



# Extension FactSheet

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## Clopyralid and Other Pesticides in Composts

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A question that compost users frequently ask is, “What happens to pesticides during composting?” This question is important since even at low levels, certain commonly used pesticides can be toxic in the environment. For example, diazinon (now banned) and pendimethalin (Prowl) are toxic to fish even at concentrations of parts per billion (ppb) in water. Birds are quite sensitive to diazinon poisoning, and as little as 2 parts per million (ppm) of 2,4-D (Weed-B-Gone) or 50 parts per billion of Clopyralid significantly reduce the growth of sensitive plants like tomato.

### What Happens to Pesticide Residues in Composts?

For the most part, pesticides are rapidly degraded during the composting process and do not persist at concentra-

tions that affect human health, garden plants, or crops. Studies done in the early 1990s on pesticide residues at composting facilities which accept yard trimmings showed that although many commonly used pesticides are occasionally found on yard trimmings entering the facilities, very low or undetectable levels are present in commercially produced composts. Two exceptions are DDT metabolites and chlordane which, although banned for many years, still persist in the environment. Laboratory studies have confirmed that most commonly used pesticides, including diazinon, 2,4-D, pendimethalin, and atrazine, are degraded to very low levels either chemically or by microorganisms during composting. However, recently an herbicide called Clopyralid (sold under the trade names: Reclaim, Stinger, Transline, Confront, Lontrel, Curtail

**Table 1. Persistence, decay rate, and safe concentrations of commonly used herbicides that may be found in compost feedstocks and composts.**

Pesticide	Trade Name	Reported Half Life in Soil (days)	Estimated Composting Half Life (days)	Plant Safe Conc. in Soil (ppb)
2,4-D	Weed-B-Gon, Hi-Dep® Weedar® 64 Weed RHAP A-4D®, Weed RHAP A	7	7–14	500
Atrazine	AAtrex®, Atratul®, Atrazine	100–300	21–50	nd
Clopyralid	Stinger®, Reclaim®, Transline®. Confront, Curtail, Millenium Ultra	15–287	1–2 years <sup>a</sup>	3
Diazinon	Basudin, Dazzel, Gardentox, Kayazol, Knox Out, Nucidol, Spectracide, Diazinon	14–28	1–2	na
Dicamba	Banvel®, Banex®, Trooper®	7–42	nd	50
Glyphosate	Roundup®, Rodeo®, Accord®	3–130	nd	nd
MCPP	Kilprop, Mecopar, Triester-II, Mecommin-D, Triamine-II, Triplet TriPower, Trimec-Encore, U46 KV Fluid	< 60	nd	600
Pendimethalin	Prowl, AC 92553, Accotab, Go-Go-San, Herbadox, Penoxalin, Sipaxol, Stomp and Way-Up.	90	7–14	100
Picloram	Tordon®, Grazon®, Access®, Pathway	20–300	nd	10

Abbreviations: nd—no data, na—not applicable, a—limited data.

and Millenium Ultra) has been found in composts at levels that may impact the growth of certain plant species.

Pesticides are lost from composts via many different pathways. The most desirable fate is complete “mineralization” or complete biodegradation to CO<sub>2</sub>. Another potential fate is volatilization into the atmosphere, which may be accelerated by high composting temperatures. Pesticides can also leach out of compost during rain events. In addition, many pesticide residues are incorporated into the organic matter fraction of compost after biotransformation in a form that is chemically different than the parent compound and therefore not biologically active. It is not desirable for pesticides to remain unchanged during compost production, especially since they could be concentrated as mass and water loss occurs during composting.

A literature review of more than 100 studies on pesticide biodegradation (Buyuksonmez, F., R. Rynk, T.F. Hess, E. Bechinski. 2000. Occurrence, Degradation and Fate of Pesticides during Composting. *Compost Sci. Util.* 8(1):61-81) concluded that pesticide residues in composting feed stocks do not appear to be a concern, that compost appears safe for food crops, and that none of the composts analyzed in the cited studies exceeded concentrations thought to affect human health or be phytotoxic to sensitive plants.

### **Clopyralid: A Persistent Pesticide That Can Cause Problems**

Since this review was published, compost contamination problems have been documented with an herbicide known as “clopyralid” in Ohio, Washington, Pennsylvania, New Jersey, and California. This herbicide, produced by Dow

AgroSciences, is sold under the following trade names: Reclaim, Stinger, Transline, Confront, Lontrel, Curtail, and Millenium Ultra. It is used to control broadleaf weeds, including Canada thistle, perennial sow-thistle, coltsfoot, and other species primarily on rangeland, grass pastures, lawns, non-cropland areas, and rights-of-way.

The problem is that, unlike most pesticides, clopyralid is very persistent in composts and manures and is largely unaffected by the composting process. Most plants are not damaged by clopyralid, even at rates used on lawns and agricultural crops. However, plants in the bean family (Leguminosae), the potato/tomato family (Solonaceae), and the sunflower family (Compositae) are very sensitive to this herbicide. It can stunt tomato, clover, lettuce, pea, lentil, sunflower, pepper, and bean plants at levels in compost as low as 10 parts per BILLION! Since the level of clopyralid on grass the day of application is 10,000 to 50,000 ppb, even a small amount of contaminated material entering a composting facility or directly applied to sensitive crops can cause major problems.

Clopyralid residues at levels well above those capable of injuring certain plants have been detected in grass clippings, straw, leaves, manure and bedding, and finished composts. The states of Washington and California recently banned clopyralid use in residential lawn care for this reason. Species in the Leguminosae, Solonaceae, and Compositae are so sensitive that a small amount of clopyralid-treated grass, collected along with leaves in the fall, has been shown to contain enough clopyralid to stunt growth. The most sensitive plants to clopyralid are red clover, sunflower, peas, and tomato (Table 2).

In addition to yard trimmings, agricultural products can also become contaminated with clopyralid and a re-



Tomato plant grown in compost containing residues of clopyralid showing leaf cupping (courtesy Washington State University).



Pepper plant grown in Clopyralid contaminated compost displaying atypical leaf development (courtesy Pennsylvania State University).



Pinto bean plant grown in potting soil containing residues of clopyralid showing shoot malformation (courtesy Washington State University).

**Table 2. Lowest clopyralid concentrations in compost based growing mixes where herbicide effects were observed.**

Plant Type	Day 14	Clopyralid Concentration (parts per billion)		
		Day 40	Day 72	Day 91
Grass, most ornamentals	>30000	>30000	>30000	>30000
Wheat	>300	>300	>300	
Sweet Basil	>300	>300	>300	
Japanese Buckwheat	>300	>300		
Cucumber	100	10		
Lettuce	10	10	10	
Tomato	3	3		
Peas, Beans	10	1		
Sunflower	1	1	3	
Red Clover	1	1	3	3

Source: W. Brinton, E. Evans, Composting News, April 2002.

lated compound called picloram (Table 1). When fed to cattle, these herbicides pass directly through the animal and are excreted in the manure. For example, horse manures tested at Washington State University, and used in a local garden, showed damaging levels of clopyralid. Cattle manure can also contain these residues if the animals graze or eat grass or hay where these compounds have been applied.

Organic farmers are especially concerned about this issue since they often rely on composts and manure to supply soil fertility. In addition to the likelihood of crop injury as described above, if herbicide residues are found on these farms, organic certification is lost for at least three years.

### What Can Be Done

- Homeowners and farmers should think twice about using products containing clopyralid (Millenium Ultra, Lontrel, and Confront, Stinger, Hornet, Transline, Reclaim) or picloram (Tordon®, Grazon®, Access®, Pathway) if you recycle leaves, grass, cuttings, or compost manure from pastured livestock. The herbicide should be used cautiously in areas where crop residues may be composted or where animals graze.
- For commercial composters, a simple plant growth bioassay test can be used to assess the threat of herbicide contamination. This test is done commercially by various compost testing laboratories (see the web sites below). Seeds of plants sensitive to clopyralid,

like tomato or red clover are planted directly into a compost amended soil and a control soil known to contain no clopyralid contamination. Symptoms of clopyralid damage, including loss of apical dominance, leaf cupping, and atypical shoot development are monitored. It should be noted that bioassays may show damage that is not related to clopyralid, such as high soluble salts. Therefore it is important to look at the probability of contamination in feedstocks and conduct pesticide residue analyses of positive bioassay samples before making a judgment on the existence of clopyralid residues in composts.

- Those using compost can be assured that clopyralid does not affect human or animal health or grasses, corn, berries, tree fruit, or the vast majority of woody and perennial ornamental plants. In fact, products containing clopyralid residues could be applied safely to soils where some of these crops are grown.

### Links to More Information

<http://dnr.metrokc.gov/swd/resrecy/composting/clopyralid.shtml>  
<http://www.jgpress.com/BCArticles/2002/020257.html>  
<http://www.puyallup.wsu.edu/soilmgmt/Clopyralid.htm>  
<http://css.wsu.edu/compost/bioassay.htm>  
<http://css.wsu.edu/compost/compost.htm> (Bioassay)  
<http://www.age.psu.edu/extension/ompec/ICSpaper.pdf>  
<http://www.woodsend.org/aaa/bionews.html> (Compost testing)

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