Q&A

What you should know about Milestone® specialty herbicide

Vegetation managers and foresters rely on Milestone® specialty herbicide to control unwanted weeds and brush beneath electrical power lines; along railroad beds, roadsides and pipelines; in commercial forestry[1] and wildlife openings, including grazed areas on these sites; and on range and pasture and Conservation Reserve Program (CRP) sites. Milestone is a flexible formulation that can be used in a variety of ways to achieve vegetation management goals.

The following information provides specifics on Milestone and explores questions often asked concerning its use.

What is Milestone?

Milestone from Dow AgroSciences is designed and developed specifically for long-lasting control of problem weeds and certain woody brush, vines and legumes, including noxious and invasive species. Milestone® specialty herbicide is registered for use on noncropland areas, including industrial sites and rights-of-way (such as roadsides, electric utility and communication transmission lines, pipelines and railroads). It also is accepted for use in forested areas,[1] nonirrigation ditch banks, natural areas (such as wildlife management areas, wildlife openings, wildlife habitats, recreation areas, campgrounds, trailheads and trails), and grazed areas in and around these sites.

What is the active ingredient in Milestone?

The active ingredient in Milestone is aminopyralid, developed and patented by Dow AgroSciences specifically for the management of susceptible broadleaf weeds, including many noxious and invasive plant species. It is effective at low rates (3 to 7 fluid ounces of product per acre) as compared with most other registered herbicides, including 2,4-D, clopyralid, triclopyr, picloram and dicamba. In addition to low use rates, it provides residual control, which reduces the need for re-treatment in areas with the potential for susceptible weed seeds to germinate.

How does Milestone work?

Milestone works systemically, translocating throughout the entire plant and accumulating in meristematic tissues, including the roots. It interferes with plant growth metabolic pathways affecting the growth process. The disruption of plant growth results in the control and death of susceptible plant species.

Will Milestone® specialty herbicide work in a tank mix?

Milestone is an excellent tank-mix partner and is compatible with most other herbicides. Tank-mixing Milestone improves control of conifers, brush and hardwood species, and when mixed with Garlon® 3A specialty herbicide, it provides an excellent solution for chemical side trimming. A nonionic surfactant may be added to improve spreading on leaves and uptake through the leaf cuticles. When tank-mixing, use only in accordance with the most restrictive precautions and limitations on the respective product labels, and always perform a jar test to ensure the compatibility of the products being used.

Does Milestone stay where you spray it?

Because of its formulation, aminopyralid is essentially nonvolatile. It settles on the application site and won't change into a gas that can be carried off the application site by air movement. Milestone can be applied aerially or by ground through broadcast or spot treatment applications, or added to basal bark mixtures for enhanced control of target species. Users still must follow all label precautions so spray drift does not occur.

Which weeds does Milestone® specialty herbicide control?

Milestone is labeled for consistent and dependable control of susceptible noxious and invasive broadleaf plants and woody brush, including horseweed (marestail), Canada thistle, musk thistle and other biennial thistles, knapweeds, annual fleabane, kudzu, perennial sowthistle, prickly lettuce, henbit, common ragweed and yellow starthistle. Field trials have shown that it provides effective control with little or no injury to desirable cool- and warm-season grasses, including bermudagrass and bahiagrass. See the product label for a complete list of weeds Milestone controls.

What are the use rates for Milestone?

Milestone controls labeled weeds at rates of 3 to 7 fluid ounces per acre, which puts fewer pounds of active ingredient in the environment than industry standards. It controls many key broadleaf weed species at rates substantially lower than other currently

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registered herbicides. On all labeled use sites, it is important not to apply more than 7 fluid ounces per acre of Milestone® specialty herbicide per growing season as a result of broadcast, including repeat applications, or more than 14 fluid ounces as a spot application.

Will plants become resistant to Milestone?

Aminopyralid has an auxinic growth regulator mode of action. Despite extensive use, herbicides with this mode of action have demonstrated a low risk of resistance compared with herbicides that have other mode-of-action classifications, such as ALS inhibitors, photosystem II inhibitors or ACCase inhibitors.

What happens to plants after they've been treated?

Within hours or days of application, the stems and leaves of labeled weeds stop growing and turn brown, with few exceptions. Most annual susceptible weeds will be controlled within four to eight weeks after application; however, complete control of main stems and roots may take longer. Milestone is primarily a postemergence herbicide, but also has preemergence soil residual activity on many important weeds. It can be applied to weeds at any growth stage, but specific weeds may have optimal growth stages for control. Because of its residual activity, control may last all season long or, depending on the weed species, into the season after application. The residual activity also helps control germinating seeds of susceptible weeds. Long-term control is extended if desirable plants move into the treated area, effectively outcompeting the reinfestation of the target weeds.

What is the environmental impact of Milestone?

Milestone has been reviewed and registered under the Reduced Risk Pesticide Initiative of the U.S. Environmental Protection Agency (EPA). This program is reserved for compounds that demonstrate less risk to humans and the environment than market standards. Milestone® specialty herbicide carries a "Caution" signal word and does not require a special license for purchase or application.

Because of its essentially nonvolatile formulation and low use rates, Milestone provides effective control with reduced exposure to workers and the environment. In addition, it can be sprayed up to the water's edge.

What is the effect of Milestone on animals and humans?

In Dow AgroSciences laboratory testing, aminopyralid has been shown to be "practically nontoxic" to birds, fish, honeybees, earthworms and aquatic invertebrates. "Practically nontoxic" is the EPA's least toxic category. While aminopyralid is slightly toxic to the eastern oyster, algae and aquatic vascular plants, it would require rates of application far beyond what is recommended by the product label for weed control to raise the risk above any level of concern established for these organisms by the EPA.

All pesticides sold in the United States must be accepted for registration by the EPA based on a minimum of 120 scientific studies showing that the pesticide will perform its intended function without "unreasonable adverse effects" on humans, animals or the environment. The EPA defines "unreasonable adverse effects" as any unreasonable risk to man or the environment, taking into account the economic, social and environmental costs and benefits of the use of the pesticide. (*See Table 1 on Page 3.*)

Researchers determine the highest dose of a product that still shows no negative effect on animals and call this the No-Observable-Adverse-Effect Level (NOAEL). Scientists also determine a maximum exposure level — exposure to the highest estimated concentration level that could be expected with normal use. Using these two measurements, they calculate a "safety factor." This factor shows a multiple of the highest labeled application rate that an animal would have to be exposed to in order to reach NOAEL.

Aminopyralid's acute toxicity has been found to be Category IV for acute oral and dermal toxicity (least toxic rating) by the EPA. Acute toxicity is commonly measured by the single-exposure lethal dose or lethal concentration that causes death in 50 percent of treated laboratory animals. LD_{50} indicates the lethal dose of a chemical per unit body weight of an animal and is expressed as milligrams

Table 1. Environmental toxicology tests with aminopyralid.

Study	Species	Value
Birds		
Avian oral	Bobwhite quail	LD_{50} > 2,250 mg ae/kg bw
Avian dietary	Bobwhite quail	LD_{50} > 5,620 mg ae/kg diet
Avian dietary	Mallard duck	LD_{50} > 5,620 mg ae/kg diet
Fish		
Acute toxicity	Rainbow trout	96 hr LC_{50} > 100 mg ae/L
Acute toxicity	Bluegill	96 hr LC_{50} > 100 mg ae/L
Acute toxicity	Sheepshead minnow	96 hr LC_{50} > 120 mg ae/L
Aquatic Invertebrates		
Acute toxicity	Water flea (*Daphnia magna*)	48 hr EC_{50} > 100 mg ae/L
Acute toxicity	Mysid shrimp	96 hr LC_{50} > 100 mg ae/L
Acute toxicity	Eastern oyster	Slightly toxic 48 hr EC_{50} > 89 mg ae/L
Growth and reproduction	Water flea (*Daphnia magna*)	NOEC = 100 mg ae/L
Chronic toxicity	Midge	NOEC = 130 mg ae/L
Honeybees		
Acute contact	Honeybee	48 hr LD_{50} > 100 ug ae/bee
Acute oral	Honeybee	48 hr LD_{50} > 120 ug ae/bee
Earthworm		
Acute toxicity	Earthworm	14 d LC_{50} > 1,000 mg ae/kg soil
Algae and Aquatic Plants		
Acute toxicity	Freshwater green algae	Slightly toxic 72 hr E_rC_{50} = 30 mg ae/L
Acute toxicity	Freshwater blue-green algae	Slightly toxic 120 hr EC_{50} = 27 mg ae/L
Acute toxicity	Saltwater diatom	Slightly toxic 72 hr E_bC_{50} = 77 mg ae/L
Acute toxicity	Freshwater diatom	Slightly toxic 96 hr EC_{50} = 14 mg ae/L
Acute toxicity	Duckweed (*Lemna gibba*)	Slightly toxic 14 d EC_{50} > 88 mg ae/L

per kilogram (mg/kg). LC_{50} is the lethal concentration of a chemical per volume of air or water and is expressed as milligrams per liter (mg/L). More toxic compounds carry a low value of LD_{50} or LC_{50}, while practically nontoxic compounds have a high value.

Additionally, tests on aminopyralid have concluded it is "not likely to be carcinogenic to humans" as classified by the EPA, is nonmutagenic, does not interfere with reproduction and has no adverse neurological effects. (*See Table 2 on Page 4.*)

How does this relate to my protection?

If you were to become exposed, it might happen during mixing or handling the product at application, or through skin absorption from touching treated vegetation before it dries, or through accidental ingestion, like eating treated berries. To avoid exposure from the application, when using a handgun, you can apply the spray to the foliage and back out of the treated area to avoid walking through wet, treated vegetation and you can stay away from the treated area until leaves, stems and bark have dried. Since the product is rapidly absorbed into the vegetation, you can limit your exposure by using common sense and avoiding the area until the vegetation has dried.

What if I walk across a treated area?

Exposure may occur from walking into an area that is still wet from a foliar treatment. However, the dose received from this type of activity should not be high enough to cause harm. Applicators should always wash their clothing, separately from other laundry, every day after work. Scientists have determined "there is no route of exposure or scenario suggesting that the general public will be at any substantial risk from longer-term exposure to aminopyralid even when the compound is applied at the maximum labeled application rate."[2]

Do I need to stay indoors during the application?

No. However, it's a good idea to stay away from the application site during treatment and until the vegetation dries. After applicators apply the foliar treatment, avoid the area until the vegetation dries.

Whom may I contact for more information?

Contact your Dow AgroSciences vegetation management specialist or call the Customer Information Center at 800-263-1196 for more information about Milestone or aminopyralid, or visit www.MilestoneVMHerbicide.com.

Table 2. Mammalian chronic toxicity studies with aminopyralid.

Test	Species	Toxicity Parameters
2-year chronic feeding	Rat	Not carcinogenic NOAEL (mg/kg/day): Male = 50, Female = 500
Teratogenicity	Rat	Not teratogenic NOAEL (mg/kg/day): Maternal = 1,000 Developmental = 1,000
Teratogenicity	Rabbit	Not teratogenic NOAEL (mg/kg/day): Maternal = 250 Developmental = 500
Reproductive toxicity	Rat	No adverse reproductive effects NOAEL (mg/kg/day): Parental = 1,000 Reproductive = 1,000
Acute and chronic neurotoxicity	Rat	No adverse neurological effects NOAEL (mg/kg/day) = 1,000
Mutagenicity Assay (*in vitro*)	Ames test	Negative
Mutagenicity Assay (*in vitro*)	CHO/HGPRT	Negative
Mutagenicity Assay (*in vitro*)	Mouse micronucleus	Negative

[1]Milestone specialty herbicide is labeled for use in forestry site preparation treatments in AL, AR, GA, LA, MN, MS, NC, SC, TX and VA.
[2]Aminopyralid Human Health and Ecological Risk Assessment. U.S. Forest Service and National Park Service. June 2007.

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