Sustainable Herbaceous Energy Crop Production in the Southeast United States

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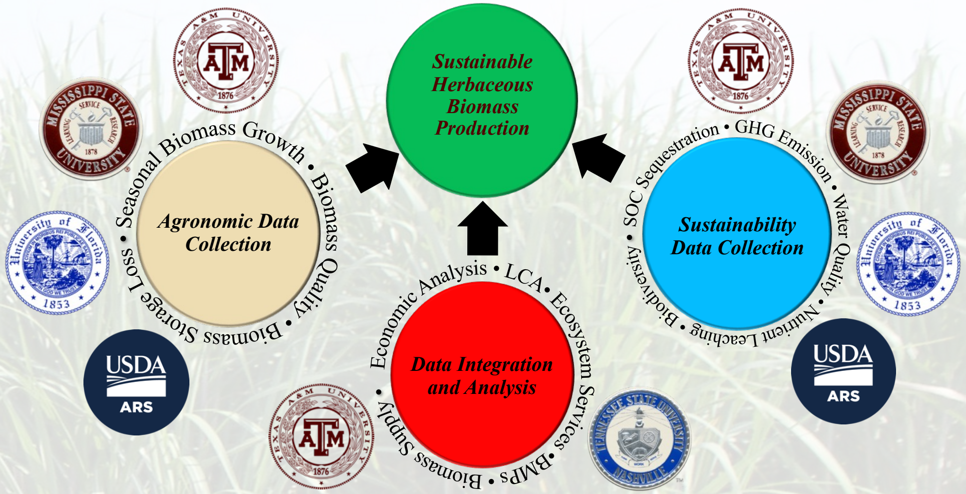
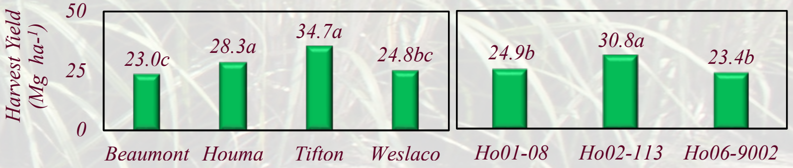
Overriding Goals

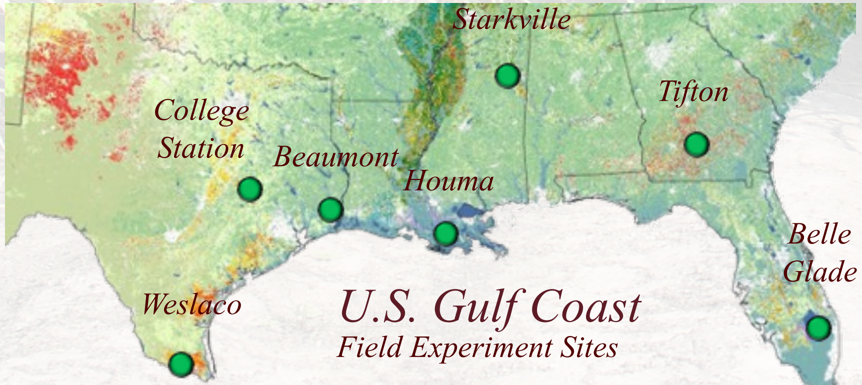
- *To characterize the seasonal dynamics of biomass sorghum and energycane production as purpose-grown energy crops*
- *To assess the economic viability and environmental sustainability of energy crop production and potential impact on conventional crop production*
- *To develop site-specific best management practices and operational plans to optimize biomass production, harvest and storage*



Biomass Production as Purpose-Grown Energy Crops



Source	DF	Sum of Squares	F Ratio	Prob
Model	17	1531.32	3.33	0.0001*
Genotype (G)	2	50.14	0.93	0.3998
Site (S)	5	143.59	10.64	<0.0001*
G × S	10	43.59	0.16	0.9983
Error	78	2108.26		
C. Total	95	3639.57		



U.S. Gulf Coast
Field Experiment Sites

June 7, 2023 - DOE Purpose-Grown Energy Crops Workshop
Supported by DOE Bioenergy Technologies Office (BETO)

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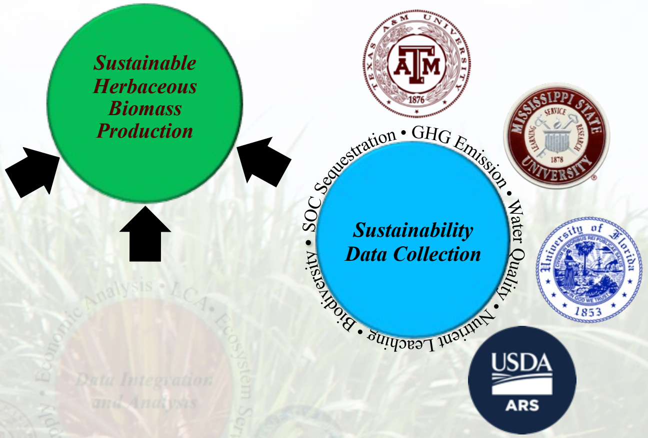
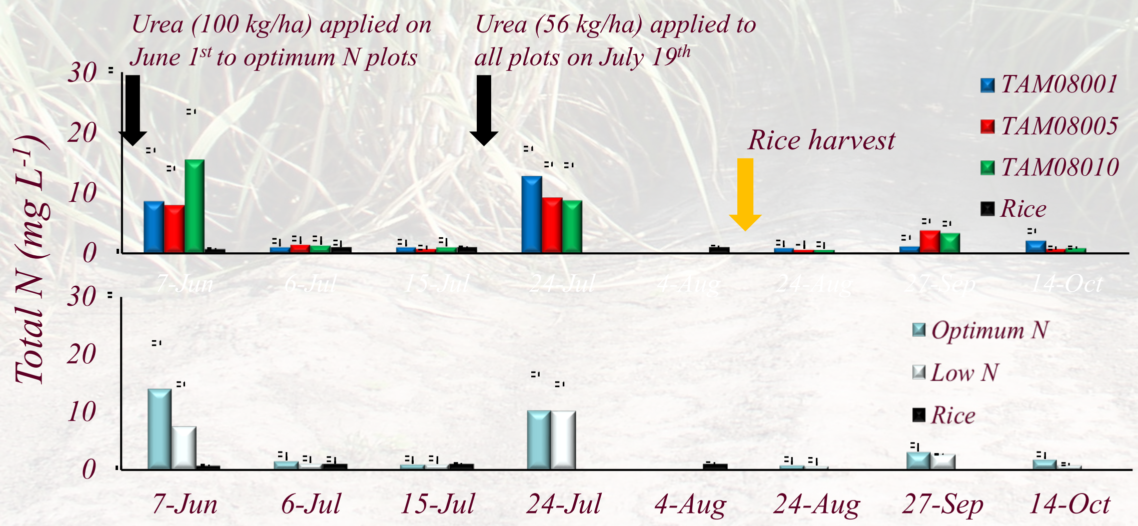
Environmental sustainability of energy crop production

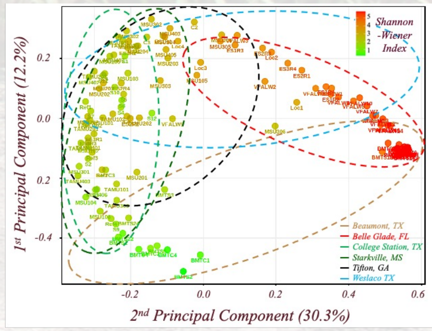
- *Soil C and N by layer*
- *Water percolation and runoff including sediment load and dissolved N*
- *NOx and CH_4 emissions*
- *N, P and K nutrient removal by bioenergy crops and the dominant conventional crop at each research site*
- *Energy use in biomass sorghum and energycane production using the GREET model*
- *Arthropod and microbial biological diversity*





Nitrous Oxide Emission

Source	DF	Sum of Squares	F Ratio	Prob
Model	5	392037.7	10.71	0.0060
Genotype (G)	2	15481.4	1.06	0.4043
N Rate (N)	1	355721.3	48.58	0.0004
G x N	2	20835.0	1.42	0.3121
Error	6	43933.5		
Total	11	435971.2		



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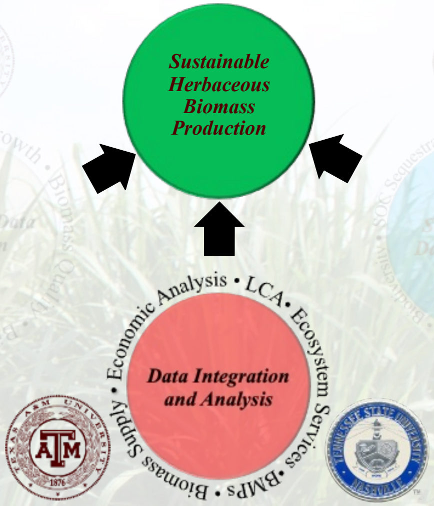
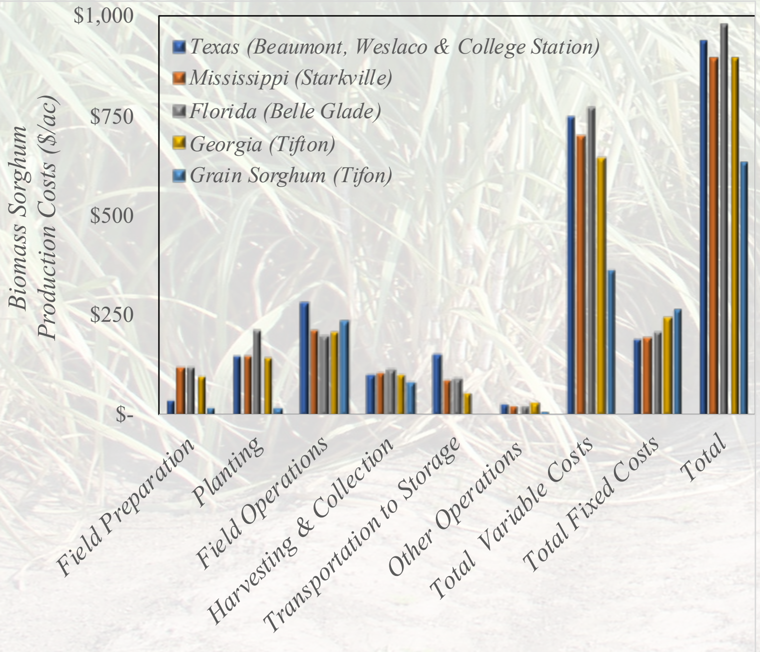
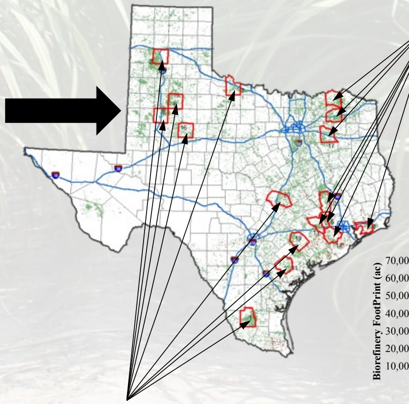
Economic viability and potential impact on conventional crop production

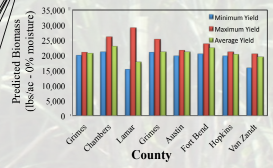
- *To develop site-specific BMPs and operational plans to optimize biomass production, harvest and storage*
- *To determine the putative impact of a bioenergy industry on conventional crop production*

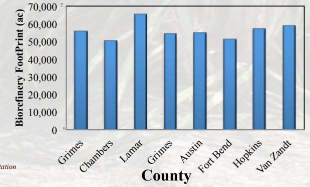


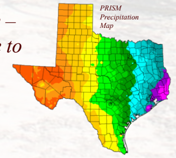
Beta Test for a Comprehensive Southeast U.S. Bioenergy Facility Site Selection Analysis Focusing on Texas











Biorefinery Footprint to Produce 200 M Liters Ethanol/Yr

***Table 4**. Analysis of variance for the proportion of conventionally planted crop acreage in Texas that would putatively convert to producing either biomass sorghum or energycane as cellulosic feedstock.*

Source	DF	Sum of Squares	Mean Square	F Ratio [b]
Model	12,859	170,976,444,975	13,296,247	13,296,247
Year	29	1,467,117,506	50,590,259	26,678
County	253	30,491,086,462	120,518,128	63,554
Soil Type	10	451,732,745	45,173,274	23,821
Irrigation Practice	1	2,571,350,864	2,571,350,864	1,355,976
Original Crop	12	11,823,607,181	985,300,598	519,588
Commodity Price Scalar	4	5,612,903,334	1,403,225,834	739,977
Biomass Price ($/Mg)	4	11,818,281,592	2,954,570,398	1,558,064
2-Way Interactions	12,546	106,740,365,292	1,726,507,617	4,487
Error	6,455,765	12,242,127,979	1,896	
Total	6,468,624	183,218,572,954		

Successful establishment of a bioenergy economy will likely be determined by government seed funds and development of regional commodity grant support programs to promote increasingly more efficient bioenergy crop production and management systems