



Using Biosolids in Gardens and Landscapes

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS156E

Introduction

Closing the recycling loop means turning waste materials into useful products. We close the recycling loop in our gardens and landscapes when we use compost made from yard debris and food waste, and organic fertilizers made from fish or poultry waste, or biosolids products. Most recycled organic waste materials are composted, dried, heated, pelletized, or otherwise treated to make them safe and convenient for use as soil amendments.

Biosolids Production

Biosolids are a recyclable organic material produced in municipal wastewater treatment plants. Biosolids are made from wastewater solids—the organic and mineral matter recovered during wastewater treatment. The wastewater solids are digested (broken down by microorganisms) to reduce odors, pollutants, and pathogens (that is, microorganisms that cause disease). Excess water is removed to create a product that can be handled as a solid. Additional heat treatment of the biosolids reduces pathogens to background levels, creating a product suitable for gardens and landscapes.

Biosolids must meet quality standards that are regulated through the Federal Clean Water Act. Class A biosolids meet the strictest pathogen standards, based on federal treatment and monitoring requirements. Only Class A biosolids are available for home garden and landscape use. Not all wastewater treatment plants produce biosolids for public use, so its availability varies depending on your location.

Biosolids Uses

Research shows that biosolids build soil organic matter, improve soil tilth, and benefit crops under a wide range of conditions by providing nitrogen, phosphorus, and organic matter. (See publications listed in the Further Reading section for biosolids research findings). Biosolids products are a locally produced and inexpensive source of plant nutrients and organic matter. Using biosolids products is one way to close the recycling loop, thus benefiting your community and the environment (Figure 1).

Although biosolids products provide the same benefits as organic fertilizers and soil amendments, biosolids are not organically certified; therefore, gardeners following certified practices should not use biosolids.

Class A is the highest standard of pathogen removal for biosolids. To meet Class A requirements, biosolids must be treated by a process that reduces pathogens to low levels (such as high-temperature composting, heat-drying, or high-temperature digestion). The process must be monitored to show that it meets required treatment times and temperatures, and the biosolids must be tested and shown to meet standards for pathogen levels. Besides meeting Class A standards, biosolids for home and garden use must also meet the strictest standards for trace element pollutant levels. Biosolids currently produced in the Northwest have low levels of trace elements and meet these standards.



Figure 1. Planting in beds amended with biosolids compost, Seattle, WA. (Photo courtesy of Kate Kurtz, King County Dept. of Natural Resources)

This fact sheet is part of the WSU Extension Home Garden Series.

Biosolids Types

There are three main types of biosolids for use in the garden or landscape, and each of these types has different properties and different uses. The three types are heat-dried products, composts, and Class A blends. All three materials have been processed with heat to destroy pathogens.

Heat-dried biosolids

Heat-dried biosolids are the most nutrient-rich form of biosolids available to home gardeners (Figure 2). These biosolids are rapidly dried by intense heat, at temperatures ranging from 300 degrees to more than 1000 degrees Fahrenheit, depending on the type of equipment used. Heat-drying biosolids kills pathogens while retaining most of the nutrients, producing pellets that are similar to those contained in organic fertilizers. Because they have not been diluted with other materials, heat-dried biosolids contain a high concentration of nutrients. Nitrogen (N) content typically ranges from 4% to 7%, with similar levels of phosphorus (P) (measured as P_2O_5). Nitrogen availability in the first season after application is about 40%, which is similar to the percentage provided by poultry manure. A 50-lb bag of heat-dried biosolids with 6% total N provides enough available N to fertilize 400 to 600 square feet of garden at a rate of 2 lb to 3 lb of N per 1000 square feet. The same amount of biosolids will cover 1200 square feet of lawn at a single application rate of 1 lb N per 1000 square feet.

Heat-dried biosolids from different sources vary in physical properties. Some of these biosolids are uniform pellets (Figure 3), while others are more variable in size and may be dusty, making them less pleasant to handle. Heat-dried biosolids may produce odors when they become wet from rainfall or irrigation water. If you plan to fertilize a large garden or lawn area with heat-dried biosolids, test a smaller section first to see if odor could become problem.

Biosolids compost

Composting kills pathogens in biosolids by exposing the pathogens to high temperatures (greater than 131°F).



Figure 2. Heat-dried biosolids from Pierce County, WA, packaged and marketed as a fertilizer. (Photo by Craig Cogger, WSU Extension)



Figure 3. Pellets of heat-dried biosolids. (Photo by Craig Cogger, WSU Extension)

The minimum time for exposure to high temperatures ranges from 3 days to 15 days, depending on the composting system used. Biosolids alone do not have enough porosity to supply the oxygen needed by composting organisms. Commercial composters combine biosolids with coarse, carbon-rich materials, such as wood waste or yard debris, to produce a mix that has suitable porosity, carbon, and moisture for composting (Figure 4.)



Figure 4. Making biosolids-yard debris compost using a turned windrow system, Kelowna, BC. (Photo courtesy of Gordon Light, City of Kelowna, BC)

Diluting biosolids with carbon-rich materials reduces the concentration of plant nutrients, and composting reduces the availability of these nutrients to plants. Biosolids composts typically contain 1.5% to 2% total nitrogen, with about 5% to 10% of that nitrogen available to plants during the first year. Thus, composted biosolids products have much lower nitrogen availability than heat-dried products. The main benefit of these composted products is as a soil amendment to build organic matter and improve soil physical properties. Use biosolids compost as you would use other types of compost (Figure 5). If you are establishing a new raised bed or a garden in soil with little organic matter, apply from 1 inch to 3 inches of biosolids compost



Figure 5. Harvesting lettuce in a Seattle community garden amended with biosolids compost. (Photo courtesy of Kate Kurtz, King County Dept. of Natural Resources)

and mix it into the soil. Use smaller amounts (1/2 inch to 1 inch) in the following years.

Biosolids blends

A few wastewater treatment plants produce Class A biosolids by using high-temperature digestion at 131°F or higher. Undiluted biosolids are sticky and clump readily, so they are not convenient to use in gardens. Blending these biosolids with other materials reduces clumping, making them easier to use. Blending materials include sand, sawdust, and bark. Blended products include lawn and garden amendments (Figure 6), potting and raised bed mixes (Figure 7), and manufactured topsoils. Biosolids blends typically contain less than 1.5% nitrogen and phosphorus because they have been diluted by the woody and sandy components of the blends. Properties of different biosolids blends vary, depending on the composition and purpose of the blend. Refer to the instructions provided by the product manufacturer for guidance on uses and application rates for a specific blend. Tacoma, WA, and Vancouver, BC, are two Northwest cities that produce biosolids blends.



Figure 6. Lawn and garden mix from Tacoma, WA, made up of Class A biosolids, sawdust, and screened sand. (Photo by Craig Cogger, WSU Extension)



Figure 7. Raised beds amended with biosolids potting mix from Tacoma, WA. (Photo by Craig Cogger, WSU Extension)

Biosolids blends initially have higher nitrogen availability compared to biosolids composts because the biosolids are fresh, so there is more rapid nutrient release. These products provide adequate nitrogen for garden crops in the first year after application. By the second year, however, nitrogen release from the biosolids is much slower, while the decomposing wood product actually ties up or immobilizes N, making it unavailable to plants. Consequently, gardeners using biosolids-wood blends should apply 3 to 4 lb. N per 1000 square feet of garden in the second year. Do not apply additional phosphorus. For recommendations on applying N refer to WSU Extension publication EM063E, *A Home Gardener's Guide to Soils and Fertilizers*.

Protecting health and the environment

When working with biosolids, use the same precautions that you would use with any garden product. For example, wash your hands before handling, preparing, or consuming food. Any fertilizer or soil amendment can harm water quality if allowed to run off into surface water. Keep products off sidewalks, driveways, and gutters to reduce runoff to storm drains. Know the best use for your product and avoid over-application.

Apply heat-dried biosolids at rates and times based on soil test recommendations or fertilizer recommendations provided by local or regional University Extension publications. Apply biosolids composts as described above to increase soil organic matter and improve soil physical properties, and apply biosolids blends based on the properties of the specific blend. For recommendations on appropriate uses and application rates for organic soil amendments, refer to WSU Extension Publication FS123, *Organic Amendments in Yards and Gardens: How Much is Enough?* (Cogger and Stahnke 2013) at <http://cru.cahe.wsu.edu/CEPublications/FS123E/FS123E.pdf> and WSU Extension Publication PNW646, *Soil Fertility in Organic Systems: A Guide for Gardeners and Small Acreage Farmers* (Collins et al. 2013) at <http://cru.cahe.wsu.edu/CEPublications/PNW646/PNW646.pdf>.

Biosolids are rich in phosphorus; consequently, repeated applications will eventually increase soil P to excessive levels. If your soil test shows excessive levels of P, reduce or stop using biosolids and other P-rich amendments, particularly if water can run from your lawn or garden into storm drains or ditches. Biosolids do not contain much potassium (K), so you may need to supplement with K if your soil test shows low K levels.

Some gardeners are concerned about wastewater contaminants in biosolids, such as trace metals, household chemicals, and pharmaceuticals. Biosolids produced today contain low levels of trace metals and the availability of the metals to plants is also low, resulting in negligible risk to garden crops. Biosolids composts and blends have even lower levels of trace metals, sometimes lower than the levels found in the background soil. Biosolids contain low levels of some household chemicals and pharmaceuticals; however, these substances are either bound tightly to the soil or are broken down by soil and composting organisms. The likelihood of exposure to these household chemicals and pharmaceuticals is much greater with household use than through contact with garden crops or soils.

Obtaining biosolids for your garden or landscape

Where available, most Class A biosolids products can be obtained in bulk through local wastewater treatment plants. Some products are sold bagged or in bulk at garden or landscape supply stores. Most biosolids producers will have instructional guides that describe their product and its proper uses. Check with your local wastewater treatment plant to find out if they produce a Class A product and, if so, what kind it is and how it can be obtained.

Further Reading

Biosolids

Sullivan, D.M., C.G. Cogger, and A.I. Bary. 2015. Fertilizing with Biosolids. *Pacific Northwest Extension Publication* PNW 508e. Oregon State University. https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/pnw508_0.pdf

United States Environmental Protection Agency (EPA). 1994. A Plain English Guide to the Part 503 Biosolids Rule. EPA/832/R-93/003. USEPA Office of Wastewater Management. Washington, DC.

Organic soil amendments

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Enough? *Washington State University Extension Publication* FS123E. <http://cru.cahe.wsu.edu/CEPublications/FS123E/FS123E.pdf>

Collins, D., C. Miles, C. Cogger, and R. Koenig. 2013. Soil Fertility in Organic Systems: A Guide for Gardeners and Small Acreage Farmers. *Pacific Northwest Extension Publication* PNW 646. Washington State University. <http://cru.cahe.wsu.edu/CEPublications/PNW646/PNW646.pdf>

Research on biosolids and soil quality

Brown, S., K. Kurtz, A. Bary, and C. Cogger. 2011. Quantifying Benefits Associated with Land Application of Residuals in Washington State. *Environmental Science & Technology* 45: 7451–7458. http://www.researchgate.net/publication/51503318_Quantifying_benefits_associated_with_land_application_of_organic_residuals_in_Washington_State

Cogger, C.G., A.I. Bary, A.C. Kennedy, and A. Fortuna. 2013. Biosolids Applications to Tall Fescue Have Long-Term Influence on Soil Nitrogen, Carbon, and Phosphorus. *Journal of Environmental Quality* 42: 516–522. doi:10.2134/jeq2012.0269.

Cogger, C.G., A.I. Bary, E.A. Myhre, and A. Fortuna. 2013. Long-Term Crop and Soil Response to Biosolids Applications in Dryland Wheat. *Journal of Environmental Quality* 42: 1872–1880. doi:10.2134/jeq2013.05.0109.

Soil testing

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Horneck, D.A., D.M. Sullivan, J.S. Owen, and J.M. Hart. 2011. Soil Test Interpretation Guide. *Oregon State University Extension Publication* EC 1478. Oregon State University. <https://catalog.extension.oregonstate.edu/ec1478>.

Washington State Pest Management Resource Service. 2014. Analytical Laboratories and Consultants Serving Agriculture in the Pacific Northwest. <http://analyticallabs.puyallup.wsu.edu/analyticallabs/>



By **Craig Cogger**, Extension Soil Specialist, WSU Puyallup Research and Extension Center.

Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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