

UPDATE ON ROUNDUP-BRANDED HERBICIDES FOR CONSUMERS

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WHAT IS THE ISSUE?

For decades, herbicides containing the active ingredient glyphosate have been sold under the trade name Roundup. These products are used for non-selective control of broadleaf and grassy weeds in landscape settings. Whether it be controlling problematic weeds in hardscapes (i.e., driveways, patios), in ornamental or vegetable gardens, or renovating a lawn, Roundup-branded herbicides are used widely across Tennessee and beyond. Usage is so common that practitioners often use the terms “glyphosate” and “Roundup” interchangeably. However, this common terminology has been confusing in recent years because certain Roundup-branded products sold to consumers contained herbicides other than (or in addition to) glyphosate, which some may have not realized.

This potential for confusion has increased because beginning in 2024, many Roundup-branded herbicides available to consumers **will no longer contain glyphosate at all**. This active ingredient is being replaced by a combination of multiple active ingredients (e.g., diquat, fluazifop, and triclopyr) in select products. See Image 1.

These changes have the potential to create confusion for consumers as it relates to the appropriate selection and use of these herbicides. In particular, the use of alternative active ingredients can have many potential implications including differences in:

- Labeled use scenarios, including where and when products can be used
- The species of weeds controlled by a given product
- Appropriate application rates or techniques
- The potential for herbicide movement and soil residual activity, which could affect injury to desirable plants and windows for planting after application.

While these changes will be reflected on product labels, consumers who have used Roundup-branded herbicides for many years may not immediately recognize these changes or understand the importance of reading and reviewing labels before use. Failure to follow label directions may undermine efficacy and increase the likelihood of off-target movement and associated risks.



Image 1. Roundup-branded herbicide that does not contain glyphosate available to consumers in 2024.

HISTORIC USE OF GLYPHOSATE IN ROUNDUP-BRANDED HERBICIDES

Glyphosate is an inhibitor of EPSP (5-enolpyruvylshikimate-3-phosphate) synthase [Weed Science Society of America (WSSA) Group #9], an enzyme involved in synthesis of aromatic amino acids that is not found in mammals. Glyphosate is a non-selective herbicide used to control a broad spectrum of broadleaf and grass weeds postemergence. **Acute toxicity of glyphosate is low** ($LD_{50} > 5000$ mg/kg), and it is considered non-volatile. It is rapidly bound to soil, allowing planting to occur after application in most cases. Glyphosate has been sold under the trade name Roundup for more than five decades. Additional information about glyphosate can be found in UT Extension publication [W827 – Frequently Asked Questions: Glyphosate](#).

WHAT IS CHANGING?

In 2024, many Roundup-branded herbicides will be available for consumer use that contain active ingredients other than glyphosate. Background information on several of these active ingredients is presented below from the Herbicide Handbook published by the Weed Science Society of America (Senseman, 2007).

Table 1. Selection of Roundup®-branded herbicides available to consumers in 2024.

Note that many do not contain glyphosate.

Trade Name	Active Ingredients	Use in Lawns	Use in Landscape Beds	Use in Vegetable Gardens	Use in Hardscapes
Roundup for Lawns	MCPA + quinclorac + dicamba + sulfentrazone	Yes	No	No	No
Roundup Extended Control	Glyphosate, imazapic, diquat	No	Not recommended	No	Yes
Roundup Weed and Grass Killer – Exclusive Formula	Triclopyr + fluazifop + diquat	No	Not recommended	No	Yes
Roundup Dual Action	Triclopyr + fluazifop + diquat + imazapic	No	Not recommended	No	Yes
Roundup Weed and Grass Killer III	Glyphosate + pelargonic acid	No	Yes	Yes	Yes
Roundup Poison Ivy and Tough Brush Killer	Glyphosate + triclopyr	No	No	No	Yes

Diquat

Diquat is a **non-selective herbicide** that controls broadleaf and grassy weeds via photosynthetic inhibition (WSSA Group #22). Treated plants exhibit rapid wilting and desiccation within hours of treatment, which limits translocation throughout the plant. Diquat is rainfast within one to two hours after application. **Acute toxicity of diquat is greater than glyphosate**, with oral LD₅₀ values ranging from 30 to 400 mg/kg. Diquat is rapidly absorbed to soil particles and unavailable for plant uptake.

Fluazifop

Fluazifop is a selective herbicide that controls **grassy weeds** by inhibiting fatty acid biosynthesis (WSSA Group #1). **Fluazifop has no activity on broadleaf weeds**. Fluazifop is readily absorbed into grass leaves, rainfast within two hours after application, and translocates throughout the plant thereafter. Acute toxicity of fluazifop is fairly low (LD₅₀ = 2721 to 4096 mg/kg). Risk of fluazifop volatility after application is also considered low. **Residual activity in the soil after application (average half-life of 15 days depending on soil characteristics) limits plant establishment after application**. For example, label directions for fluazifop (Fusilade II, Syngenta Professional Products, Greensboro, NC) require turfgrass establishment from seed to be delayed at least 14 days after application.

Triclopyr

Triclopyr is an auxin-mimic herbicide (WSSA Group #4) used for selective control of **broadleaf weeds**. Triclopyr is absorbed into plant tissue and requires at least a four-hour period without rain for maximum efficacy. Triclopyr translocates throughout the plant after application and results in twisting and curling of plant stems and petioles, a phenomenon referred to as epinasty. See Image 2.

Volatility risk with triclopyr is considered low and acute toxicity is intermediate (LD₅₀ = 713 mg/kg). **Triclopyr is not readily adsorbed to soil and can persist for upwards of 46 days depending on soil characteristics**, which limits planting thereafter. For example, label directions for triclopyr (Turflon Ester Ultra, Corteva AgriSciences, Zionsville, IN) require turfgrass establishment from seed to be delayed at least 14 days after application. Triclopyr is a Group #4 herbicide and applications pose risks to desirable flowering plants in landscapes. See Image 3.

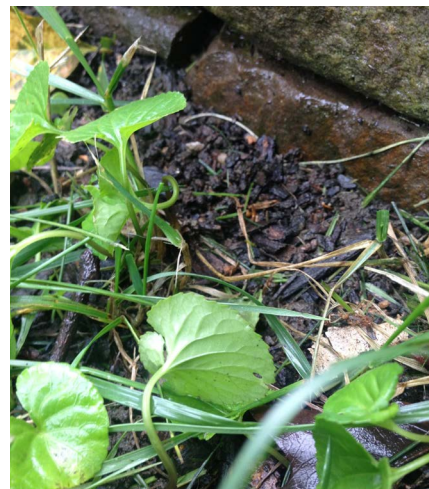


Image 2. Epinastic growth of wild violet (*Viola* spp.) following application of an auxin-mimic herbicide (WSSA Group #4).

MCPA

MCPA [(4-chloro-2-methylphenoxy) acetic acid] is an auxin-mimic herbicide (WSSA Group #4) used for selective control of **broadleaf weeds**. MCPA is absorbed into foliage and readily translocates to growing points resulting in epinastic growth of stems and petioles (Image 2). Acute toxicity of MCPA is intermediate (LD_{50} = 800 to 1160 mg/kg) and it **can be volatilized after application depending on formulation**. The average half-life of MCPA is 5-6 days but it can persist in soil 1 to 6 months based on soil moisture content.

Quinclorac

Quinclorac is an auxin-mimic herbicide (WSSA Group #4) used for **selective control of broadleaf and grassy weeds**. It is absorbed via both foliage and roots and translocated throughout the plant. Symptoms following treatment vary among broadleaf and grass weeds susceptible to quinclorac. Acute toxicity of quinclorac is considered fairly low (LD_{50} > 2610 mg/kg) and volatility risks are negligible. **Quinclorac can persist in soil for extended periods limiting planting after application**. In turfgrass, quinclorac (Drive XLR8. BASF Corporation. Research Triangle Park, NC) can be applied before planting but must be delayed upwards of 28 days thereafter (in most cases) until juvenile plants mature.

Sulfentrazone

Sulfentrazone is a selective herbicide that controls **broadleaf weeds**, as well as **grass-like monocots** such as yellow nutsedge (*Cyperus esculentus*), via disruption of chlorophyll synthesis (WSSA Group #14). Sulfentrazone is absorbed via both roots and foliage with the latter resulting in rapid desiccation and necrosis of treated tissue. Sulfentrazone is non-volatile; however, **it can persist in the soil for more than 120 days depending on soil characteristics**. In turfgrass, establishment from seed must be delayed at least 28 days after sulfentrazone (Dismiss Turf Herbicide. FMC Corporation. Philadelphia, PA) application.

Imazapic

Imazapic controls **broadleaf, grassy, and sedge weeds** via disruption of amino acid synthesis (WSSA Group #2). Imazapic is absorbed via foliage and translocated to root tissues. Acute toxicity of imazapic is low (LD_{50} > 5000 mg/kg), as is likelihood of volatilization. Imazapic availability in soil varies according to pH; imazapic is considered highly available (weakly adsorbed) in alkaline (high pH) soil, whereas it is less available (greater adsorption) in acidic soils, as well as those with high organic matter and clay content. Imazapic availability in the soil changes depending on soil conditions. See Image 4. **The average half-life of imazapic in soil is 120 days which limits planting after treatment**. For example, plant-back intervals following imazapic treatment (Plateau. BASF Corporation. Research Triangle Park, NC) can be as long as 48 months depending on application rate and planted species.

Pelargonic Acid

Pelargonic acid is a **non-selective herbicide** used for broad-spectrum control of green vegetation including broadleaf and grassy weeds, as well as mosses. **Pelargonic acid is a contact herbicide. It does not translocate** and only burns treated tissue via an unknown mechanism (WSSA Group #0). Acute toxicity of pelargonic acid is low (LD_{50} > 5000 mg/kg); however, it can be volatilized after application. **Pelargonic acid is not persistent in soil**.



Image 3. Young oak tree (*Prunus spp.*) showing damage from nearby use of the herbicide triclopyr (WSSA #4). Image credits: Theodore D. Leininger, USDA Forest Service, Bugwood.org



Image 4. Damage to *Hydrangea paniculata* bloom showing distorted flower formation from use of Roundup® Extended Control (glyphosate + imazapic + diquat) as an edge treatment for weed control in the landscape bed when the homeowner had thought they selected a glyphosate-only Roundup® product. Image credits: Celeste Scott.

HOW TO MOVE FORWARD

It will be critically important that **consumers carefully read labels** to understand the herbicidal active ingredients contained in each Roundup-branded product, as well as where the product should be used for weed control. The wide array of active ingredients now contained in Roundup-branded herbicides will likely change use sites previously treated with Roundup-branded products that only contained glyphosate. For example, if inadvertently applied during a lawn renovation, several Roundup-branded products available in 2024 would negatively affect the establishment of newly planted turfgrass seed. Additionally, inadvertent applications of several Roundup-branded products in landscape beds to vegetable gardens could result in undesirable injury.

FINAL THOUGHTS

Local Extension offices can assist with weed control strategies and selecting optimal Roundup-branded products for use in lawns and gardens. A complete list of University of Tennessee Extension offices can be found at:

<https://utextension.tennessee.edu/office-locations-departments-centers/>.

Always refer to herbicide product labels for specific information on proper product use, tank-mix compatibility, and turfgrass tolerance. Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the University of Tennessee Institute of Agriculture. For more information on turfgrass weed control, visit the University of Tennessee's turfgrass weed science website, www.tnturfgrassweeds.org.

LITERATURE CITED

Senseman, S.A. 2007. Herbicide Handbook, 9th edition. Weed Science Society of America. Lawrence, KS.



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