HERBICIDE BASICS

What is an Herbicide?

Pesticides are compounds used to kill the bad actors in our homes, gardens, agricultural operations and even in our natural forests and meadows. An *insecticide* is a pesticide that kills insects. A *fungicide* kills molds, mildews and other funguses. A *rodenticide* kills mice and rats, and an *herbicide* kills plants. Pesticides are designed to work by altering the biochemistry of the organisms they are meant to control. If used and handled correctly, modern-day herbicides are unlikely to have a long-term impact on people, animals, and insects, because they alter biochemical processes found only in plants.

When it comes to controlling invasive plants, herbicides are usually necessary when the threat from their uncontrolled growth far outweighs any environmental risk, such as harming desirable plants, from herbicide application. While there is always a concern about adding anything "unnatural" to the environment, unlike the pesticides of yesteryear, most modern herbicides are not likely to accumulate in the environment or leach into ground water. Many herbicides – particularly those used for invasive plant control – break down quickly once exposed to light and air or soil microorganisms.

Today's herbicides are highly-effective, low risk, and environmentally-friendly. Their toxicity to humans and animals is lower than that of many common household cleansers or the contents of the bottles in your bathroom's medicine chest. Wildlife managers rely upon herbicides to control invasive plants with the goal of improving and restoring wildlife habitat and biodiversity.

All pesticides are reviewed by the Environmental Protection Agency (EPA) and must pass stringent tests for toxicity, environmental impact, and effectiveness, before they can be sold. And they are re-evaluated at least every 15 years to reflect new science and current methodology. In addition, the US Forest Service carries out their own extensive risk assessment for all pesticides used on Forest Service lands. Both agencies assess risk based on the likely exposure an agricultural or forest worker would have to the product in an entire year. This exposure is much higher than for someone using herbicides only to control invasive plants on their own property.

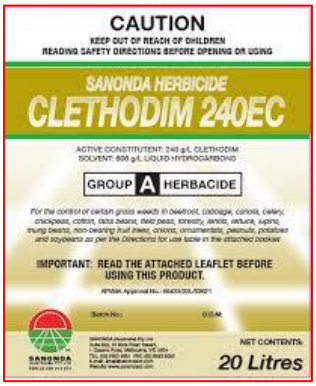
Read the Label

The label is a legally binding agreement between the EPA, the manufacturer, and the user.

The label provides directions for proper use: where, when, how, and on what to use it.

The label provides safety precautions and disposal instructions.

The label contains the product's brand name, chemical name, and common name.



The label contains all the information you need to know to use the product correctly.

Toxicity – the ability to injure living organisms – is measured several ways. Acute toxicity is determined by the amount of a product it takes to kill 50% of test animals, usually rats, during a single, short-term exposure to the product through ingestion, absorption through the skin, or inhalation through the lungs. This amount is called the LD50 (lethal dose 50), which is measured in milligrams of product per kilograms of body weight. The *larger* the LD50, the *lower* the toxicity, so products with a high LD50 are the safest to use. Products containing glyphosate have an LD50 value *greater than* 5,000 mg/kg. The EPA stops testing at a LD50 of 5,000 because this represents an exposure to an almost impossible amount of a product. For instance, a person weighing 150 lbs. would have to ingest ¾ lbs. of a product and exhibit a toxic effect to measure an LD50 of 5,000. Substances with an LD50 of 5,000 are essentially non-toxic. It's interesting to note that caffeine has a LD50 of 192 mg/kg, and nicotine, found in cigarettes, has a LD50 of 50 mg/kg. Glyphosate, even with its extremely high LD50 and thus no toxicity to humans and animals, is one of the most toxic to plants.

Safe Use

The EPA approves pesticide label directions, and those labels are legal documents. When using any herbicide, it is important to follow all label directions – it is a violation of federal law to do otherwise. The label indicates which types of plants the herbicide treats and in which locations it may be used. When you apply an herbicide, you must wear all protective gear required by the label. Such gear usually includes wearing long sleeves, long pants, boots, and waterproof gloves. (Tyvek or nitrile gloves are recommended.)

Certain signal words, such as "Caution," "Warning," and "Danger" appear in large letters on all pesticide labels. These signal words are based upon acute toxicity and indicate the potential hazard involved with mishandling the pesticide. *Caution* indicates slight hazard, with an LD50 more than 500 mg/kg. (Remember, the *higher* the LD50 the *safer* the product.) *Warning* indicates moderate hazard, with an LD50 of 50 to 500 mg/kg. *Danger* indicates the greatest hazard when handling a product, with an LD50 of a trace to 50 mg/kg. The signal word may vary from product to product depending upon the concentration of the active ingredients. Thus, a concentrated herbicide containing glyphosate at 53.8% carries on the label the

word "Warning," while the ready-to-use 2% glyphosate product carries the word "Caution."

Some herbicides are prominently labeled "Restricted Use" because they are more hazardous if not used correctly. These may only be applied by someone who is a "certified applicator" and who earned that certification by studying and passing a test. Products that are not "restricted" are "general use" and may be applied by anyone on their own property or by anyone working for the landowner. All herbicides commonly used to control nonnative invasive plants are general use and can be applied by anyone on their own property.

A grass-specific herbicide was used here to kill Japanese stiltgrass, a highly aggressive invasive grass, while leaving the broadleaf, flowering plants unharmed.

Herbicide Selectivity

Some herbicides are *broad-spectrum*, meaning they will kill any type of plant. Others are *selective*, meaning they target very specific kinds of plants. A *broadleaf specific* herbicide kills the classes of plants that have broad, flat leaves. An example of this is a weed-killer applied to a lawn – it is designed to kill dandelions and such, which are broadleaf plants, but does not harm the lawn grasses. A *grass-specific* herbicide kills grasses and does not harm broadleaf plants. You might choose a broadleaf specific herbicide to control Japanese honeysuckle in a field because it will not harm the grasses. And you might choose a grass-specific herbicide to kill Japanese stiltgrass in a forest, because it will not harm the wildflowers, even if you spray them directly. When using a broad-spectrum herbicide, be very careful to avoid applying the herbicide to nontarget plants, because they could be harmed or killed. Techniques for applying herbicides safely and correctly and for avoiding damage to desirable plants are discussed in the PRISM factsheet *Controlling Invasive Plants Effectively & Safely with Herbicides*.

Herbicide Activity

Most herbicides are *post-emergent*, meaning they act on developed plants, while others are *pre-emergent*, meaning they kill seedlings as they sprout and before they emerge from the ground. Some herbicides become active only if absorbed by a plant's leaves. These are termed *foliar-active*. Others must be absorbed by plant roots; these are termed *soil-active*. Some herbicides have more than one type of activity, especially if used in a high concentration. For instance, some foliar herbicides, if highly concentrated, might be absorbed through tender young bark of shrub and tree saplings if it drifts onto them. Know the herbicide you are using and apply it correctly.

Using Blue Ridge PRISM's Factsheets

PRISM's factsheets on invasive plants do not provide recommendations for specific herbicides. Instead, the PRISM collaborated with the Virginia Department of Forestry (VDOF) to develop an easy-to-use chart of best practices and recommended herbicides for the most common invasives in our region. These herbicides are ones that have the least impact on the surrounding environment compared to other choices. In addition, the suggested control methods are the most benign approved by the US Forest Service. This VDOF chart is titled *Non-Native Invasive Plant Species Control Treatments* and can be downloaded from the PRISM website.

The VDOF chart lists the name of the active ingredient of the suggested herbicide. These herbicides are usually sold as several brand-named products and all are commonly available. Keep in mind that the concentration of the active ingredient varies from product to product. Unless you choose a ready-to-use (RTU) product, you must mix a concentrated herbicide with water or horticultural oil along with a surfactant and a specialized dye to obtain the correct concentration for your specific use.

Is Roundup Safe?

Some people worry that Roundup®, which contains the active ingredient glyphosate, causes cancer or harms the environment. Recently, the European Union, the EPA and the UN's Food and Agriculture Organization reviewed all the scientific research on the health effects of glyphosate and concluded that it is not likely to cause cancer. For the 227-page EPA report of September 2016, see www.regulations.gov.

Glyphosate, an herbicide, does not kill insects and pollinators. Rather, when used indiscriminately it can kill native plants that butterflies, such as monarchs, need for survival. Roundup's bad reputation is due, in part, to its use in agriculture. If farmers plant "Roundup-Ready" crops, they can spray the entire field, including the row-crops, killing the weeds without harming the crop. It is how the product is used, not the product itself, that could harm the environment if it kills native plants. The PRISM recommends using glyphosate on targeted invasive plants at the lowest effective concentration, so as to do the least possible harm to valuable native plants.

Glyphosate used in invasive plant control does not enter the food chain. It breaks down quickly once exposed to sunlight, water and soil microorganisms. Based on decades of testing and use, glyphosate is considered to be one of the safest and most effective herbicides available.