

Herbicide Residues in Manure, Compost, or Hay¹

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When purchasing compost, it is important to understand that some manure-based products can contain herbicide residues that can affect the growth of certain plants. Manure from animals that have been fed forage treated with aminopyralid or other closely related herbicides, such as clopyralid or picloram, can be contaminated with these herbicides, which severely restrict the growth of legume and solanaceous crops and other broadleaf plants. Fortunately, a simple plant bioassay can be conducted in the field to test for herbicide contamination, and there are many options to consider if contaminated compost has been applied.

Herbicide

Aminopyralid is a highly effective herbicide that is commonly sprayed on pastures and hayfields as Milestone™, GrazonNext HL™, or Chaparral™. This herbicide is safe on grasses, but effectively manages many of our noxious and invasive broadleaf weeds, including tropical soda apple. Aminopyralid works by mimicking the natural plant growth hormone auxin. As the herbicide is absorbed into plant tissue, rapid and uncontrollable growth occurs until the plant “grows itself to death.” Grasses are highly tolerant to this herbicide because they rapidly metabolize the molecule and sequester it in special parts of the cell so it is no longer available for herbicide action. Many broadleaf plants cannot accomplish the metabolism/sequestration

step and succumb to herbicide effects. Fortunately, aminopyralid targets a process that is unique to plants; therefore, humans and other animals are not affected by this herbicide. Livestock can actually graze treated pastures immediately after aminopyralid application as the herbicide quickly passes through the animal with no ill effects and is excreted in manure (urine and feces) soon after ingestion.

Compost

Animal manure or compost is an ideal amendment to naturally improve soil fertility and organic matter content. However, not all manure or compost is created equal. Some may contain weed seeds, while others could potentially be contaminated with herbicide. Unfortunately, manure contamination can occur if the animal has been fed forage treated with aminopyralid, or other closely related herbicides such as clopyralid or picloram. Since aminopyralid is absorbed into plant leaves, where it is sequestered for the lifetime of that leaf, even if the grass is cut, dried, and baled as hay, the herbicide remains. When this forage is fed to livestock, the leaf tissues are broken down and the herbicide is released within the digestive tract of the animal and excreted in manure. For this reason, all herbicides containing aminopyralid explicitly state that manure or treated grass cannot be used as mulch or compost for sensitive broadleaf crops (Figure 1).

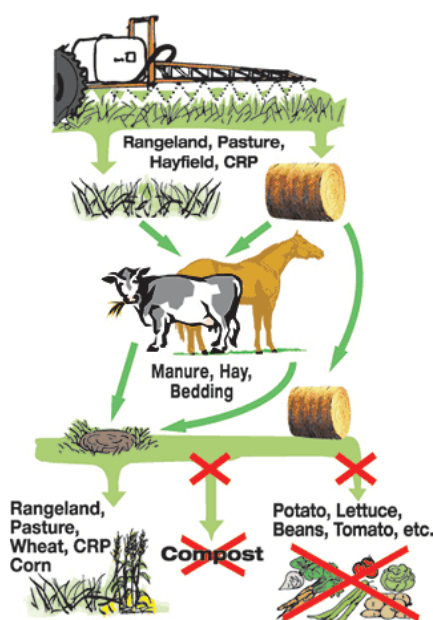
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Forage and Manure Management



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Figure 1. Illustration on the GrazonNext HL™ label describing how aminopyralid-treated forage can be handled.

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Questions to Ask When Purchasing Bulk Compost or Mulch

When purchasing compost, it is important to specifically ask if all precautions have been made to ensure the product is herbicide-free. If this question cannot be satisfactorily answered, or if the material will be used to produce high-value crops, it would be prudent to personally evaluate the quality of this product by conducting a plant bioassay.

Conducting a Bioassay

A bioassay is a process where plants are used as an indicator of herbicide residues. However, not all plants are equally sensitive to aminopyralid. Grass crops, such as corn or wheat, are extremely tolerant; brassica crops (broccoli, cauliflower) are only moderately sensitive, whereas legume (peas and beans) and solanaceous crops (tomato, potato, pepper) are extremely sensitive. Most analytical laboratories can detect aminopyralid in soil down to concentrations of 20–50 parts per billion (ppb). Tomato plants have been shown to be profoundly affected at rates as low as 0.2 ppb. Therefore, tomato or bean plants are a far better indicator of herbicide presence than sending samples to an analytical laboratory.

Conduct the bioassay by taking 4–8 samples from the compost pile and filling an ordinary garden pot or plastic cup with drainage holes. Also prepare 4–8 cups using bagged

potting mix that does not contain animal manure or grass compost (a bark and sand mixture would be ideal). The bagged potting mix will serve as your control or standard for comparison. In all cups, plant 2–4 pea or tomato seeds and place in an area with adequate temperature and light to promote proper growth. Water the cups when the soil begins to show dryness, but avoid overwatering. Monitor the plants regularly to see if herbicide symptoms develop.

If the compost has been spread onto a garden or field, the bioassay can still be conducted. A row of pea or bean seeds can be planted directly into the site and evaluated for proper growth and emergence. In a field bioassay, peas or beans are preferable to tomatoes since the larger seeded species will often emerge faster and more evenly. If possible, also seed an area where no compost or mulch was applied to serve as your control. This process can be completed several times over weeks or months to closely monitor the herbicide concentrations that might be present.

Aminopyralid Injury Symptoms

Aminopyralid is a synthetic plant growth hormone that is highly mobile within the plant. Therefore, symptoms of aminopyralid often appear in the newest tissues and manifest as improper leaf formation and expansion (Figure 2). Higher concentrations will typically result in stem twisting or even root formation on the stems (Figure 3). Blooms (flowers) are quite sensitive to this herbicide and may abort even if leaf symptoms are not obvious.



Figure 2. Low-dose aminopyralid damage on tomato. Note the damage is in the newest and most actively growing tissues.

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Figure 3. Higher doses of aminopyralid will result in leaf malformation and stem bending/twisting.

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Steps to Consider if Contaminated Manure or Compost Has Been Added to a Garden or Field Site

If a bioassay confirms that your site has herbicide residues, there are many options to consider. First, the site does not have to be abandoned if a suitable crop can be chosen. If any aminopyralid is present, it will likely preclude planting carrots, any legume crop (peas and beans), or solanaceous crops (tomato, potato, pepper). Conversely, corn is highly tolerant and will grow without any adverse effects.

It is also important to understand that soil microbes are quite effective at converting aminopyralid into permanently inactive forms. Research has shown that the half-life (time required for half the herbicide to be broken down) of aminopyralid in soil is 34.5 days (Shaner 2014). Therefore, in time the herbicide will be fully degraded, and the field or garden area can be returned to normal production. Keep in mind that the bioassay should always be conducted before any replanting decision is made. To hasten this process, a grass crop can be planted that will absorb herbicide from the soil. The grass can be clipped and clippings discarded onto a site labeled for aminopyralid applications (pastures, fence rows, etc.). Tilling the grass back into the soil will re-release the herbicide and start the process all over again. Additionally, breakdown of aminopyralid in plant residues or manure is more rapid under warm, moist soil conditions and may be enhanced through supplemental irrigation.

Soil removal is a laborious process, but potentially useful if a small area is to be reclaimed. The soil that is removed does not need to be sent to a landfill or handled as

hazardous waste. Rather, the herbicide-containing soil can simply be applied to any site where the herbicide can legally be applied (pastures, fence rows, etc.).

Conclusions

Communication between the sellers and users of compost products is important to ensure that they are not contaminated with herbicides. Proper stewardship of aminopyralid, as promoted by Dow (<http://www.dowagro.com/en-us/range/forage-management/aminopyralid-stewardship> and <http://www.manurematters.com/na/en/>), will help mitigate non-target species effects. Users of aminopyralid should read and follow all label directions. If a producer intends to sell or distribute forage products treated with aminopyralid, the recipient should be informed about the use precautions and restrictions. Proper communication can help avoid potential issues of herbicide contamination in home landscapes and gardens.

Reference

Shaner, D. L. ed. 2014. *Herbicide Handbook*. 10th ed. 43–46. Lawrence, KS: Weed Science Society of America.