

glufosinate

2-amino-4-(hydroxymethylphosphinyl)butanoic acid

CAS # Acid (racemic mixture): 53369-07-6

Acid (unstated stereochemistry): 51276-97-2

Acid (*D*-isomer): 35597-44-5

Ammonium salt (unstated stereochemistry): 77182-82-2

H(10)

NOMENCLATURE

Common name: glufosinate (BSI, ISO, WSSA)

Other name(s): HOE 00661; HOE 39866;

phosphinothricin; *DL*-homoalanine-4-yl-(methyl)-phosphinate; glufosinate-ammonium=ammonium (4-hydroxy(methyl)phosphinoyl)-*DL*-homoalaninate or ammonium *DL*-homoalanin-4-yl(methyl)phosphinate (IUPAC)

Trade name(s): FINALE™; RELY®; IGNITE®; BASTA®

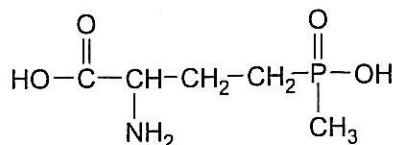
Chemical family: organophosphorus

CHEMICAL AND PHYSICAL

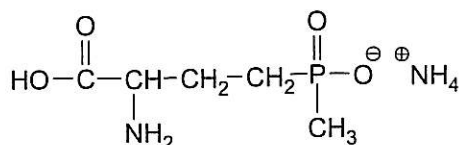
PROPERTIES

Chemical structure

glufosinate acid



glufosinate ammonium salt



Molecular formula: Acid C₅H₁₂NO₄P; NH₄ salt C₅H₁₅N₂O₄P

Molecular weight: Acid 181.13 g/mole; NH₄ salt 198.16 g/mole.

Description: White to light-yellow crystalline powder, slightly pungent odor

Density: 1.4 g/mL (20 C)

Melting point: 215 C

Boiling point: 99.5 C

Vapor pressure: 1.0 x 10⁻⁴ Pa (25 C)

Stability: Highly stable

Solubility:

☞ water 1,370,000 mg/L (pH 7, 20 C)

☞ organic solvents g/100 mL (20 C):

☞ acetone 0.016 *n*-hexane 0.02

☞ ethanol 0.065 toluene 0.014

☞ ethyl acetate 0.014

pK_a: <2, 2.9, and 9.8

K_{ow}: NA

HERBICIDAL USE

Glufosinate can be applied POST at 0.35-1.7 kg ai/ha (0.32-1.56 kg ae/ha) in non-crop areas and as a directed spray in field-grown and container nursery stock. It is non-selective and controls a broad spectrum of annual and perennial grass and broadleaf weeds. Glufosinate also can be used in a

spray-to-wet application at 1.41-3.75 g ai/L of water. Glufosinate can also be used in Liberty-Link crops such as corn and canola that have been genetically modified (see mechanism of resistance section) for broad spectrum POST weed control.

USE PRECAUTIONS

Fire hazard: IGNITE is combustible

Corrosiveness: Non-corrosive

Storage stability: Stable for 2 yr at 25 C

Cleaning glassware/spray equipment: Clean equipment with detergent or approved tank cleaners.

Emergency exposure: Flush eyes with water for at least 15 min. Wash skin with soap and water. If ingested, drink 1-2 glasses of water, induce vomiting, and seek medical attention. Phenobarbitol was an efficient therapeutic agent in animal antidote studies.

Incompatibilities: None known

BEHAVIOR IN PLANTS

Mechanism of action: Inhibits glutamine synthetase activity and the production of glutamine (more details on pages 13)

Symptomology: Chlorosis and wilting usually occur within 3-5 d after application, followed by necrosis in 1-2 wk. Rate of symptom development is increased by bright sunlight, high humidity, and moist soil. Seedlings are not injured before emergence.

Absorption/translocation: Glufosinate requires a 6-h rain-free period after application for maximum efficacy. Little to no glufosinate is absorbed through the roots under field conditions because of rapid microbial breakdown. Glufosinate movement in xylem or phloem is limited.

Metabolism in plants: *D*-Glufosinate appears to be stable in plants (2), but *L*-glufosinate was metabolized to 4-methylphosphinico-2-oxo-butanoic acid, 3-methylphosphinico-propanic acid, and 4-methylphosphinico-2-hydroxybutanoic acid in tobacco, alfalfa, and carrots (1).

Non-herbicidal biological properties: None known

Mechanism of resistance in weeds: A gene coding for phosphinothricin acetyl transferase activity was isolated from *Streptomyces hygroscopicus* and cloned into several crops species. This enzyme converts glufosinate to a non-phytotoxic acetylated metabolite (1) by transferring the acetyl group from acetyl-coenzyme A onto the amino group of glufosinate. The genetically engineered crops are thus able to rapidly detoxify glufosinate. The trait is inherited as a simple dominant allele.

BEHAVIOR IN SOIL

Sorption: Weakly absorbed to soil

K_{oc}: Average is 100 mL/g (estimated) (7)

Transformation: Rapidly degraded by microbes in soil or surface water to 3-methyl phosphinico-propionic acid and ultimately to CO₂.

Persistence: Short soil residual life with a typical field half-life of 7 (d) (7).

Mobility: Highly mobile in soil. Despite high leaching potential glufosinate has been detected no deeper than 15 cm in field studies, presumably because of rapid microbial degradation.

Volatilization: NA

TOXICOLOGICAL PROPERTIES

Toxicity tests were conducted with technical grade glufosinate ammonium salt unless otherwise indicated.

Acute toxicity:

Oral LD₅₀ male rat, 2170 mg/kg; female rat, 1910 mg/kg; Dermal LD₅₀ male rabbit, 1400 mg/kg; female rabbit, 1380 mg/kg; 4-h inhalation LC₅₀ rat, 3.73 mg/L; Skin irritation rabbit, slight; Skin sensitization, NA; Eye irritation, NA

Subchronic toxicity: NA

Chronic toxicity: NA

Teratogenicity: NA

Reproduction: NA

Mutagenicity: NA

Wildlife:

Japanese quail oral LD₅₀, >2000 mg/kg; Honey bee nontoxic; Rainbow trout 96-h LC₅₀, >320 mg/L

Use classification: General use

SYNTHESIS AND ANALYTICAL**METHODS**

Synthesis: NA

Purification of technical: NA

Analytical methods: Contact Bayer CropScience

Historical: The ammonium salt of glufosinate was reported as an herbicide in 1981 (5). Glufosinate was introduced in Canada in 1993 and in Europe a few yr earlier, FINALE was introduced in 1994 in the U.S.

MANUFACTURER(S) AND INFORMATION SOURCE(S)

Industry source(s): Bayer CropScience

Reference(s):

1. Dröge-Laser, W. et al. 1994. *Plant Physiol.* 105:159.
2. Dröge, W. et al. 1992. *Planta* 187:142.
3. Lea, P. J. et al. 1984. *Phytochemistry* 23:1
4. Sauer, H. et al. 1987. *Naturforsch.* 42C:270.
5. Schwerdtle, F. et al. 1981. *Pflanzenkr. Pflanzenschutz. Sonderheft IX.* P. 431.
6. Tachibana K. et al. 1986. *J. Pestic. Sci.* 11:33.
7. Wauchope, R. D. et al. 1992. *Rev. Environ. Contam. Toxicol.* 123:1