



Beneficial Reuse of Municipal Biosolids in Agriculture

P²AD Pollution Prevention Assistance Division ♦ The University of Georgia Cooperative Extension

BACKGROUND INFORMATION

Farmers have known for centuries that animal manures spread on pastures and cropland can improve soil fertility. In the 1920's, farmers began to use sludge from municipal wastewater treatment plants as a fertilizer. Through decades of research, the scientific and agricultural communities have come to understand that municipal sludge or "biosolids" contain valuable nutrients and organic matter that improves the soil similar to animal manures. It is important to understand that biosolids are not raw sewage. Biosolids are organic solids that have been treated to stabilize organic matter and reduce disease causing organisms or pathogens.

This Factsheet was developed to help answer some common questions regarding the use of biosolids and to give farmers benchmarks for good practices.

REGULATORY OVERVIEW

The use of biosolids in agriculture is controlled by what is known as the 503 regulations (40 CFR Part 503), which took effect in 1993. These federal regulations were developed by the U.S. Environmental Protection Agency after nearly ten years of research on the possible risks due to diseases, heavy metals, or other components of the biosolids. The regulations set limits on the amount of metals and pathogens that can be in the biosolids, and also have requirements to reduce the possibility that the biosolids will attract flies or other pests that might spread disease. The law requires that specific conditions be met before biosolids can be applied to the land.

The 503 regulations divide biosolids that can be land applied into two groups based on the amount of pathogens: Class A and Class B. Biosolids that meet standards for very low pathogen content are Class A. Class A biosolids that are considered "Exceptional Quality" meet the most stringent requirements. The metals content is low, pathogens are low or nonexistent, and the organic matter is stabilized so that there is little odor or possibility of attracting pests that spread disease. Exceptional Quality biosolids can be used on the farm without a site permit or even bagged and sold to consumers for garden use. Class B biosolids have higher pathogen content than Class A, but meet regulatory requirements for land application and are useful for fertilizer and soil conditioners. Class B biosolids must have a site permit obtained by the wastewater treatment facility for agricultural use.

BIOSOLIDS USE – ADVANTAGES AND DISADVANTAGES

ADVANTAGES

The advantages of using biosolids as part of your fertilizer program are many. The greatest advantage is a reduction in fertilizer costs. Biosolids typically have about 4% nitrogen. This nitrogen is released slowly over time. Biosolids also contain phosphorus and many micro-nutrients which can be beneficial to crop growth.

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Another advantage is the addition of organic matter to the soil. Organic matter reduces surface runoff, reduces erosion, and improves the water and nutrient holding capacity of the soil. Studies have shown increased organic matter content can improve yields. The addition of organic matter is particularly helpful in Georgia where most soils are naturally low in organic matter.

DISADVANTAGES

The primary disadvantages to biosolids use are odors, the presence of certain metals, concern about pathogens, and potential overapplication of nutrients.

ODOR - Odor can be a public concern, not only with the use of biosolids, but with the use of manure. Management techniques such as incorporating biosolids into the soil, vegetation buffers, timing of the application, etc can be used to reduce odor problems.

METALS - Many of these metals, such as zinc and copper, are essential for plant growth, but some metals in large quantities can create problems with plant growth or animal health. The 503 regulations placed limits on the amount of metals that biosolids can contain and be used for land application. They also set limits on the maximum amount of a metal that can be applied to a site. These limits were based on the lowest amount of a particular metal that would create a health problem for people, animals, or plants. For example, the arsenic limit was based on the amount of arsenic that would create health problems in a child eating a soil mixed with biosolids. The nickel limit was set based on the amount of nickel that would cause plants growing on soil with biosolids to have poor growth or die.

Most metals do not move easily into plants or water when the soil pH is near neutral. In Georgia, the Environmental Protection Division's Guidelines for

Land Application of Sewage Sludge (Biosolids) at Agronomic Rates requires the soil pH to be maintained at 6.5 or above. However, soils should not be overlimed because a few metals - molybdenum, arsenic, and selenium, become more available and move more easily into plants at pHs above 7.0 to 7.5.

OVERAPPLICATION OF NUTRIENTS -

As with any type of fertilizer, too much of a good thing can create problems. If biosolids are not applied so that plants can use the nutrients or the soil cannot store the nutrients, excess nitrogen or phosphorus can move into surface water or groundwater. Overapplication of nitrogen can also cause high nitrate concentrations in forage that can kill animals eating the forage.

Biosolids are generally applied at a rate to meet the crop's nitrogen need. Because the phosphorus content of biosolids can be relatively high, more phosphorus can be applied than the plants need. Over time phosphorus can build up in the soil. With continued application, excess phosphorus can move into surface water creating pollution problems. A nutrient management plan can help you use biosolids with other fertilizer sources to prevent overapplication of nutrients.

PATHOGENS - Some people are concerned that biosolids can cause disease. Class A biosolids are extensively treated so that there are very few or no pathogens. Class B biosolids are also treated to reduce the levels of pathogens though some are still present. The 503 regulations require Class B biosolids to be incorporated into the soil, or restricts site access to surface applied biosolids to minimize potential exposure. The research on pathogens in land applied biosolids has not found problems with disease transmission.

WHAT THE FARMER SHOULD KNOW

What type of information do you need before you use biosolids?

1. REQUEST PERMIT INFORMATION FROM THE WASTEWATER TREATMENT PLANT.

This information should include:

- the required buffers around streams and well,
- data on the metal and nutrient content of the biosolids,
- results of soil testing,
- calculations of the correct agronomic rate,
- calculations showing how much biosolids will be applied to a particular field, and
- the record keeping requirements for showing how much biosolids were applied on each field.

2. REVIEW THE INFORMATION ON THE CONCENTRATIONS OF METALS IN BIOSOLIDS.

Concentrations are typically given in milligrams per kilogram (mg/kg) or parts per million (ppm). These two measurement units are the same. Compare the concentrations in the biosolids that will be used on your farm, provided by the wastewater treatment plant, with those listed in Table 1. If the metals concentrations in the biosolids are less than those in Table 1, metals should not accumulate to levels that would pose health risks. If the metals concentrations in the biosolids are more than those in Table 1, the wastewater treatment plant should provide you information on the total amounts of metals applied over time and the regulatory limits. You can also contact your County Extension Agent for more information on tracking the amount of metals in your soil over time.

TABLE 1.
METALS LIMITS FOR CLASS A BIOSOLIDS.

Pollutant concentration limits from the US EPA Part 503 regulations. Biosolids with metals concentrations below these limits should not accumulate to levels that would pose health risks.

POLLUTANT	MONTHLY AVERAGE CONCENTRATION (MG/KG)
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

Note that molybdenum is not listed in Table 1. The 503 regulations set a maximum limit for molybdenum at 75 mg/kg in biosolids suitable for land application. Currently, there is not a pollutant limit for molybdenum. The pollutant limit for molybdenum in the original 503 regulations was 18 mg/kg. The pollutant limit was removed because studies had shown molybdenum posed a low risk for animals. If you are concerned about molybdenum, you may want to ask the wastewater treatment plant to conduct periodic testing of the forage for molybdenum. Your County Extension Agent can also provide information about forage testing services.

3. KNOW YOUR SOIL PH.

The pH should be maintained above 6.5 and below 7.0 to 7.5. Soil pH in this range keeps the metals in the biosolids bound to soil particles.

4. REVIEW INFORMATION ON THE AMOUNT OF NUTRIENTS THE BIOSOLIDS WILL PROVIDE.

The permit request should also give you information on the amounts of nutrients that will be supplied by the biosolids and the amount of biosolids that your land can safely use. Ideally, the permit request will have a nutrient management plan to ensure the proper amounts of nitrogen, phosphorus, and potassium are being applied for good crop growth. If this type of information is not available in the permit request, you should ask the wastewater treatment plant to provide it, or you and your County Extension Agent can develop your own nutrient management plan.

5. REQUEST ANNUAL REPORTS.

Wastewater treatment plants are also required to compile annual reports with this type of information. If you are receiving biosolids, you should receive an annual summary of the amount of biosolids applied to each of your fields and the

equivalent amount of fertilizer that has been applied. You should also request data on the concentrations of metals in the biosolids applied on your fields.

If the wastewater treatment plant or their agents do not supply this type of information, or the information is not presented in a clear manner, you may want to think twice before you accept biosolids. Most biosolids reuse programs are good and want to keep their farmers informed. If you are concerned about any aspect of a biosolids application program - ask. Your County Extension Agent can often help you and has access to a number of specialists at the University of Georgia for additional assistance. He can also send soil, forage, and water samples to the Agricultural Services and Diagnostic Laboratories to help get you the information you need.



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