Use of Poultry Litter, Swine Mortality Compost, and FGD Gypsum on Reclaimed Mine Soil in Mississippi

J.J. Read, A. Adeli, D.J. Lang, K.D. Jones, and N.R. McGrew

Abstract: Knowledge of soil and plant responses to animal or industrial byproducts is needed for effective use of these potential amendments on reclaimed mine soils. This 4-yr study compared four treatments of 896 kg ha\(^{-1}\) NPK fertilizer (13-13-13), 22.4 Mg ha\(^{-1}\) poultry litter, 22.4 Mg ha\(^{-1}\) swine compost, and poultry litter combined with 11.2 Mg ha\(^{-1}\) FGD gypsum at a surface lignite mine in northeast Mississippi. Treatments were applied to plots (3.7 x 12.2 m) of common bermudagrass in May and August each year. In 2013 and 2014, leachate water was sampled periodically at 60-cm depth from one lysimeter per plot. Experimental design was a randomized complete block with three replicates. In the analysis across years, forage yield was affected (P<0.01) by the year by treatment interaction, but ranking of treatments was similar each year and values averaged greater in poultry litter than swine compost (6.47 vs. 3.37 Mg ha\(^{-1}\)). This response is credited to additional N, P, and K in poultry litter, as well as more C (approximately 35% in dry matter). In general, forage yield did not differ between poultry litter and standard NPK fertilizer treatment, which provides no organic matter. As compared to litter alone, co-application of FGD gypsum reduced soil bulk density by 9% and organic matter by 21%, and increased cation exchange capacity by 9% and soluble salts from 0.25 to 0.83 mmhos cm\(^{-1}\). Among litter-amended plots, somewhat greater forage yield in 2013 than 2014 (4.8 vs. 4.3 Mg ha\(^{-1}\)) was associated with low leachate P content of 51 x 10\(^{-6}\) g on 18 June and 16 x 10\(^{-6}\) g on 25 July 2013, as compared with 130 x 10\(^{-6}\) g in June and 97 x 10\(^{-6}\) g in July 2014. Applying poultry litter improved plant growth and soil quality parameters in a respread area.

Additional Key Words: bermudagrass, fertilizer, leachate, manure, organic matter, respread soil.

1. Poster paper presented at the 2018 National Meeting of the American Society of Mining and Reclamation, St. Louis, MO: The Gateway to Land Reclamation, June 3 - 7, 2018. Published by ASMR; 1305 Weatherweave Dr., Champaign, IL 61821.

2. John J. Read, Research Agronomist, USDA-ARS, Crop Science Research Laboratory, 810 Hwy 12 E, Mississippi State University, Mississippi State, MS, 39762; Ardeshir Adeli, Research Soil Scientist, USDA-ARS, Crop Science Research Laboratory, 810 Hwy 12 E, Mississippi State University, Mississippi State, MS, 39762; David J. Lang, Professor, Plant and Soil Sciences Department, Mississippi State University, Mississippi State, MS, 39762; Keri D. Jones, Extension Associate III, Plant and Soil Sciences Department, Mississippi State University, Mississippi State, MS, 39762; N. Rebecca McGrew, Environmental Manager, North American Coal Corporation, Red Hills Mine, Ackerman, MS

3. Work reported here was conducted near 33° 18’ N; 88° 0’ W.