Evaluating the agronomic and environmental impacts of new FL-DEP biosolids rule

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Biosolids represents a viable alternative to supply nutrients and organic matter to perennial pastures while also reducing dependence on inorganic fertilizer. Recycling biosolids in perennial pastures is also an environmentally sound option of disposal as it reduces landfill space demand and minimizes human exposure to various contaminants. Although biosolids have clear agronomic benefits, public concerns over nutrient accumulation in soils and subsequent impacts on water quality have led to stricter policies that will severely limit land application of biosolids in Florida. On July 1, 2022, the proposed amends chapter 62-640, F.A.C. rule became effective. This new biosolids rule included provisions that require a new land application site permit or permit renewal issued after July 1, 2020, to: 1. Ensure a minimum unsaturated soil depth of 2 feet at the time of biosolids application; 2. Prohibit biosolids application in sites with a seasonal high water table within 6 inches of the soil surface; and 3. Require biosolids sites to enroll in FDACS Best Management Practices program.

The new biosolids rule is expected to significantly reduce land application of Class B biosolids in Florida and will result in the loss of a valuable resource. Current application sites may not comply with the seasonal high-water table requirements or may cease biosolids application. Ranchers who have historically relied on biosolids as the main source of fertilizer will have to either seek out other fertilizer options or supplement biosolids application with inorganic fertilizer. In most circumstances, reduced (P-based) biosolids application rates may not be practical or economically feasible for farmers and will still require water quality monitoring. Replacing biosolids with inorganic fertilizer may also result in other unintended consequences such as increased operational costs and greater environmental risk of nutrient losses. More Class B biosolids are expected to be disposed in landfills, which also poses a threat to the environment.

To address these concerns, a field study was designed to evaluate the impacts of new FL DEP biosolids rule on bahiagrass responses, soil health, and water quality. Based on the new Rule 62-640, Florida Administrative Code, biosolids have to be applied at reduced rates (to meet crop P requirements). Reduced biosolids application (P-based rates) will likely not supply adequate amounts of N and other essential nutrients. New biosolids regulations also require water quality monitoring when annual P application rates exceeds 40 lb P_2O_5 A^{-1}. Our hypothesis is that biosolids application will result in no significant impact on water quality but reduced (P-based) rates will reduce bahiagrass production and nutritive value. This specific study was the main subject of Leandro Vieira-Filho PhD project. Leandro is

completing his PhD program this summer and the results will be disseminated via peer-reviewed and extension/outreach publications in the upcoming months.

Ona Field Trial Results

The study was conducted from 2020 to 2022. Treatments consisted of 2 fertilizer sources (biosolids and inorganic N and P fertilizer) applied at 3 levels: 40 lb P_2O_5 A^{-1} yr^{-1} (low), 80 lb P_2O_5 A^{-1} yr^{-1} (intermediate), 120 lb P_2O_5 A^{-1} yr^{-1} (high). Phosphorus application rates were based on new DEP biosolids regulations (maximum application rate of 113 lb P_2O_5 A^{-1} $yr^{-1}$and soil characteristics). Biosolids and commercial fertilizer were land applied in spring of each year and forage, water, and soil responses have been monitored throughout the 3-yr study.

Data demonstrated that new biosolids rule in FL detrimentally impacted bahiagrass production and nutritive value. Results showed that biosolids was an effective alternative source of N and P to replace inorganic fertilizer; however, reduced biosolids application imposed by new biosolids rule negatively affected bahiagrass production, nutritive value, and N and P accumulation in aboveground tissue. Bahiagrass annual herbage accumulation observed in the current study (ranging from 1900 lb A^{-1} in 2022 to 6200 lb A^{-1} in 2020) was 33 to 80% less than previously published data. This was due to the fact that reduced biosolids rates did not supply adequate amounts of N and P to sustain adequate forage production.

Water quality data also supports our initial hypothesis that reduced biosolids application rate did not positively affect P and N leaching. Regardless of the P rate or source, in the majority (77%) of the sampling events, leachate P concentrations were below the detection limit of 0.025 mg L^{-1} (596 out of 777 leachate samples). Low leachate P concentrations indicates negligible risks of offsite P movement. However, inorganic fertilizer resulted in slightly greater leachate NO_3-N than biosolids and control. The lack of biosolids application rate effect on leachate P and N indicates that reduction in biosolids imposed by the new regulation will likely have no positive impact on water quality. Data demonstrated that biosolids can be an environmentally sound fertilizer source to perennial grass pastures. Biosolids can also provide a steady source of nutrients that is expected to provide agronomic benefits such as increased forage productivity and nutritive value relative to unamended soils.

Summary and Conclusions

Bahiagrass pastures represent the major cropping system for biosolids recycling in Florida, but multi-year **field** data to support the sustainability and safety of the practice are scarce. Most previous studies were conducted in greenhouses or laboratories. The agronomic and environmental impacts must be demonstrated in the field to credibly promote environmentally-sound biosolids land application in pasture systems. The current experimental area offers a unique scenario where science-based information regarding the benefits and risks of land application of biosolids can be generated and disseminated. In addition to the research component, the site has also been utilized for educational purposes. As result of this project, 2 PhD and 3 undergraduate students have been trained. Results have also been disseminated though peer-reviewed articles (total of 7 as of now) and extension publications. However, the ability of biosolids to restore and protect soil functions needs further attention. We will continue our research efforts on evaluating and disseminating nutrient management programs that increase forage productivity while also providing ecosystem services such as soil organic matter accumulation, carbon sequestration, and soil and water quality preservation. More recently, we expanded the research scope of this project

to address concerns regarding the potential contamination with per- and polyfluoroakyl substances (PFAS) following biosolids application.

For any questions regarding this project, please contact Maria Silveira, Professor in Soil and Water Science at the UF/IFAS Range Cattle REC (Email: mlas@ufl.edu).

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