Florida Cattle Enhancement Grant Application
Title: Identification of superior limpograss cultivars under low-input systems

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Award ID: 024122

Project Overview

Fertilization is one of the most costly inputs in cow-calf production systems in Florida. In 2014, IFAS released two new cultivars, Gibtuck and Kenhy, and there has been a rapid increase in acreage of these new cultivars in South and Central Florida. However, there is no information regarding specific fertilization requirements of the new limpograss cultivars and whether there is any difference in fertilizer use efficiency among cultivars. The objective of these studies will be to identify limpograss cultivars with greater production, nutritive value, and persistence under low-input systems. A plot study has been conducted in three locations, Ona, Gainesville, and Marianna and the treatments are the factorial combination of two fertilization levels, 80 lb N, 20 lb P2O5, 80 lb K2O/acre, or 40 lb N, 10 lb P2O5, and 40 lb K2O/acre, four limpograss cultivars, Floralta, Kenhy, Gibtuck, and 1, and two harvest frequencies, 6 and 12 weeks.

Deliverables	Progress
1. Plant tissue samples from the last 12 week cycle of the 2016 growing season analysis - N and IVDOM	256 samples from Ona and Gainesville 2016 growing season (last 12 week cycle) were analyzed and the results presented in this report
2. Forage yield and N use efficiency 2016 data	Forage yield and N use efficiency data from the last 2016 12-week cycle from Gainesville and Ona were finalized and included in this report.
3. Plot establishment, cleaning, staging, and fertilization	The plots in Marianna were established and subjected to herbicide application, mowing, irrigation, and initial fertilization for successful establishment. Plots in Ona, Gainesville, and Marianna were maintained and fertilized.
4. Initial tissue samples for RNA extraction and gene expression from plots in Marianna	Samples were collected from Ona and Marianna and analyzed. The samples were subjected to real time PCR for Dof1, GS, and rbcs gene expression analyses. The results for Dof1 and RBCS are included in this report. The GS gene from corn and rice were tested but the expression was not detected in limpograss tissue, therefore, the results were discarded.

5. Plot harvest, sample processing and analysis for the 2017 growing season.	The first 12-week cycle harvest in 2017 were conducted in Ona, Gainesville and Marianna. Results from Gainesville and Ona are included in this report. Results from Marianna are being processed and will be available in the near future. Samples from the first 12-week cycle from Ona, Marianna, and Gainesville, and from the second 12-wk cycle from Gainesville and Ona were submitted to the laboratory for analysis.

Project completion: 100%

Project Results

Herbage yield and nitrogen use efficiency results from 2016 and the first 12-week cycle of 2017 for Ona are presented in Table 1. Gibtuck had greater herbage yield than Floralta, Kenhy, and Entry 1 had the least yield among all cultivars. Forage yield harvested from two 6-week regrowth interval or one 12-week was similar; however, forage fertilized with greater fertilization levels had greater yield than lower levels. Similarly, nitrogen use efficiency was greater for Gibtuck than the other cultivars. Regrowth interval did not affect nitrogen use efficiency; however, plots fertilized with lower levels of nitrogen had greater nitrogen use efficiency (Table 1).

Plots harvested at 6-weeks regrowth interval had greater crude protein and digestibility than 12-weeks. In addition, forage receiving greater levels of fertilizer had greater crude protein concentrations but similar digestibility. There were similar crude protein and digestibility among cultivars.

In Gainesville, there was no differences in forage yield among Kenhy, Gibtuck, and Floralta, which were greater than Entry 1. Plots harvested at 12-weeks regowth interval had greater forage yields than 6-weeks and forage fertilized with greater levels of fertilizer had greater forage yield than lower levels. In addition, plots had greater yields in the summer 2017 than fall 2016 (Table 2).

Nitrogen use efficiency was greater for Kenhy, Gibtuck, and Floralta than Entry 1. Similarly to the results at Ona, plots fertilized with lower levels had greater nitrogen use efficiency than higher levels of fertilizer and the nitrogen use efficiency was greater in the summer 2017 than fall 2016 (Table 2).

Table 1. Forage yield and nitrogen use efficiency of limpograss plots harvest in Ona in the fall 2016 and summer 2017.

Reponse variables	Forage Yield (lb DM/acre)	Nitrogen use efficiency (lb DM/lb N fertilized)	Crude Protein (%)	Digestibility (%)
Cultivar				
Gibtuck	3,300a[1]	57a	7.6a	54a
Kenhy	2,700b	41b	8.0a	53a
Floralta	2,500b	47b	7.4a	54a
Entry 1	2,000c	36c	8.1a	54a
Regrowth Interval				
6 weeks	2,600a	45a	9.2a	57a
12 weeks	2,700a	46a	6.2b	51b
Fertilization				
80-20-80	2,700a	34b	8.5a	54a
40-10-40	2,100b	54a	7.1b	53a
Harvest				
Fall 2016	1,500b	26b	7.6	52
Summer 2017	3,500a	54a	--	--

[1]Means followed by the same lower case letters within column and response variable are not different ($P > 0.10$)

There was no differences in crude protein and digestibility concentrations among cultivars. Forage harvested at 6 weeks had slightly greater crude protein and digestibility concentrations than 12 weeks.

In Ona, there were differences in Dof 1 and Rubisco gene expression among cultivars. Floralta and Entry 1 had greater Dof 1 gene expression than Gibtuck and Kenhy. Entry 1 had the greatest expression of the Rubisco gene, followed by Floralta and Kenhy. Gibtuck had the least expression of the Rubisco gene (Table 3).

Table 2. Forage yield and nitrogen use efficiency of limpograss plots harvest in Gainesville in the fall 2016 and summer 2017.

	Forage Yield (lb DM/acre)	Nitrogen use efficiency (lb DM/lb N fertilized)	Crude Protein (%)	Digestibility (%)
Cultivar				
Gibtuck	10,000a[1]	184a	4.3a	40a
Kenhy	10,800a	197a	4.0a	41a
Floralta	9,800a	183a	4.4a	38a
Entry 1	8,800b	162b	4.7a	38a
Regrowth Interval				
6 weeks	7,800b	141b	5.6a	40a
12 weeks	12,000a	222a	3.1b	38a
Fertilization				
80-20-80	10,400a	130b	4.5a	38a
40-10-40	9,400b	233a	4.2a	39a
Harvest				
Fall 2016	8,400b	154b	4.3	40
Summer 2017	11,400a	208a	--	--

[1]Means followed by the same lower case letters within column and response variable are not different ($P > 0.10$)

In Marianna, Kenhy had the least Dof 1 expression, followed by Floralta and Gibtuck, while Entry 1 had the greatest Dof 1 expression. The expression of the Rubisco gene was similar in Kenhy, Floralta, and Entry 1, which were greater than Gibtuck (Table 3).

Location/Cultivar	Dof 1	Rubisco
	Fold increase	
Ona		
Gibtuck	1.9b	1.7c
Kenhy	1.5b	2.0b
Floralta	2.2a	2.1b
Entry 1	2.5a	2.5a
Marianna		
Gibtuck	2.0b	1.9b
Kenhy	1.6c	2.7a
Floralta	2.3b	2.7a
Entry 1	2.8a	3.0a

[1]Means followed by the same lower case letters within column and response variable are not different ($P > 0.10$)

There was a significant correlation between nitrogen use efficiency and Dof1 and Rubisco gene expression. As nitrogen use efficiency increased, the fold increase in Dof1 and Rubisco gene expression decreased (Figure 1 and 2).

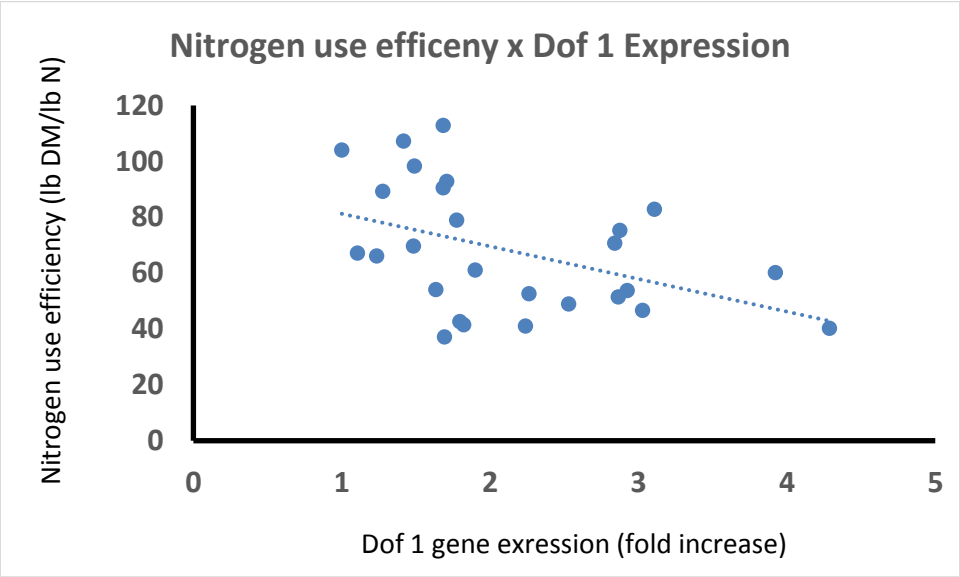

Figure 1. Correlation between nitrogen use efficiency and Dof 1 gene expression

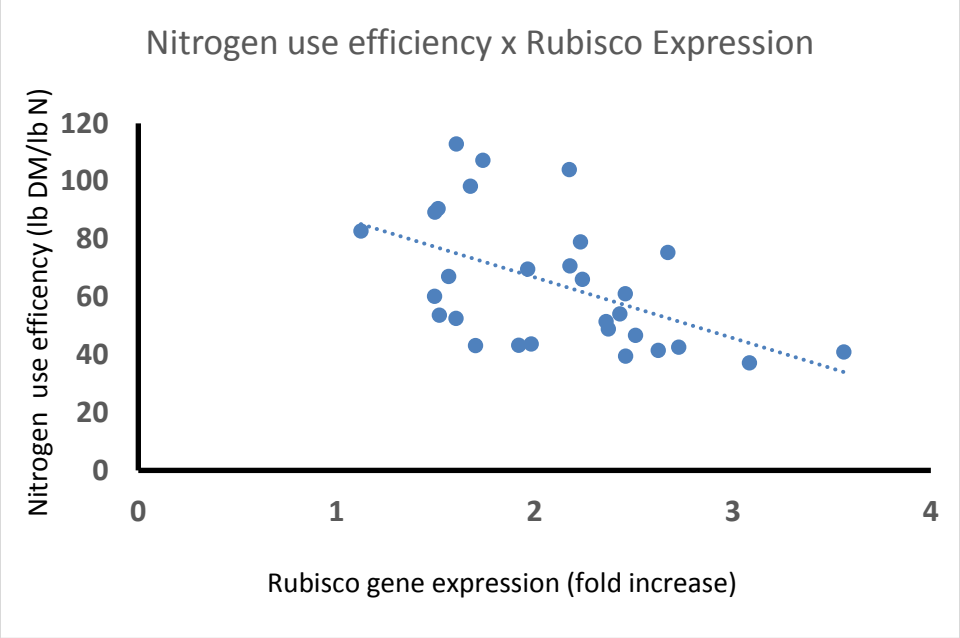

Figure 2. Correlation between nitrogen use efficiency and rubisco gene expression

Implications

Forage and livestock producers should consider planting Gibtuck or Kenhy in poorly drained soils in South Florida due to greater forage yield and nitrogen use efficiency. Gibtuck had 20% greater nitrogen use efficiency than Floralta, which could lead to significant increase in forage production efficiency.

Based on the current data, there are no attractive traits identified in Entry 1 that would justify the release of Entry 1 as a new cultivar of limpograss.

When managing limpograss for harvest as hay or silage, longer regrowth intervals should be considered if the objective is to producer greater yields. There is a detrimental effect on nutritive value; however, it can be compensated with the appropriate supplementation program. The persistence data will be collected at the end of 2017; however, there is an initial perception that plots harvested at 12-week have greater limpograss ground cover and decreased amount of undesirable species.

There was a significant but relatively small increase in forage yield when fertilizer levels were increased from 40-10-40 to 80-20-80. In addition, the nitrogen use efficiency was decreased with greater levels of fertilizer. Therefore, greater levels of nitrogen fertilization may not be economically viable. The efficiency of N fertilization in the spring/summer was greater than in the fall; however, forage produced in the fall has certainly greater value due to limited forage available.

The genes tested in this trial were promising and may be used as indicators of nitrogen use efficiency in limpograss. The goal for the continuation of the project will be to identify more genes that could also be used to select plants with greater nitrogen use efficiency. Ultimately, we could test several plants within the population of a specific cultivar and based on the expression of those genes, we will be able to select plants that will have greater production with less nitrogen fertilizer.

BUDGET FOR FLORIDA CATTLE ENHANCEMENT FUND- BUDGET JUSTIFICATION					
PROJECT TITLE: Identification of superior limpograss cultivars under low-input systems					
DETAILED LINE ITEM DESCRIPTION	QTY	% Complete	TOTAL	EXPLANATION/JUSTIFICATION OF DELIVERABLE	COMPLETION DATE
Plot establishment, maintenance, harv	N/A	100%	$ 8,843.70	Maintenance and harvest of plots in three locations, sample processing, preparation, and storage for analyses. Field supplies, fertilizer, herbicide, bags, zip ties, flags, fuel for forage harvester, parts for forage harvester	9/1/2017
Soil and forage analysis	N/A	100%	$ 1,722.92	Material for soil and forage analysis	9/1/2017
Laboratory Analyzes	N/A	100%	$23,761.38	Forage nutritive value and real time PCR analysis	9/1/2017
Final research project report	N/A			Project report detailing research, which may include, findings, future needs, results, conclusions, issues, risks, assessments and all other pertinent information.	9/1/2017
Indirect Cost	N/A		$ 4,119.38		N/A
GRAND TOTAL: (equal to percentage of completion)			**$ 38,447.38**		