Research Briefs: Sustainable Management of Nutrients in Forage-Based Pasture Soils: Effect on Animal Congregation Sites

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Purpose

Grazing animals have a dominant effect on the movement and utilization of nutrients through the soil and plant system, and thus on the fertility of pasture soils. Grazing can accelerate and alter the timing of nutrient transfers, and increase the amount of nutrients cycled from plant to soil. Long periods, position of shade, and water resources for grazing cattle can influence the spatial distribution of soil biochemical properties including soil organic carbon (C), total inorganic nitrogen (TIN), and phosphorus (TP). Our reason for conducting this study is to test whether cattle congregation sites typical on most Florida ranches, such as mineral feeders, water troughs, and shade areas are more nutrient-rich and may contribute more nutrients to surface and groundwater supply than in other pasture locations under Florida conditions.

Recent Activities

Baseline soil samples around the congregations sites (mineral feeders, water troughs, and shades) in established (>10 yr), grazed beef cattle pastures were collected. Soil samples were collected (0-20 cm) at different locations around the congregation sites following a radial (every 90 degrees) sampling pattern at 0.9, 1.7, 3.3, 6.7, 13.3, 26.7, and 53.3 m from the approximate center of mineral feeders, water troughs, and shaded areas. Prior to about 1988, pasture fields were fertilized in the spring with 90 kg N ha^{-1}, and 45 kg K_2O ha^{-1}. Pastures in STARS were managed for grazing in the spring until July followed by haying in late summer/early fall of each year.

What We Have Learned

The levels of soil TIN and TP were significantly affected by the interaction of congregation sites and distance away from the center of the sites. Mineral feeders had the highest concentration of TP followed by shades and water troughs. The higher soil TP near and around the mineral feeders can be attributed to the presence of phosphorus in the supplemental feeds. The average level of soil TP in the mineral feeders of 34.05

± 0.44 mg kg^{-1} was not high enough to be of environmental concern. Losses of soil phosphorus by overland flow are becoming a big concern when the concentrations for soil phosphorus exceeded 150 mg kg^{-1} in the upper 20 cm of soils. With TN, the shaded sites (3.42 ± 0.17 mg kg^{-1}) had either higher levels than the mineral feeders (0.72 ± 0.06 mg kg^{-1}) or water trough (1.01 ± 0.08 mg kg^{-1}) sites. Higher TIN content at the shade sites may have been more likely due to frequent urination of animals and lack of vegetation immediately adjacent to shades. The lack or total absence of vegetation within and/or near the shades then had no uptake mechanism for removal of inorganic nitrogen, unlike the heavy demand for inorganic nitrogen by bahiagrass in other areas of the pasture. An accumulation of TIN immediately adjacent to shades could lead to a potential point source that would be susceptible to leaching or gaseous losses to the environment.

Why is This Important?

Early results of the study are suggesting that cattle congregation sites may not be as nutrient-rich as previously thought, therefore may not contribute more nutrients to surface and groundwater supply under Florida conditions. If the sites at STARS can be assumed to mimic those of commercial producers, then they probably are not a source of nutrients to pollute surface and ground water supply.

For More Information

Sigua, G. C. and S.W. Coleman. 2007. Sustainable management of nutrients in forage-based pasture soils: effect of animal congregation sites. J Soils & Sediments 6(4): 249-253.

Sigua, G. C., M.J. Williams, and S.W. Coleman. 2006. Long-term effects of grazing and haying on soil nutrient dynamics in forage-based beef cattle operations. Journal of Sustainable Agriculture 29(3):115-134.

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