Building Better Soils and Pastures in the South

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Soil for Water Project

National Center for Appropriate Technology

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MISSISSIPPI STATE UNIVERSITY

EXTENSION

Center for Forage Management and Environmental Stewardship

NCAT

NATIONAL CENTER FOR APPROPRIATE TECHNOLOGY

Regenerative Grazing

- Maintain a proactive planning and active management of the grazing events
  - Grazing the appropriate amount of leaf production at the optimal time.
  - Encouraging the grazing livestock to uniformly utilize the pasture.
  - Managing grazing to maintain ample residual and allow full recovery of grazed plants before the next grazing event.

- Being adaptive and flexible, active monitoring, and managing for positive changes to improve soil health are the main differences between regenerative and traditional grazing management.
  - Soil monitoring.

- Increase the diversity of beneficial plants (grasses, legumes, forbs).

Cool-season Annual Legumes

Cool-season Perennial Legumes

They can fix from 60 to 120 pounds of nitrogen per acre.


Forage Soybeans


Cowpeas


Sun Hemp


Sericea
Lespedeza

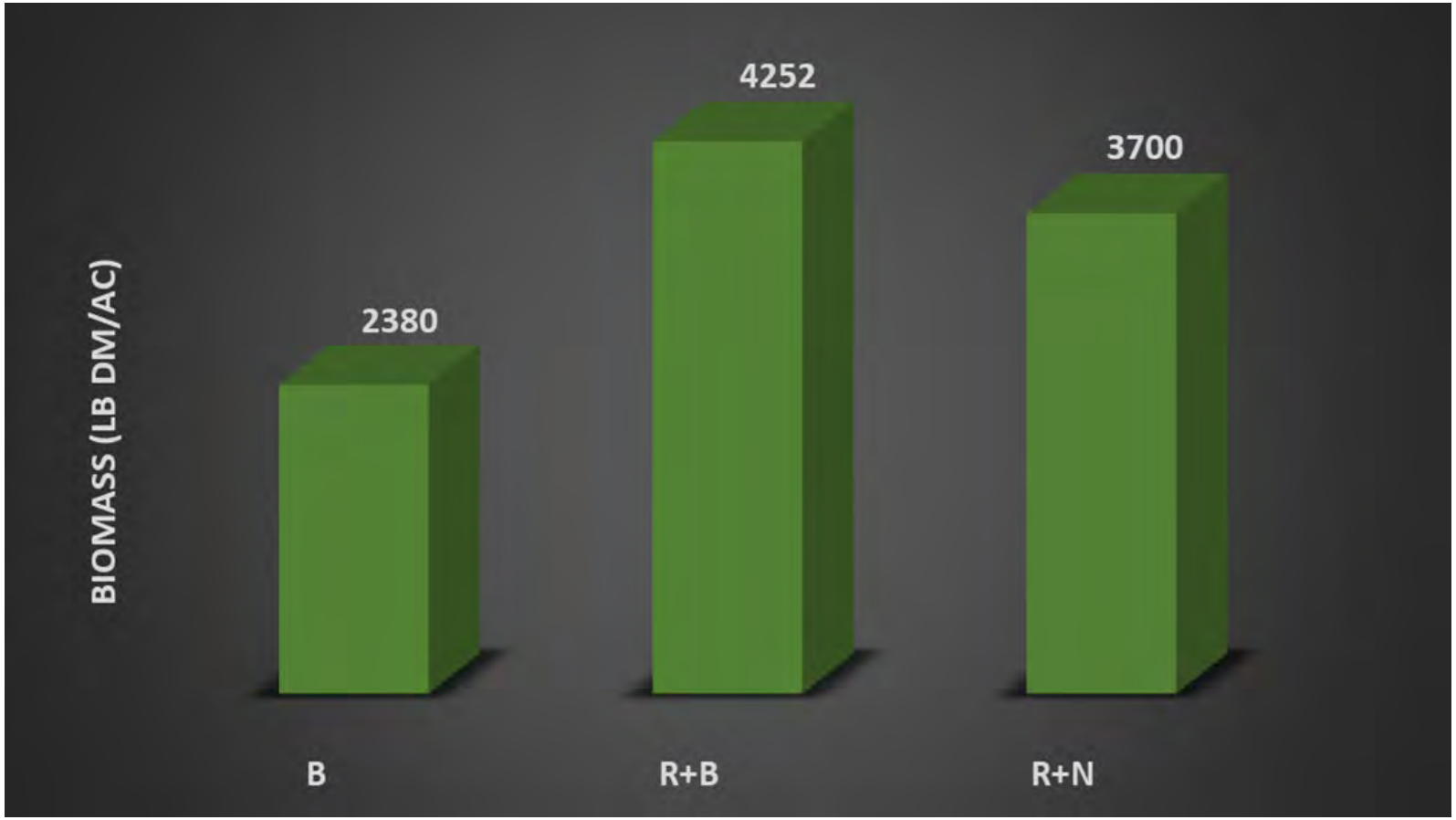

Annual
Lespedeza


Alyce clover

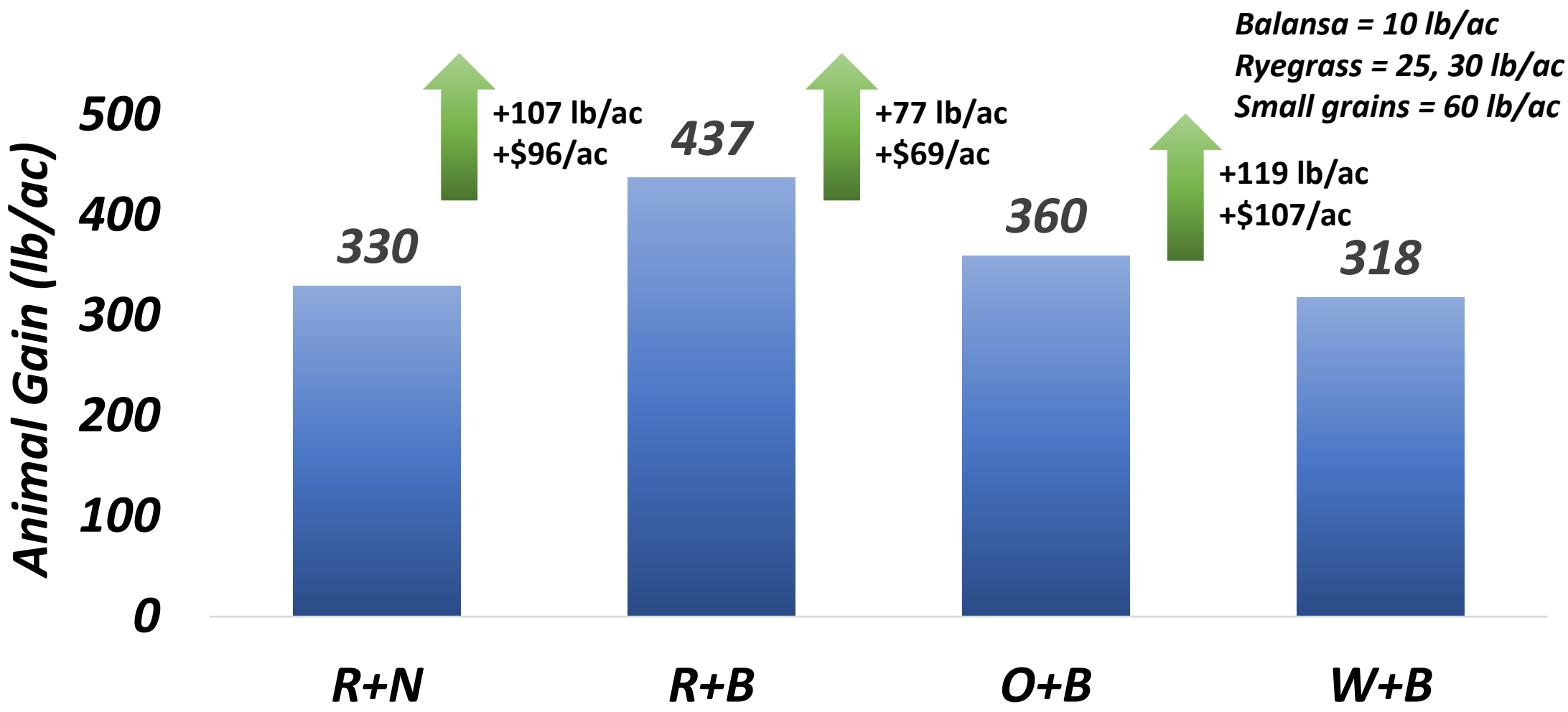

Partridge
Peas

Berseem Clover/ Annual Ryegrass Study

- Two Years = 2014-2015 and 2015-2016
- Treatments = Berseem (10 lb/ac), Ryegrass (25 lb/ac) + Berseem (10 lb/ac), and Ryegrass (25 lb/ac) + 100 lb N/ac



‘Fixation’ Balansa – Gain Per Acre



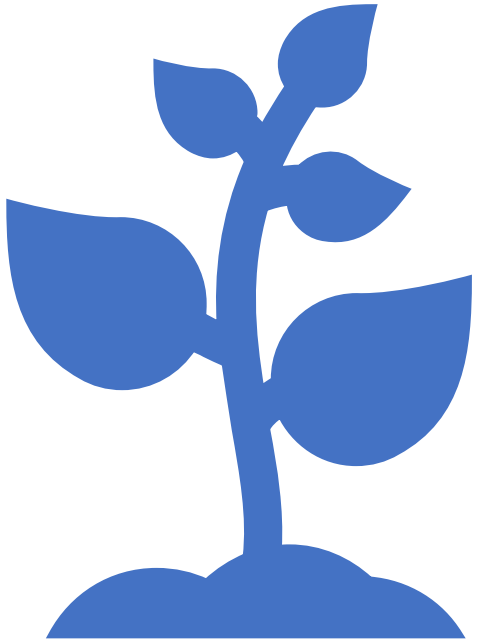
Soil for Water – Regenerative Grazing

- This project is about implementing practical, cost-effective, and lasting ways to regenerate our soil that can make livestock and communities more resilient in the face of climate disruption.

  - **Farmer Focused -** Our mission is to provide technical assistance to farmers and landowners to facilitate best management practices.

  - **Benefits Beyond the Farm –** Farmers should fully capture the values of regenerative grazing and soil health to create significant added value to the land and the livestock.

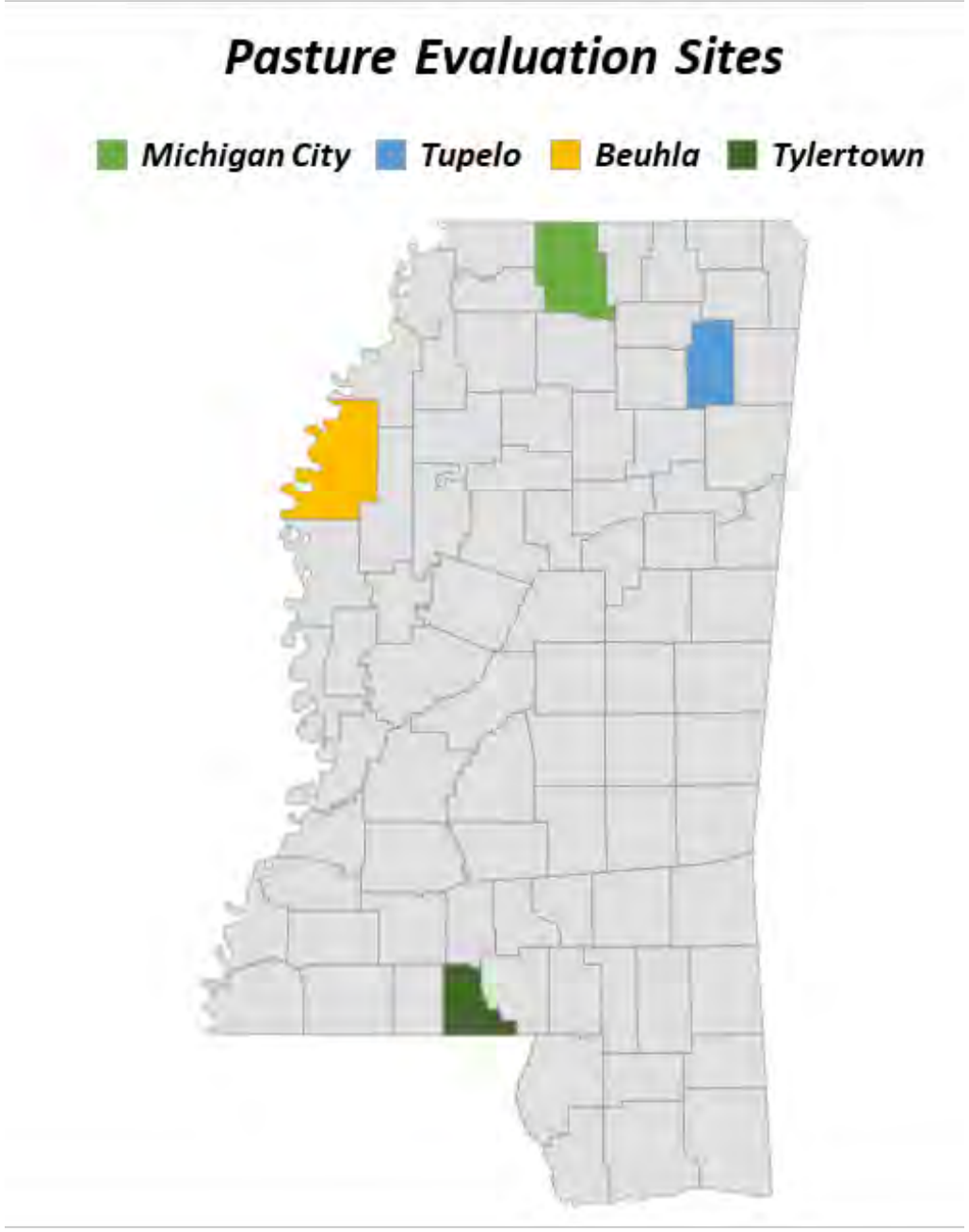
Pasture Evaluation Program



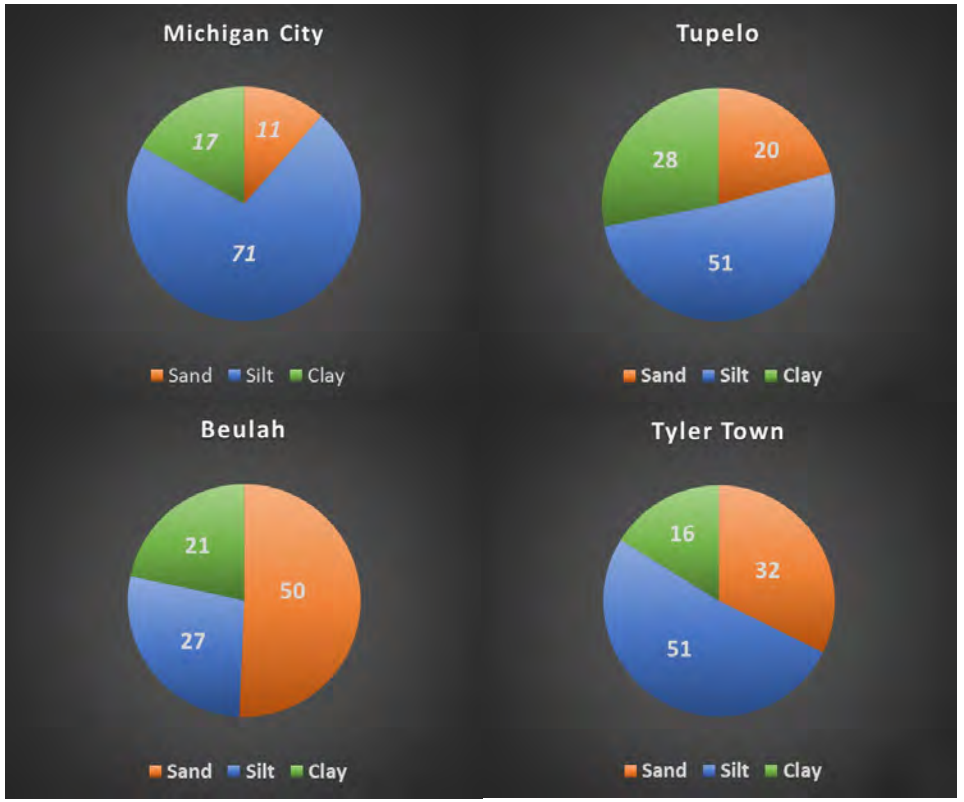
- ***Objectives:***
  - The main objective was the identification of plant species diversity.
  - Identification of physical, biological, and chemical constraints that could prompts farmer to seek improved and more sustainable soil and forage management practices.

- ***Goal***
  - To develop amore comprehensive understanding of soil health status can lead to better, regenerative, and sustainable management of forage systems and soils through adaptive, and data-driven approaches.

Locations and Soil Types



Location	Soil Type
Michigan City	Calhoun silt loam
Tupelo	Marietta loam, 0 to 2 percent slopes, occasionally flooded
Beulah	Levee - Clayey alluvium deposits
Tyler Town	Providence silt loam, 2 to 5 percent slopes, eroded



Methodology

- A pasture was selected at four locations in MS to evaluate forage species and soil quality indicators
    - Biomass samples were collected across three transects at each location
        - Each transect consisted of three sampling points that were 100 feet apart.
        - The distance between each transect was 100 ft.
        - Species composition using a grid point method.
        - Forage mass and nutritive value
    - Soil compaction and soil samples were collected at each sampling point
        - Samples within each transect were combine for soil quality analysis.

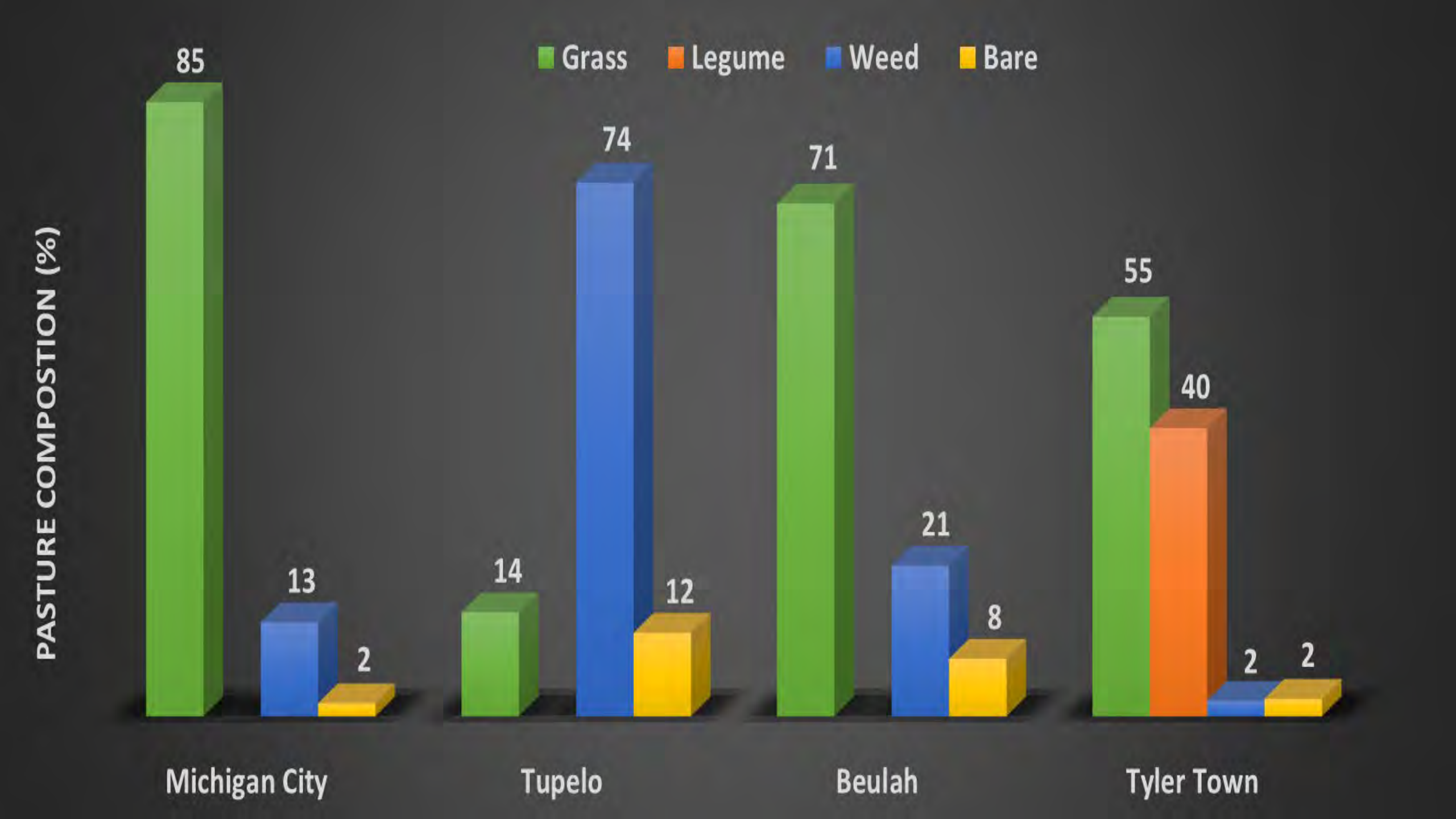

FIELDSCOUT
SC 600 Soil Compaction Meter
ON
DELETE
REVIEW
START
Spectrum

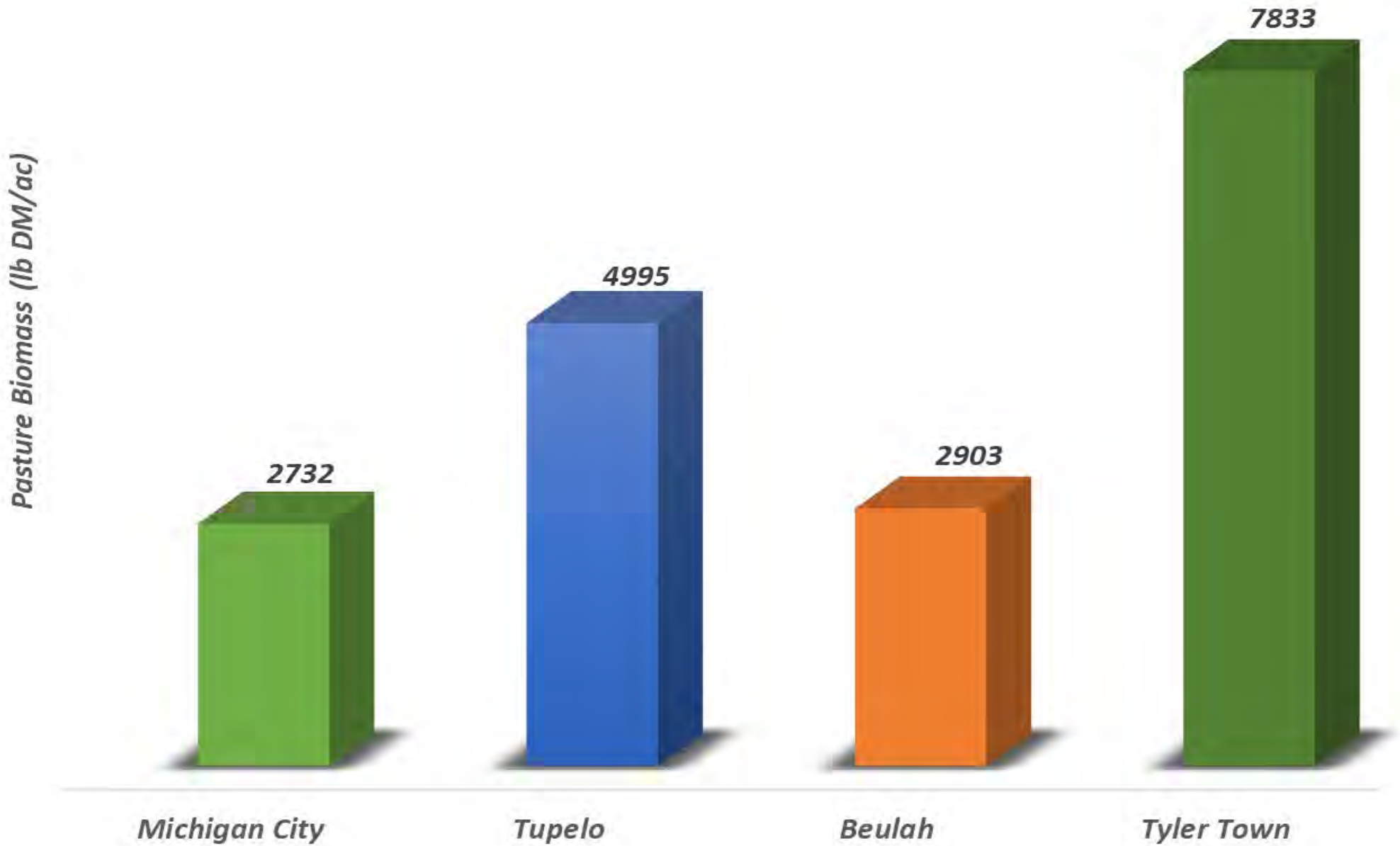
Species Composition

Location	Forage Species	Weeds
Michigan City	Texoma Tall Fescue Bermudagrass Crabgrass White clover	Horsenettle Pigweed
Tupelo	Bahiagrass	Broomsedge Pigweeed Ash

Species Composition

Location	Forage Species	Weeds
Beulah	Bermudagrass Crabgrass Dallisgrass	Broomsedge Woolly crotton Horsenettle Purselane Pepperweed PA Smartmweed
Tylertown	Bermudagrass Bahiagrass Crabgrass Red clover	Pigweed Dog fennel Purslane


Grass
Legume
Weed
Bare
PASTURE COMPOSTION (%)
85
13
2
14
74
12
71
21
8
55
40
2
2
Michigan City
Tupelo
Beulah
Tyler Town

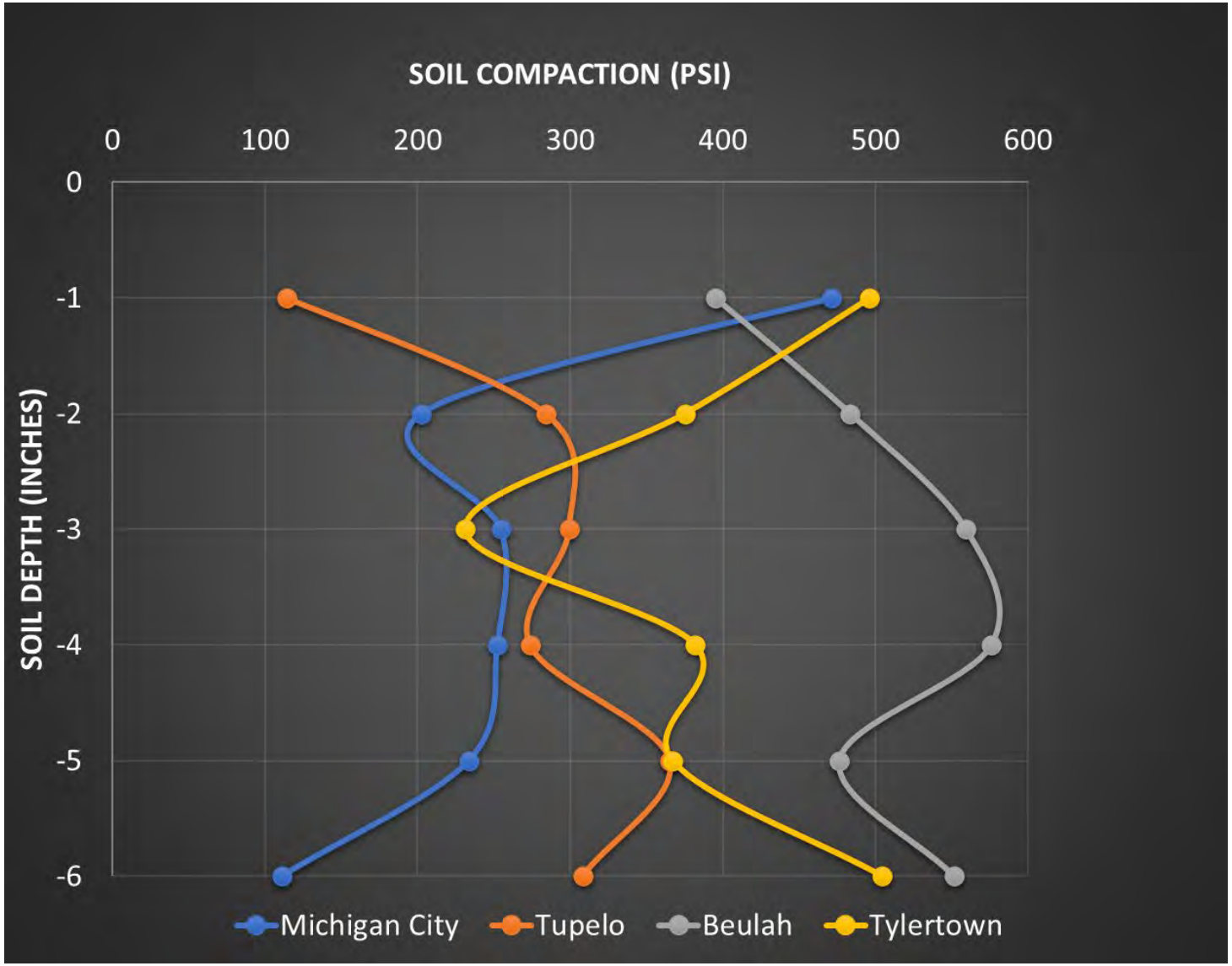

Pasture Biomass (lb DM/ac)
2732
4995
2903
7833
Michigan City
Tupelo
Beulah
Tyler Town

Forage Nutritive Analysis

Location	PROTEIN	ADF	NDF	IVTDMD	WSC
	---------- Percent Dry Matter ----------				
Michigan City	8.82	42.21	70.20	64.64	6.48
Beulah	12.02	38.56	64.42	67.99	5.80
Tupelo	9.77	39.37	63.59	65.29	5.41
Tylertown	26.34	26.54	36.25	80.92	7.36

Soil Compaction

- Most of the soil tested has a severe compaction.
  - Limit water infiltration
  - Increase nutrient movement.
  - Limit root growth.

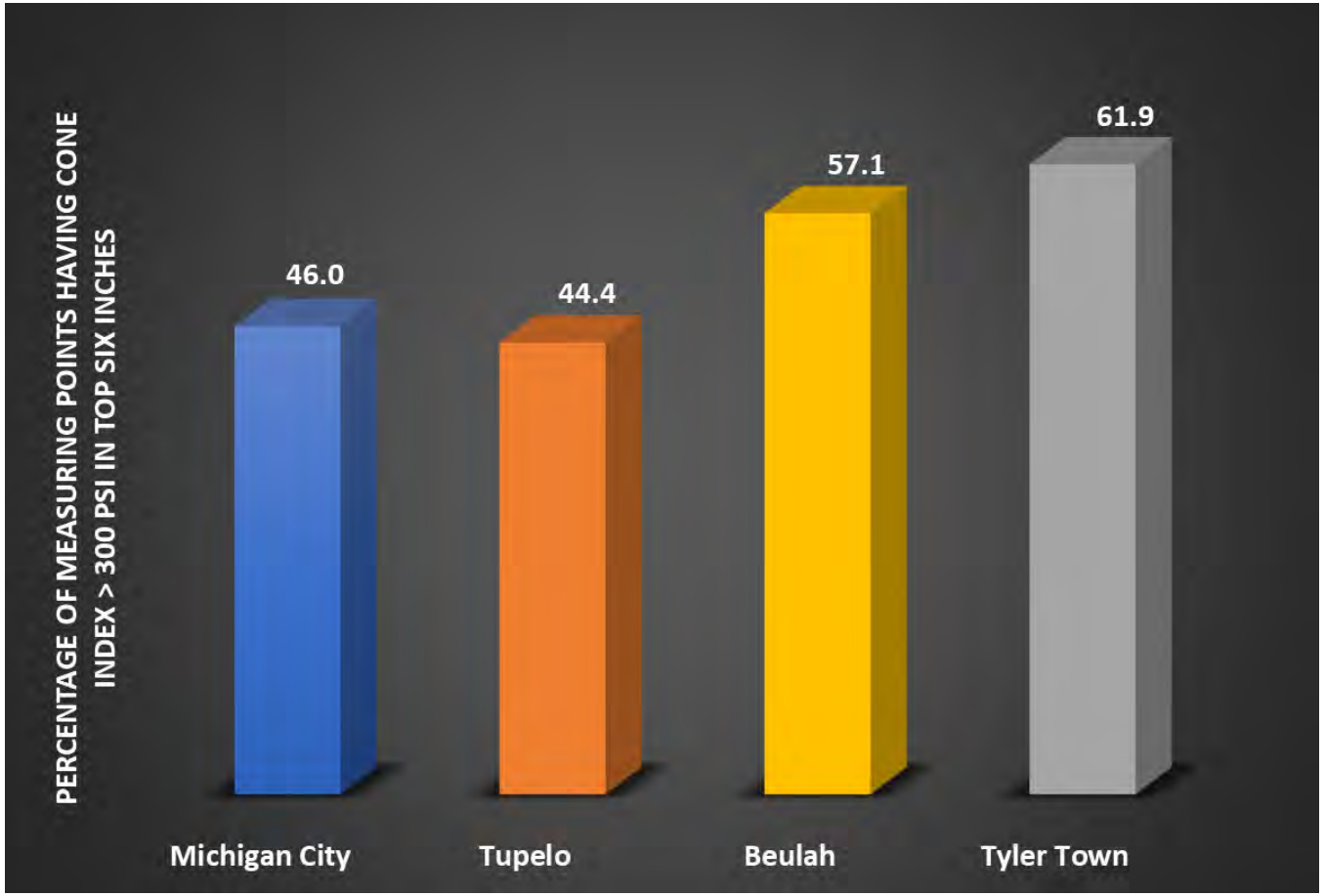


Compaction Rating

- Percentage of measuring points having cone index > 300 psi in top 6 inches

Percentage	Compaction Rating	Subsoling Recommended
<30	Little to none	No
30-50	Slight	No
50-75	Moderate	Yes
>75	Severe	Yes

Duiker, 2002



Soil Physical Properties

Location	Predicted Available Water Capacity (AWC) (g H_20 g^{-1} soil)	Aggregate Stability (AS) (g g^{-1} soil)
Michigan City	**0.29 A**	**44.3 B**
Tupelo	**0.23 B**	**52.4 A**
Beulah	**0.21 B**	**23.8 C**
Tylertown	**0.23 B**	**28.5 C**
P-value	*0.0004*	*0.0001*

Soil Biological Properties

Location	Organic Matter (OM) (%)	Soil Organic Carbon (SOC) (%)	C:N Ratio	Soil Protein Index (SPI)	Soil Respiration (SR) (mg g^{-1} soil)	Active Carbon (AC) (ppm)
Michigan City	3.8	1.86 AB	10.9 BC	6.0	0.8	408
Tupelo	3.8	2.13 A	17.3 A	6.8	0.7	357
Beulah	3.6	1.45 C	10.1 C	4.7	0.5	343
Tylertown	3.6	1.81 B	11.9 B	5.3	0.7	390
P-value	*NS*	*0.0078*	*0.0002*	*NS*	*NS*	*NS*

Soil Chemical Properties- pH and Macronutrients

		Macronutrients				
Location	**pH**	**P**	**K**	**Ca**	**Mg**	**S**
		---------- lb/ac ----------				
Michigan City	**5.8 AB**	**9.5 B**	**131 B**	**3231 A**	**162 B**	**12 C**
Tupelo	**5.2 B**	**4.3 B**	**178 B**	**2151 B**	**218 B**	**18 B**
Beulah	**5.2 B**	**18.8 B**	**414 A**	**2312 AB**	**659 B**	**10 C**
Tylertown	**6.1 A**	**55.6 A**	**323 A**	**1921 B**	**247 B**	**37 A**
P-value	*0.0357*	*0.0186*	*0.0019*	*0.0459*	*0.0368*	*<.0001*

Soil Chemical Properties - Micronutrients

Location	Micronutrients					
	Al	B	Cu	Fe	Mn	Zn
	lb/ac					
Michigan City	93 B	0.33 B	0.73	16.3 A	39.0 A	1.5 C
Tupelo	354 A	0.33 B	1.13	23.5 A	42.7 A	2.5 B
Beulah	47 B	0.27 B	0.67	27.1 A	14.0 A	3.9 A
Tylertown	31 B	0.60 A	0.47	1.3 B	8.6 B	3.5 A
P-value	*0.0039*	*0.0063*	*NS*	*0.0058*	*0.0036*	*0.0011*

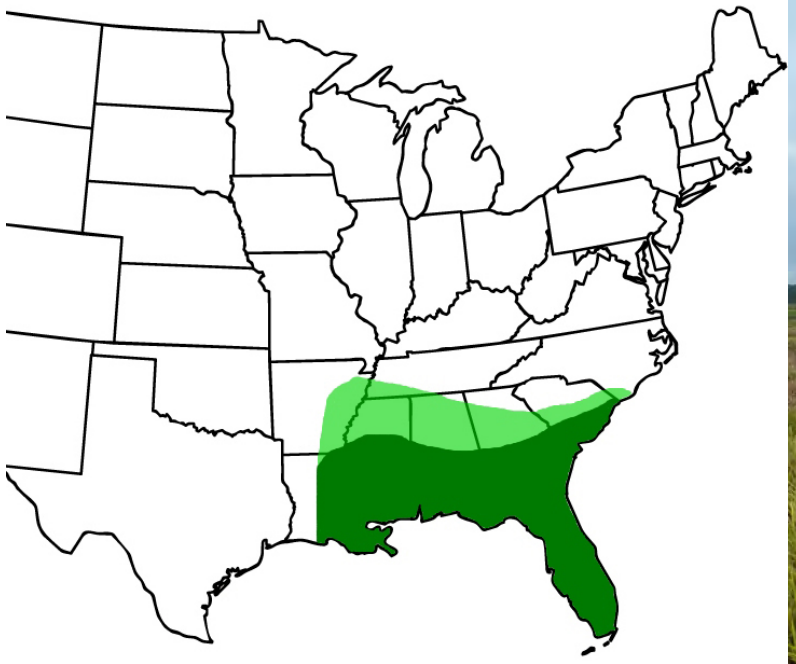
Soil Health Scores

	Physical		Biological				Chemical				
Location	AWC	AG	OM	SPI	SR	AC	pH	P	K	ON	Score
Michigan City	97 A	76 A	81	43 AB	71 A	31	54 B	68 B	90	100 A	71 A
Tupelo	84 B	83 A	56	57 A	56 AB	20	5 C	61 B	100	81 B	61 AB
Beulah	83 B	29 C	70	30 B	35 B	21	0 B	93 AB	100	100 A	56 B
Tylertown	84 B	44 B	66	35 B	67 A	27	78 A	100 A	100	100 A	70 A
P-value	*0.0014*	*<.0001*	*NS*	*0.0489*	*0.036*	*NS*	*0.0384*	*0.0428*	*NS*	*0.0006*	*0.0479*

- **< 20 indicates *Very Low (constraining)* functioning.**
- **20 - 40 indicates *Low* functioning.**
- **40 to 60 indicates *Medium* functioning.**
- **60 and 80 indicates *High* functioning.**
- **> 80 or greater indicates *Very High* functioning.**

Ongoing Research Project

- There are over 11 million acres of bahiagrass across the southern USA.
- Evaluation of commercially available liquid fertilizers in bahiagrass production.
- Nitrogen use efficiency, improvement in nutritive value, cost of production and return.



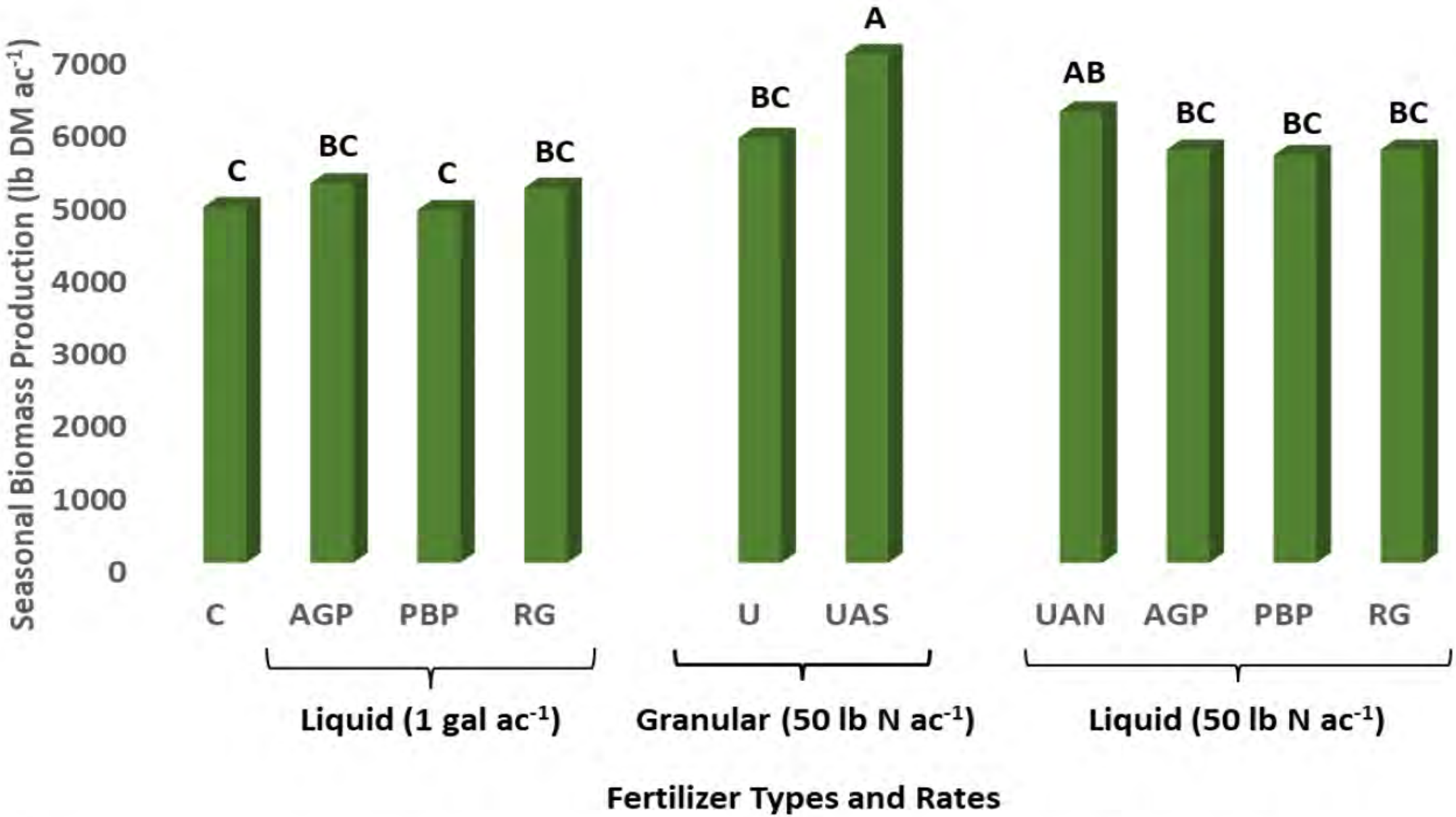


Figure 2. Biomass production of Tifton 9 bahiagrass when treated with granular of liquid fertilizers.

Units	Bulk Amount Applied	Treatment	Yield (lb/ac)	Yield Increase (%)**	Fertilzer Cost ($/ton or $/Gal)	Cost ($/ac)	Cost ($/lb DM increase)
lbs	0	Control	4893	--	--	--	
lbs	218	Urea (46-0-0)	5844	19	938.00	101.96	0.11
lbs	304	Urea Ammonium Sulfate (33-0-0S)	6998	43	825.00	125.00	0.06
Gal	42	Urea Ammonium Nitrate Solution (32-0-0)	6207	27	730.00	114.06	0.09
Gal	3	AgritechPlus (10-20-10)	5221	7	37.00	111.00	0.34
Gal	132	Agritech Plus*	5684	16	37.00	4884.00	6.17
Gal	3	Pasture Booster Prime (30-0-0)	4852	-1	54.99	164.97	-4.02
Gal	48	Pasture Booster Prime*	5608	15	54.99	2639.52	3.69
Gal	3	Royal Grow (30-0-0)	5160	5	35.00	105.00	0.39
Gal	48	Royal Grow*	5684	16	35.00	1680.00	2.12

Denotes application of product to meet the recommended application of 50 lb N/ac per cut.

****Percent Yield increase compared to the control.***

Forages Adaptation in a Resilient Climate – Brachiaria Cultivar Evaluation

- Study conducted at four locations (Starkville, Brooksville, Newton, McNeil).
- 11 Brachiaria cultivars.

Outreach Programs

- ***Training Participations***
  - White Sand Research Unit – Poplarville (2023)
  - New Albany, MS (2022) – Small Ruminants
  - Ripley, MS (2023) – Small Ruminants
  - Hattiesburg, MS (2023) – Small Ruminants
  - Beef Cattle Field Day- Coastal Plain Experiment Station (2023)
  - Cool-season Forage and Grazing Management Field Day (2023)
  - Lexington, MS (2023) – New Beginning Farmers, Ranchers, Veterans
  - Working Efficiently with Livestock Producers (WELP) (2023)
    - NatGLCI
    - 30 USDA-NRCS Agents from AR, MS, LA

- ***Training Curriculum Small Ruminants***
  - Programs include Forage identification, suitability, and grazing management
  - Parasite identification and FAMACHA certification
  - Animal Health


MISSISSIPPI STATE UNIVERSITY
EXTENSION
APRIL 5, 2023
9 AM – 12 PM
Registration Starts at 8:45 AM
1767 Agronomy Road
Starkville, MS 39759
Beef cattle and hay producers, agricultural industry representatives, government personnel, and the general public.
COOL-SEASON FORAGE AND GRAZING MANAGEMENT FIELD DAY
Forage Variety
Nutrient Management
Cover Crops
Grazing Management
This is a free event, but registration is required!
Register at https://bit.ly/2023CSFT
Registration closes on March 31, 2023, by 5:00 PM
Contact information
Dr. Rocky Lemus at (662) 325-7718 or Rocky.Lemus@msstate.edu
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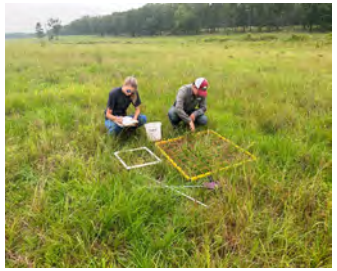


SHEEP & GOAT FARMERS' TRAINING
@ Tippah County
TAKING THE LAB TO THE FARM
MISSISSIPPI STATE UNIVERSITY EXTENSION
SARE
NRCS
AMACHA
4th APRIL, 9:00 am.
Tippah County Extension Office
10791B Hwy 15 S. – Fairgrounds
Ripley, MS 38663
For more information contact Mr. Brandon Alberson at (662) 837-8184
BASIC HERD HEALTH - Dr. Michael Pesato
FAMACHA - Dr. BJ McClenton & Mr. B. Alberson
PARASITE LAB - Dr. Leyla Rios & Ms. Lindsey Dearborn
FORAGES - Dr. Rocky Lemus
Register at bit.ly/2023TIPPAHCOGOAT
MISSISSIPPI STATE UNIVERSITY EXTENSION
Extending knowledge. Changing lives.
NCAT

Summary

- *It is important to recognize that it will take several years for soils to turn around depending on many complex factors.*
  - *Soil biological processes are complex, and they interrelate with the microbial species, soil moisture, temperature, soil structure, organic matter, forage species, and livestock classes.*

- *Soil quality depends on plant root growth, grazing management, and forage species diversity*
  - *Assess your forage resources.*
  - *Understand your soils and soil nutrient balance.*
  - *Develop a grazing management strategy that fits your operation and needs.*
  - *Implement a well-executed rotational grazing system also allows the recycling of plant nutrients in the paddocks.*
  - *Develop a targeted weed control program.*

Contact US

Mississippi Forages

MSForages

http://bit.ly/mississippiforages

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