BIOSOLIDS RECYCLING research notes

NORTHWEST BIOSOLIDS MANAGEMENT ASSOCIATION

Response of Forage Grass to Biosolids Fertilization

Reserachers and Collaborators

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Background

As a crop to receive biosolids forage grass has several advantages, including a potential for high uptake of nitrogen. Other advantages include available sites close to biosolids production areas, and a longer season of application than is had for most row crops. The potential for leaching losses from grass crops is lower than for row crops, because of the intensive root system of established grasses, efficient removal of available nitrogen and a long season of growth in favorable climates. It is important to have good estimates of biosolids nitrogen availability, to determine application rates that will meet crop nitrogen needs without increasing the potential for leaching loss. We have only limited information on how processes such as heat-drying and thermophilic digestion affect biosolids nitrogen availability. One way to estimate nitrogen availability is to measure nitrogen recovery in the crop directly in the field. Forage grasses are well suited for field nitrogen recovery measurements because of their efficient uptake of available nitrogen.

Objectives

We conducted this research to compare nitrogen recovery from heat-dried and dewatered biosolids applied to forage grasses under field conditions in the Pacific Northwest, and to make practical recommendations for appropriate biosolids application rates for intensive forage grass production.

Methods

We established replicated small plots, planting tall fescue on a well-drained soil in Puyallup, Washington, and perennial ryegrass on a poorly drained soil in Buckley, Washington. We applied heat-dried and dewatered biosolids at three rates at each site (approximately 260 to 780 lb/acre/yr at Puyallup and 180 to 540 lb/acre/yr). Each site also had ammonium nitrate and unfertilized check treatments. Biosolids were surface-applied to the forage three times per year for two years, and yield, forage nitrogen concentration, and apparent nitrogen recovery were determined at each harvest. We measured residual soil nitrate-nitrogen in the fall.

Results

During the two years of this study, heat-dried biosolids were similar to dewatered biosolids in their ability to supply nitrogen to the forage grasses at both well-drained and poorly-drained sites. The heat-dried materials had an advantage in year one at the Buckley site, while in year two at Puyallup, we observed slightly greater nitrogen recovery from the dewatered biosolids. Application of 1000 to 1100 lb/acre of biosolids nitrogen over two years produced similar yield and nitrogen recovery as 480 lb/acre ammonium nitrate nitrogen applied to tall fescue at Puyallup. At Buckley, application of 640 to 770 lb/acre biosolids nitrogen over two years produced similar yield and nitrogen recovery as 300 lb/acre ammonium nitrate applied to perennial ryegrass. Our data suggest that in the short run, even higher application rates are beneficial, as biosolids nitrogen rates as high as 1660 lb/acre over two years increased yields and nitrogen uptake without increasing residual soil nitrate. We do not know if these rates can be sustained over the long term.

Significance

This work demonstrates that heat-dried and dewatered biosolids are effective nitrogen sources for forage production. Forage grass can use large amounts of biosolids nitrogen under intensive management. At low levels of forage management biosolids nitrogen application must be lower.

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