BAHIAGRASS FORAGE PRODUCTION AND QUALITY AS AFFECTED BY MUNICIPAL BIOSOLIDS

R.M. Muchovej [1] and J.E. Rechcigl [2]

[1] University of Florida, IFAS, SWFREC, P.O. Drawer 5127, Immokalee, FL 33934

[2] University of Florida, IFAS, RCREC, Rt. 1, Box 62, Ona, FL 33865

ABSTRACT

Production of biosolids has been increasing consistently in the last few years. Land application of wastes is being regarded as an alternative means of disposal and as a source of inexpensive fertilizer material. Pastures are particularly attractive in this regard since the areas occupied are extensive and large amounts of fertilizer are required for adequate production. The objective of this study is to investigate the effects of various rates of biosolids on bahiagrass yield and quality. Forage samples were collected from each plot from April to December. Significant increases in dry matter production, crude protein content and in vitro digestibility were obtained for both years of biosolids application. A small residual effect of the treatments applied in the first year is verified during the second year. Sporadic increases in plant and soil metal contents are not substantial to yield environmental concerns, even with the higher rates of biosolids.

KEYWORDS

sewage sludge, *Paspalum notatum*, yield, crude protein, IVODM, digestibility

INTRODUCTION

Disposal of large quantities of wastes, including biosolids, has become a major problem facing societies worldwide as a consequence of population increases and urbanization. Biosolids can be applied to agricultural land to help improve soil physical properties (e.g., water retention, infiltration, aggregate stability) as well as the chemical characteristics (e.g., cation exchange capacity and plant nutrient status) (Hue, 1995).

Pasture grasses are normally under fertilized and are desirable targets for biosolids utilization. The use of livestock as an intermediate consumer of crops subjected to waste application may alleviate potentially toxic trace element effects to humans. A "typical" nutrient composition of biosolids is 3.2% N, 1.4% P. 0.2% K, 2.7% Ca, 0.4% Mg and up to 5% Fe (Hue, 1995). Based on this composition, these materials can be used as low grade N and P fertilizer and also a source of Ca, Mg, and Fe. Iron deficiencies in sorghum and barley have been corrected by biosolids (McCaslin and O'Connor, 1985; McCaslin et al., 1986).

In Florida there are currently over 5 million hectares of pastures that require fertilization. Of these, 2 million are planted with bahiagrass *(Paspalum notatum* Flugge). Most of the grasslands show signs of N and Fe deficiencies. Additions of both N and S have been shown to increase yield and protein content of bahiagrass in Florida spodosols dramatically (Sveda et al., 1992).

The objective of this field study was to investigate the effects of municipal biosolids on bahiagrass yield and quality.

MATERIALS AND METHODS

The study was set up on an established Pensacola bahiagrass pasture growing on Myakka fine sand at the Range Cattle Research and Education Center, in Ona, Florida. The pH of the soil is approximately 5.0 and no liming corrections were made. Treatments were applied in April, 1994 and in March, 1995 and consisted of 7 rates (0, 0.55, 1.1, 2.2, 4.4, 8.8 and 17.6 Mg/ha) of surface-applied granular biosolids. In addition to the absolute control (0 kg sludge), positive control plots received 180 kg N/ha, as Ammonium Nitrate and 180 kg N/ha, as Ammonium Sulfate. Treatments were applied on 6m x 3m plots and were arranged in a randomized complete block design, with 4 replications. The residual effect of sludge is also being investigated. Additional plots were established for this purpose.

Forage was harvested to a 5.0 cm height at approximately every 35 d from Spring (April) to Fall (December) each year, for yield, crude protein and IVODM determinations. The digestions were performed at the Research Center and the extracts were analyzed by the Analytical Research Laboratory, the Animal Nutrition Laboratory and the Forage Research Laboratory, from the University of Florida, in Gainesville. The values for crude protein content were obtained by multiplication of the total Kjeldahl N concentration by a factor of 6.25.

The amount of nitrogen recovered in the forage was calculated upon comparison of these values for N recovered in the forage against the amount of N added in the various amendments (biosolids or soluble fertilizers).

RESULTS AND DISCUSSION

Bahiagrass forage yields increased in a linear fashion with increasing rates of biosolids (Table 1). Crude protein was increased to values above those obtained with the soluble N sources especially with the higher rates of biosolids (Table 1).

Nitrogen recovery rates reached values higher than 75% for the lowest biosolids rate. Increasing rates resulted in greater N concentration and accumulation in the forage but comparatively lower recovery rates were verified (Table 1). Similar findings have been reported in the literature for N recovery by Pensacola bahiagrass in response to N fertilizer rates (Wilkinson and Langdale, 1974) . Over 50% of the N present in the biosolids was contained in the plant tops in the first year, and most of this N was removed within the first month after application. Thus, it would appear that the rate of N mineralization from biosolids is rather high in the first few months after application.

Increased forage digestibility was verified at the time of the first harvest with increasing rates of biosolids (Table 1). As time progressed, increases in IVODM were still observed with the highest rate of biosolids. This may be specially important in the later summer and fall since forage digestibility is usually reduced with plant maturity.

Plant and soil metal (Cu, Zn, Mn, Fe, Mo, Pb, Cd, and Ni) contents were not altered substantially to yield environmental concerns, even with the higher rates of biosolids.

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Table 1
Total yield (five harvests), crude protein, N recovery, and *in vitro* digestibility of bahiagrass forage as affected by biosolids and nitrogen fertilizers

Biosolids	Yield	Crude Protein (%)	N Recovery (%)	IVODM(%)		
Mg/ha	Mg/ha	June	July	June-December	June	July
0	9.5	9.19	7.88	-	49.1	47.8
0.55	10.3	9.25	8.34	77.4	49.1	47.5
1.1	11.4	9.69	7.94	54.8	50.6	47.6
2.2	11.6	9.81	7.88	42.0	51.1	47.4
4.4	15.5	12.0	8.19	52.9	53.4	47.0
8.8	17.8	13.13	8.44	40.6	56.4	48.8
17.6	20.4	14.94	11.62	31.8	58.1	57.7
AN [1]	16.6	11.75	9.88	83.5	51.7	48.3
AS [2]	14.3	11.75	7.69	51.2	52.0	47.2

[1] AN=180 kg N as Ammonium Nitrate; [2] AS=180 kg N as Ammonium Sulfate