FROM THE GROUND UP: A FARMER-LED ON-FARM RESEARCH EVALUATING THE POTENTIAL OF A NEW FERTILIZER SOURCE FOR NITROGEN IN PASTURES FOR MISSOURI

K. Deep[1], C. Roberts[1], G. Singh[1], J. Vredenburgh[2]
[1]University of Missouri, Columbia MO
[2]Ohio State University, Columbus OH

ABSTRACT

This research is a part of a transdisciplinary network of farmers leading on-farm research and innovation groups across Missouri, where farmers are leading the design and implementation of nitrogen (N) fertilizer treatments. The Objective of this on-farm research trial in southwest Missouri is to determine whether green lightning fertilizer technology can fulfill the N requirement of pasture in a more economical and sustainable way than the conventional sources of N.

The cost of N fertilizer is one of the important factors in the overall profitability of forage production in Missouri. Nitrogen fertilizer alone could cost 8-10% of the total operating cost for pasture establishment in Missouri. Most N fertilizers are susceptible to loss through volatilization and leaching, which could also reduce the return on investment for growers with pastureland. Almost all the fertilizer made today relies on the Haber–Bosch process for ammonia synthesis, which has a significant environmental impact. Green lighting fertilizer is based on the concept of synthesizing N-based fertilizer through humid air using plasma in a sustainable way.

The pasture plots were treated with green lighting fertilizer (20-gal ac^{-1}), a product that the manufacturer claims contain nitrate, ammonium nitrate (40 lbs N ac^{-1}), Super-U (40 lbs N ac^{-1}), and a no-N fertilizer control plot. Baseline soil sampling was done in each plot for the soil fertility analysis before the treatments were established. The treatments were applied in last week of March 2025, and all fertilizer sources were applied using a utility drone. Forage yield and quality data were collected in April and May 2025. The N treatments will be applied for the next three years, and forage sampling will continue to document any significant changes between pasture plots.

In April, there was a significant difference in yield between green lightning fertilizer and conventional fertilizer treatments ($p = 0.0021$), and a marginal difference between green lightning and the control treatment ($p = 0.0548$). Green lightning produced a 20.6% lower yield than the control, 32% lower yield than ammonium nitrate, and 39.4% lower yield than urea in April. In the May forage biomass sampling, the only significant difference was between green lightning and conventional fertilizers, where green lightning produced 28.2% lower yield than ammonium nitrate and 33.5% lower yield than Super-U. Technical issues with the machine during the first application may have limited nitrate production,

and nitrogen was below detectable levels in the GL fertilizer, possibly explaining the lower forage yield.