**Beyond the Barnyard: Optimizing Nutrient Efficiency in Colorado's Dairy Production Through Precision Manure Management with NIRS Technology**

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Manure fertilizer from dairy production creates environmental impacts on many levels, but of specific concern are the environmental impacts from nutrient losses that occur from application of manure fertilizers. In Colorado, current gaps exist in managing nutrients from livestock manure systems, instating a need for evaluating how to address these gaps and efforts to mitigate them. With my research, I aim to do so through the use of near-infrared-reflectance (NIRS) technology. The HarvestLab3000 by John Deere is a commercial NIRS sensor available to manure handlers and livestock producers. It can be used to predict manure dry matter, organic matter, total nitrogen, ammonium, phosphorus, and potassium. This system provides on-the-go nutrient analysis of manure fertilizers to adjust application rates in real time and better meet plant and soil needs. The driving question behind my study ishow can using manure sensors improve the environmental impacts from manure fertilizers in Colorado? To answer this question I am using a mixed methods approach that couples quantitative and qualitative methods of data collection and analysis. The objectives of my study are 1) compare ammonia losses from manure application with and without NIR manure sensors with those of the most common CO manure management practices, 2) evaluate the impact of manure application with and without NIR manure sensors on soil N dynamics and key soil health parameters (*e.g.*, bulk density, soil organic carbon, aggregate stability, electrical conductivity, and soil microbial communities), 3) compare the impact of manure application with and without manure sensors on crop yield and quality, 4) complete an economic analysis of dairy manure application with and without the use of manure sensors, 5) hold focus groups with different stakeholder groups in Colorado necessary to successful adoption of more sustainable nutrient management practices, and 6) work with collaborative groups in at the academic and governmental level to establish a manure nutrient shed in Northern Colorado. Ultimately, my aim with this research is to aid producers in honoring their roles as stewards of the lands and environment while supporting their economic and production goals. The results of this study will help drive decisions that support industry needs while facing changes to environmental regulation.