

## Pyridine Herbicide Carryover: Causes and Precautions

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In certain situations, livestock manure, compost, hay, and grass clippings used as mulch or a soil amendment can cause plant injury.

Due to their persistence, some of the pyridine carboxylic acid herbicides may injure sensitive plants if not properly managed. The active ingredients of most concern are aminocyclopyrachlor, aminopyralid, clopyralid, and picloram. These herbicides eventually break down due to heat, exposure to sunlight, moisture, and microbial action. However, the primary factor in their degradation is aerobic microbial action. Breakdown is particularly slow in manure and compost piles, due to lack of oxygen. These compounds may persist for as long as several years in certain situations.

Not all herbicide products containing active ingredients in the pyridine carboxylic acid family pose a high risk of carryover, because of their chemical properties and/or uses:

- The active ingredients fluroxypyr and triclopyr are much less persistent than aminocyclopyrachlor, aminopyralid, clopyralid, and picloram. However, they too can damage non-target plants if treated forage, compost, or manure derived from animals grazing on treated forage is used on or near sensitive plants shortly after application. In addition, some have grazing and haying restrictions.

- Some products are unlikely to cause carryover problems because of their label directions and legal uses—for example, those for forestry, industrial sites, and rights-of-way.

Nonetheless, all users of herbicide products containing active ingredients in the pyridine family—especially aminocyclopyrachlor, aminopyralid, clopyralid, and picloram—must be aware of possible carryover issues, take steps to prevent problems, and follow label directions.

### Background Information

The active ingredients listed above are found in products registered for use on pastures and forage crops, grain crops, certain fruits and vegetables, and noncrop areas—including turf, wildlife and habitat management areas, forestry, industrial sites, and rights-of-way. In these settings, they are used to control broadleaf weeds. They are used on pastures and fencelines because they control weeds that reduce forage quality and quantity. They also manage some weeds that produce toxins that can, in turn, sicken or kill animals that graze them in pastures or eat them in hay. Several products can be used on seasonally dry wetlands (including ditchbanks, dry ditches, and dry canals), and can be applied up to the edge of aquatic areas. These products are ideal for controlling weeds along creeks and streams in natural areas and around stock ponds. The pyridine carboxylic acid herbicides target many troublesome broadleaf weeds, including many that are exotic and/or invasive. When formulated in a product combining several active ingredients, they broaden the product's control spectrum.

Toxicity and environmental fate data submitted to EPA to support the registrations of products containing these active ingredients show that livestock, including animals raised for meat or other products destined for human consumption, can safely consume hay and/or graze in treated pastures. These herbicides pass through an animal's digestive tract and are excreted in urine and manure. They are very low in mammalian toxicity.

Some products containing these active ingredients were registered under EPA's Reduced Risk Pesticide initiative. In order to qualify for this registration track, a compound must demonstrate lower risk to humans and the environment than other available alternatives. Some of the factors that contribute to a product being registered via the "reduced-risk" track include having low toxicity to mammals and other animals, being offered as a nonvolatile formulation, and having low label use rates. Many carry a CAUTION signal word. Most are not classified as restricted-use pesticides, which means that users do not have to be Virginia-certified applicators.

As noted above, in some situations, these herbicides can remain active for long periods of time. They can move, in solution, with rainfall, irrigation, and dew—and remain active in soil contaminated by leaching and/or runoff. They do not pose a problem when label directions are followed and they remain on the intended/treated site. However, they can harm sensitive plants if transported elsewhere by drift, runoff, or leaching. These herbicides may also be a problem when moved intentionally, as is the case when treated plants (ex. grass clippings) or manure from livestock consuming treated forage are used for mulch or composted.

Many pyridine carboxylic acid herbicides have label restrictions regarding subsequent plantings/crop rotations, where treated material may be used (such as hay and manure), and when moving livestock from treated to untreated areas. Although restrictions for moving grazing animals may be only a matter of days, rotational crop restrictions may be as long as several years. Note that restrictions on moving livestock are (relatively) short because livestock will metabolize residues of pyridine herbicides they ingest by eating treated plants. The treated forages and manure from animals that graze them will be exposed to air, heat, light, and aerobic microbes—which will cause these herbicides to break down. The half-lives for these herbicides may be much longer than expected if they end up in anaerobic (no or low oxygen) situations—such as manure piles or unworked compost. The same is true if treated forages are dried and baled. Hay and straw are purposely cured (dried), baled, and stored in a way that minimizes or eliminates microbial action (decomposition).

## **Plant Injury Symptoms**

- poor seed germination
- twisted growth
- twisted, cupped, and elongated leaves
- misshapen fruit
- reduced yields
- mortality (especially that of seedlings and young plants)

(Note that these symptoms can also result from disease, insects, and herbicide drift.)

## **Sensitive plants include**

cotton  
eggplant  
grapes  
legumes (beans, peas)  
lettuce  
peppers  
potatoes  
spinach  
strawberries  
tobacco  
certain flowering ornamental/bedding plants, including dahlias, marigolds, and some varieties of roses  
members of the Compositae (daisies, sunflowers) family  
members of the Umbelliferae/Apiaceae family, which includes Angelica spp., some herbs (anise, chervil, coriander, cumin, dill, fennel), and some vegetables (carrots, celery, parsnips, parsley)

## **Precautions/Stewardship Tactics**

### ***For gardeners***

If you obtain grass clippings, compost, or manure, ask your supplier if his/her pastures, grass stands, or crops were treated with an herbicide—and if so, which one(s). Ask the supplier what active ingredient(s) these products contain. (If he or she doesn't know, consult the product labels or your local Extension agent.)

If you get your manure from horse owners, realize that they may not know where the hay they fed their horses came from, or what it was treated with. Even if they do know their source, they may not have asked about herbicide treatments.

If you don't know the history of plant matter or manure you intend to use:

- don't put hay, straw, grass clippings, manure, or compost on or near sensitive plants.
- do a bioassay by planting beans in pots with a mix of the manure (or plant material) and commercial potting soil.
- use compost, hay, straw, or grass clippings with unknown "pedigrees" only on or near nonsensitive crops—and wait several years before planting sensitive crops in that soil.

## ***For growers and ornamental turf managers***

If you use any of the pyridine carboxylic acid herbicides (especially aminocyclopyrachlor, aminopyralid, clopyralid, or picloram), be sure to tell anyone who wants to use treated plant material or manure from animals that grazed treated forages that they may risk carryover injury. Be sure to provide information about herbicide use to people who obtain grass clippings, hay, manure, or compost from you. Follow all label instructions re: use of treated plants and manure management.

## **For more information, contact**

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P. Lloyd Hipkins, Extension weed scientist (noncrop and aquatics)

## **Sources**

Crop Protection Handbook, MeisterPro, 2012  
DowAgrosciences website: <http://www.dowagro.com/>  
Environmental Protection Agency - Pesticide website: <http://www.epa.gov/pesticides/>  
ExtToxNet website: <http://extoxnet.orst.edu/>  
Herbicide Carryover in Hay, Manure, Compost, and Grass Clippings, North Carolina State University factsheet (07/09), prepared by Jeanine Davis, NCSU Extension specialist, Department of Horticultural Science, and Sue Ellen Johnson, NCSU forage specialist, Department of Crop Science  
Herbicide Handbook (9th edition), Weed Science Society of America, 2007  
The Pesticide Manual (14th edition), British Crop Production Council, 2007

## **Virginia-registered products containing selected pyridine carboxylic acid herbicides (as of February 2012)**

### **Aminocyclopyrachlor**

Method 50SG  
Method 240SL  
Perspective  
Streamline  
Viewpoint

### **Aminopyralid (cont.)**

Forefront HL  
Forefront R&P  
Milestone  
Milestone VM  
Milestone VM Plus  
Radar

### **Aminopyralid**

Capstone  
Chaparral  
Opensight

**Clopyralid**

Accent Gold  
Andersons Golf, Turf, and Professional Turf  
Products with Millennium Ultra (four  
products)  
Brazen  
Broadstrike Plus  
Broadstrike Plus Corn PRE/PPI  
Clean Slate  
Clopyr Ag  
Clopyralid 3  
Confront  
Curtail  
Cody  
Hornet  
Howard Johnson's Weed & Feed with  
Millennium Ultra (four products)  
Kudzu Killer  
Lebanon Proscape (three products)  
Lontrel Turf and Ornamental  
Millennium Ultra 2  
Quali-Pro 2-D  
Redeem R & P  
Refute  
Scotts Fertilizer Plus Confront Broadleaf  
Weed Control 30-5-5  
Spur  
Stinger

**Clopyralid (cont.)**

Surestart  
Thistledown  
Transline  
Tripleflex

**Picloram**

Forestry Tordon K  
Forestry Tordon 101  
Forestry Tordon 101R  
Grazon P&D  
Gunslinger  
Hiredhand P + D  
Outpost 22K  
Pathway  
Picloram + D  
Picloram 22K  
Sekor P+D  
Surmount  
Terva 22K  
Toram P+D  
Tordon 101 Mixture  
Tordon 101 Weed and Brush Killer  
Tordon 101R Forestry Herbicide  
Tordon RTU  
Tordon K / 22K  
Trooper 22K  
Trooper Extra Selective  
Trooper P+D  
Trooper Pro

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