



Clear Up the Confusion: Know How to Select the Appropriate Herbicide to Control Weeds

Kai Umeda, Shaku Nair, Michael Chamberland



Figure 1. Colorful and shapely packaged pesticide products on a garden center's shelves. Photo by S. Nair

Selecting an appropriate herbicide for a weed problem can be a confusing task. Hoeing weeds would have been a simpler task than a baffling experience trying to select an herbicide off the shelf loaded with pesticides. This University of Arizona Cooperative Extension bulletin will provide information describing how to determine which herbicide to use against weeds in different landscapes.

How to choose the right herbicide when many names, descriptions, and claims are so confusing. (Figure 1)

- There are numerous herbicide products in the marketplace, many with the same name.
- Herbicide products are described as being able to control most weeds (broad-spectrum), grassy weeds, broadleaved weeds, and to kill the roots, shoots, and leaves.

- Many can be used selectively and safely in lawns and gardens or for total vegetation control in non-crop areas, patios, driveways, and sidewalks.
- Some can be fast-acting, rainfast (resistant to washing off from leaves), or long-lasting in the soil to give extended residual control.
- Herbicides can be ready-to-use (RTU) in a squirt bottle or purchased as a concentrate of the active ingredient for mixing with water.

Read the small print on the herbicide label to know what is in the container

- Brand names are catchy to entice the sales of herbicides
 - Some familiar names are Roundup*, GroundClear*, WeedClear*, Weed B Gon*, Weed Stop*, Preen*, Weed and Feed

- Colorful labels and containers with images of dying weeds are appealing, as well as the prices, and product claims of the ability to kill most weeds .
- The small print lists the active ingredient(s) in the container and its concentration as the important component(s) responsible for ultimately killing the weed(s).
- Chemical name is the long descriptive chemistry e.g. N-(phosphonomethyl)glycine
- Common name is often a shortened or abbreviated version of the chemical name, e.g. glyphosate, diquat, imazapic, penoxsulam, sulfentrazone, 2,4-D, dicamba (Figure 2).

ACTIVE INGREDIENTS:

| | |
|--|--------------|
| *Glyphosate, N-(phosphonomethyl)glycine, in the form of its ammonium salt..... | 73.3% |
| Diquat dibromide [6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide] | 2.9% |
| OTHER INGREDIENTS: | <u>23.8%</u> |
| | 100.0% |

*Equivalent to 66.6% of the acid, glyphosate
1.0 pound contains 0.73 pound of the ammonium salt of glyphosate and 0.03 pound of the dibromide salt of diquat.

ACTIVE INGREDIENTS:

| | | |
|--|---------------|---|
| Glyphosate, isopropylamine salt [†] ... | 1.00% | [†] Contains 0.06 lb. glyphosate acid equivalent and ^{††} 0.006 lb. imazapic acid equivalent per US gallon. |
| Imazapic, ammonium salt ^{††} | 0.08% | |
| Diquat dibromide | 0.04% | |
| OTHER INGREDIENTS | <u>98.88%</u> | |
| TOTAL | 100.00% | |

| | |
|-----------------------------------|--|
| ACTIVE INGREDIENTS: | THIS PRODUCT CONTAINS: |
| Penoxsulam | 0.14% 0.013 lb Penoxsulam per gallon or 0.14%. |
| Sulfentrazone | 0.14% 0.013 lb Sulfentrazone per gallon or 0.14%. |
| 2,4-D, dimethylamine salt | 1.46% 0.109 lb 2,4-dichlorophenoxyacetic acid equivalent per gallon or 1.21% |
| Dicamba, dimethylamine salt | 0.41% 0.031 lb 3,6-dichloro-o-anisic acid equivalent per gallon or 0.34%. |
| OTHER INGREDIENTS: | 97.85% |
| Total | 100.00% |

This product is called "GroundClear Vegetation Killer – Concentrate"

- Features:
- 1 year of weed control
 - Quick action within 6 hours
 - Can be applied to driveways, sidewalks, fence lines, patios, gravel areas
 - Signal word: Warning



The active ingredients are glyphosate and imazapyr. Glyphosate is a broad-spectrum herbicide effective in roots and shoots of most plants. Imazapyr is a broad-spectrum herbicide effective in roots and shoots of plants and can last in the soil.

ACTIVE INGREDIENTS:

| | |
|---------------------------------------|---------------|
| Glyphosate, isopropylamine salt | 2.97% |
| Imazapyr, isopropylamine salt | 0.47% |
| OTHER INGREDIENTS: | <u>96.56%</u> |
| TOTAL: | 100.00% |

THIS PRODUCT CONTAINS:
0.033 lb imazapyr acid equivalent per gallon or 0.38%
0.188 lb glyphosate acid equivalent per gallon or 2.20%
*when compared to previous formula

This product is called "GroundClear Weed & Grass Killer"

- Features:
- Quick action within 15 minutes
 - Can be applied to patios, landscape beds, vegetable gardens
 - Organically certified
 - Signal word: Caution



The active ingredient is ammonium nonanoate, also known as the ammonium salt of pelargonic acid, a long-chain fatty acid, derived from beef tallow. It is a fast-acting burndown herbicide.

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| | |
|--------------------------------|--------------|
| ACTIVE INGREDIENT | wt% |
| Ammonium Nonanoate..... | 5.0% |
| OTHER INGREDIENTS | <u>95.0%</u> |
| Total | 100.0% |

Ortho Ground Clear Weed & Grass Killer contains 0.42 lbs. of ammonium nonanoate per U.S. gallon

This product is called "GroundClear Weed & Grass Killer Super Concentrate"

- Features:
- Quick kill formula
 - Can be applied to patios, landscaped areas
 - Kills the roots of weeds
 - Signal word: Caution



The active ingredients are diquat, fluazifop and dicamba. Diquat is a fast-acting burndown herbicide; Fluazifop is effective against grassy weeds; Dicamba is effective against broadleaved weeds.

Active Ingredients:

| | |
|------------------------------------|---------------|
| Diquat dibromide: | 2.53% |
| Fluazifop-P-butyl: | 0.84% |
| Dicamba, Dimethylamine salt: | 0.67% |
| Other Ingredients | <u>95.96%</u> |
| Total | 100.00% |



Figure 2. Small print on different herbicide labels showing active ingredients.

Glyphosate in RoundUp*





RoundUp is a very popular herbicide, that was first developed as a sprayable product containing the active ingredient **glyphosate**. It is effective against a broad spectrum of weeds (non-selectively or indiscriminately killing both grasses and broadleaved plants). It acts by entering the plant through the leaves and spreads throughout the plant, shoots and roots, to stop new growth and resulting in death. There are many glyphosate-based products available for professional,

commercial, and residential/homeowner uses, with varying concentrations of active and inert ingredients added to make up the formulated product (Figure 4). Recently, the name “RoundUp” became a marketing brand name targeted for retail consumers. “RoundUp” products now include non-glyphosate herbicides that can be used to provide an extended period of weed control or even be safely used on lawns. Glyphosate is chemically an acid that is formulated as a salt to enable mixing to be sprayed in water. The concentration of the amount of acid equivalent varies among products (Table 1).








Figure 4. “Roundup” products.

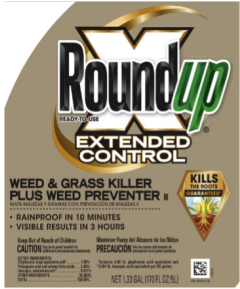


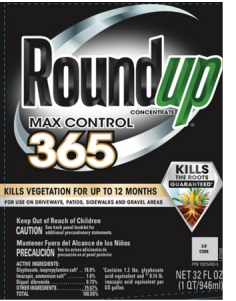
Table 1. Different Roundup products with active ingredient compositions, uses, and signal words.


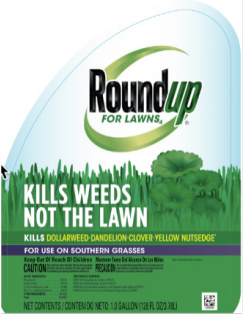

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|-------------|---|--|--|---|
| |  |  |  |  |
| Composition | Roundup PowerMax 5.5 lb/gal K ⁺ salt 4.5 lb a.e. | Roundup QuikPro 0.73 lb NH ₄ ⁺ salt/lb product 66.6% a.e. 0.03 lb diquat | Roundup ProMax 5.5 lb/gal K ⁺ salt 4.5 lb a.e. | Roundup ProConcentrate 5 lb/gal IPA ⁺ salt 3.7 lb a.e. |
| Uses | Roundup Ready® crops | Professional use Non-crop, industrial sites | Professional use Non-crop, industrial and turf and ornamental sites | Professional use Industrial and turf and ornamental sites |
| Signal word | Caution | Caution | Caution | Caution |

*K = potassium salt, NH₄ = ammonium salt, IPA = Isopropylamine salt

| | | | | | |
|-------------|---|---|---|--|---|
| |  |  |  |  |  |
| Composition | Roundup Concentrate Plus glyphosate IPA ⁺ 1.2 lb a.e./gal + diquat | Roundup Super Concentrate glyphosate IPA ⁺ 3.6 lb a.e./gal | Roundup Concentrate glyphosate IPA ⁺ 18% + triclopyr | Roundup Extended Control glyphosate IPA 1.2 lb. a.e./gal + diquat + imazapic | Roundup Max Control glyphosate IPA ⁺ 1.2 lb a.e./gal + diquat + imazapic |
| Uses | Concentrate plus | Super concentrate | Brush killer | Weed & grass killer + weed preventer | Kills vegetation for up to 12 months - Driveways, patios, sidewalks, gravel area |
| Signal word | Caution | Caution | Caution | Caution | Caution |

[†]IPA salt = Isopropylamine salt

| | | | | |
|-------------|--|---|---|--|
| |  |  |  |  |
| Composition | Roundup Extended Control Ready to Use glyphosate IPA 0.06 lb a.e./gal + pelargonic acid + imazapic | Roundup Extended Control Concentrate glyphosate IPA 1.2 lb. a.e./gal + diquat + imazapic | Roundup Max Control 365 Ready to Use glyphosate IPA 0.06 lb a.e./gal + diquat + imazapic | Roundup Max Control 365 Concentrate glyphosate IPA 1.2 lb a.e./gal + diquat + imazapic |
| Uses | Ready to use - Weed & grass killer + weed preventer | Concentrate - Weed & grass killer + weed preventer | Ready to use - Kills vegetation for up to 12 months - Driveways, patios, sidewalks, gravel area | Concentrate - Kills vegetation for up to 12 months - Driveways, patios, sidewalks, gravel area |
| Signal word | Caution | Caution | Caution | Caution |

| | | | |
|-------------|---|---|---|
| |  |  |  |
| Composition | Roundup Landscape Weed Preventer No glyphosate - Pendimethalin | Roundup for Lawns No glyphosate - Penoxsulam, sulfentrazone, 2,4-D dimethylamine salt, dicamba dimethylamine salt (Southern lawns) - MCPA, dimethylamine salt, quinclorac, dicamba dimethylamine salt, sulfentrazone (Northern lawns) | Roundup for Lawns Crabgrass Destroyer No glyphosate - Topramezone |
| Uses | Preemergence - Prevents weeds and grasses up to 6 months. Pendimethalin acts in the soil preventing weed seedling roots to grow. | 2,4-D and dicamba are effective on the shoots and leaves of many broadleaved weeds. Sulfentrazone is relatively fast-acting for burndown of nutsedge leaves only. Penoxsulam acts on some hard to control weeds. | Bleaches crabgrass. Topramezone acts on the leaves and shoots of weeds inhibiting the chlorophyll production in plants. |
| Signal word | Caution | Caution | Caution |

Different Roundup's kill weeds differently and may cause injury to landscape trees and plants

There are a multitude of Roundup products that are available and they may be formulated with multiple or different herbicides so that a broader spectrum of weeds or specific target weeds can be controlled immediately or slowly. Glyphosate is effective only when it enters the leaves of weeds and eventually kills the plant after a week or so. Different types of injury may occur on desirable landscape trees and shrubs if glyphosate or other combined herbicides drift away from the intended target weeds. Soil-active herbicides added to glyphosate to provide extended preemergence weed control may injure desirable trees and shrubs if applied near the root zone or dripline of trees and shrubs.

Always read the label and understand its directions then follow the directions for proper use of the herbicide. The label is the law!

- Identify and know what weeds are to be targeted
 - The weed should be listed on the label
- Be sure the herbicide can be used where intended
- Use recommended label rates, do not cut or double rates
- Apply at the correct time for the appropriate stage of growth of the weed(s). Herbicides applied at the wrong time to mature weeds can be ineffective and this wastes time and money.
 - Know the precautions and potential hazards of the selected herbicide
 - Be safe and know about the signal word
 - There are herbicides with different modes of action, and those that act before (preemergence) or after (postemergence) weeds have emerged from the soil.
- Wear the proper personal protection equipment (PPE)
- Clean up, store, or dispose of container and spray equipment properly

Personal Protective Equipment (PPE)

The following PPE or more are recommended during any pesticide (including herbicide) application: rubber gloves to prevent dermal contact; goggles to prevent eye injury; and rubber boots to eliminate contact when walking through sprayed areas. Appropriate PPE can greatly reduce the potential for pesticide exposure and potential health impacts. However, **using PPE does not completely eliminate risk.**

*Pesticide products mentioned are trademarked brand products not intended to be specifically endorsed for use. Always read and follow product label instructions before using any pesticides. Consult with the University of Arizona Cooperative Extension or other professional consultants to ensure safety and reliability of pesticide products for the intended use.



THE UNIVERSITY OF ARIZONA

Cooperative Extension

AUTHORS

KAI UMEDA

Area Agent, ANR/Turfgrass

SHAKU NAIR

Associate in Extension, Community IPM

MICHAEL CHAMBERLAND

Assistant Agent, ANR/Urban Horticulture

CONTACT

KAI UMEDA

kumeda@cals.arizona.edu

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