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The XX International Grassland Congress took place in Ireland and the UK in June-July 2005. The main congress took place in Dublin from 26 June to 1 July and was followed by post congress satellite workshops in Aberystwyth, Belfast, Cork, Glasgow and Oxford. The meeting was hosted by the Irish Grassland Association and the British Grassland Society.

Proceedings Editor: D. A. McGilloway

Publisher: Wageningen Academic Publishers, The Netherlands

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Effect of applied biosolids to bahiagrass pastures on copper status of cattle

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Keywords: biosolids, bahiagrass, copper deficiency, cattle

Introduction When grazing ruminants consume forages high in Mo but adequate in S, there is a risk of molybdenosis (a Mo-induced Cu deficiency). This occurs when Mo, S, and Cu join to form Cu-thiomolybdate complexes in the rumen that are not readily absorbed (Suttle, 1991). High dietary S reduces Cu absorption, possibly due to unabsorbable Cu sulphide formation, independent from its part in thiomolybdate complexes. The use of municipal sludge (biosolids) as a pasture fertiliser is of interest since some contain high Mo which may induce Cu deficiency. The objective of this study was to evaluate the performance and Cu status of cattle grazing pastures fertilized with biosolids.

Materials and methods Angus yearling steers (n = 96) were randomly assigned to bahiagrass (*Paspalum notatum* flugge) pasture (n = 32) treated with three high Mo-containing biosolids varying in mineral content for 151 d and evaluated for Cu status. Soils were well drained and acid (pH 5.0 to 5.8). The biosolids are classified as high quality and originated from Tampa and Largo, Florida and Baltimore, MD. Copper concentrations of biosolids varied from 431 to 989 pm and Mo from 12 to 60 ppm. Biosolids and NH_4NO_3 (control) fertiliser were applied to 0.81-ha pastures at a rate of either 179 kg N/ha (X) or 2, 3 and 6 X, for a total of six treatments. The treatments were control, L1x, L2x, B3x, B6x, T3x and T6x. There were three animals per pasture with from four to six replicates of treatments. One of three steers of each plot received a 3-ml subcutaneous injection of Cu glycinate (60 mg Cu/ml).

Results Weight gains were independent of treatments, and did not reflect potential Cu deficiencies. Forage Cu was low (5.0 to 8.0 ppm), Mo was low (<1.0 ppm) and S was high (0.4 to 0.45%). Forage Cu was less than NRC requirements of 10 ppm (McDowell, 2003) at termination. Mean liver Cu concentration for control animals was 110 ppm, compared to mean range of 29 to 83.4 ppm for biosolids treatments (Table 1). Plasma Cu was likewise less than control animals. Liver Cu was dramatically higher (<0.001) for Cu glycinate treatments.

Table 1 Plasma and liver concentrations as affected by biosolids treatments

	Liver Cu (ppm, DM)		Plasma Cu (μg/ml)	
Treatments[a]	Day 1	Day 151	Day 1	Day 151
Control 1X	84.2 ± 37.9	110.6 ± 33.6[cde]	1.21 ± 0.08[bc]	0.68 ± 0.09[c]
Largo 1X	86.0 ± 43.8	63.2 ± 38.8[cd]	1.13 ± 0.09[b]	0.55 ± 0.11[bc]
Largo 2X	80.9 ± 43.8	83.4 ± 38.8[cd]	1.17 ± 0.09[bc]	—
Baltimore 3X	69.5 ± 33.9	61.8 ± 30.1[cd]	1.37 ± 0.07[bcd]	0.47 ± 0.08[bc]
Baltimore 6X	84.5 ± 33.9	40.3 ± 30.1[bc]	1.29 ± 0.07[bcd]	0.50 ± 0.08[bc]
Tampa 3X	105.3 ± 31.0	29.0 ± 27.5[b]	1.32 ± 0.07[bcd]	0.37 ± 0.08[b]
Tampa 6X	87.5 ± 31.0	41.0 ± 27.5[bc]	1.29 ± 0.07[bcd]	0.51 ± 0.08[bc]

[a]Data represent treatment means and standard errors. Means with different superscripts are significantly different at P<0.05

Conclusions Pastures treated with high Mo containing biosolids resulted in a decline of Cu status of steers. The decline in Cu status was not due to Mo, but most likely from low forage Cu (<6 ppm) and high forage S (> 0.4%).

References

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