



How Composting, Ensiling & Animal Digestion Affect Weed Seeds

The Problem

Weed seeds are often found in compost piles and silage, as well as animal manure. While the process of animal digestion can reduce the viability of many weed seeds, a certain percentage often survives, regardless of the animal, from cattle to poultry and waterfowl. Rarely, some seeds actually germinate better after a day or two in animal digestive tracts. Likewise, seed survival in compost and silage remains a question for many producers working to slow the spread of weeds on their operation.

Animal Digestion

The process of animal digestion usually reduces weed seed viability, but this effect varies based on livestock types and also weed species. In a Nebraska study, between 10 to 25% of weed seeds fed to cattle, hogs, horses, and sheep were recovered in the manure, but only 25% germinated on average.



Photo credits: USDA

Chickens were the most effective in destroying weed seeds; most weed species were unsuccessful at passing through their digestive tracts, and only small numbers of velvetleaf seeds were recovered. However, although few in number, 62% of the recovered velvetleaf seeds did germinate, which suggests the gizzard may have actually scarified the seed and stimulated germination.



Animal Digestion (continued)

In a study conducted in Alberta, most grasses did not survive the rumen of cattle, while 45 to 56% of redroot pigweed, common lambsquarters, and wild buckwheat seeds remained viable. In general, **small, hard-coated seeds are most likely to survive animal digestion**, as they are more resistant to the acid and grinding actions they encounter there. Keep in mind also that processed feed that is part of an animal's diet, such as feed for commercial laying hens, broilers, or swine, typically undergoes milling, steaming, and pelleting which kills weed seeds.

Fortunately, the practice of ensiling crop harvests and composting manure and plant materials can reliably reduce the viability of weed seeds if these processes are done in a manner that enhances seed decay. These common processing tactics can be a valuable tool in an integrated weed management system.

Composting: Heat & Moisture Work Together



Spreading manure can spread weed seeds as well, if the manure isn't properly protected and processed with seedkill in mind. (Photo credit: Penn State University)

Composting involves letting organic materials, such as plants or animal waste, decompose aerobically (with oxygen) in piles or storage containers that are managed to maintain the right levels of carbon, nitrogen, oxygen, water and heat. Commercial compost often relies on large quantities of low-value or discarded plant material that often have weed seeds within the material. However, when the composting process is properly managed, the viability of these weed seeds can be reduced.

The primary way that composting affects seed viability is through **heat**. Compost piles that reach up to 120 to 140 degrees Fahrenheit for up to two weeks are usually sufficient to kill most weed seeds, as well as perennial plant structures such as tubers, rhizomes, and bulbs. However, some weed species may require exposure to temperatures as high as 180 degrees for reliable, complete seedkill.



Reaching and maintaining these high temperatures outside the core of a pile can be difficult. As a result, compost piles must be turned and mixed regularly in order to maximize the number of weed seeds exposed to the heated core. Outer edges of the pile, or cool pockets that persist within, are the likeliest source of weed seed survival from a heated compost pile.

Another factor that greatly influences the effectiveness of the compost process to reduce seed viability is **moisture**. In general, higher moisture compost is more likely to increase seed mortality. For example, beef feedlot manure with adequate moisture has been shown to kill weed seeds completely in one week, whereas dry manure requires one to three months and high heat for total weed seed kill.

Unfortunately some weed species withstand composting and are resistant to decay, thanks to **hardseedness**, a quality wherein thick, fibrous seedcoats slow or prevent water absorption, allowing a seed to stay dormant and protect its inner seed embryo. These include morningglory, velvetleaf, common purslane and field bindweed (see Figure 1).

Ensiling: The Power of Fermentation

Ensiling is a longstanding method of preserving forage. Various methods of encasement, from plastic wrap to airtight silos, are used to seal moist, freshly harvested forage crops (usually corn, alfalfa or forage grasses) in an anaerobic (oxygen-free) environment. This spurs the fermentation process, wherein bacteria feed upon the plant sugars, producing lactic acid, which lowers the pH of the plant matter. This low-pH environment prevents spoilage and preserves the forage for months at a time.



Silage is a popular feed source for livestock, which has the added benefit of good weed seed kill, if processed correctly. (Photo credit: USDA)



Dozens of studies dating back to the 1930s have confirmed that the ensiling process significantly reduces weed seed viability. The acids weaken the seedcoat, enter the seeds, and kill the seed embryo. In general, grass seeds are more susceptible to seed death in silage than broadleaf seeds. About 28% of grass species will survive ensiling methods compared to 52% of broadleaf species, on average. Moreover, seeds that do survive ensiling are usually weakened and less likely to germinate. On average, surviving seeds only retain about 27 to 37% of their original seed viability.

As with composting, seeds with the highest risk of surviving and spreading in silage tend to be hard-seeded, such as velvetleaf, burcucumber, Indian jointvetch, biserrula, rose mallow and sweetclover. However, other common silage survivors include non-hardseeded weed seeds such as curly dock and broadleaved dock (see Figure 1). This suggests other factors are at play as well, such as the age of the seed.

It's proven difficult to tease out how different types of ensiled crops and the ensiling method might affect seed survivability. But in general, the longer a crop is ensiled, the greater the reduction in seed viability, with this effect tapering off after 90 days.

Protect Your Piles

When storing compost or manure, take precautions to avoid the introduction of weed seeds. Weed seeds can invade during the handling and moving process, particularly if soil contaminated with seeds is mixed into the compost. Compost or manure stored outside can also collect weed seeds that travel via wind or water, and then become a source of weed seed spread.



Open-air manure pits can collect wind or waterborne weed seeds. (Photo credit: Claudio Rubione, GROW)



Watchlist: Super Seed Survivors

These species have proven the most likely to survive composting & ensiling methods:

- Morningglory species
- Burcucumber
- Velvetleaf
- Field bindweed
- Legume species, such as Indian jointvetch and biserrula
- Vetches
- Mallow species such as rose and common mallow
- Yellow sweet clover
- Curly or broadleaf dock
- Needlegrass
- Common purslane

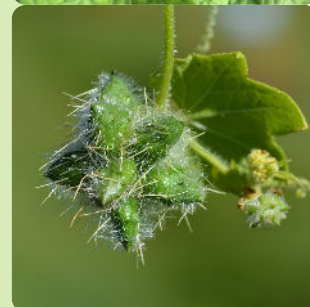
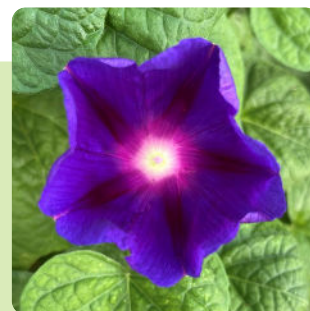


Figure 1. A list of the weed species most likely to survive composting and ensiling. (Graphic: Emily Unglesbee, GROW; photos by Claudio Rubione, GROW and Gustavo Camargo Silva, Texas A&M)

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