

What happens to the materials that disappear down our drains? In our modern society it is easy to think, “out of sight is out of mind,” that waste miraculously evaporates once it has vanished into the pipeline. Early humans knew better. Agrarian societies have been using both human and animal waste to fertilize the land for as long as humans have planted seeds, and those seeds have been thriving. The materials that wash down our drains are not a waste; they are a valuable, age-old resource for enriching the soil.

Our modern wastewater treatment facilities are not only water cleaning systems, but they are also reclamation factories that produce safe, reusable solids/biosolids. Recycling biosolids for beneficial use is gaining acceptance worldwide and encouraged by the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Food and Drug Administration, the National Association of Conservation Districts, and land grant universities nationwide.

Locally, recycling biosolids is promoted by the Michigan Department of Environmental Quality (MDEQ), the Michigan Department of Agriculture (MDA), Michigan State University (MSU), and the Michigan Water Environment Association. The Michigan Municipal League, the Michigan Farm Bureau, and the Michigan Township Association also encourage recycling biosolids. This support is based on extensive, scientific research that has established the environmental safety and agricultural value of recycled biosolids for:

- Returning resources back to the land
- Utilizing waste as a resource
- Adding nutrients to the soil, including important micronutrients
- Improving soil structure and fertility

What are biosolids?

Biosolids are the nutrient-rich processed organic material derived from wastewater treatment. The variety of substances in the wastewater determines the composition of the solids and can include domestic wastewater, non-hazardous industrial discharges, and storm water. At the treatment plant, wastewater is first separated into settled solids and liquid effluent. Various processes treat, stabilize, and disinfect the solids, destroying harmful bacteria and reducing odors. Biosolids end up in the form of a liquid slurry or dried to a semi-solid state.

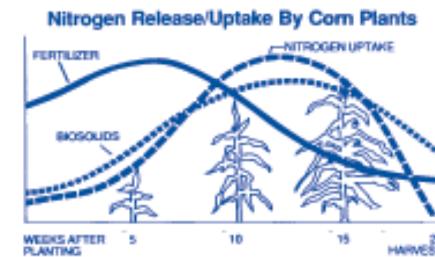
What nutrients do biosolids contain?

Biosolids contain the three primary crop nutrients -- nitrogen, phosphorus, and potassium. Biosolids contain several other nutrients that crops need in smaller amounts, such as calcium, magnesium, sulfur, zinc, copper, and iron. Most commercial fertilizers do not contain these necessary micronutrients.

Is there any benefit to the organic matter in biosolids?

By using biosolids, farmers are able to replenish the soil's organic matter and help maintain long-term productivity of the soil. The organic matter in biosolids helps to improve soil structure and increases the soil's ability to absorb and store water which helps sustain crops through dry spells and reduce runoff and soil erosion.

Organic matter also releases nitrogen and other nutrients over several growing seasons as soil bacteria slowly break it down. This slow release is more beneficial to crops as the nutrients become available as crops need them. Most nutrients in commercial fertilizers are available at the beginning of the growing season and have a greater chance of leaching away in the soil, especially nitrogen. As the chart below shows, the biosolids nitrogen becomes available as the crop grows and takes it up.



This demonstrates that the biosolids nitrogen is more efficiently used than fertilizer nitrogen and is therefore less likely to pollute groundwater. In addition, the amount of biosolids applied is closely regulated.

What other ways do biosolids benefit the environment?

Biosolids improve soil fertility, contribute to recycling efforts, and minimize the stress humans place on the environment. Beneficial use of biosolids enriches the soil by contributing useful, organically based products. In nature's cycle, the use of wastewater products helps reduce the amount of waste destined for landfills and reduces the need for petroleum based chemical fertilizers.

Who decides where to apply biosolids, on what crops and how much?

The local wastewater treatment plant that generates the biosolids, or their designated qualified land application contractor, decides on the site of biosolids application. The site must meet Michigan Department of Environmental Quality (MDEQ) requirements with isolation from wells and surface water, slope, soil background nutrient levels, crop nutrient requirements, and site accessibility.

Biosolids are generally applied to crops for animal feed: corn, soybeans, small grains, and hay. Biosolids are also applied to pasture, tree farms, and sod. Food crops can also be grown with biosolids after a 14 to 38 month harvest restriction, depending on the crop.

Biosolids are applied only in the amounts required to meet the Nitrogen needs of the crop to be grown.

Are there odors associated with land applying biosolids?

Biosolids applied to cropland in Michigan are primarily liquid subsurface injection. Other application methods include semi-solid surface spreading and incorporation, and liquid and semi-solid surface application. However, many of the odor causing bacteria in biosolids have been destroyed in the biosolids stabilization process. A slight earthy odor may exist in the immediate area of application, and in the case of surface application, may be noticeable for a few days in humid weather.

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Is there any economic value to biosolids application?

Besides improving the soil, land-applying biosolids can supplement or replace commercial fertilizer. Using current fertilizer costs, biosolids can provide nutrients worth over \$100 per acre.

Biosolids Nutrient Value

Based on 4-8 dry tons/acre
Biosolids application (per acre)

Nutrient	lbs. applied	Value
Nitrogen	150	\$52.00
Phosphorus	150	54.00
Potassium	30	4.00
Copper	3	3.60
Zinc	5	2.50
Calcium*	1200	48.00

Total Value \$164.10

*For biosolids containing lime

How do we prevent wastes from contaminating biosolids?

Industrial discharges are tightly regulated through mandatory pretreatment requirements imposed on all industrial discharges entering municipal wastewater treatment plants. Sensitive to the need for safe, high quality biosolids, the EPA and the MDEQ provide guidelines and enforce regulations for their content and use.

The EPA, USDA, and major universities, including MSU, have performed extensive research on beneficial uses of biosolids and developed comprehensive regulations to ensure that no contamination results from beneficial use programs.

Are there disadvantages to land applying biosolids?

Land application is closely monitored to ensure that it is safe and there are no increased risks to humans, animals, or the environment.

The amounts of metal from biosolids application are usually no larger than those that exist naturally in the soil. In fact, many of these trace metals found in the soil are beneficial. The zinc, copper, iron, manganese, and magnesium are essential for humans, animals, and plants. These are not uncommon ingredients of a vitamin tablet or enriched breads and cereals. Chromium and selenium are essential for humans, and nickel is important in poultry. Of all the metals in biosolids, only lead and cadmium are of human health concern. However, their concentrations are very low and the allowable amounts applied are strictly regulated.

Biosolids may contain a very small number of pathogens (bacteria and viruses) after the treatment process. When applied to land, sunlight or the soil environment kills the pathogens.

Regulations for metals and pathogens are based on more than four decades of land applying biosolids experience and intensive research by the EPA, USDA, and major universities nationwide, including MSU. It is important to note that no illnesses related to land application of biosolids have ever been documented.

How is land application of biosolids regulated?

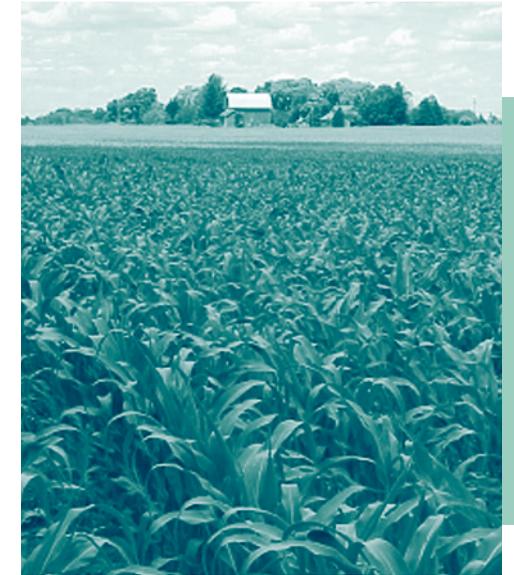
The Land Application of Biosolids program is closely regulated by the MDEQ. Each wastewater treatment plant (WWTP) must contact the MDEQ before commencing their land application program.

Each WWTP then complies with all MDEQ and EPA regulations when land applying biosolids, including monitoring and record keeping. Each MDEQ representative who oversees land application will audit the WWTP records and inspect land application sites. The audit includes reviewing biosolids quality data, soil testing data, application rates, and nutrients and metals applied.

The land application inspection will include checking for proper application procedures, slope and isolation restrictions, and proper injection/incorporation. Periodic testing of the biosolids and soil will also be conducted as needed.



Application and Recycling of Biosolids



Commonly Asked Questions about Land Application of Biosolids



For More Information: Michigan Department of Agriculture

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