



# KNOW YOUR HERBICIDES

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## What are herbicides?

A herbicide is a pesticide used to kill or control weeds. Selective herbicides kill targeted weeds in a given field without causing any harm to the crop plants. They inhibit the growth of weeds through various mechanisms. Some of them are acted by interfering with the growth of the weed and or metabolism and some are often based on plant hormones.

Herbicides with no selectivity, such as glyphosate and paraquat are non-selective in nature. They have the capacity to kill almost all types of plants. Selectivity greatly depends on the time and dose of the herbicide applied. Non-selective herbicides can be harmful, even to normally tolerant plants, if the dose is too high.

## How are herbicides applied?

Herbicides are also categorized based on their broad herbicidal action. Herbicides are applied either as pre-emergence or post-emergence. That means herbicides are applied either before or after weeds emerge from the soil which has started to grow. Pre-emergence herbicides control weeds after they germinate or emerge from the soil surface. Whereas post-emergence herbicides control those weeds that are already growing and easily become visible in a crop or non-crop field. Some herbicides are applied to the soil and are taken up by the roots or shoots of seedlings. They are said to have soil activity. Herbicides that are applied to plant foliage have foliar activity. Some herbicides have both activities. Herbicides with a high degree of soil activity are usually applied as pre-emergence.

## How does the herbicide work?

Contact herbicides kill the plant parts when they come in contact, such as the leaves, but generally are not carried down to the roots. Contact herbicides are very effective against annual weeds. Systemic herbicides translocate throughout the weed plant to kill roots and all other plant parts, through the process of translocation. In this process a herbicide is moved from the site of uptake to the site of action where it kills the weed. Systemic herbicides are most effective against perennial weed. Herbicides kill target plants by causing accumulation of a toxic substance after spray and by inhabiting the action of enzyme at the target site.

## How long does the herbicide take to control weeds?

Based on methods of application and type of herbicides, usually, herbicides take around 2 to 4 weeks to completely control the weeds. When using a non-selective herbicide one has to take extra care when using on or around the crop plants.



## Will herbicide damage to my crop?

No, if herbicides are applied according to recommended guidelines in a particular crop based on dose, time of application, spray methods, spray volumes, speed of spray, etc. it is safe to the crop plants and will control weeds in the field effectively.

## Are herbicides harmful to human and animal?

Yes, if they are applied in improper dose and time then this may not harm to crop plants. If herbicides are applied without taking any safety measure and precaution as given in this information folder, they may also harm the person. As herbicides are synthetic chemicals and designed to kill weeds, hence poses toxicity at varying level. Therefore, it is always recommended to check the toxicity signal on the herbicides packet/containers. It is always recommended to keep herbicide out of reach to children and animals. Do not throw or reuse the used container of herbicide, it may have harmful effects on your health. After use, make a habit to dispose used herbicide container/ packets properly. Don't leave herbicide container/ packets unattended when it is not in use.

To understand herbicide toxicity, refer the Table 1, which is based on LD<sub>50</sub> values of herbicides. The LD<sub>50</sub> value is a statistical estimate of the number of mg of toxicant per kg of bodyweight required to kill 50% of a large population of test animals.

**Table-1 LD<sub>50</sub> Values of herbicides**

LD <sub>50</sub> of active ingredient (mg/kg)	Estimated lethal amount of pure active ingredient for a 70 kg adult male	Examples
<5	A few drops	-
5-50	1 teaspoon	Dinoseb
50-500	30 g or 2 tablespoons	Diquat
500-5000	500 g or 500 ml	Atrazine, alachlor
>5,000	>1000 g or 1000 ml	DCPA, chlortoluron

## What are the precautionary measures to minimize herbicide risk?

As stated earlier, herbicides are synthetic chemicals and designed to kill weed plants and may be considered as poison/toxic substances, hence their improper and excessive use may result in severe damage to the standing or successive crops but may also result in high persistence and residues in the soil and crop plants. Apart from harmful effects to the crops, the avoidance of safety instructions and kit during preparation, spraying of herbicide and disposal may severely affect the physical health of the persons/farmers who are engaged in the herbicide spray work. It is always recommended to follow safety instruction and use of safety kit not only for herbicides but also for other class of pesticides too. Some common precautionary measures to minimize herbicide risk are given below:

- ▶ Only registered and recommended formulations / brands in accordance with state laws and regulations should be adopted.
- ▶ Ensure to read, understand and follow all of the label directions when mixing and applying herbicides. Take particular note of the toxicity of the herbicide and any adverse effects on other crops, trees, wildlife or human health.
- ▶ Remember, more is not better. Use the appropriate application rate mentioned on the label.
- ▶ Some herbicides are selective, and only kill certain types of plants, while others are non-selective and kill almost any type of plant. Therefore, we shall have to be very much careful while applying non-selective herbicides.
- ▶ Some herbicides kill weeds quickly, others can take up to a week or more, so wait after spray, and let allow herbicide to work on weeds. Some herbicides persist in plants and soils for longer duration, while others only remain in plants or soil for a short period of time.
- ▶ Some herbicides have active ingredients that are more likely to move through soils towards groundwater. Others are much less likely to move through soils, so read the instruction carefully and check the texture of the soil of your field before applying any herbicide.
- ▶ Assess possible damage due to downwind from the paddock to be sprayed. An advantage of spraying in high wind speeds is that you know the direction in which the spray will drift. Drift can also be a problem in very light winds, particularly if there is a temperature inversion.
- ▶ Adopt the methods to reduce drift problems. For example, using low pressure nozzles or low nozzle height. Remember that no current method eliminates drift problems.
- ▶ Assess the risks and decide if they are worth taking. For example, if you are spraying a selective herbicide in wheat and downwind there are other wheat crops, you are probably fairly safe to spray in a strong wind. On the other hand, if you are spraying knockdowns herbicides (non-selective) and downwind there is a belt of new trees/plants you have been trying to establish, wait for more favourable spraying conditions.
- ▶ Wind speed is the main factor to be considered at the time of spraying for winter crops. Do not spray if the maximum wind speed is greater than the speed at which you are spraying. If the wind speed is greater than your speed of travel, then you put yourself into risky situation as you come into contact with the drift when spraying with the wind behind you.
- ▶ Individuals who are mixing, loading, transporting and applying herbicides can minimize their exposure to herbicides by wearing the personal protective equipment (PPE) specified on the herbicide label. Standard PPE used for most types of herbicide applications includes rubber boots, protective aprons or suits face mask, goggles and rubber gloves.



- » Water contaminated as a result of the washing the spraying equipments must be disposed of by scattering over the barren land.
- » Discard use of herbicides which are ineffective or are causing significant undesirable effects.
- » Do not blow, suck or apply your mouth to any sprinkler, nozzle or other spraying equipments. Spraying should always be done in the direction of the blowing wind to avoid skin exposure and inhalation.
- » Do not use the empty containers of herbicides for any other purpose. Destroy the empty containers immediately by digging and burying into the soil.

Depiction of safety kit to be used during the herbicide spray is presented below:



**Herbicide protection kit**

## What are the do's and don'ts of herbicides?

- » Always read the label carefully before you buy a product and make sure that the product is intended for your specific use. Store all herbicide safely out of reach of the children and pets.
- » Make sure kids, pets and anyone not involved in the application is out of the area before mixing and applying herbicides.
- » Make sure to wear clothing that will protect you while handling herbicides. Consider wearing a long sleeve shirt, long pants, and closed-toe shoes in addition to any other protective clothing or equipment recommended by the label.
- » Mix herbicides outdoors or in well-ventilated areas.
- » Mix only what you need to use in the short term to avoid storing or disposing of excess pesticide.
- » Be prepared for any possible herbicide spill. Have paper towels, sawdust or kitty litter, garbage bags, and non-absorbent gloves on hand to contain the spill. Avoid using excessive amount of water, as this may only spread the herbicide and could be harmful to the environment.
- » Read the first aid instructions on the label before using the product. Contact the emergency services in case of medical emergency.
- » Remove personal items, belongings, such as toys, clothing, or tools etc. from the spray area to avoid contamination.
- » When spraying herbicides indoors, make sure the area is well ventilated.
- » When applying herbicides as a spray or dust outside, avoid windy conditions.
- » After using herbicides, wash your hands with soap and water properly before smoking, drinking or eating.
- » Use the appropriate amount of herbicide according to the area to be sprayed. Applying more herbicide than the label directions may waste money and may harm people, pets or the environment.
- » Do not assume a herbicide purchased for one type of weed control in a particular crop can be used in other crop for control of same or other weeds and always remember herbicide are crop and weed specific.
- » Buy only what you need. Storing and disposing of leftover herbicide can lead to unnecessary risks and create environmental pollution.
- » Review the storage and disposal section of the label for information on how the product should be stored and disposed of, including the empty container.



- » Re-read the label before using or re-using a herbicide, don't rely on your memory.
- » Do not use herbicide in any manner other than those specifically listed on the label; it is against the law.
- » Never remove a herbicide label from the container, or use unlabeled herbicides.
- » People who work with herbicides tend to be less safety-conscious when they are mixing herbicides or spraying. They climb with, lift and pour open containers of herbicides, and they often work alone, which can be dangerous.
- » The first step in the safe mixing of herbicides, is to read the label. Always make special note of relative toxicity of the herbicide. This will be stated on the label as "highly toxic" (*danger-poison* or *danger*), "moderately toxic" (*warning*) or "least toxic" (*caution*), etc.
- » Always keep required personal protective equipment, first aid, emergency telephone numbers and instructions regarding mixing, application, doses and labeled sites near the spraying field

### Know the guidelines for safely mixing and loading the herbicides

- » Only authorized herbicide handlers or trained person or supervisors should be in the mixing and loading area. All handlers should be wearing proper personal protective equipment (PPE). No other persons, and no animals, should be present.
- » To prevent spills, place herbicide containers in a secure place.
- » Take proper position when you're opening and handling container/packets.
- » Read and follow label directions. Pay special attention to warnings and precautions written on the container/packets.
- » Never stir herbicide with your hands. Use a stir-stick.
- » Use a catch basin, a container within a container-to further prevent inadvertent spills. For example, a measuring jar can be placed inside a plastic tub. If the measuring jar happened to be tipped over, the spill will be collected to the tub.
- » It is suggested that never pour herbicide at eye level. In fact, never lift any open herbicide container higher than your chest. Mix and pour concentrated herbicide not higher than your waist level. A spill or splash could be disastrous.
- » If herbicide are spilled or splashed on you, remove your clothing immediately and wash yourself thoroughly within two minutes. Then wash your clothing.
- » Protect your eyes with splash-proof goggles.

- » Stand with your back to the wind so any fumes or dusts are blown away from you.
- » Take precautions and never pour herbicide directly into a spray tank. Always mix and dilute the herbicide in a small container.
- » Always pour the herbicide into water. Never pour water into the herbicide. When pouring, keep your head well above and to one side of the spray tank opening. This will reduce the chance of your face being splashed with the droplets of herbicides.
- » Mix and load on a concrete slab where spills can be contained, or, if no slab is available, use a catch basin.
- » Avoid mixing or loading near surface water or a well head in the field.
- » Do not leave a herbicide tank unattended.
- » Never allow a spray tank to overflow. The cleanup could be a costly and dangerous measures involved day and night work.

### How to clean equipment and containers

Rinse remaining herbicide traces from application equipment before storage and before undertaking extensive repair. Rinse equipment at different approved sites in the field. Triple-rinse or pressure-rinse empty herbicide containers at the mixing site before you recycle or dispose of the containers. Do this immediately once you have emptied out the herbicide from the container. Add the rinse water to the sprayer tank and spray it out over an approved site, or use it to mix the next batch.

#### Note:

**For more information, you can visit ICAR-DWR, Jabalpur or nearest All India Coordinated Research Project on Weed Management centres.**

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