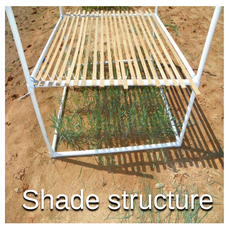
# QUALITY AND YIELD OF SEVEN FORAGES GROWN UNDER PARTIAL SHADING OF A SIMULATED SILVOPASTURE SYSTEM IN EAST TEXAS

J.E. Hill[1]*, K.W. Farrish[1], J.L. Young[1], B. Oswald[1], and A. Shadow[2]

Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University[1], and USDA Natural Resources Conservation Service, East Texas Plant Materials Center[2]

Woden soils, typic Paleudalfs, moderately well drained, acidic, low organic matter, marginally productive, used frequently for hay fields, grazing, and managed forests

Plugs started in green-house and planted at a rate of three plugs per linear foot (48 per plot)




Individual wood slatted shade structures are adjustable in height; 50% shaded by area

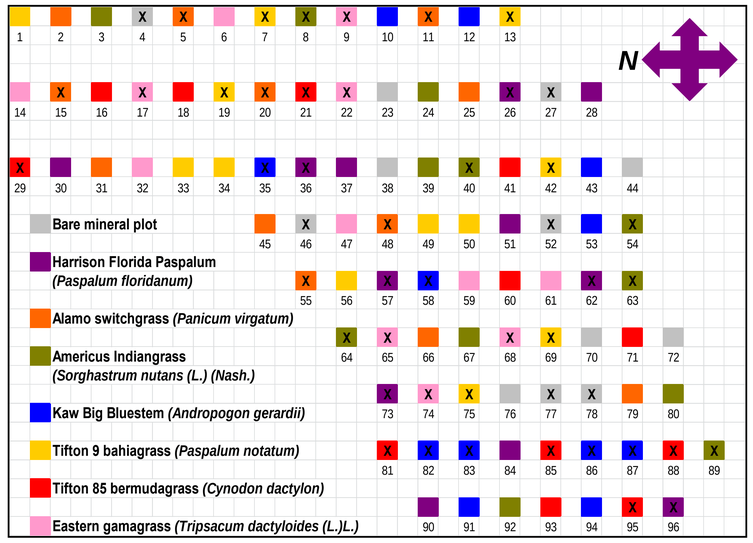
## Introduction

Large demands for products such as fiber and food have placed much demand on the world's resources; methods must be adopted that reduce pollution and utilize resources in a more sustainable way. Silvopasture is a type of agroforestry that combines tree production with grazing animals and has been shown to increase nutritional quality of both warm and cool season forage species (Burner and Brauer, 2003, Beurgler *et al*., 2005). Additionally, silvopasture allows a producer to diversify their products in a more economically sound way, with both short and long term income sources.

## Objectives

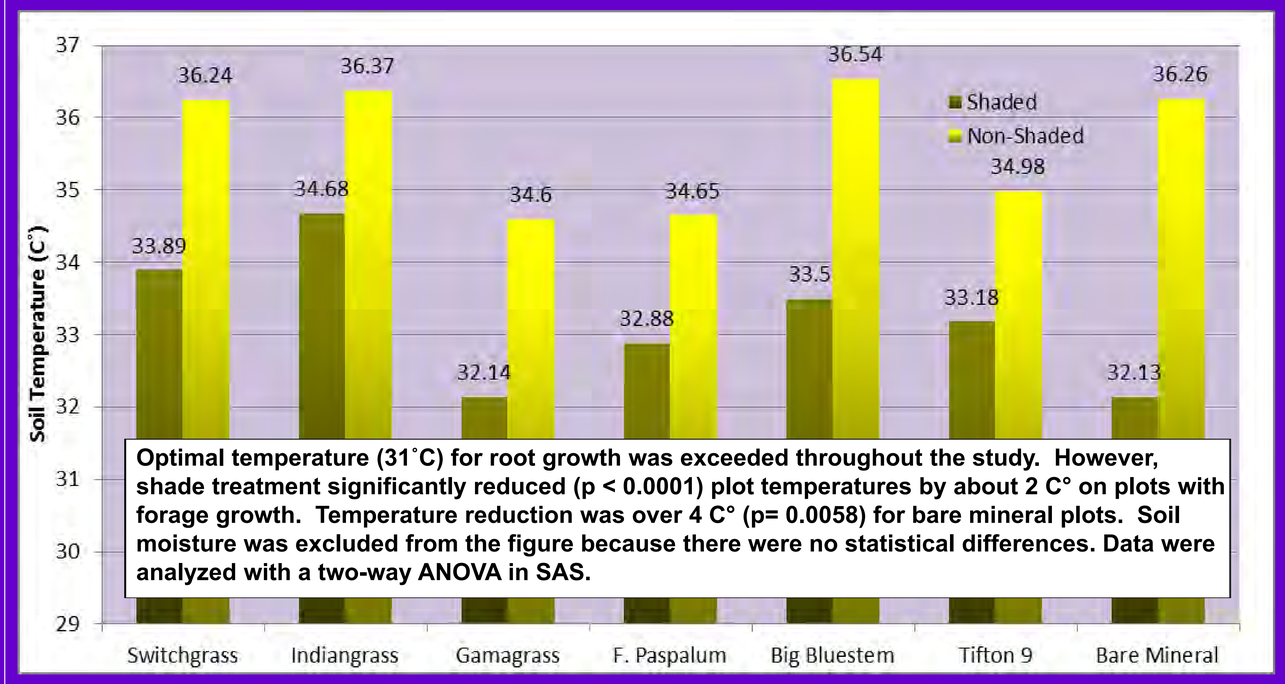
- Determine effects of species and cultivar on yield and quality of seven forage types under 50% shading typical of silvopasture systems
- Determine effects of nitrogen (N) rate (two levels) on yield and quality parameters of best performing forage types under partial shading typical of silvopasture systems
- Develop a simple prediction model that will estimate yield and quality of selected forages grown in a simulated silvopastoral system

*NIRS calibrations for each forage type are also being created

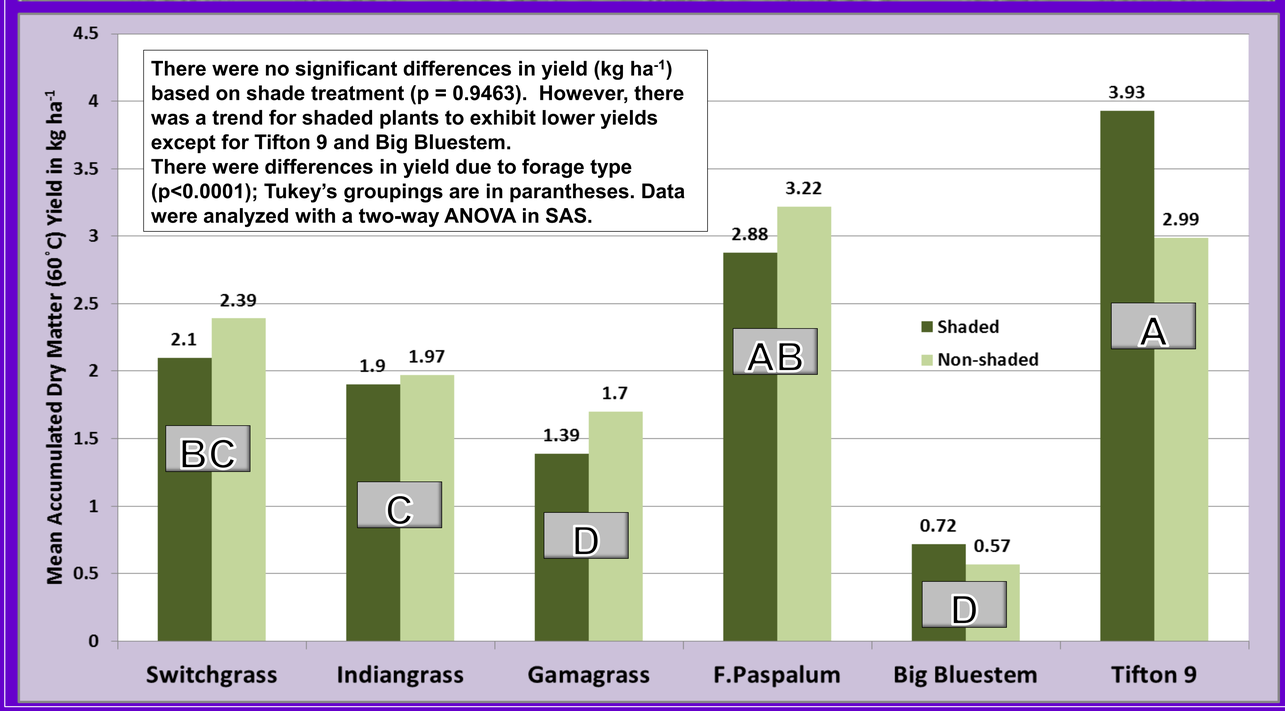



**A completely randomized 7 x 2 factorial design is used in this study with seven forage types (above) and two shade (light) levels: full sun, 50% full sun.**

**Forages clipped when approximate height is achieved (55-60 cm) and down to a minimum height (20 cm natives; 10 cm introduced grasses) to simulate intensive grazing. All plant heights were recorded, then samples were ground to 1 mm and analyzed for DMY, CP, NDF, ADF, IVTD and elemental composition.**




**Optimal temperature (31˚C) for root growth was exceeded throughout the study. However, shade treatment significantly reduced (p < 0.0001) plot temperatures by about 2 C° on plots with forage growth. Temperature reduction was over 4 C° (p= 0.0058) for bare mineral plots. Soil moisture was excluded from the figure because there were no statistical differences. Data were analyzed with a two-way ANOVA in SAS.**




**There were no significant differences in yield (kg ha$^{-1}$) based on shade treatment (p = 0.9463). However, there was a trend for shaded plants to exhibit lower yields except for Tifton 9 and Big Bluestem.**
**There were differences in yield due to forage type (p<0.0001); Tukey's groupings are in parantheses. Data were analyzed with a two-way ANOVA in SAS.**

Table 1. Mean CP, NDF, ADF, and IVTD values for each forage type, with p > F and Tukey's groupings reported (α = 0.05). There were no differences due to shade (p > F = 0.1305 - 0.9891). It should be noted that the establishment year is currently underway.

| Response Variable and p > F for forage type at alpha = 0.05 | n | mean | Tukey |
|---|---|---|---|
| | ---------- | g cg$^{-1}$ -------- | ---------- |
| **CP (p = 0.0677)** | | | |
| Tifton 9 bahiagrass (*Paspalum notatum*) | 18 | 15.37 | na |
| Alamo switchgrass (*Panicum virgatum*) | 26 | 15.36 | na |
| Kaw Big Bluestem (*Andropogon gerardii*) | 4 | 14.75 | na |
| Americus Indiangrass (*Sorghastrum nutans*) | 22 | 14.91 | na |
| Harrison Florida Paspalum (*Paspalum floridanum*) | 26 | 15.75 | na |
| Eastern gamagrass (*Tripsacum dactyloides*) | 23 | 16.72 | na |
| **NDF (p = 0.0290)** | | | |
| Tifton 9 bahiagrass (*Paspalum notatum*) | 18 | 69.05 | AB |
| Alamo switchgrass (*Panicum virgatum*) | 26 | 67.99 | AB |
| Kaw Big Bluestem (*Andropogon gerardii*) | 4 | 71.04 | A |
| Americus Indiangrass (*Sorghastrum nutans*) | 22 | 69.98 | AB |
| Harrison Florida Paspalum (*Paspalum floridanum*) | 26 | 69.23 | AB |
| Eastern gamagrass (*Tripsacum dactyloides* | 23 | 67.50 | B |
| **ADF (p = 0.0066)** | | | |
| Tifton 9 bahiagrass (*Paspalum notatum*) | 18 | 40.64 | AB |
| Alamo switchgrass (*Panicum virgatum*) | 26 | 40.01 | AB |
| Kaw Big Bluestem (*Andropogon gerardii*) | 4 | 41.52 | A |
| Americus Indiangrass (*Sorghastrum nutans*) | 22 | 40.93 | AB |
| Harrison Florida Paspalum (*Paspalum floridanum*) | 26 | 40.82 | AB |
| Eastern gamagrass (*Tripsacum dactyloides* | 23 | 38.15 | B |
| **IVTD (p = 0.0113)** | | | |
| Tifton 9 bahiagrass (*Paspalum notatum*) | 18 | 64.36 | AB |
| Alamo switchgrass (*Panicum virgatum*) | 26 | 67.09 | A |
| Kaw Big Bluestem (*Andropogon gerardii*) | 4 | 63.18 | B |
| Americus Indiangrass (*Sorghastrum nutans*) | 22 | 66.27 | AB |
| Harrison Florida Paspalum (*Paspalum floridanum*) | 26 | 67.63 | A |
| Eastern gamagrass (*Tripsacum dactyloides* | 23 | 65.40 | AB |

**Table 2. Plant tissue analyses of elemental concentrations of certain elements with significant differences due to forage type. There were no significant differences due to shade.**

| Forage type | P | K | Ca | S |
|---|---|---|---|---|
| | ---------- | -------g cg$^{-1}$ | ---------- | ---------- |
| Tifton 9 bahiagrass (*Paspalum notatum*) | 0.1462 C | 2.0201 AB | 0.2694 BC | 0.3148 AB |
| Alamo switchgrass (*Panicum virgatum*) | 0.2108 A | 1.5777 B | 0.1987 CD | 0.2189 BCD |
| Kaw Big Bluestem (*Andropogon gerardii*) | 0.1444 C | 1.9280 B | 0.2692 BC | 0.1741 CD |
| Americus Indiangrass (*Sorghastrum nutans*) | 0.1521 BC | 1.7921 B | 0.3241 AB | 0.1349 D |
| Harrison Florida Paspalum (*Paspalum floridanum*) | 0.1649 ABC | 2.7360 A | 0.3781 A | 0.3918 A |
| Eastern gamagrass (*Tripsacum dactyloides*) | 0.1983 AB | 2.1561 AB | 0.1818 D | 0.2567 BC |
| P > F | 0.0005 | 0.0012 | <0.0001 | <0.0001 |

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