BIOSOLIDS RECYCLING research notes

NORTHWEST BIOSOLIDS MANAGEMENT ASSOCIATION

Biosolids as a Nutrient Source for Dryland Wheat

Researchers and Collaborators

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Background

Dryland wheat is an excellent crop for beneficial reuse of biosolids in the Pacific Northwest, because: 1) risk of runoff or public contact with pathogens is low, 2) metal uptake is small at agronomic application rates, 3) wheat has a deep root zone that can capture some deep-moving nitrate, and 4) a large land base is available. Wheat farmers have become interested in biosolids because they are an inexpensive form of nitrogen, and farmers perceive potential additional benefits from the organic matter in biosolids. Nitrogen is usually the key nutrient for determining biosolids application rates. Biosolids producers, farmers, and regulators need good estimates of biosolids nitrogen availability to develop sustainable biosolids management. We conducted the research described in this fact sheet between 1992 and 1995.

Objectives

Our objectives were to determine the availability and downward movement of biosolids nitrogen applied to soft-white winter wheat grown in a crop-fallow rotation and make practical recommendations for biosolids nitrogen management.

Methods

We established biosolids on-farm tests at three sites in the 9 to 12 inch rainfall zone of the Columbia Plateau of Washington, where wheat fallow is the main cropping system. We used large (700 to 1,000-ft-long) plots to allow farmers to carry out normal field activities. We applied 2 to 3 rates (3 to 10 dry tons/acre; 257 to 853 lb total nitrogen/acre) of dewatered (21 to 30 percent solids) biosolids at the beginning of the fallow cycle, and compared biosolids treatments with aqua or anhydrous ammonia, and with fertilized controls. Measurements included grain yield, grain protein, and nitrogen uptake, along with straw yield and nitrogen uptake, and flag leaf nitrogen concentration. We also measured plant-available nitrogen in the soil during the fallow, after harvest, and during the second fallow. Soils were sampled to a depth of six feet where possible to observe nitrogen levels throughout the soil profile.

Results

Nitrogen availability from biosolids was dependable and consistent in the 3 sites, despite differences in environment among the sites. We found that 29 percent of the biosolids nitrogen was in available form by the end of the summer fallow, compared with a predicted availability of 26 to 31 percent, using EPA estimates. More nitrogen became available during the crop year. The lowest rates of biosolids used in this study provided enough nitrogen for peak yields, with variable increases in protein and residual soil nitrate. Drawbacks to higher rates were reduced crop yield (from water stress) and quality (from increased protein), and increased risk of nitrate movement below the root zone. Under the conditions of this study, agronomic rates appear to be lower than the lowest rates (257 to 330 lb/acre) that we applied. Evaluation of lower biosolids rates (100 to 300 lb/acre total nitrogen) will be valuable in refining biosolids application recommendations for soft-white winter wheat in a dryland fallow rotation.

Significance

Low rates of biosolids seem to provide the most practical benefits for wheat production, by reducing agronomic and environmental risks, and spreading benefits over a larger acreage of farmland. In Douglas County, where biosolids are available at a cost of $1 per wet ton (including application), demand for biosolids now exceeds supply. In 1992, three farmers received biosolids. By 1995, 75 wheat farmers had signed up to become part of the biosolids program.

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