

Herbicide Carryover in Hay, Manure, Compost, and Grass Clippings:

Caution to Hay Producers, Livestock Owners, Farmers, and Home Gardeners

Many farmers and home gardeners have reported damage to vegetable and flower crops after applying horse or livestock manure, compost, hay, and grass clippings to the soil. The symptoms reported include poor seed germination; death of young plants; twisted, cupped, and elongated leaves; misshapen fruit; and reduced yields. These symptoms can be caused by other factors, including diseases, insects, and herbicide drift. Another possibility for the source of these crop injuries should also be considered: the presence of herbicides in the manure, compost, hay, or grass clippings applied to the soil.

The Herbicides of Concern

Aminopyralid, clopyralid, fluroxypyr, picloram, and triclopyr are in a class of herbicides known as *pyridine carboxylic acids*. They are registered for application to pasture, grain crops, nonresidential lawns, certain vegetables and fruits, and roadsides. They are used to control a wide variety of broadleaf weeds, including several toxic plants that can sicken or kill animals that graze them or eat them in hay. Based on USDA-EPA and European Union agency evaluations, when these herbicides are applied to hay fields or pasture, the forage can be safely consumed by horses and livestock – including livestock produced for human consumption. These herbicides pass through the animal's digestive tract and are excreted in urine and manure. They can remain active in the manure even *after* it is composted. They can also remain active on hay, straw, and grass clippings taken from treated areas. The herbicides leach into the soil with rainfall, irrigation, and dew. As with many other herbicides, they can remain active in the treated soil.

The chemicals of greatest concern are picloram, clopyralid, and aminopyralid because they can remain active in hay, grass clippings, piles of manure, and compost for an unusually long time. These herbicides eventually break down through exposure to sunlight, soil microbes, heat, and moisture. Depending on the situation, the herbicides can be deactivated in as few as 30 days, but some field reports indicate that breakdown can take as long as *three to four years*. Degradation is particularly slow in piles of manure and compost. When mulches, manures, or composts with herbicide activity are applied to fields or gardens to raise certain vegetables, flowers, or other broadleaf crops, potentially devastating damage can occur.

Table 1. Herbicides registered for use in North Carolina that contain picloram, clopyralid, and aminopyralid are:

Pasture and hayfields	Commercial turf and lawns	Commercial vegetables and fruits
Curtail (2,4-D + clopyralid)	Confront (triclopyr + clopyralid)	Clopyr AG (clopyralid)
Forefront (aminopyralid + 2,4-D)	Lontrel (clopyralid)	Stinger (clopyralid)
Grazon P+D (picloram + 2,4-D)	Millennium Ultra Plus (MSMA + 2,4-D + clopyralid + dicamba)	
Milestone (aminopyralid)	Millennium Ultra and Ultra 2 (2,4-D + clopyralid + dicamba)	
Redeem R&P (triclopyr + clopyralid)		
Surmount (picloram + fluroxypyr)		

All products listed are manufactured by Dow Agrosiences with the exceptions of the Millennium products by Nufarm and Clopyr by United Phosphorus.

Crops known to be sensitive to picloram, clopyralid, or aminopyralid are:

Beans	Carrots	Compositae family
Cotton	Dahlias	Eggplant
Flowers, in general	Grapes	Legumes
Lettuce	Marigolds	Mushrooms
Peas	Peppers	Potatoes
Roses, some types	Spinach	Sugar beets
Strawberries	Sunflowers	Tobacco
Tomatoes	Umbelliferae family	Vegetables, in general

How to Prevent Herbicide Damage to Nontarget Plants

The label on every herbicide contains detailed instructions for use, including animal feeding restrictions and safe use of manure or crop residues. When used as directed on the labels, these herbicides should not cause the problems noted above. The manures and plant residues are safe to apply to grass pastures and grass hayfields – effectively recycling them. Most of these herbicides have a crop rotation restriction of at least 12 months before any vegetable or forage legume crop can be planted in treated land.

The problems arise when the hay, manure, grass clippings, or other affected materials are sold or given to others who have no knowledge of the herbicides used or of the adverse effects their residues can have on other plants. The information about the herbicide persistence and effects on broadleaf plants does not always follow the hay, manure, compost, or other materials. Every individual in the chain of use for products treated with these herbicides should provide detailed information on the herbicide restrictions to prevent potentially catastrophic problems for other farmers and gardeners, and for themselves (including possible liability).

Hay Producers and Dealers. If you raise hay, make sure you know if any herbicide used has the potential to remain active in the manure or urine after consumption. Communicate – verbally and in writing – that the manure is not usable as a fertilizer, soil amendment, or compost for broadleaf plants. Landowners should know and have a written record of the herbicides applied to their fields.* Custom applicators should communicate exactly what products are applied to customers’ fields and provide a copy of the herbicide label(s). The labels provide all the information on restrictions. The herbicides of concern can also remain active on the hay itself. Be cautious about selling or giving away old hay for use as mulch or for making compost. The hay can be sold for consumption by livestock and horses, but be sure the purchaser is aware that the herbicide will pass through into the manure. Advise people feeding this hay to their animals to spread the manure on *grass* pastures or *grass* hayfields, being sure to follow all safety guidelines and regulations. According to the herbicide labels, plant materials treated

with these herbicides should not be considered safe for growing sensitive crops until the materials are completely decayed. Accelerate breakdown of plant residues by incorporating evenly into the surface soil. Breakdown of the herbicides is most rapid in sunlight under warm, moist conditions and may be enhanced with irrigation.

Livestock and Horse Owners. If you buy hay for your animals, ask the farmer or seller which herbicides, if any, were used in producing the hay. Consult a copy of the herbicide label from a farmer or online. A simple indicator that these herbicides were *not* used in the production of hay is the presence of legumes, such as lespedeza, clovers, or alfalfa. If the hay has legumes in it, it has not been treated with any of these herbicides. The absence of legumes in hay, however, does not mean that these herbicides are present. If you do not know the herbicide “history” of the hay, do not sell or give away the manure from animals who consumed the hay for use in growing plants or to make compost as it may contain one of the herbicides of concern. Manures that contain these herbicides can be safely spread on *grass* pastures or *grass* hayfields. Contact your local Extension agent or NRCS office to develop a manure management plan. Note: It takes 4 – 7 days for most animals’ digestive tracts to clear and the manure produced to be free of any herbicide residue.

Farmers and Gardeners Wanting to Use Manure or Compost. Before acquiring or using manure – fresh, aged, or composted – ask what the animals were fed, the origin of the hay, and what, if any, herbicides were used on the hay or pasture. Some livestock owners can tell you this, but many might not know the products used or origin of the hay they purchased. They may suggest the manure is “safe” because their animals have not been affected. If you don’t know which, if any, herbicides were used, use the bioassay described below to test for the presence of these herbicides. Do not use the manure or compost to grow sensitive crops without knowing its herbicide history or testing to see that it is safe. If you find yourself with a small quantity of contaminated manure or compost, spread it on a *grass* pasture, *grass* hayfield, or non-sensitive, nonfood crop area. Great care should be taken in using contaminated manure or compost to grow commercial food crops. Consult the herbicide product label to determine if the pesticide is labeled for use (legally permitted to be applied) to that crop. If the product has already been applied to the soil, tilling it several times during the growing season, irrigating the area, and planting it into a non-sensitive cover crop for a year or two will help the herbicides break down. Conduct a pot or field bioassay, as described below, before planting any sensitive crops in the area.

Farmers and Gardeners Wanting to Use Hay or Grass Clippings. If you want to use hay or grass clippings as mulch or in your compost pile, find out what, if any, herbicides were used on the field or lawn. Be particularly careful about obtaining grass clippings from golf courses and other commercial turf fields where these herbicides are commonly used. Most homeowners do not use these herbicides because they are not labeled for use on residential lawns. If you find yourself with contaminated hay or grass clippings, spread them on non-sensitive, nonfood crop areas, burn them, or arrange to have them disposed of safely. If the hay or grass clippings have already been applied to the field or garden, remove them, till the soil, sow a non-sensitive cover crop, and let it grow for a year or two to help the herbicide break down. Conduct a pot or field bioassay, as described below, before planting any sensitive crops in the area.

How to Test for the Presence of Herbicides: Pot and Field Bioassays

Some laboratories can test for the presence of these herbicides, but the tests are expensive and not as sensitive as a plant bioassay that you can perform yourself. This simple pot bioassay involves growing beans or peas, which are very sensitive to the presence of these herbicides, in the manure or compost. First, take a number of random, representative samples (small shovelfuls) from throughout the pile of manure or compost, being sure to get deep inside the pile. Mix thoroughly. If there are separate sources of manure or compost, conduct individual assays for each. Prepare 3 to 6 small (4- to

5-inch) pots with a 2:1 mix of the manure or compost and a commercial potting mix with fertilizer. Fill several control pots with only the commercial potting mix. Put saucers underneath each pot, or position the pots far enough apart so that water running out of the bottom of the pots will not reach another pot. Plant three pea or bean seeds in each pot, water, and let them grow for two to three weeks, until there are three sets of true leaves. If the peas or beans in the control pots grow normally and the ones in the pots with manure or compost do not, you can assume the manure or compost is contaminated with an herbicide which will adversely affect sensitive plants. If they all grow normally, it would be reasonable to assume that the manure or compost is fine. Keep in mind, however, that the test will be only as good as the samples you take. It would be better to err on the side of too many samples than too few (at least 20 per pile). You can create a similar test for hay or grass clippings by filling the pot with commercial potting mix and spreading a thick layer of the hay or grass clippings on top. This bioassay is explained in detail on the Washington State University Web site: <http://www.puyallup.wsu.edu/soilmgmt/Pubs/CloBioassay.pdf>

If a field or garden site has previously been treated with one of the herbicides of concern or been contaminated through the application of treated manure, compost, hay, or grass clippings, a field bioassay can be conducted. Plant peas or beans in short rows scattered throughout the affected area. If herbicidal symptoms appear, do not plant sensitive plants; plant grasses. Test again the following year. If the test plants grow normally, it should be safe to grow broadleaf crops.

Responsible Herbicide Use = Healthy Farms and Gardens

Animal manures and composts made from them are excellent sources of nutrients and organic matter for growing food crops. Soils mulched or amended with manure and compost become dark, aromatic, fertile, and active with earthworms and beneficial microorganisms. Farmers and gardeners are encouraged to use these products, but must exercise proper caution to prevent damage.

Herbicides are important tools that hay producers use to produce quality, weed-free hay. The use of these particular herbicides is no more likely in North Carolina than in any other state. Many North Carolina hayfields and pastures do not have herbicides applied on a regular basis. Hay and pasture acreage is among the “greenest” in North Carolina, delivering multiple environmental benefits.

Everyone should read an herbicide’s product label instructions before use. It is very important to remember that each pesticide product label states, “It is a violation of Federal law to use this product in a manner inconsistent with its labeling.” Hay producers need to inform buyers of any herbicides they have applied to their fields and provide them with a copy of the herbicide label with the restrictions. Likewise, livestock and horse owners who give or sell manure for composting or crop production must be aware of what they are feeding their livestock and horses and share that information. All parties must honestly communicate with the end-users of the hay and manure. Farmers and gardeners should ask about the herbicide history of manure, compost, hay, or grass clippings they acquire. Farmers and home gardeners need to be fully informed about what they are applying to their soil because the results can be disastrous for a farm business or gardener if one of these herbicides has been applied.

** EPA’s Office of General Counsel recently interpreted section 12(a)(2)(G) of the Federal Insecticide Fungicide and Rodenticide Act (FIFRA), which states “It shall be unlawful for any person to use any registered pesticide in a manner inconsistent with its labeling.” The EPA interpreted this section as it relates to a grower hiring an applicator to apply a pesticide and whether the grower can be held liable under FIFRA if post-application label requirements (such as preharvest intervals, plant back restrictions, crop rotation restrictions, and restricted entry intervals) are not complied with on the grower’s treated land. The Office of General Counsel believes a grower can be held responsible for any violations associated with these post-application requirements.*

Resources for More Information

Washington State University Web site on clopyralid carryover. The site includes pictures of affected vegetables, research results, and the bioassay protocol:

<http://www.puyallup.wsu.edu/soilmgmt/Clopyralid.htm>

Article from Minnesota Extension explaining the problem in hay and how to avoid it. The article is devoted to “ditch hay,” but the information is relevant to all hay:

<http://www.extension.umn.edu/distribution/livestocksystems/M1197.html>

CDMS Agro-chemical database with access to all the herbicide labels:

<http://www.cdms.net/LabelsMsds/LMDefault.aspx?t>

Dow Agrosiences United Kingdom Web site with information on aminopyralid:

<http://www.manurematters.co.uk/>

2009 North Carolina Agricultural Chemicals Manual for information on recommended pesticides for use in North Carolina:

<http://ipm.ncsu.edu/agchem/agchem.html>

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