 1974 - glyphosate (Roundup) available - among the world's most important herbicides- Control broad-spectrum of weed spp.
- As in 2010, more than 200 herbicides from 22 mode-of-actions available in the market.

4



Herbicide Nomenclature

1. **Active ingredient** - the chemical in the herbicide formulation primarily responsible for its phytotoxicity.
2. **Trade name** - a trademark or other designation by which a commercial product is identified.
3. **Common name** - each herbicidal chemical has one common name assigned to it. In many cases, the common name is a simplified version of the chemical name.

5



Herbicide Nomenclature

4. **Chemical name** - the systematic name of a chemical compound according to the rules of nomenclature of the International Union of Pure and Applied Chemistry (IUPAC), Chemical Abstracts Service (CAS) or other organization.

Example:



← **trade name**
name product
is sold under

← **common name** →
identifies active
ingredient

AVOID CONTACT OF HERBICIDE WITH FOLIAGE, GREEN STEMS, EXPOSED NON-WOODY ROOTS OR FRUIT OF CROPS (EXCEPT AS SPECIFIED FOR INDIVIDUAL ROUNDUP READY® CROPS), DESIRABLE PLANTS AND TREES, BECAUSE SEVERE INJURY OR DESTRUCTION MAY RESULT.
2004-1
Not all products recommended on this label are registered for use in California. Check the registration status of each product in California before using.
Read the entire label before using this product.
Use only according to label instructions.
It is a violation of Federal law to use this product in any manner inconsistent with its labeling.
Read the "LIMIT OF WARRANTY AND LIABILITY" statement at the end of the label before buying or using. If terms are not acceptable, return at once unopened.
THIS IS AN END-USE PRODUCT. THIS COMPANY DOES NOT INTEND AND HAS NOT REGISTERED IT FOR REFORMULATION. SEE INDIVIDUAL CONTAINER LABEL FOR REFORMULATION LIMITATIONS.

1.0 INGREDIENTS
ACTIVE INGREDIENT:
Glyphosate[s]-[s]phosphonate[methyl]glycine
in the form of its isopropylamine salt 41.0%
OTHER INGREDIENTS: 59.0%
100.0%

chemical name
describes the active ingredient

6



Herbicide Toxicity

- Toxicity: danger/poison level
- LD₅₀ (lethal dose): An LD₅₀ represents the individual dose required to kill 50 percent of a population of test animals.
- The lower the LD₅₀ value, the less chemical that is required to reach lethality. (LD₅₀10 is more toxic than LD₅₀100).

7



Herbicide Classification

Herbicides can be classified based on:

A. Selectivity:

1. Selective:

Toxic to some species and much less toxic to others at a given dosage. A selective herbicide kills weeds but not the crop.

2. Non-selective:

kills or severely damages all or most species. A non-selective herbicide kills weeds and potentially crops.

8

Selective vs. Nonselective Herbicides



Selectivity may be due to differential absorption, translocation or physical (morphological) differences between species.



9



Examples: 2,4-D, mecoprop, dicamba control many broadleaf weeds.

A selective herbicide can be made non-selective by applying improperly or by applying high rates. Selectivity is usually rate dependent.

10

Selective vs. Nonselective Herbicides

Nonselective herbicides control plants regardless of species.

Examples: Glyphosate, glufosinate and paraquat are nonselective, foliar absorbed herbicides. (Note – glyphosate is selective to certain turf species at low rates)

11

Herbicide Selectivity

Selective: A herbicide that is more effective in controlling some plant species than others.



Broad-Spectrum/Non-Selective: A herbicide that controls many plant species.



12

Herbicide Classification



B. Activity:

1- Contact herbicides:

kill only the portion of green tissue that is contacted.

- a. Effective only on tissue contacted by application of herbicide.
- b. Very little movement (translocation) within the plant.
- c. Full spray coverage essential (because no translocation, must get spray deposited on most of plant).

13

Herbicide Classification



- d. Usually exhibit acute effects - kill rapidly
- e. Effective for annuals, usually ineffective for perennials (because no translocation to underground reproductive organs)
- f. Can be selective or non-selective.

14



Contact herbicides do not kill perennial underground structures such as rhizomes, tubers and bulbs. Repeat applications to regrowth may eventually drain the plants' underground resources, but it is better to try to control perennial weeds with systemic herbicides.

Use contact herbicides on annual weeds.

15



Herbicide Classification

2- Systemic herbicide:

are extensively translocated in a plant's vascular system from point of absorption (leaf or root) to sites of action.

- Absorbed by roots or above-ground parts (depends upon particular herbicide and application method), translocate within plant.

16



Herbicide Classification

- Good spray coverage is necessary with all herbicides, but less critical than contact herbicides because of systemic herbicides can be translocated.
- Effective on annuals, some are effective on perennials; effective on perennials because of translocation to underground organs.
- Can be selective or non-selective.

17



Herbicide Classification

Systemic herbicides are transported throughout the vascular system along with nutrients, water and organic materials necessary for plant growth. Systemic herbicides require days to weeks for total control. (herbicide must travel throughout plant)

Systemic herbicides are more effective on perennial weeds than **contact herbicides**.

18



Herbicide Classification

C. Residual activity:

1. Residual: Herbicide retains activity on susceptible weeds for some time following application. Length of residual depends upon the particular herbicide and the application rate.

2. Non-residual: Herbicide has activity only on weeds present at time of application. Does not provide control of weeds that emerge after application.

19



Herbicide Classification

D. Type/time of application:

- **Pre-plant:** applied to soil, prior to planting the crop. They are **nonselective** herbicides that kill desirable and undesirable plants.
- **Pre-emergence:** applied to the soil prior to emergence of the crop or weed
- **Post-emergence:** applied after emergence of the crop or weed.

POST herbicides are applied directly to the emerged weed, and are usually more effective on seedlings.

Example: 2,4-D is a POST, selective, systemic, foliar absorbed herbicide.

20



Herbicide Classification

POST herbicides usually should be avoided in high temperatures degrees. The weeds could be drought-stressed and also the herbicide could become volatile and drift to non targeted sensitive plants.

21



Herbicide Classification

E. Methods of application:

Refer to the ways herbicides can be applied:

1. Broadcast: applied over the entire field.
2. Band: applied to a narrow strip over the crop row.
3. Direct: applied between the rows of crop plants with little or no herbicide applied to the crop foliage.
4. Spot treatment: applied to small, weed-infested areas within a field.

22



23