

# Micro-Plot Research and Demonstration of Forage Nutrient Management in Arkansas

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## Introduction

Fertilizer management is often the greatest expense in forage production, and update research is limited. A major reason for limited research availability is due to the challenges of conducting applied research statewide, in a manner that is efficient and applicable to producers, agents, and researchers alike. Most research requires specific management, large areas of producer land, and often requires a large workload and specialized equipment. Additionally, the added costs associated with fertilizer management research is a barrier for large-scale on-farm research. Therefore, a method is needed to conduct statistically sound research that also demonstrates management needs and has limited negative impacts on producer operations.

## Objective

Develop micro-plot research trials for conducting statewide research in forage nutrient management to reduce the limitations of cost, labor, timing, and impact to producer-owned operations.

## Materials and Methods

- Three research objectives were identified for statewide assessment through on-farm replicated research in warm season grasses.
  1. Evaluate the influence of Nitrogen application rate on forage biomass production.
  2. Evaluate the influence of Sulfur application rate on forage biomass production.
  3. Evaluate the influence of Nitrogen stabilizers on forage biomass production.
- Micro-plot research trials were designed using a Latin-squared research design, where the number of treatments and replications are equal.
- Individual plot size was limited to 5 foot wide by 5 foot deep, no alleyways or buffer zones were used between plots or replicates, resulting in the largest area used per objective being 25 foot by 25 foot.
- Protocols were developed outlining methods, treatments, and data collection.
- Treatments were assigned based on the specific objective as follows:
  1. 5 Nitrogen rates: 0, 25, 50, 75, 100 lb Nitrogen/acre.
  2. 4 Sulfur rates: 0, 10, 20, 40 lb Sulfate/acre
  3. 4 Nitrogen stabilizer treatments: None, NBPT, NBPT<sup>†</sup> + Duromide, NBPT<sup>†</sup> + DCD<sup>‡</sup>.  
<sup>†</sup>N-butyl thiphosphoric triamide, <sup>‡</sup>Dicyandiamide
- Research protocols, pre-weighed fertilizer products, data collection sheets, and clippers for harvesting biomass were offered to agents interested in conducting the micro-plot trials.
- Plots were established on producer-owned operations in areas with high visibility.
- Treatments were applied following the procedures outlined in the provided protocol.
- Data collection occurred approximately 30 days after applications by clipping biomass from a 1 square foot area from each plot, weighing each collected sample, and air drying 5 samples for 7 days for moisture content for yield correction.
- Collected data was analyzed using proc GLM in SAS 9.4, data was compiled, analyzed, interpreted, and results collated by the soil fertility extension specialist.
- Research reports of statewide results were provided to each county for use in demonstration booklets, at county production meetings, and other outreach opportunities.

## Results



Picture 1. Clipper and quadrat used for harvest

8 Counties conducted the nitrogen rate trial →  
11 producer-owned locations →  
Results were similar across locations →  
Nitrogen application is often more →  
important than the rate.

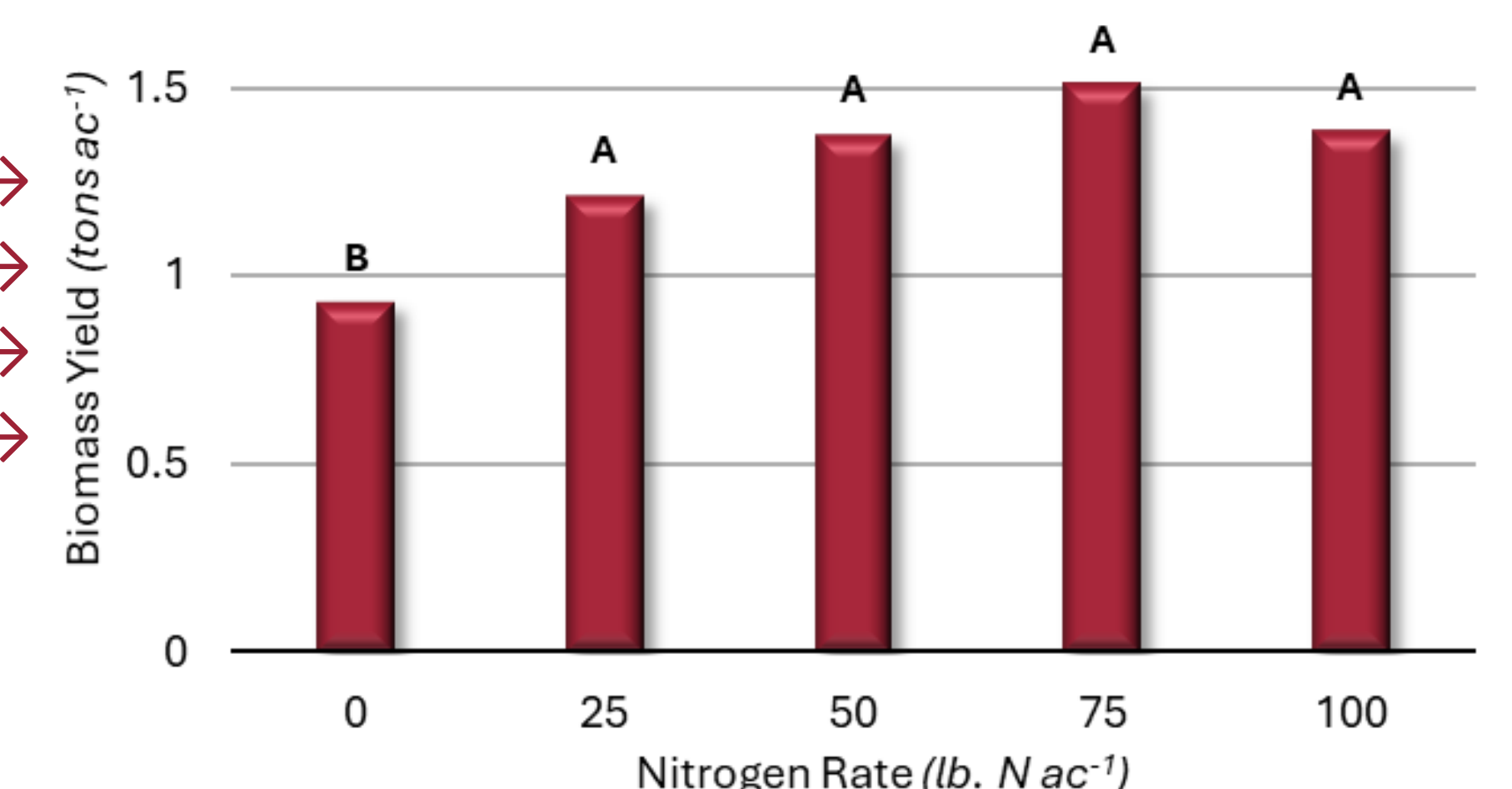


Figure 1. Average air-dry forage yield (tons/ac) by nitrogen application rate across all locations. Letters represent statistical differences, where treatments with the same letter are not different.

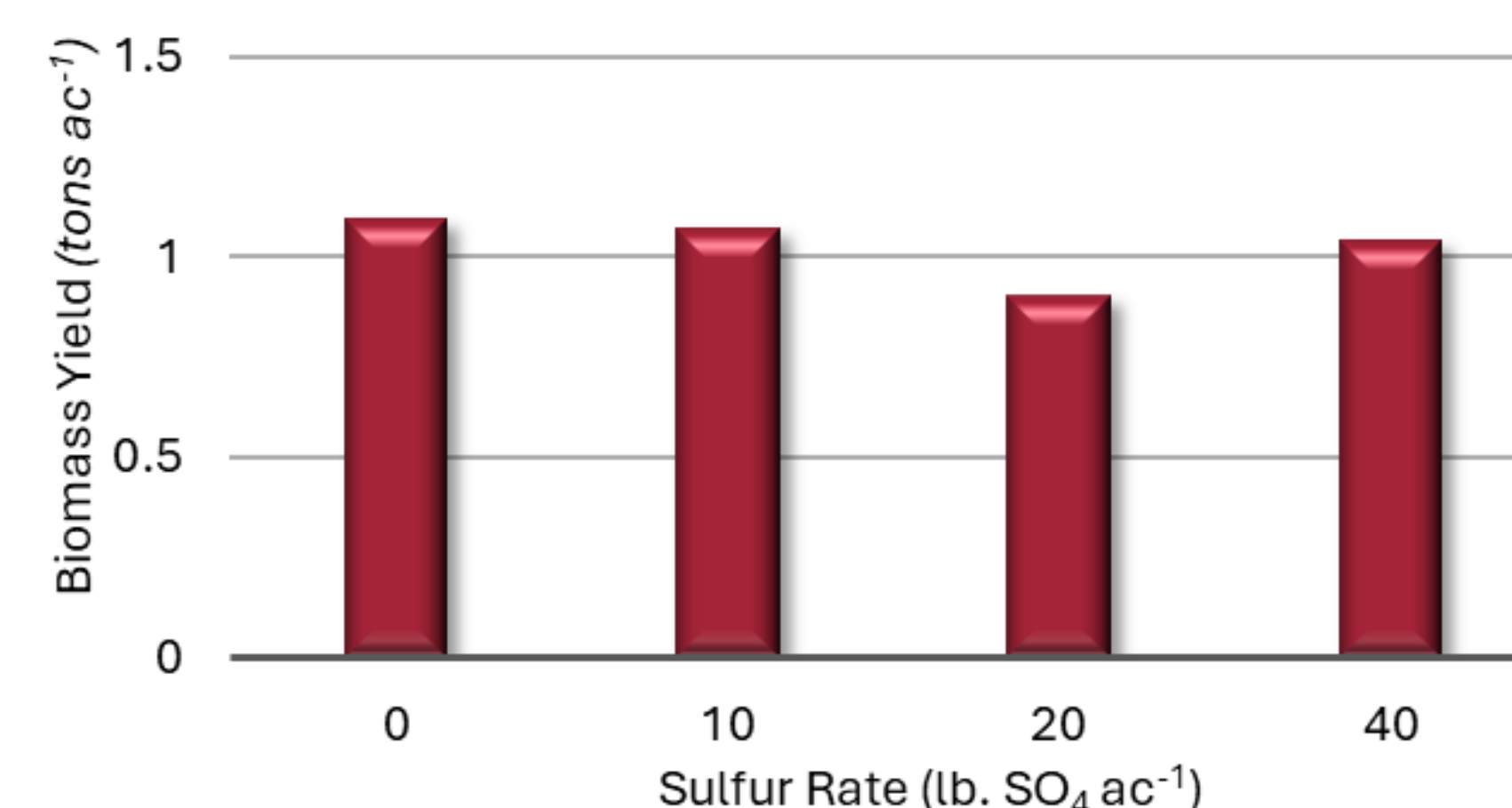


Figure 2. Average air-dry forage yield (tons/ac) by sulfur application rate across all locations

←5 Counties conducted the sulfur rate trial  
←6 producer-owned locations  
←All locations met soil test requirements for an application of sulfur  
←Sulfur application did not impact biomass yield production



Picture 2. Trial in Lafayette county showcasing proximity to local road.



Picture 3. Harvest at the Univ. of Arkansas at Monticello Farm

6 Counties conducted the Nitrogen stabilizer trial →  
7 producer-owned locations →  
Nitrogen stabilizers did not improve biomass yield production →  
Precipitation after application reduced the need for N stabilizers. →

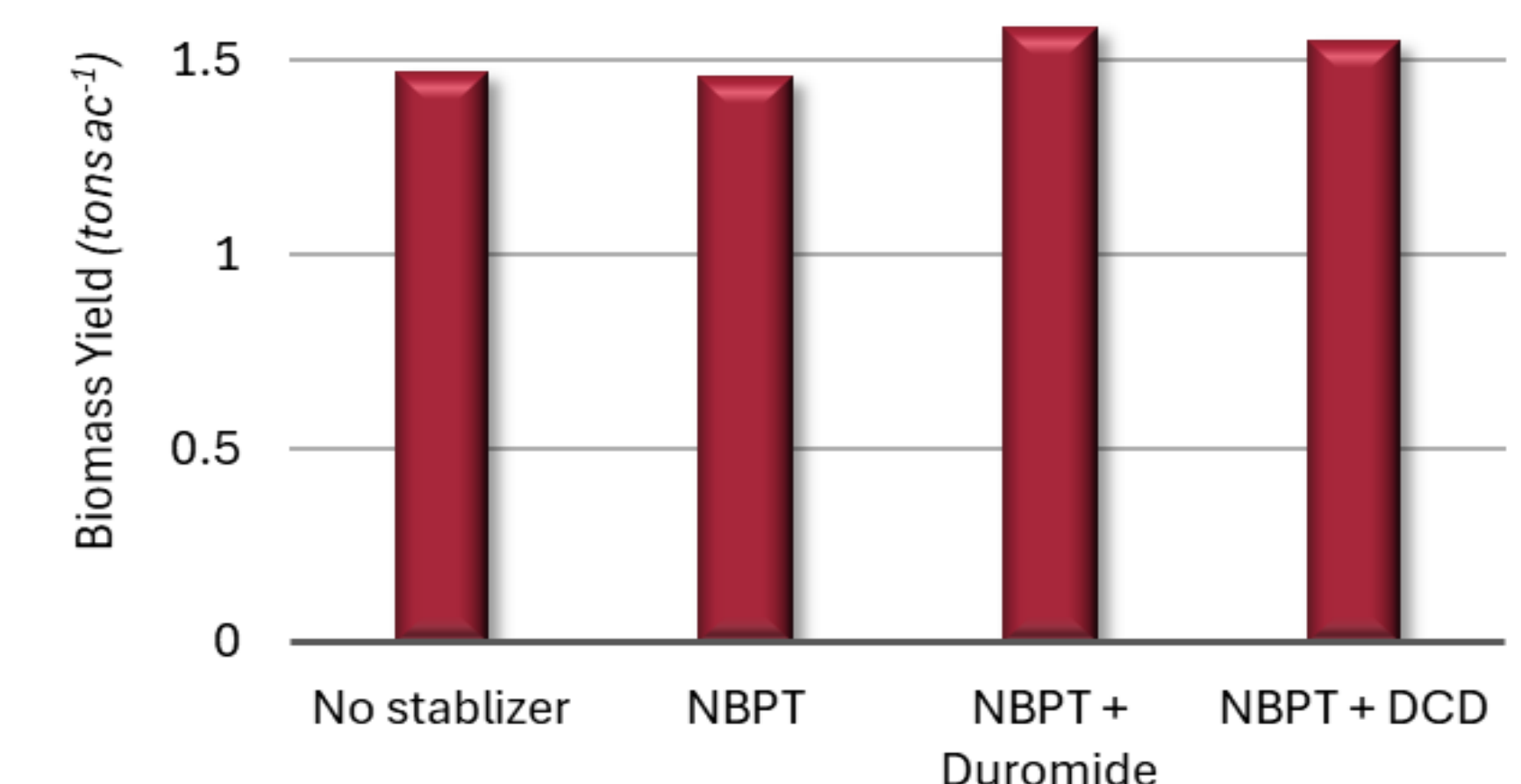


Figure 3. Average air-dry forage yield (tons/ac) by nitrogen stabilizer treatment across all locations

## Summary

### Research Results

- Nitrogen application showcases the need to apply nitrogen, while also demonstrating and supporting current nitrogen rate recommendations.
- Sulfur application rate did not improve short-term biomass production. More research is needed to identify the impact of sulfur management for forage production.
- Nitrogen stabilizers were not impactful as all locations received timely rainfall that reduced the potential need. More research is needed to identify responses during dry conditions.

### Positive Impacts

- Agents reported an increased understanding of research, recommendations, and confidence in making fertilizer recommendations to forage producers.
- Producers reported visual differences compared to producer management showcasing a need for fertilizer applications.
- Encouraged producers to fertilize pastures and hay fields, who often would not.
- Feedback and interest from agents and producers, indicates value in micro-plot research and demonstration trials