



University of Idaho

College of Agricultural
and Life Sciences

USDA-NIFA

Alfalfa Seed and Alfalfa Forage Systems

Award no.: 2025-70005-45361

09/15/2025 through 09/14/2028

Understanding the Impact of Weed Diversity & Biomass on Alfalfa Forage Yield, Forage Nutritive Value, Animal Performance, & Production Economics

Sushmita Sharma¹, Albert Adjesiwor¹, Clint Beiermann², Eric Westra³, Sarah Lancaster⁴, Nevin Lawrence⁵, Doohong Min⁴, Andrew Kniss⁴, Randa Jabbour⁴, Mireille Chahine¹, Patrick Hatzenbuehler¹

¹University of Idaho | ²University of Wyoming |

³Utah State University | ⁴Kansas State University |

⁵University of Nebraska-Lincoln

Objective #1

1. Evaluate the impact of weed diversity and biomass on forage dry matter yield and nutritive value of established and newly seeded alfalfa:
 - a. quantify how weed control in newly seeded alfalfa affects weed diversity, forage yield, and alfalfa nutritive value.
 - b. estimate the relationship between the proportion of individual weed species and forage nutritive value of artificial mixtures (0, 25, 50, 75, 100% by weight of weed biomass)
 - c. assess weed diversity, forage yield, and nutritive value of randomly sampled established alfalfa,



Objective #2

2. Quantify the impact of weed biomass on animal performance and production economics
 - a) estimate the impact of weeds on milk production,
 - b) economic analysis of weed impacts on alfalfa forage production and milk production



Objective #3

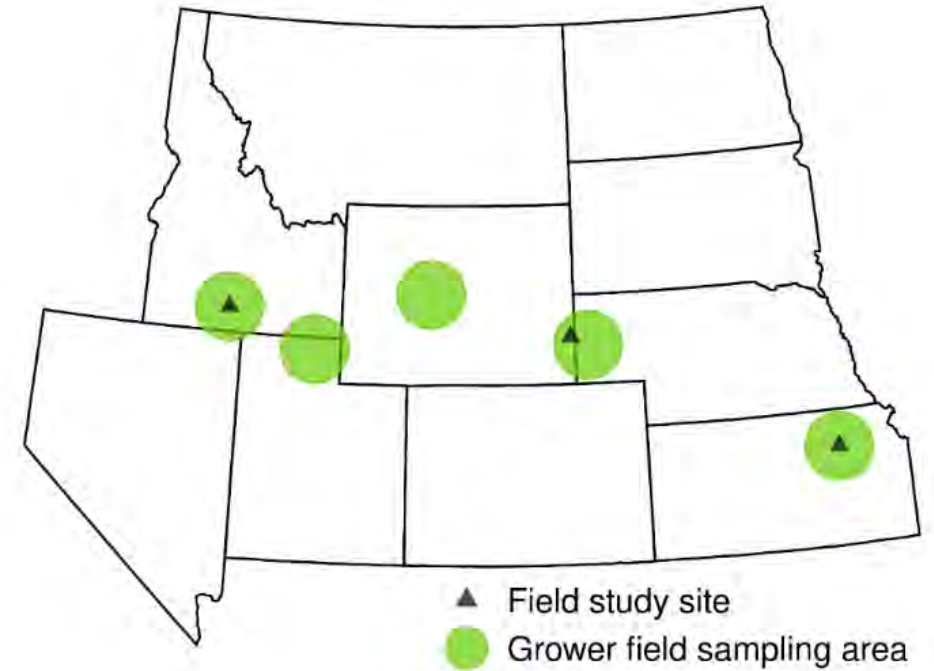
3. Engage stakeholders through multiple approaches about weed impacts on alfalfa forage yield, nutritive value, milk production, and economics.

- a) Use interviews and survey questionnaires to understand farmer approaches to weed management in alfalfa.
- b) Develop an interactive web-based decision aid to illustrate weed impacts on alfalfa forage yield and nutritive value based on data from across the region.
- c) Use extension presentations and publications to educate stakeholders on best management practices to reduce weed impacts on alfalfa forage yield and nutritive value



Institutions and study sites

- University of Idaho
- University of Wyoming
- Utah State University
- Kansas State University
- University of Nebraska-Lincoln



Objective #1

On-going field studies in Idaho, Kansas, and Wyoming

Treatment*	Timing ^a	Rate (g ai/ha)
nontreated	-	-
EPTC	PRE	2940
acetochlor	Early POST	1260
imazamox	POST	44
Bromoxynil	POST	44 + 420
imazamox + bromoxynil	POST	44 + 420
EPTC <i>fb</i> imazamox	PRE <i>fb</i> POST	2940 <i>fb</i> 44
EPTC <i>fb</i> imazamox + bromoxynil	PRE <i>fb</i> POST	2940 <i>fb</i> 44 + 420
acetochlor <i>fb</i> imazamox	POST	1260 <i>fb</i> 44
acetochlor <i>fb</i> imazamox+ bromoxynil	POST	1260 <i>fb</i> 44 + 420

*Herbicide treatments were selected to create weed biomass and species gradient



Sample plot photos from the Kimberly, ID site



nontreated



EPTC fb imazamox



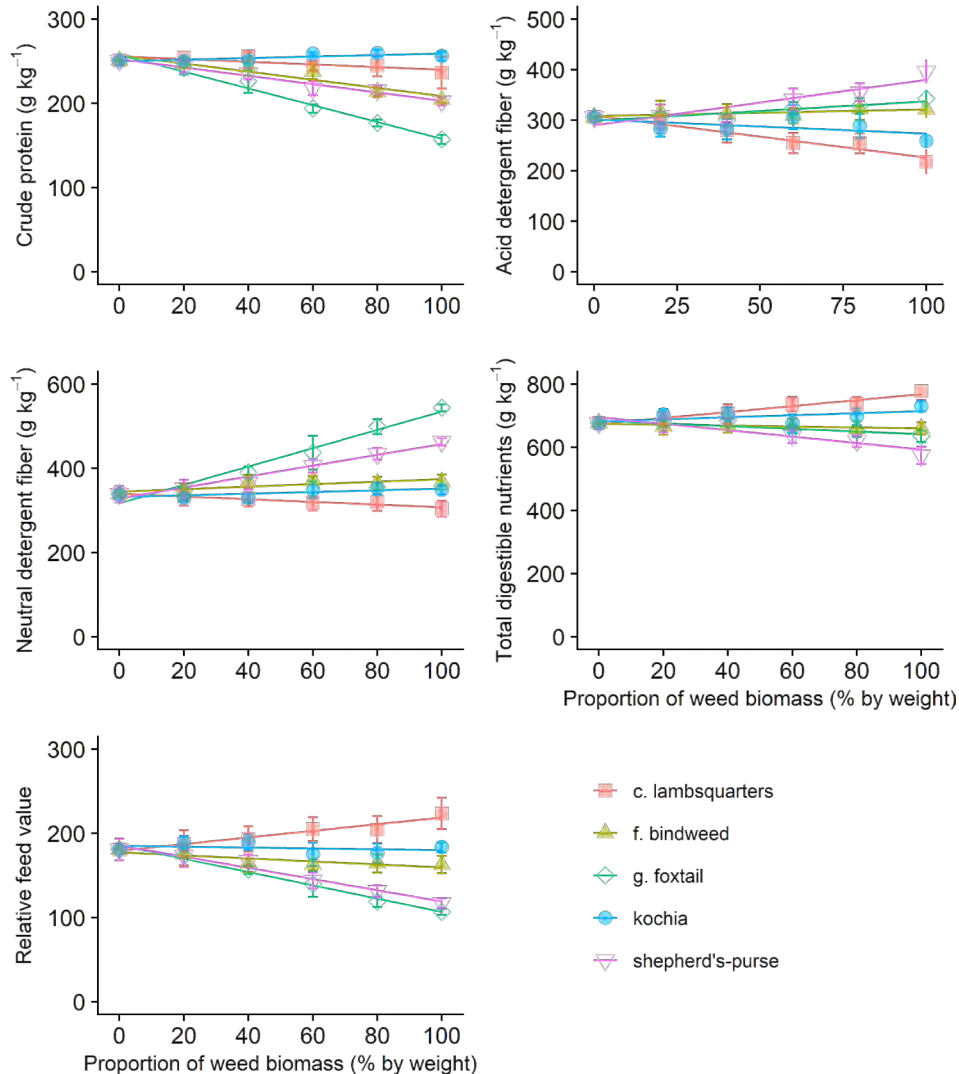
bromoxynil



imazamox + bromoxynil



Expected results/outcomes: Weed biomass threshold

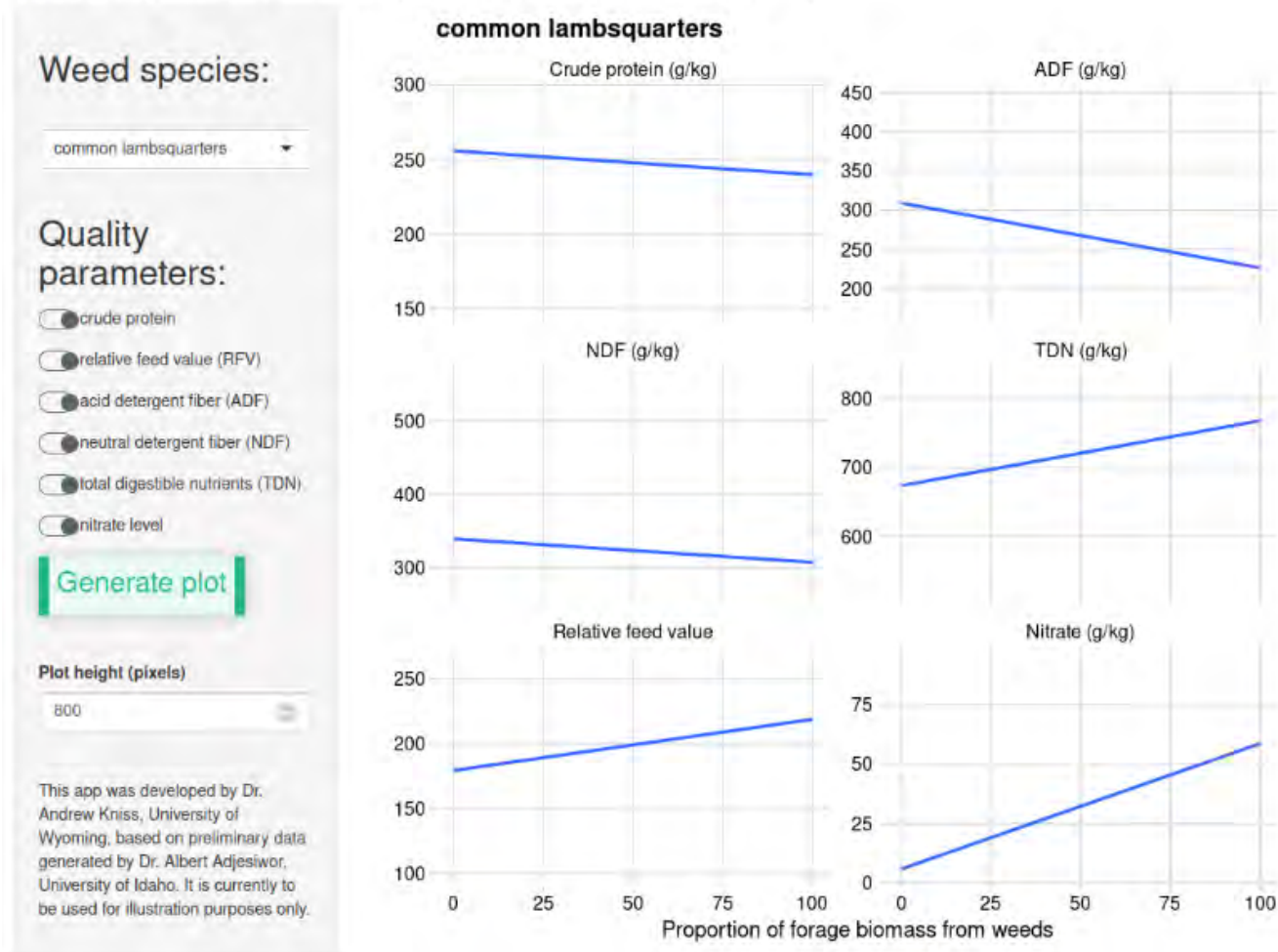


Sample weed biomass threshold developed from preliminary data generated by Dr. Adjesiwor.



Expected results/outcomes: Interactive Web App

Weed impact on alfalfa quality (version 0.1 DRAFT)



Sample **interactive web app** developed by Dr. Kniss from preliminary data generated by Dr. Adjesiwor.

Draft prepared for this grant is available at:
<https://wyoweeds.shinyapps.io/AlfalfaQuality/>

Expected results/outcomes

- Greater understanding of the effects of individual broadleaf and grassy weed species and biomass on alfalfa **forage accumulation**, **nutritive value**, **milk production** and **economic returns**.



Acknowledgment



Alfalfa Seed and Alfalfa Forage Systems
Award no.: 2025-70005-45361

- National Alfalfa & Forage Alliance (NAFA)

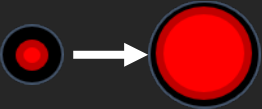


Harnessing alfalfa as a functional feed to combat fescue toxicosis and heat stress in cattle

Brittany E. Davis, **S. Ray Smith***, Donald G. Ely, Ronald J. Trotta, David L. Harmon, Jeffrey W. Lehmkuhler, Leanne Dillard, Jennifer R. Weinert-Nelson, and John B. May

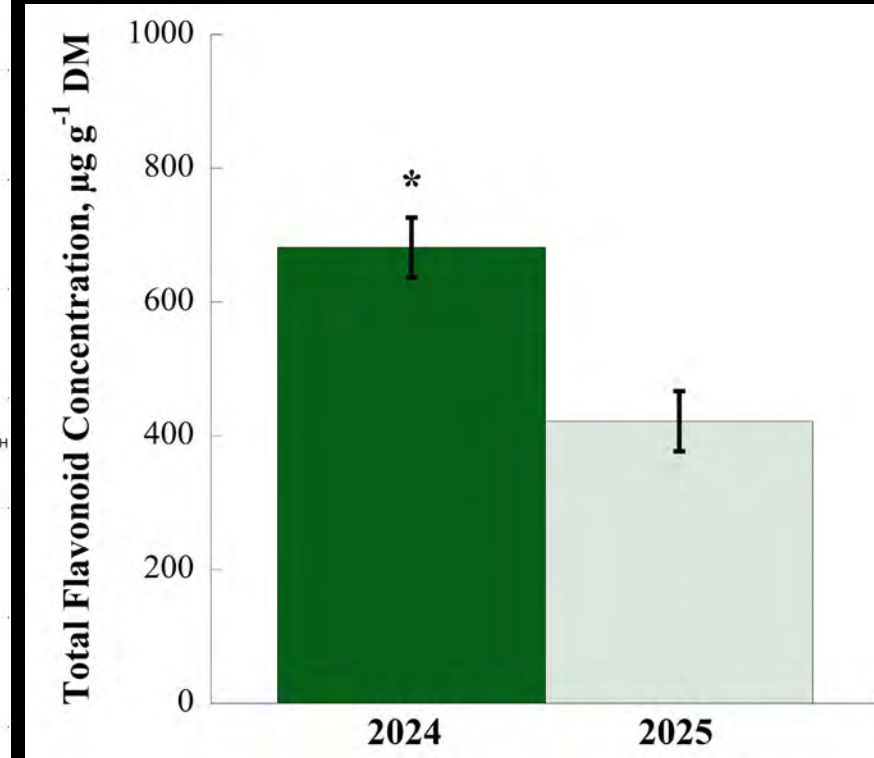
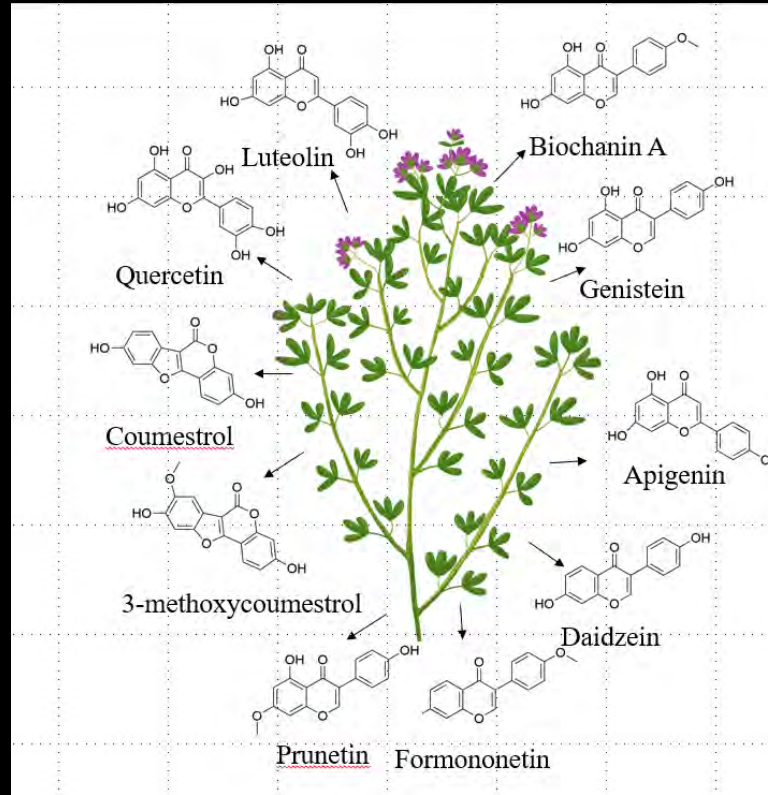
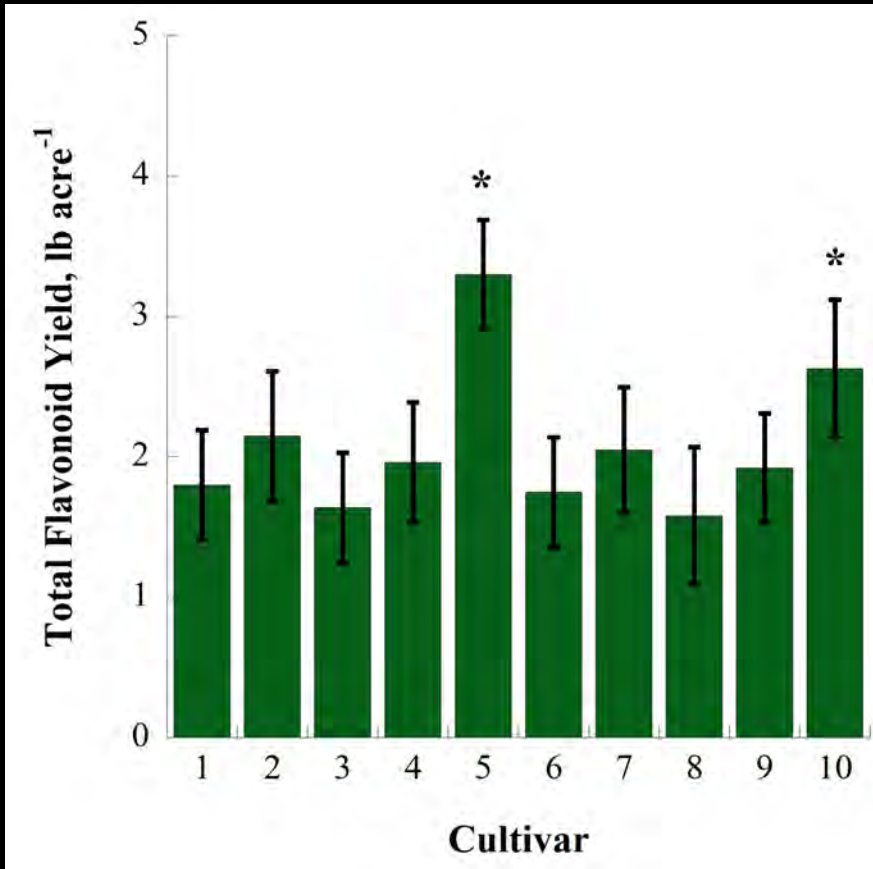


Functional Forages

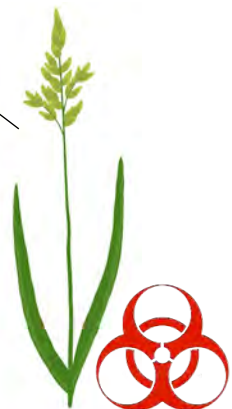
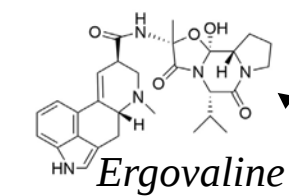
- Legumes (ex: clovers, soybean, alfalfa)
- Contain Bioactive Flavonoids
 - Antioxidants and Phytoestrogens
- Added benefits beyond nutrition:
 - *Antimicrobial Growth Promoter* (+24 – 30% ADG)
 - *Vasodilator* 
 - *Fescue Toxicosis*
 - *Heat Stress* 



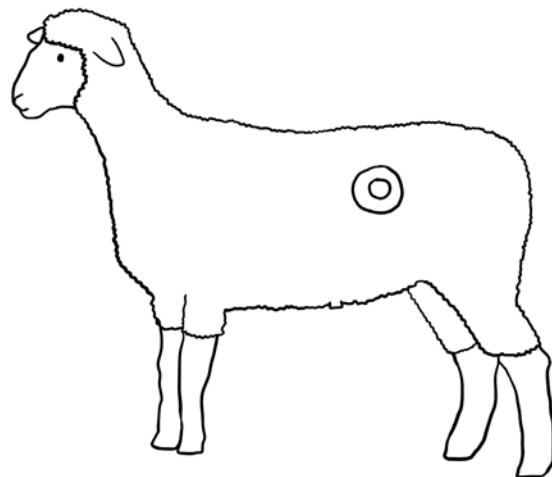
Flavonoid and coumestan concentrations in alfalfa cultivars grown at University of Kentucky, Spindletop Farm (May 2024 & 2025; Farrell *et al.*^{a,b})



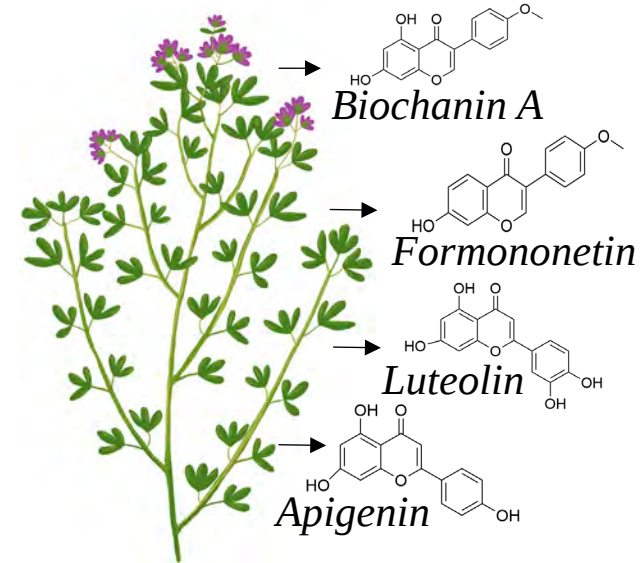
Alfalfa Cultivars: 1, Alfabar; 2, Ameristand 428TQ; 3, FSG-527; 4, GA-409; 5, GA-497HD; 6, GA-535; 7, MVS4220Q; 8, Mariner V; 9, Saranac AR (certified); 10, WL3521HQ.



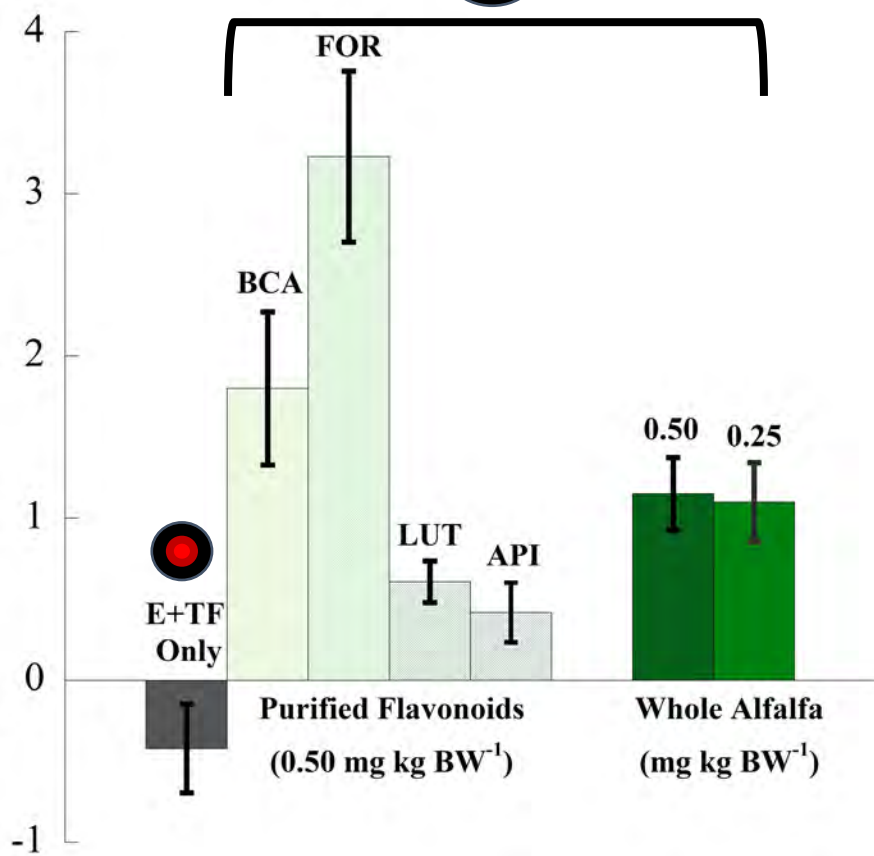
+



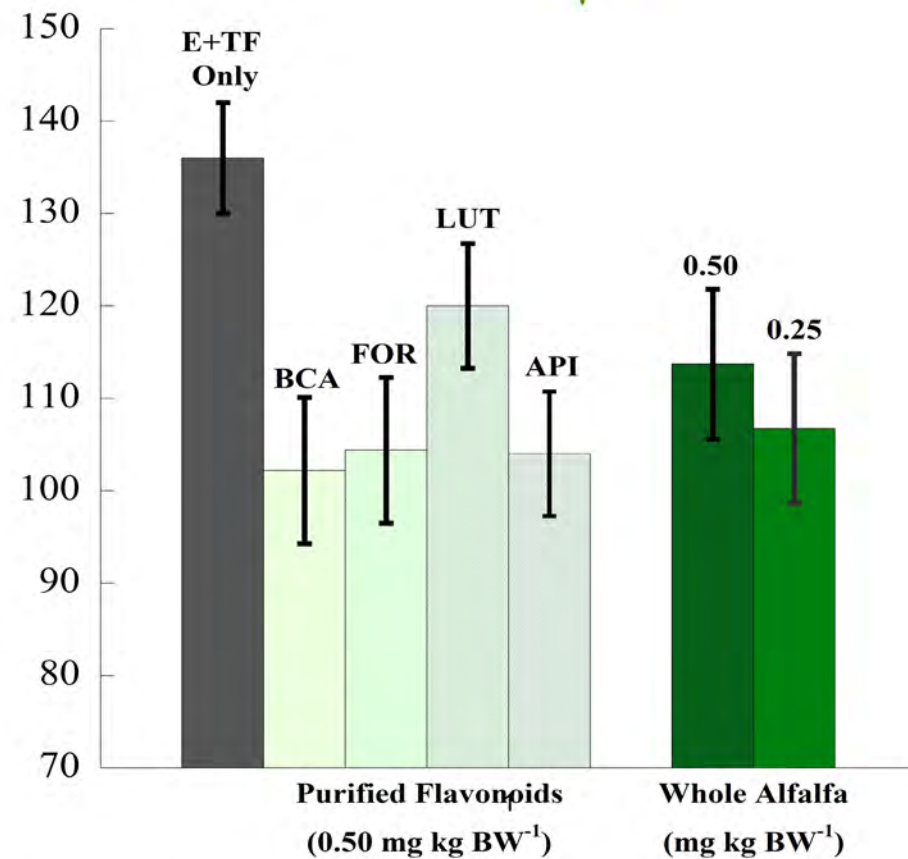
±



Blood Flow Rate
Proportionate difference from baseline



Respiration Rate, breaths min⁻¹



2025 USDA-NIFA, ASAFS Grant: Harnessing alfalfa as a functional feed to combat fescue toxicosis and heat stress in cattle

(Award #: 2025-70005-453641; \$731,168.90)

Objectives:

1. Determine the efficacy of alfalfa isoflavones and flavones in alleviating fescue toxicosis at supplementation levels relevant to alfalfa inclusion in beef feeding systems.
2. Characterizing isoflavones, flavones, flavonols, and coumestans in alfalfa varieties adapted to the southeastern United States as well as influences of factors such as stage of maturity and seasonal/environmental impacts on concentrations of these flavonoids.
3. Evaluate the application of supplementing alfalfa as a functional feed for prevention of fescue toxicosis and heat stress in beef cattle.
4. Conduct outreach to disseminate results of this research and, more generally, information related to the practical application of alfalfa in beef production systems to stakeholders.



**UNIVERSITY OF
GEORGIA**
College of Agricultural &
Environmental Sciences
*Institute of Plant Breeding,
Genetics and Genomics*

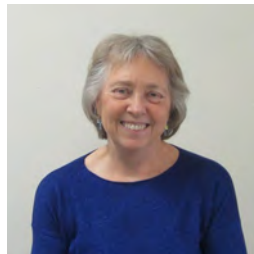
Unlocking Forage Yield and Stand Persistence Potential of Alfalfa in Low pH Soils

Alfalfa Seed and Alfalfa Forage Systems Research Program (AFRP) funded project

Focus:

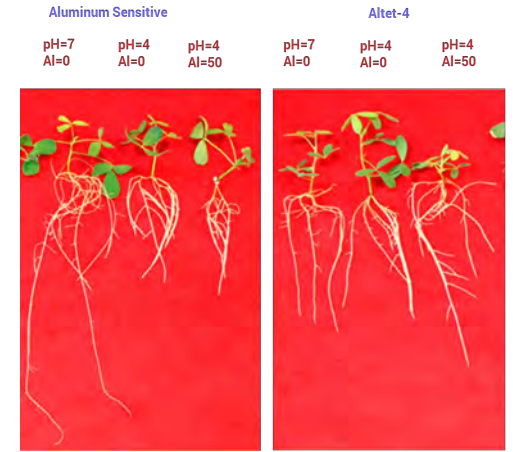
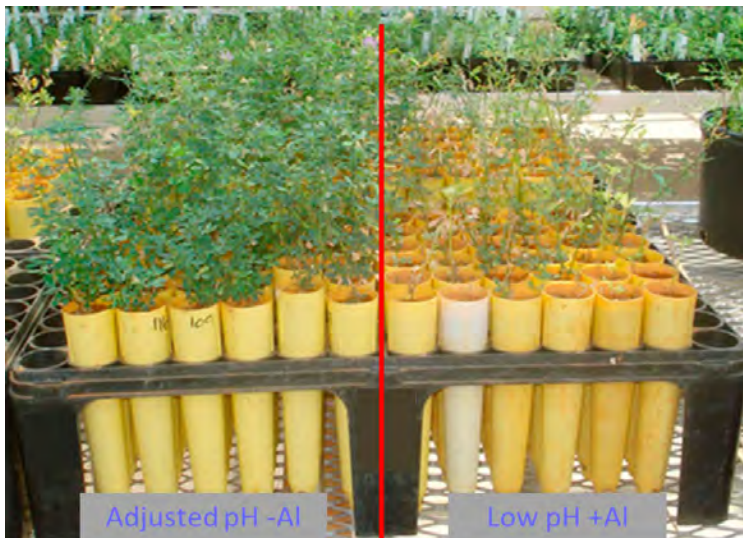
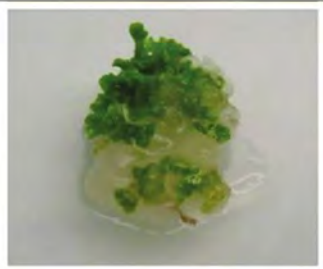
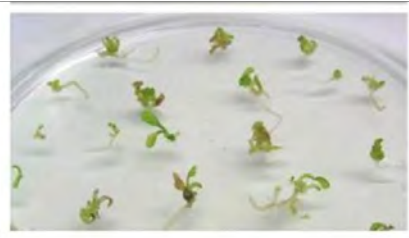
- A panel of 200 half-sib families selected from 1200 accessions evaluated in low pH
- Identify alfalfa germplasm with optimal yield and stand persistence in low-pH soils in four states
- Develop genomic resources and strategies to improve the resilience and sustainable production of alfalfa in regions with low-pH soils

Partners:



The quest for low pH alfalfa cultivars

Are we there yet ?...



Change of Approach



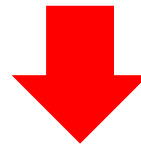
A Backward Approach



Soil pH



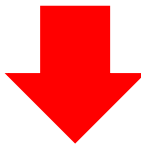
Aluminum ions



**Nutrient
availability**



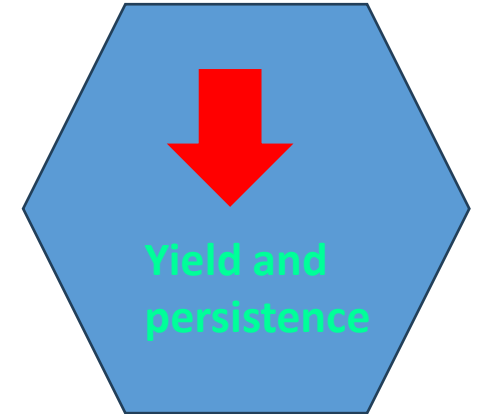
**Cell wall
rigidity**



**Root
development**

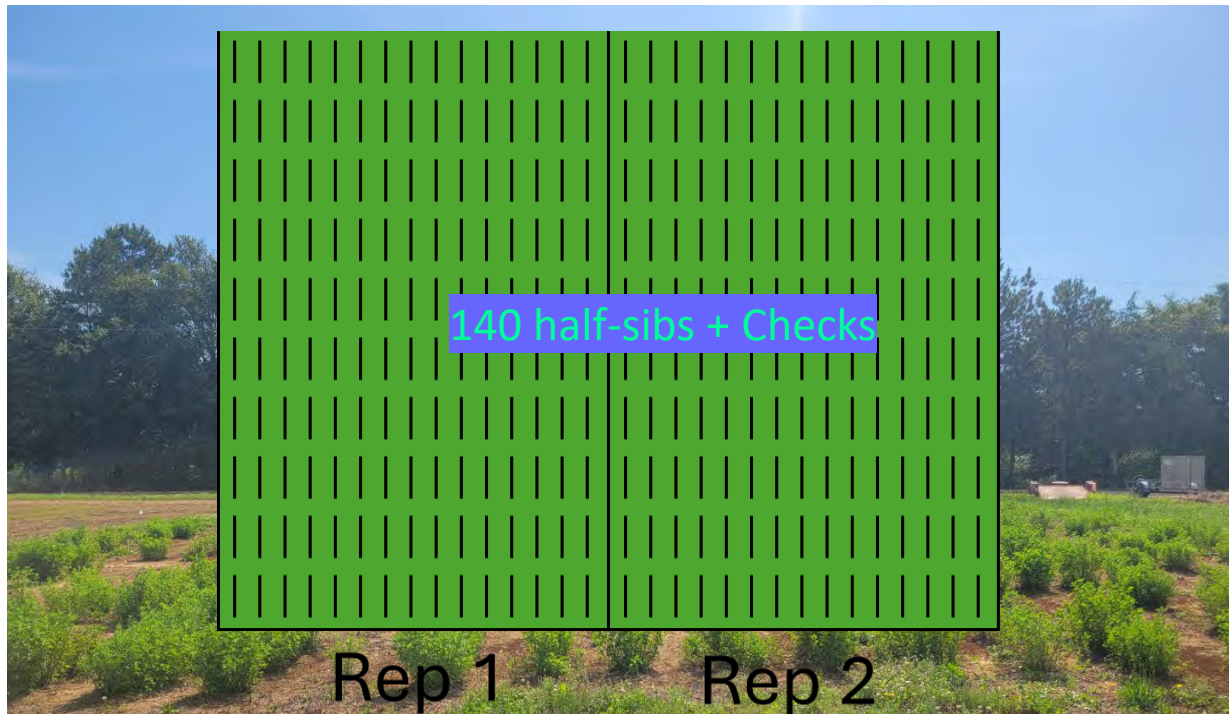


**Water and
nutrient uptake**

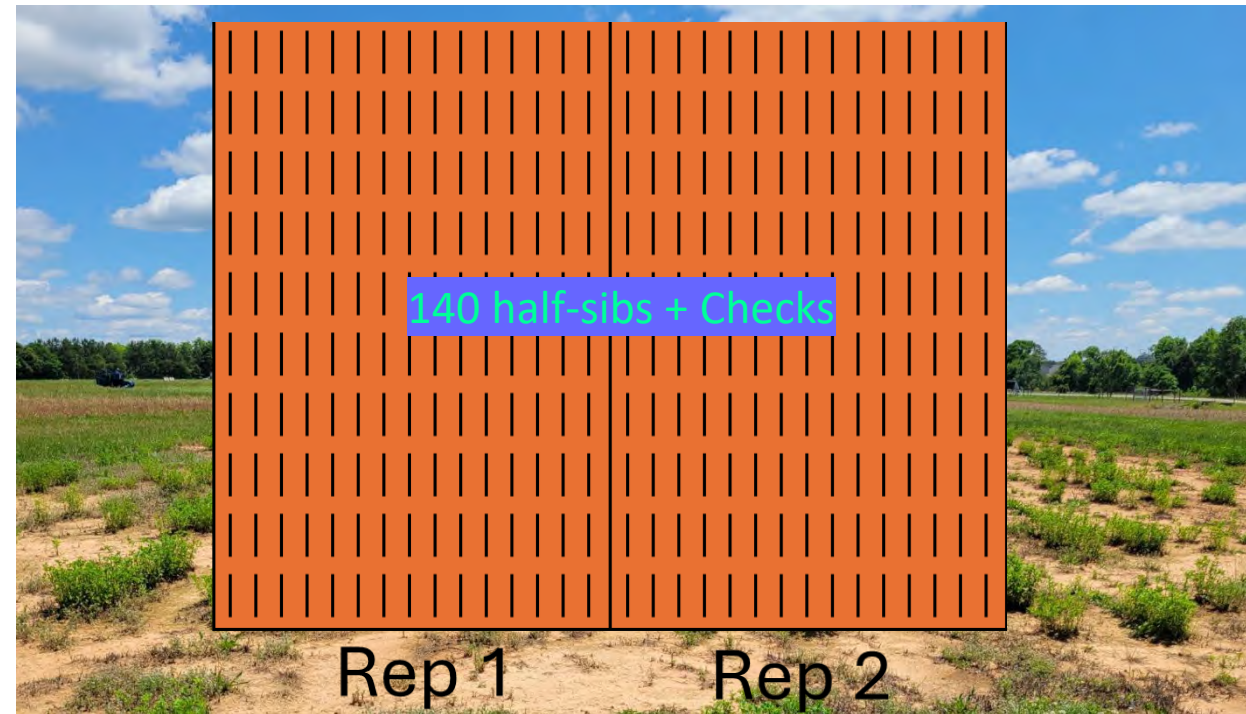


Multi-location x year field evaluation

Athens: Adjusted pH = 6.37, Ex Al = 2.29 mg/kg



Low pH = 4.90, Ex Al = 10.41 mg/kg



Tifton: Adjusted pH = 7.07, Ex Al = 0.01 mg/kg

Low pH = 4.90, Ex Al = 11.38 mg/kg

Acid Soil Adaptation Index

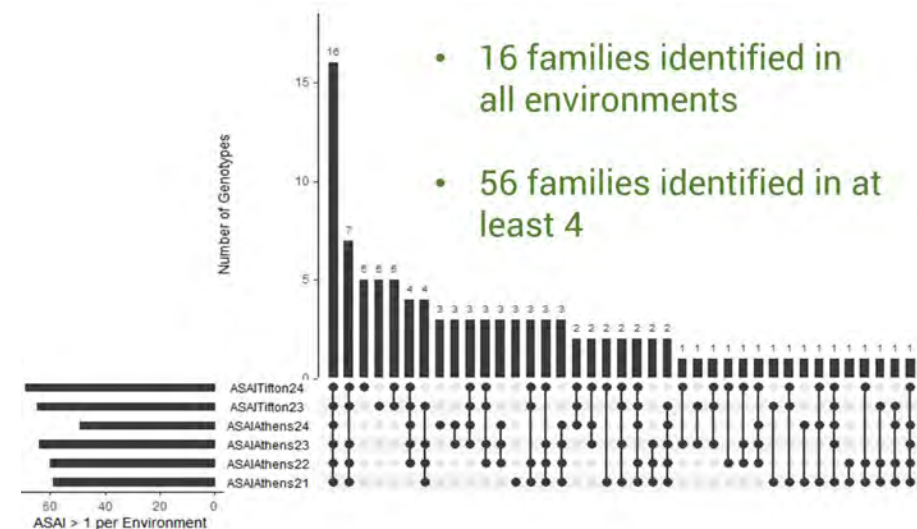
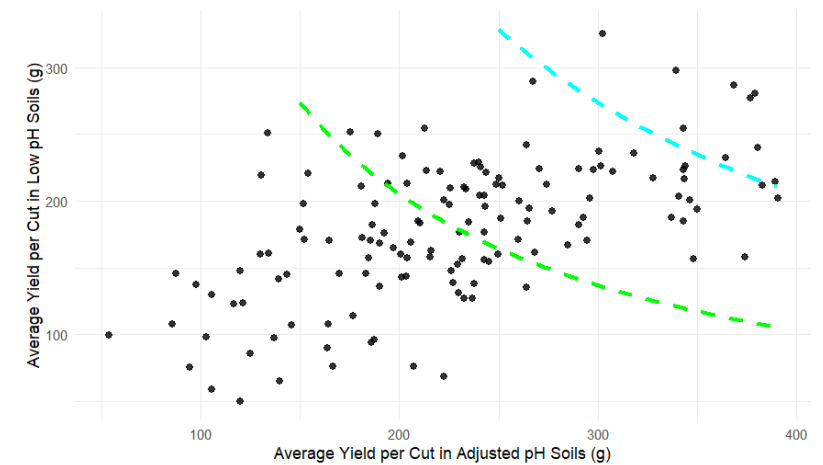
Locations × Years



Acid soil adaptation index (ASAI)

$$ASAI = \frac{Y_s \times Y_p}{\mu_s \times \mu_p}$$

- Y_s = Yield in low pH condition,
- Y_p = Yield in adjusted pH condition,
- μ_s = Average yield in low pH condition,
- μ_p = Average yield in adjusted pH condition







The Rebellion of the Queen: Alfalfa as the Optimum Forage for Climate-Smart Dairy Systems

North American Alfalfa Improvement Conference
(July 15, 2026; Stillwater, MN)

Alyssa Neff¹, Yuma Glenn¹, Guojie Wang², Elaine Claffey¹, Gonzalo Ferreira¹
Virginia Tech¹, Penn State University²

Alfalfa Project Overview



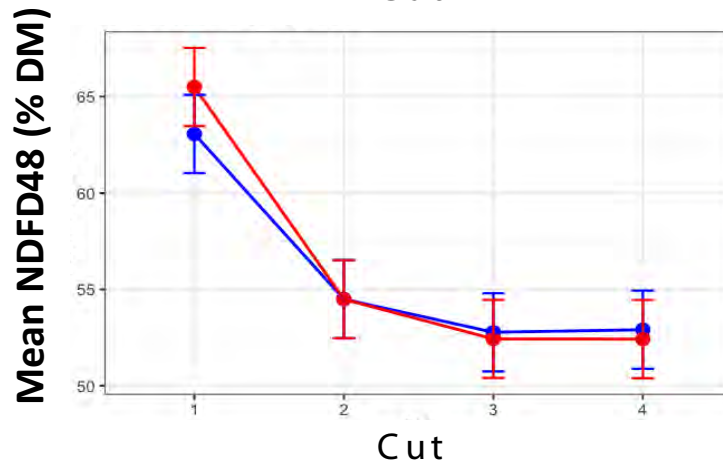
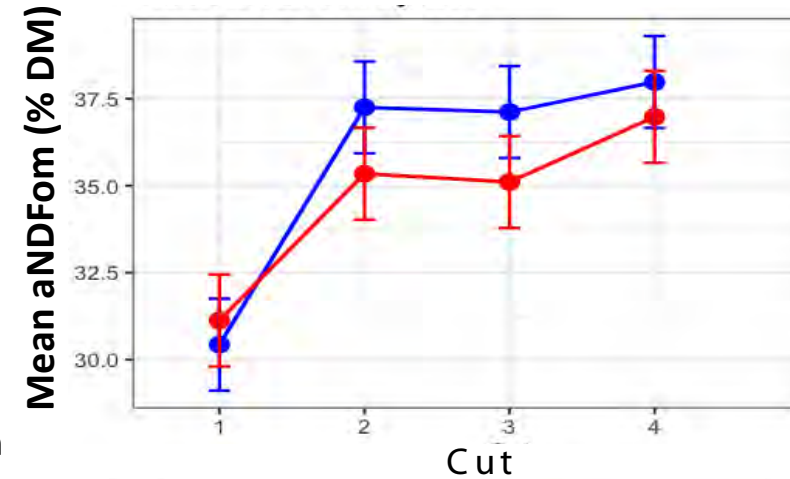
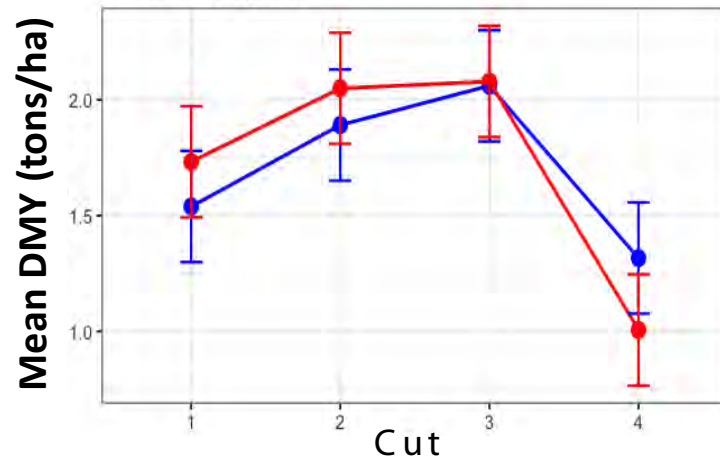
- Plot Study
- Alfalfa Field for Animal Studies
- Animal Study
- Additional Findings



Plot Study

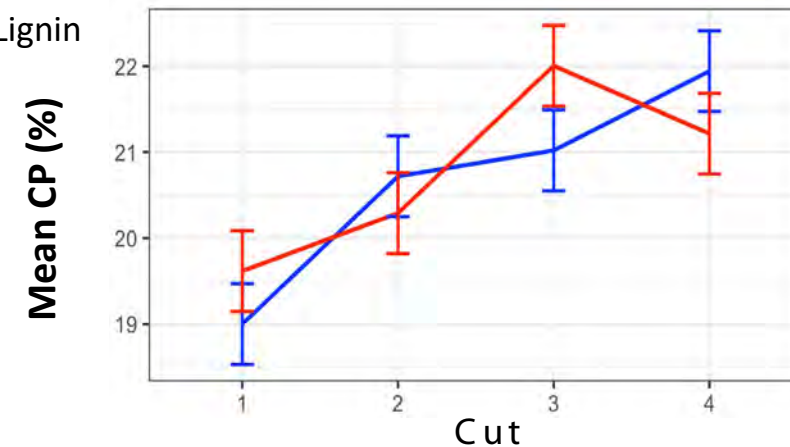


- Year 1- 192 samples harvested from across 4 cuts
- Year 2- 120 samples harvested from 3 cuts so far



Red = Reduced Lignin

Blue = Conventional Lignin



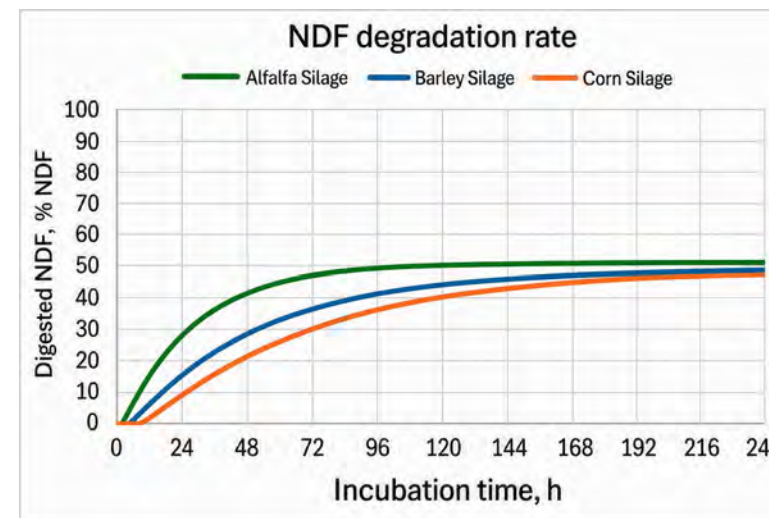
Animal Study



Table 2. Performance, methane emissions, and ruminal metabolism.

	Corn Silage	Alfalfa Silage	SEM	P value
Milk yield, kg/d	39.3	38.2	0.73	0.29
Dry matter intake, kg/d	21.3	19.9	0.47	0.06
Milk fat, %	3.64	3.80	0.24	0.43
Milk protein, %	3.14	3.09	0.02	0.18
Milk lactose, %	4.89	4.90	0.01	0.80
Milk fat yield, kg/d	1.42	1.44	0.11	0.84
Milk protein yield, kg/d	1.23	1.18	0.02	0.14
Milk lactose yield, kg/d	1.92	1.87	0.04	0.30
ECM yield, kg/d	40.7	40.2	1.58	0.71
Feed efficiency, kg ECM/kg DMI	1.91	2.01	0.07	0.12
MUN, mg/dL	13.6	12.9	0.41	0.24
Methane production, g/d	270	272	17	0.93
Methane yield, g/kg DMI	12.6	13.5	0.91	0.47
Methane intensity, g/kg ECM	6.5	6.7	0.41	0.77
Passage rate of uNDF, %/h	5.85	5.50	0.68	0.67
Pool size of uNDF, kg	3.6	3.2	0.26	0.07

ECM: Energy-Corrected milk



Alfalfa Project

Additional Findings & Acknowledgements



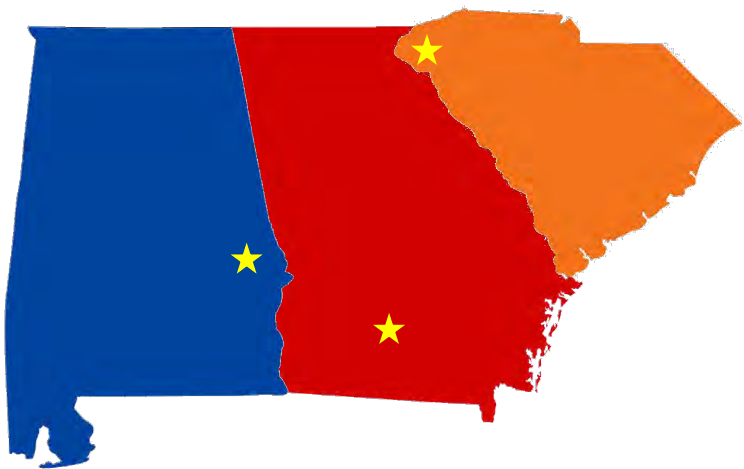
DAIRY FORAGE
RESEARCH LABORATORY



WE HELP DAIRY FARMERS,
NUTRITIONISTS, AND CONSUMERS



Alfalfa IS for Beef Cattle!



NIFA ASAFS # 2024-06244



United States Department of Agriculture
National Institute of Food and Agriculture



Jennifer J. Tucker, M. Kimberly Mullenix, Liliane S. da Silva, S. Maggie Justice, R. Lawton Stewart, W. Brandon Smith, William Secor, and Matias Aguerre

Objectives

1. To evaluate the use of alfalfa in beef cattle diets compared to “business as usual” drylot diets for backgrounding steers and heifer development in the South.
2. To develop an economic analysis of alfalfa-based feeding systems and alfalfa production in the South.
3. To create awareness on management and use of alfalfa as a primary feed source for southern livestock producers and expand alfalfa-based training and knowledge beyond technical educators and producers targeting point of sale industry contacts.



Benefits

1. This will help to provide management and use recommendations to southern livestock producers, enhance adoption of alfalfa in the region, and improve system stability.
2. This will result in user-friendly interactive budgets for producers considering utilization of alfalfa in their operation.
3. This will provide Extension education and resources for producers to make informed decisions about alfalfa management and use and increase stability of their operations

****Overall this work will help to improve management practices, enhance education efforts, increase economic tools, and expand alfalfa utilization in the region.**



Objective 1: Research

- Experiment 1: Evaluating Alfalfa Baleage for Backgrounding Weaned Beef Calves (Tifton, GA)
- Experiment 2: Evaluating Alfalfa Baleage for Heifer Development for Replacement in the Herd (Clemson, SC)
- Experiment 3: In Vitro Digestibility of Alfalfa in Beef Cattle Diets as Compared with “Business As Usual” Drylot Feeding Strategies (Auburn, AL)



Objective 2: Economic Analysis

Objective 3: Extension and Outreach Efforts Enhancing Alfalfa for Beef Cattle





- Alfalfa-based products are an option for beef cattle producers in the Southeast to:
 - Diversify feeding strategies
 - Use Nutrient-rich Forage additives to increase digestibility
 - Increasing returns to the operation
- Alfalfa can enhance Southeastern Beef Systems!

