

# Accord® XRT II and Rodeo® specialty glyphosate herbicides from Dow AgroSciences

The EPA has set a maximum contaminant level (MCL) of 700µg/L for this active ingredient in drinking water. A recent model calculated that the average concentration that might be expected in surface and groundwater to be 0.063µg/L and 0.0011µg/L. In Europe, where thousands of drinking water samples are routinely screened for pesticides, there has never been a confirmed, reproducible detection of glyphosate exceeding the 0.1µg/L limit for pesticides.<sup>5</sup>

## Volatility

The active ingredient in Accord XRT II and Rodeo herbicides is non-volatile.<sup>6</sup> That means they do not produce vapors that could move into the air and cause unreasonable adverse effects to non-target vegetation or odors to disturb the public.

## Effects on Animals/Wildlife

Research done with laboratory animals shows that glyphosate is poorly absorbed when ingested. What little is absorbed is rapidly eliminated, resulting in minimal tissue retention.<sup>3</sup> Feeding studies with chickens, cows, and pigs have shown extremely low to no residues in meat and fat following repetitive exposure. Negligible residues have also been reported in wild animals such as voles, chipmunks, hares, and moose after feeding in treated areas. A series of bioaccumulation studies done to determine if glyphosate concentrated in the edible portions of fish and game, indicated that it did not accumulate in the food chain.<sup>7</sup>

In addition numerous lab and field studies with the active ingredient in Accord XRT II and Rodeo have been conducted on non-target species such as birds, deer, mice, voles, chipmunks, and various aquatic organisms. Based on an extensive review, the EPA has determined that the effects of the active ingredient in Accord XRT II and Rodeo on birds, mammals, fish and invertebrates are minimal.<sup>3</sup>

Dow AgroSciences believes the overwhelming conclusion of these studies is clear: aside from the intended removal of target vegetation, glyphosate-based end-use products have little, if any, unreasonable adverse impact on terrestrial and aquatic animals or on ecosystems in which the animals live.<sup>7</sup>

For additional information, consult the appropriate federal and state labels, supplemental labels, and Material Safety Data Sheets for Accord XRT II and Rodeo herbicides.

## References

<sup>1</sup> Hance, R. J. 1976. Adsorption of glyphosate by soils. *Pestic. Sci.* 7:363-366.

<sup>2</sup> *Herbicide Handbook*, 7th Edition. 1994. Weed Science Society of America, Champaign, Illinois.

<sup>3</sup> U.S. Environmental Protection Agency, Office of Pesticide Programs, Reregistration Eligibility Decision (RED) Document for Glyphosate, (EPA738-R-93-014, Sept. 1993).

<sup>4</sup> Goure, W. F. 1992. *The Environmental Fate of Glyphosate: A Review of Laboratory and Field Studies*.

<sup>5</sup> Rolling Revisions of WHO Guidelines for Drinking Water Quality Report of Working Group Meeting on Chemical Substances for the Updating of WHO Guidelines for Drinking Water Quality. 22-26 April, 1997.

<sup>6</sup> Tomlin, C.D.S. 2000. *The Pesticide Manual*, 12th Edition: British Crop Protection Council, 488491.

<sup>7</sup> Sullivan D.S., and T.P Sullivan. 1997. *Non-Target Impacts of the Herbicide Glyphosate, a Compendium of References and Abstracts*. 4th Edition. Applied Mammal Research Institute, Summerland, B.C., Canada.

<sup>8</sup> McMahon, C.K., and P.B. Bush. 1992. Forest worker exposure to airborne herbicide residues in smoke from prescribed fires in the southern United States *American Industrial Hygiene Association Journal* 53:265-272.

<sup>11</sup> Dow AgroSciences. [www.dowagro.com](http://www.dowagro.com). Labels and MSDS.

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State restrictions on the sale and use of Accord XRT II apply. Consult the label before purchase or use for full details. Always read and follow label directions.

V01-000-167 010-50829 DAS (3/11)

## General Information

Accord XRT II and Rodeo are part of the Dow AgroSciences portfolio of aquatic, vegetation management and forestry products.

Accord XRT II and Rodeo herbicides are registered for the broad-spectrum control of a wide variety of undesirable woody, broadleaf and grass species on rights-of-ways, aquatic and forestry sites across the United States. These vegetation management tools are formulated to meet the special needs of professional vegetation managers and foresters.

The active ingredient in Accord and Rodeo herbicides, glyphosate, is one of the most widely used in the world. It is registered for use by farmers, homeowners and industrial vegetation managers and is sold in more than 130 countries.

## Product Characteristics

Accord XRT II, like Accord Concentrate and Rodeo are post emergent products that are most often applied to the foliage of target vegetation. Each of these products contains 5.4 pounds of glyphosate per gallon. Glyphosate is harmless to most plants once in the soil because it is quickly adsorbed to soil particles, and even when free, it is not readily absorbed by plant roots.<sup>1</sup>

Accord XRT II features a patented 3rd generation dimethylamine (DMA) salt that delivers proven, consistent broad-spectrum control in a less viscous, easier-to-handle formulation. This formulation contains a unique and proprietary blend of surfactants that helps deliver superior performance. Rodeo is formulated with flexibility in mind and does not contain a surfactant. It is well-suited for instances where custom mixing of herbicide products is desired. It is registered for use in and around water. Rodeo is fully labeled for use in all aquatic sites. It does not contain a surfactant.

Glyphosate is formulated as a water-soluble salt to meet a wide variety of weed control needs. It was developed by Monsanto Company in the early 1970s. In 2001, Dow AgroSciences licensed the trademarks for Accord and Rodeo herbicide products.

In the environment and in the plant, the salt formulation converts to the biologically active acid form. For this reason, active ingredient concentration is commonly expressed as the acid equivalent (ae) in pounds per gallon or grams per liter. The term acid equivalent refers to the part of the formulation that can be converted to the acid.

## Mode of Entry

In order for an herbicide to control plants, it must first be absorbed by the plant. The active ingredient in Accord XRT II, and Rodeo is absorbed by green growing foliage of target plants. Prior to use, Accord XRT II, and Rodeo are diluted with water to facilitate coverage. In most cases the actual spray solution is approximately 98% water.

Foliar applications generally achieve maximum efficacy when applied after full leaf extension, before foliage colors in the fall, and when soil moisture is adequate for normal plant growth.

These products can also be applied directly to the cambium of a cut stump.

## Mode of Action

When Accord XRT II or Rodeo are broadcast onto target weeds and brush, the droplets land on the surface of the leaf. Within a few hours, they are absorbed through the cuticle of the leaf into the plant. Because their active ingredient has a structure similar to the naturally occurring plant amino acid glycine, target plants have trouble telling glyphosate and glycine apart. As a result, glyphosate travels with glycine as it moves through the plant vascular system toward the actively growing roots and shoots.

When Accord XRT II or Rodeo arrive at these meristematic regions, they block the shikimic acid pathway, thereby inhibiting the production of EPSP synthase. This enzyme is vital to the production of three aromatic amino acids essential for protein synthesis. This metabolic pathway is found only in plants.



As protein production stops, the plant begins to die. Accord XRT II and Rodeo herbicides also inhibit chlorophyll synthesis which causes the leaves to lose color. Actual absorption time may depend on the weather. On average, one to three hours are required for sufficient herbicide to enter the plant to ensure good vegetation control.

It takes one to two weeks for most herbaceous weeds to show symptoms of exposure to Accord XRT II and Rodeo. Yellowing of leaves is followed by wilting and finally necrosis. In woody plants, the symptoms may take a month or more to appear. Visible effects include gradual wilting or yellowing, followed by complete browning, deterioration of plant tissue and ultimate decomposition of the underground roots and rhizomes. Late summer application results are often not apparent until the following spring. These include failure to break bud and small, deformed leaves. In addition, the upper portion of the stem or leaders may be pale in color, dry, and brittle.

## Registration and Testing

Before pesticides can be sold or distributed in the United States, they must be registered by the U.S Environmental Protection Agency (EPA). Initial pesticide registrations require a minimum of 120 tests that can take companies up to 15 years to complete at a cost of up to \$50 million dollars. The EPA requires that these studies be conducted on each pesticide to demonstrate if the pesticide can be used without posing unreasonable adverse effects to humans or the environment.

Accord XRT II and Rodeo, and their active ingredient, have one of the most extensive worldwide health and environmental effects databases ever completed. The EPA, state agencies and other regulatory bodies throughout the world have reviewed more than 1,000 separate studies.

## General Information on Toxicity

All substances can be toxic. It is the dose level or amount, and conditions of exposure, that make their effect toxic or harmful.

Toxicological testing with laboratory animals serves as a model for evaluating the potential of a substance to cause adverse effects in humans. Toxicology studies measure the effects of direct and indirect exposure to the substance. Toxicologists divide the toxicity of a substance into four categories: acute, sub acute, subchronic and chronic.

Acute toxicity results from a single dose of the substance through ingestion, inhalation, skin, or eye exposure. Results from single-exposure oral, dermal and inhalation tests are expressed as LD50 or LC50 values. These values refer to the “lethal dose” or “lethal concentration” necessary to kill 50 percent of a test population. In the case of Accord XRT II and Rodeo, the LC50 exceeds the amount of herbicide used in a typical application. These tests are done with a product’s active ingredient as well as with the end-use formulation.

Sub-acute, sub-chronic and chronic toxicity result from repeated exposure to a chemical for a period of time. Sub-acute toxicity is based on repeated exposure for one month or less, sub-chronic for one to three months, and chronic for more than three months. It is not uncommon for the toxic effects of repeated exposure to differ from those produced by a single exposure.

In addition to these standard toxicology tests, numerous studies are also conducted on other non-target species such as birds, small and large mammals, and aquatic organisms. These diverse tests focus on specifics such as how the product affects birds’ ability to lay eggs and the ability of the eggs to survive. Other studies examine the impact of the chemical on habitat change and bacteria in the soil.

When reviewing the results of these tests, it is important to keep in mind that in many of these tests the EPA requires exposure rates well above any that would be expected under normal use conditions or labeled use rates.

## Active Ingredient Studies

### Acute Toxicity

The EPA classifies acute toxicity of pesticides by placing results of different laboratory tests into categories with Toxicity Category I being the most toxic and Toxicity Category IV being the least toxic. Categories are based on the dosage at which the toxic effect was observed. The active ingredient in Accord XRT II, Accord Concentrate, and Rodeo herbicides is rated a Category IV compound for acute exposure. See Table 1.

**Table 1. Acute (single) Exposure Studies with the Active Ingredient in Accord XRT II, and Rodeo.<sup>2</sup>**

Exposure Route	Species	Toxicity	EPA Category
Glyphosate			
Oral LD50	Rat	5,600 mg/kg <sup>1</sup>	IV
Dermal	Rabbit	>5,000 mg/kg	IV
Inhalation LC50	Rat	Non-volatile <sup>2</sup>	—
Eye Irritation	Rabbit	Slight	IV
Skin Irritation	Rabbit	Non-Irritating	IV

<sup>1</sup>Milligram test substance per kilogram of body weight.

<sup>2</sup>Will not vaporize enough to inhale.

### Long-Term Toxicity Studies

Long-term toxicological studies have been conducted to determine the effects of prolonged exposure to the active ingredient in Accord XRT II, Accord Concentrate, and Rodeo herbicides. High doses were administered on a daily basis for the average lifetime (two years) of rats and mice and one year for dogs. Few effects were observed in the rat and mice studies. These effects were present only at high levels of exposure well beyond those expected in actual use situations. No effects were seen at any dose in the dog study.<sup>3 z</sup>

### Carcinogenicity

The EPA classifies the carcinogenic potential of pesticides by placing the results of laboratory evaluations into categories ranging from Category A to Category E, based on a thorough review of results from toxicological testing required by and submitted to the agency. Accord XRT II, Accord Concentrate, and Rodeo are classified as Category E. This category is the designation given to a compound that demonstrates no evidence for carcinogenicity in at least two animal tests in different species.<sup>3</sup>

### Mutagenicity

Extensive tests designed to look for gene mutations, chromosome aberrations, and DNA damage and repair from exposure to the active ingredient in Accord XRT II, Accord Concentrate, and Rodeo were conducted. Results of studies demonstrate that glyphosate does not cause mutations.<sup>3</sup>

### Reproductive Tests

Studies show that the active ingredient in Accord XRT II, Accord Concentrate, and Rodeo does not cause birth defects or reproductive problems in laboratory animals<sup>3</sup>. In a study where the ingredient was fed continuously over two generations, weight reductions were seen only at a very high dose level. Low dose levels in this study and in a three-generation study did not affect the offspring. Nor were any adverse effects observed on the ability of those offspring to develop into normal adults.<sup>3</sup>

## Environmental Fate Studies

**Additional tests were conducted with the active ingredient in Accord XRT II and Rodeo to determine how an herbicide behaves in the environment.**

### Soil Degradation

The active ingredient in Accord XRT II and Rodeo herbicides in soil is degraded over time by microorganisms to carbon dioxide<sup>3</sup>. Studies show that this degradation process does not harm the microorganisms naturally present in the soil. Microbial degradation occurs under both aerobic (with air) and anaerobic (without air) conditions. The average half-life of glyphosate is less than 45 days in soil and less than eight days in natural water. There are many factors effecting half-life such as soil pH, soil temperature, and soil moisture. For instance, higher soil temperatures will decrease the half-life which means the amount of active ingredient in the soil will breakdown faster as the half-life decreases. It does not accumulate in soil, even after repeated applications.<sup>4</sup>

