US Composting Council®

USCC Position: Persistent Herbicides

The US Composting Council calls on chemical manufacturers to withdraw herbicides known to persist in soil and compost with phytotoxic plant effects and to take responsibility for the damage these persistent herbicides cause, and on the US EPA and state agencies to take immediate and decisive action to prevent further environmental and financial damage.

THE PROBLEM

What Are Persistent Herbicides?

Persistent herbicides are a class of systemic herbicides that are used to control a wide variety of broadleaf weeds. These herbicides are formulated to survive multiple years of exposure in a growing environment. This relatively new class of herbicides called "pyridine and pyrimidine carboxylic acids" has been designed for use in hayfields, horse pastures, agricultural crop production, golf courses, right-of-ways, and lawns to kill off unwanted weeds and to remain effective for several months to years. These herbicides do not impact grasses, but once ingested, can pass through mammals into their manure, urine or bedding chemically intact.

The most prevalent persistent herbicides are clopyralid (Dow AgroSciences, first registered in 1978), aminopyralid (Dow AgroSciences, 2005), aminocyclopyrachlor (DuPont, 2010), and picloram (Dow AgroSciences, 1963). Less prevalent compounds in the same class include fluroxypyr, dopyralid, and triclopyr. Many of these compounds appear on labels in slightly different variations making identification by the untrained applicator or a testing lab difficult.

Persistent Herbicide Trade Names

Clopyralid:	Cloypry AG, Confront, Lontrel, Mellenium Ultra, Reclaim, Stinger, Transline
Aminopyralid:	Chaparral, CleanWave, ForeFront, GrazonNext, Opensight, Milestone
Aminocyclopyrachlor:	Imprelis, Perspective, Plainview, Streamline, Viewpoint
Picloram:	Tordon, Grazon

Persistent Herbicides Contaminate Soil and Threaten the Composting Industry

Persistent herbicides found in compost and soils directly harm the environment and threaten the economic viability of many industries, including the multi-billion dollar composting industry in the United States. Composters face liability claims, product testing, and financial losses. With every new incident of crop damage due to herbicide-contaminated compost, consumer confidence in the use of compost will decline.

Despite the known severity of this issue for more than a decade, chemical companies continue to produce herbicides that persist in compost and soils, and the US Environmental Protection Agency (EPA) continues to approve the registration and re-registration of these products while taking no meaningful action to resolve the problem.

Recent incidents of persistent herbicides in compost and soils have underscored the urgent need for action. Nurseries, landscapers, crop farmers, and gardeners are among the industries threatened when soil is contaminated. Aminocyclopyrachlor-contaminated soil kills trees. Soils with trace amounts of aminopyralid stunt crops and hamper seed germination.

Manufacturers must take responsibility for the damage their chemicals cause. The US EPA must take immediate and decisive action to prevent further environmental damage while protecting composters and compost users from additional financial losses.

Ultimately, if these compounds continue to be used, compost producers will have no choice but to refuse to accept any feedstocks that may contain them. As a result, some of these organic materials will be landfilled or burned instead of composted. In landfills, organic materials contribute to emissions of methane, a potent greenhouse gas. By sending biodegradable organic materials to landfills and incinerators, we drain the soil of potentially recyclable nutrients and carbon rather than using these materials to displace chemical fertilizers and improve soil productivity in a more sustainable way.

A Decade of Environmental Harm and Financial Losses

Herbicide-contaminated compost is not a new problem. The first incidents of herbicide contamination in compost were reported in 2000 in Spokane, Washington, where compost produced from yard trimmings contaminated with clopyralid damaged vegetable and garden crops. The City of Spokane suffered an estimated four million dollars in damages and the facility was forced to close.[1] The City had joined a class-action lawsuit with other composting operations against Dow, but only received $23,000 in compensation.

At Washington State University, the cost from two years' lost sales, analytical testing, and liability claims paid to growers whose tomato crops were decimated by clopyralid-contaminated compost totaled approximately $250,000. A year later, organic growers in Eastern Washington State lost their certification due to clopyralid contamination.

Since the first incident, evidence of compost contamination by persistent herbicides has been documented throughout the United States, including California, Oregon, Pennsylvania, Texas, Maine, New Jersey, New York, Kansas, Idaho, North Carolina, Minnesota, and Vermont. In 2001 in Pennsylvania, clopyralid was found to be the contaminant in compost that killed home gardens and nursery plants.[2] In 2009, farmers and gardeners in North Carolina lost crops from mulch, hay or compost that had been contaminated by aminopyralid.[3] Whatcom County in Washington reported losses estimated at hundreds of thousands of dollars to community gardens and several organic farms due to aminopyralid contamination in 2009 and 2010.[4]

Other countries have also experienced problems. In the United Kingdom, crop damage related to aminopyralid was so extensive in 2008 that Dow voluntarily suspended sale of the herbicide.[5]

In 2010, DuPont released another persistent herbicide under the name Imprelis, which contains the active ingredient aminocyclopyrachlor. Within a year of introduction, Imprelis was linked to widespread damage and death of trees, particularly balsam fir, Norway spruce and white pine. A class-action lawsuit was filed on behalf of homeowners across the country who had contracted with professional lawn services that used Imprelis. In August 2011, DuPont issued a voluntary recall of Imprelis. One week later, the US EPA issued a Stop Sale Order.

Imprelis damaged trees in Ohio in 2011. Photo by F. Michel.

In Vermont in 2012, the Green Mountain Compost facility (owned by the Chittenden Solid Waste District, CSWD) received 510 confirmed complaints of herbicide damage to a variety of garden plants and ended up paying 449 claims. Settling those complaints and retrieving unsold product from its resellers, cost CSWD an estimated $270,000. CSWD incurred another $372,000 for testing and legal assistance to address the issue. The loss in value added sales of products that could not be made or sold due to the presence of persistent herbicides added another estimated $150,000. CSWD's costs totaled approximately $792,000. The culprit? Mainly aminopyralid, although other primary persistent herbicides of concern (clopyralid and picloram) were also found in compost. That regulators were unable to identify all sources of contamination is a most troubling aspect of this incident.

Other troubling aspects of the Vermont experience:

- The compost was found to cause plant damage with concentrations of aminopyralid as low as 1 ppb.
- No government or independent lab exists in the United States that can adequately test for aminopyralid in compost at or below the 1 ppb level.
- Only the persistent herbicide manufacturers (Dow AgroSciences and DuPont) are currently capable of testing for herbicides in complex matrices with high organic content such as composts and manures at the low part-per-billion levels at which sensitive garden plants are impacted.
- Lack of testing capability contributed to Green Mountain Compost's loss of value added sales.
- Regulators could not determine the source of the contamination; that is, which feedstock accepted

by the facility was contaminated with aminopyralid.

How Do Persistent Herbicides Contaminate Compost?

Commercial composting involves a process of intense and prolonged biological activity at high temperatures. This environment not only results in rapid degradation of food scraps and other feedstocks, but is also extremely effective at degrading the vast majority of conventional (i.e., non-persistent) herbicide and pesticide residues into harmless constituents. Although herbicide residues were sometimes detected in feedstocks at commercial composting facilities, they were rarely detected in the finished product.[6] This is not the case with the pyridine and pyrimidine carboxylic based persistent herbicides.

Persistent herbicides are relatively new compounds that have been formulated by the manufacturers specifically to be resistant to biological degradation. While most residual traces of herbicides typically breakdown in a compost pile in a matter of days, the molecular bonds joining the pyridine- and pyrimidine-based compounds can be resistant for months or even years. Pyridine and pyrimidine carboxylic acid herbicides have been found to persist in compost with phytotoxic effects. Miniscule concentrations of these herbicides in compost, as low as 1 to 10 parts per billion (ppb), are toxic to a variety of common flowers and vegetables including tomatoes, beans, lettuce, carrots, potatoes, sunflowers, petunias, daisies, asters, carnations, and lupines. Symptoms include twisted and stunted stems, curled leaves, reduced and misshapen fruit, and poor seed germination.

Crop damage at Green Mountain Compost, VT, in 2012. *Top*: tomato plant. *Bottom*: Eggplant.

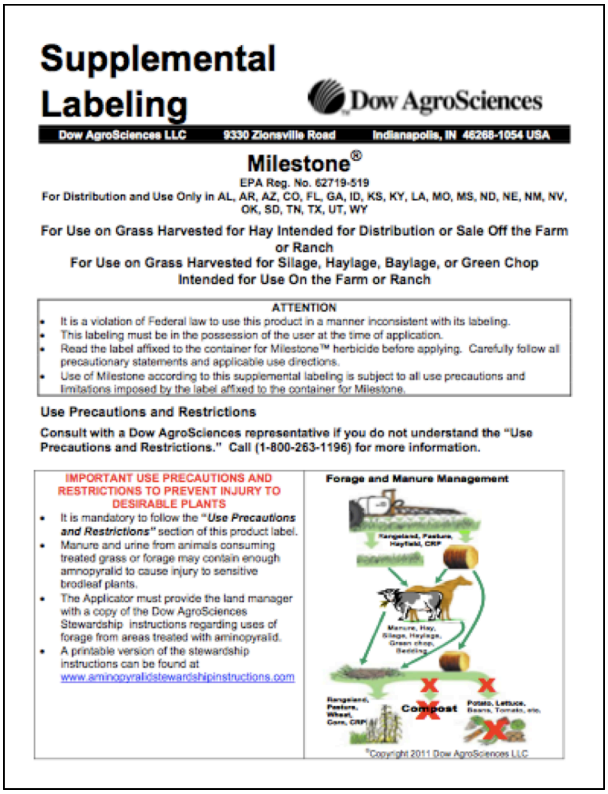
The most common pathway known for persistent herbicides making their way into compost is through manures and bedding, although grass clippings and other yard debris can be contaminated as well. Depending on the region, these compounds are used in variable amounts on horse pastures, hay and grain fields, golf courses, right-of-ways, and lawns. In fine turf establishment, seeding with straw is a common practice. After the grass germinates, the straw is often sent to a composting facility or is mulched in place. As a result, any herbicide residue will either contaminate the compost or the soil.

The labeling requirements for many of the persistent herbicides stipulate that manures from animals grazing in treated areas or hay and grass clippings from treated areas are not to be sent to a compost facility. These labels are ineffective.

Labeling Requirements Are Ineffective

Warning labels on herbicide products are ineffective in preventing the contamination of composting feedstocks and compost. People do not consistently read or follow the label. Even if herbicide applicators are provided with clear and accurate instructions on the product's warning label, there is still a long chain of communication that must be followed from application personnel to land owners, harvesters of plant residuals, brokers, processers, distributors, resellers, retail customers (farmers), haulers, and finally compost facilities in order to prevent contaminated feedstocks from being received. It is virtually impossible to ensure that the integrity of this chain of communication will be maintained. Instructions on labels often appear complicated, they may not be read completely, or if they are, are not fully understood or not followed accurately. Though some applicators might follow instructions correctly, there are usually others downstream who receive treated residues and may be unaware of the initial labeling requirements. Others may be aware of labeling requirements but choose to ignore them. There are too many loopholes in the chain through which contaminated residuals can sneak through into composting facilities.

In farm use, the information on the use in a field often does not get communicated to the hay buyer. The hay buyer may sell the hay to a dairy or horse owner without communicating the use of the herbicide-related restrictions. The farmer may not communicate the information to the hauler, who brings the manure to a composter. In urban/suburban use, the applicator may not tell the home or business owner, who may then set the grass at the curb for collection.



Supplemental Labeling

Dow AgroSciences

Dow AgroSciences LLC 9330 Zionsville Road Indianapolis, IN 46268-1054 USA

Milestone®

EPA Reg. No. 62719-519

For Distribution and Use Only in AL, AR, AZ, CO, FL, GA, ID, KS, KY, LA, MO, MS, ND, NE, NM, NV, OK, SD, TN, TX, UT, WY

For Use on Grass Harvested for Hay Intended for Distribution or Sale Off the Farm or Ranch

For Use on Grass Harvested for Silage, Haylage, Baylage, or Green Chop Intended for Use On the Farm or Ranch

ATTENTION

- It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
- This labeling must be in the possession of the user at the time of application.
- Read the label affixed to the container for Milestone™ herbicide before applying. Carefully follow all precautionary statements and applicable use directions.
- Use of Milestone according to this supplemental labeling is subject to all use precautions and limitations imposed by the label affixed to the container for Milestone.

Use Precautions and Restrictions

Consult with a Dow AgroSciences representative if you do not understand the "Use Precautions and Restrictions." Call (1-800-263-1196) for more information.

IMPORTANT USE PRECAUTIONS AND RESTRICTIONS TO PREVENT INJURY TO DESIRABLE PLANTS

- It is mandatory to follow the ***"Use Precautions and Restrictions"*** section of this product label.
- Manure and urine from animals consuming treated grass or forage may contain enough aminopyralid to cause injury to sensitive broadleaf plants.
- The Applicator must provide the land manager with a copy of the Dow AgroSciences Stewardship instructions regarding uses of forage from areas treated with aminopyralid.
- A printable version of the stewardship instructions can be found at www.aminopyralidstewardshipinstructions.com

Forage and Manure Management

Dow revised its label with a prominent pictograph on 6/22/11, following aminopyralid contamination problems in Whatcom County, WA. However, labels were ineffective in preventing aminopyralid contamination of compost and soils in Vermont in 2012.

Composters Cannot Keep Contaminated Feedstocks out of Their Sites

At this time, no quick and inexpensive methods exist for detecting toxic herbicides in compost or compost feedstocks. Testing for specific contaminants is expensive, prohibitively so for many composters. Few qualified laboratories exist to test for low levels of persistent herbicides. In some cases, testing methods and instrumentation are not commercially available; even government and independent labs cannot test down to the parts per billion concentrations of contaminants that are known to cause phytotoxic effects.

Even if testing programs were considered at compost facilities, sampling, testing, and methods of evaluation do not exist to assess the complex nature of compost feedstocks. It is unknown how many samples are required from a batch of compost to adequately determine if it is contaminated with persistent herbicides.

To augment the unavailable, expensive, and unreliable chemical analyses of compost and compost feedstocks, bioassays or growth trials may be performed on sensitive plants to detect the presence of herbicides. The drawback to this method of detection is that trials cannot be performed on concentrated compost mediums until the compost has fully matured – often many months after the initial incorporation of materials and the majority of resource investment have occurred. Growth trials can lead to false positives and also have the drawback of not being able to readily differentiate between various herbicide types. Growth trials are an ineffective means of testing individual feedstocks.

A Decade of Regulatory Inaction

The US EPA is the federal agency responsible for the registration of herbicides according to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). In that capacity, "the agency is responsible for protecting against any unreasonable adverse effects on the environment. This includes any unreasonable risk to man and the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide, or a human dietary risk from residues that result from a use of a pesticide in or on any food…"[7]

While certain pyridine and pyrimidine herbicide residues in composts may not threaten human or animal health, they adversely affect the environment. In addition to soil toxicity, plant and crop damage and associated environmental costs, persistent herbicides have had a significant adverse financial impact on composters. Clearly the US EPA is not meeting its mandate as required by FIFRA for protecting the environment, composters, users of compost and the compost industry from "any unreasonable adverse effects."

The US EPA has a disturbing legacy of inaction in addressing the problem of persistent herbicides in compost. Soon after the first reported incidents of clopyralid contamination in 2000, it became evident that the system for approving herbicides for distribution was in drastic need of revision.[8]

From 2000, incidents of clopyralid contamination in compost increased in various locations throughout the U.S., particularly in the Pacific Northwest. As the problem escalated, composters were held liable for crop damage and facilities suffered financial losses due to lost sales or were forced to close.

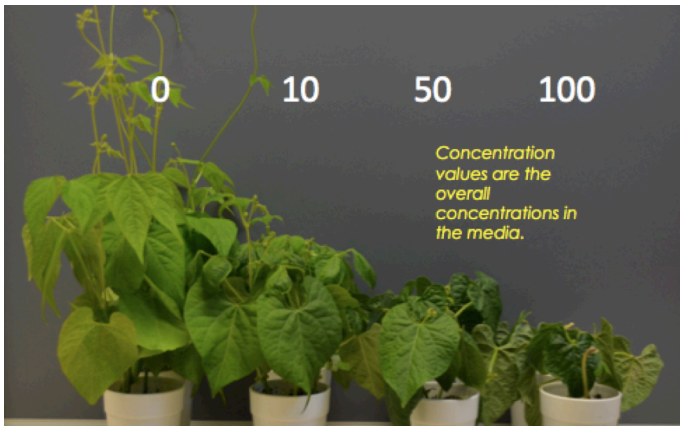
Public agencies in Oregon and Washington State sent a letter to the US EPA urging the agency to reexamine its criteria for registration of herbicides to include the ultimate end use of urban yard trimmings, food scraps,

and agricultural wastes. The letter emphasized that the fate of residual herbicides must be tested in the composting cycle to insure that no residual herbicide remains. The letter also emphasized that the ultimate responsibility in dealing with clopyralid residues should not be on the shoulders of compost producers but on those of the manufacturers of herbicide-containing products.[9]

In 2002, various stakeholders, including members of the scientific community and composting associations, met with the US EPA calling on the agency to revise the registration process to prevent further contamination of compost and financial losses to the industry. Meetings were held, details on environmental and financial impacts were presented, and assurances were given that relevant research on the persistence of herbicides in compost would be performed and that changes would be made to the registration process. Yet nothing was done.

In spite of the problems encountered with clopyralid, and the compost industry requests to change the registration process, Dow AgroSciences and DuPont have continued to develop new herbicides using active ingredients known to be persistent in compost. The US EPA has continued to register new and more potent herbicides despite knowledge of their persistence in compost, the history of plant damage, composters' financial losses, misplaced liability, and litigation. This is evident in the registration of aminopyralid by Dow in 2005 and aminocyclopyrachlor by DuPont in 2010, which have resulted in numerous reported incidents of plant damage from compost contaminated with these persistent herbicides.

With the registration of Imprelis, the US EPA was called upon again in 2011 by the compost industry to overhaul the registration process and remove the herbicide from the market until research was completed to test and guarantee the safety of compost feedstocks that contained it. Again, nothing was done. And these potent and persistent herbicides have continued to inflict environmental damage to gardens and crops, and financial damage to composters.



This bioassay test on bean plants grown for 30 days in potting media containing yard trimmings compost demonstrated leaf deformation and lack of shoots in concentrations of aminopyralid as low as 10 ppb (dry basis).

Source: Dr. Fred Michel, Ohio State University

Following the Vermont incident, compost stakeholders once again met with US EPA in August 2012 calling for a moratorium on the use and sale of persistent herbicides known to be phytotoxic to plants in compost, development of a fate-in-compost screen for chemical registration, and creation of a fund paid into by manufacturers to cover remediation costs.

While the US EPA is amenable to developing a test method to pre-screen herbicides for their fate in compost, to date, no meaningful action has been taken by the agency. After more than a decade, the industry is still in meetings with the US EPA making essentially the same requests with little, if any, indication of forward movement by the agency. Its inaction threatens the viability of the compost industry and the safety of the compost used by gardeners, farmers, landscapers, horticulturists, and many others.

There are no labs available outside of the chemical manufacturers' labs that can identify some of these compounds at the levels at which they cause harm, including the EPA's own lab. The US EPA should not be registering chemicals that cannot be identified in concentrations known to cause significant problems.

TIME FOR ACTION

The US EPA should revoke the registration of all herbicides known to persist in compost at levels that are toxic to plants and require that these products be removed from the market.

The damage to composters and compost markets due to persistent herbicides, including clopyralid, picloram, aminopyralid, and aminocyclopyrachlor, is conclusive and undeniable. These same herbicides continue to inflict environmental and financial damage as evidenced by the most recent incident of contamination in Vermont. Despite labeling requirements and usage restrictions, incidents of contamination from herbicides known to persist in compost continue and will not stop until these toxic chemicals are removed from the market.

Until the protocols and new testing requirements are developed and in place, all existing persistent

herbicides including derivative products should be immediately withdrawn from the market to prevent further contamination of compost.

The US EPA should develop a universal testing method for all persistent herbicides.

The test method should be capable of consistently and reliably determining the concentration of the persistent herbicide in expected matrices and feedstocks. The test method must detect limits known to impact sensitive garden plants. Commercial labs should be required to show proof of proficiency for extraction and analytical procedures developed.

The US EPA should change the registration process for herbicides to require an evaluation of compostability and persistence in compost.

When evaluating the persistence of herbicides in compost as part of the registration process, the US EPA should develop standards that must be met in order for an herbicide to receive approval. A standardized testing protocol should be based on data such as:

- how long the herbicide persists and at what concentrations
- what plants are susceptible and at what concentrations
- the dose-response relationship*
- the no observed adverse effect level (NOAEL)

The only way to ensure that persistent herbicides are kept out of compost sites and compost is to change the registration process for herbicides to require testing for compostability and persistence in compost and to reject the registration of any herbicide found to persist in compost at phytotoxic levels. The details of the testing protocols and research needed should be developed and agreed upon by the US EPA, independent research scientists, and the compost industry.

The US EPA should not approve the registration of herbicides that persist in compost at concentrations that are toxic to plants and crops.

The environmental and financial risk to the multi-billion dollar compost industry is too great to do anything less than change the registration process and ban all herbicides that persist in compost at phytotoxic levels. If this action is not taken, environmental damage and financial losses will continue to escalate for composters, the compost industry, home gardeners, and industries that use compost including commercial agriculture, horticulture, and landscaping.

State pesticide regulators should urge the EPA to take swift action.

While most states do not regulate herbicides by themselves, they will all feel the impact of contaminated composts and soils. State regulatory authorities should urge the EPA to take action on this issue, and in the absence of action, increase oversight and restrictions on the use of these persistent herbicides.

Herbicide manufacturers must be required to provide the results of third party peer-reviewed research that demonstrates no adverse impacts of herbicides on plant growth following the compost process.

The length of time needed for completion of the composting process varies significantly based on technology used, attention to process management and the factors that govern decomposition, and end markets which in some cases call for immature compost that is not fully stabilized.

The compost industry should provide input as to the appropriate time required for the testing protocol to insure the safety of compost.

Herbicide manufacturers should take financial responsibility.

Herbicide manufacturers should pay for:

- All necessary research, testing methods, protocols, lab equipment, and all other costs associated with testing their products for registration.
- All damages associated with their persistent herbicides including, but not limited to, testing costs incurred by composters, contaminated compost that cannot be sold, and other losses to composters, farmers and gardeners.

* The dose response is the maximum concentration level for all persistent herbicides in compost that will not damage various sensitive garden plants. Dow AgroSciences has recently indicated the upper thresholds that its compounds should remain below: 5 ppb for picloram, 10 ppb for clopyralid, 1 ppb for aminopyralid. Identifying the level of additive effects when two or more herbicides are detected is also needed. Ideally a third party – perhaps paid for by the herbicide manufacturers – should identify dose responses.

- Development of quick and inexpensive bioassays, specific to each herbicide.
- All bioassays and other tests to determine if their herbicides are in composters' feedstocks and product.

Manufacturers of persistent herbicides that render compost toxic to plants should immediately remove all of these products from the market and cease all further distribution.

Despite labeling requirements, warnings and usage restrictions, persistent herbicides continue to find their way into compost facilities, contaminate compost products, and inflict damage on the compost industry, individual composters, and both commercial and residential users of compost. The only way to stop these impacts is to remove these herbicides from the market and to stop producing new versions that are more potent and toxic to plants.

The US Composting Council calls on manufacturers to develop herbicides that are compatible with the composting process and the beneficial uses of compost.

Furthermore, manufacturers should stop the introduction and use of persistent herbicides that cannot be adequately detected by government labs or independent private labs. Herbicides should not be sold and marketed unless they can be tested for in complex organic matrixes such as compost and manures.

[1] California Agricultural Briefing, 2002. Composters sue Dow AgroSciences over contamination with clopyralid http://subscript1.bna.com/pic2/caag.nsf/id/RSAR-5HUJH2?OpenDocument

[2] Houck, N. E. Burkhardt. 2001. Penn State research uncovers clopyralid in compost. BioCycle July.

[3] Barbara Pleasant, "Milestone Herbicide Creates Killer Compost, Mother Earth News, July 24, 2009. http://www.motherearthnews.com/Grow-It/Milestone-Herbicide-Contamination-Creates-Dangerous-Toxic-Compost.aspx#axzz2LKIehntd

[4] Colleen Burrows, Washington State University Extension, "Herbicide Contamination of Dairy Derived Organic Matter in Whatcom County," February 2011, available online: http://whatcom.wsu.edu/ag/aminopyralid/. And Bill Richards, "Farms' problems with a herbicide may be back." Crosscut.com, Crosscut Public Media, Seattle. August 6, 2010. http://crosscut.com/2010/08/06/agriculture/20038/Farms-problems-with-herbicide-may-back/

[5] Dunk, Marcus.2008. "Plants in gardens and allotments all over Britain are dying: the reason is surprising as it is disturbing." Mail Online / Gardening http://www.dailymail.co.uk/home/gardening/article-1069379/Attack-killer-compost-The-disturbing-reason-plants-Britain-dying.html

[6] Michel, F.C., S. Munoz-Castaneda, R. Baker, D. Hurak, A. Pentz, S, Nanita. "Biodegradation of aminocyclopyrachlor and clopyralid herbicides during yard trimmings composting." In Proceedings of the 7th International Conference ORBIT 2010. Heraklion, Crete.

[7] US EPA, "Summary of the Federal Insecticide, Fungicide, and Rodenticide Act," available online at http://www.epa.gov/lawsregs/laws/fifra.html

[8] Rynk, Robert. 2000. "Dealing with herbicide residues in compost." Biocycle. September; and Bezdicek, D., M. Fauci. D. Caldwell, R. Finch, and J. Lang. 2001. "Persistent herbicides in compost." Biocycle. July 2001.

[9] Bezdicek, D., M. Fauci. D. Caldwell, R. Finch, and J. Lang. 2001. "Persistent herbicides in compost." Biocycle. July 2001.

US Composting Council
www.compostingcouncil.org

About the USCC: The United States Composting Council (USCC) is a national not-for-profit organization dedicated to the development, expansion and promotion of the composting industry. For more information visit www.compostingcouncil.org