

Prospects for Producing Ethanol from Sugar in the United States

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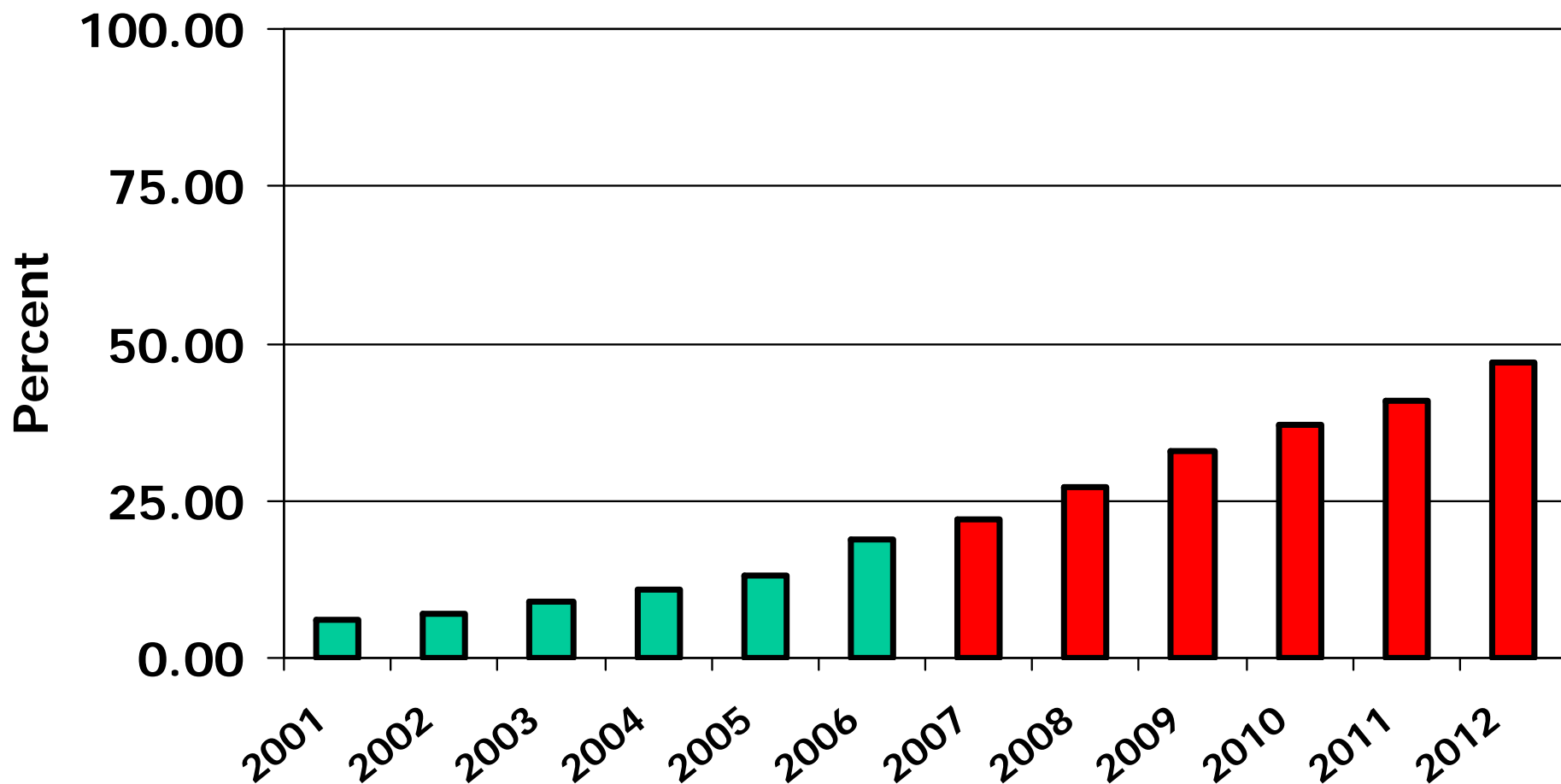
Outline

- Background:
- Previous Studies
- Our Sugarcane to Ethanol Studies
- Comparison of Ethanol Production Costs of Corn/Sorghum and Sugarcane
- U.S. Sugar Policy?
- Summary and Conclusions

Background

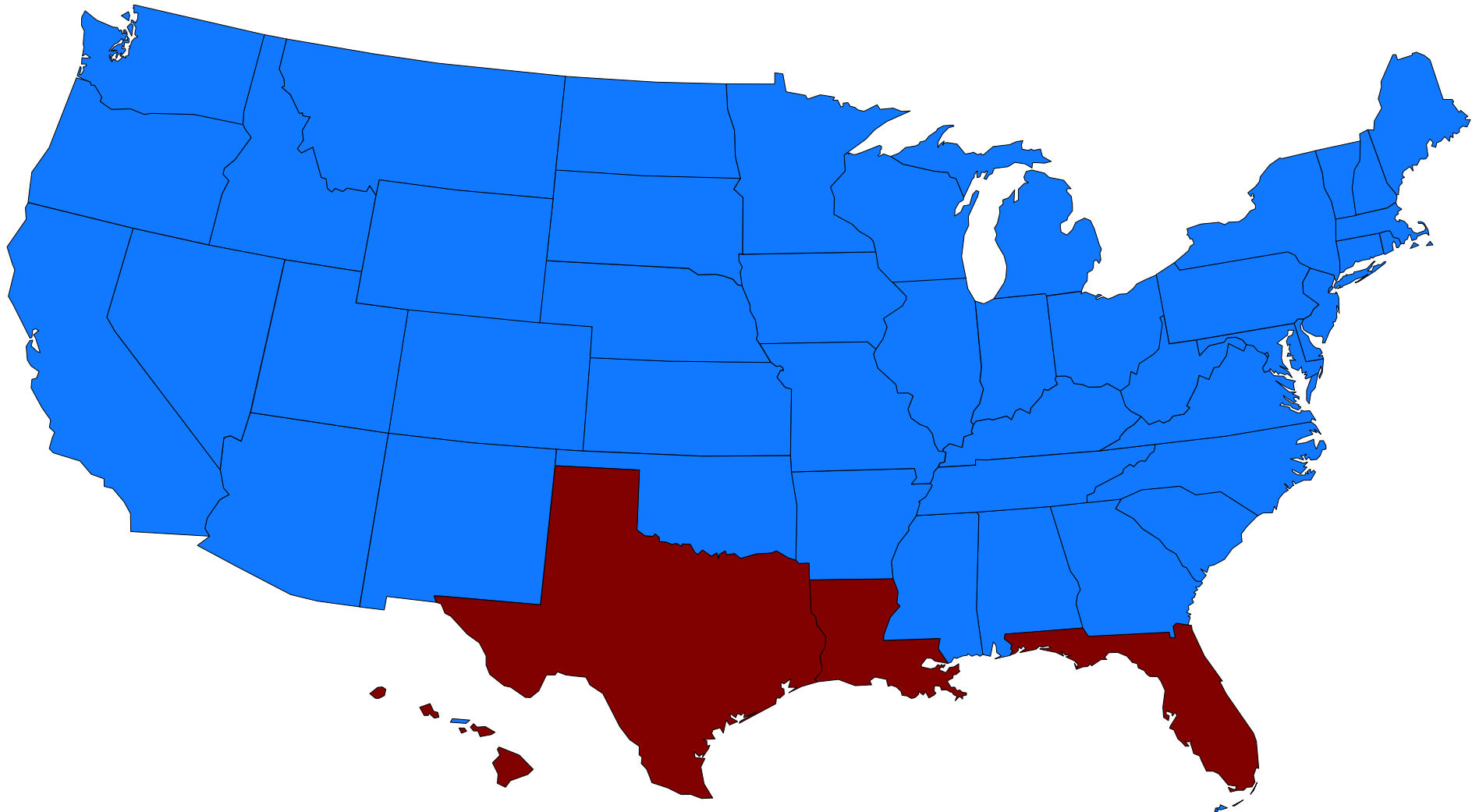
- AFPC and our Sugarcane to Ethanol Work
 - The Agricultural and Food Policy Center was established in 1983 to conduct analyses of the impacts of policy proposals and/or implementation procedures on stakeholders
 - Have gained a national reputation for modeling risk and incorporating risk in policy analyses
 - Collect financial and production information from representative farms and ranches across the U.S.
 - Primary constituency – agricultural committees of the U.S. Congress

Percent of 11 Bil Bu Corn Crop Needed to Fill Projected Ethanol Plant Capacity, 2001 – 2012.

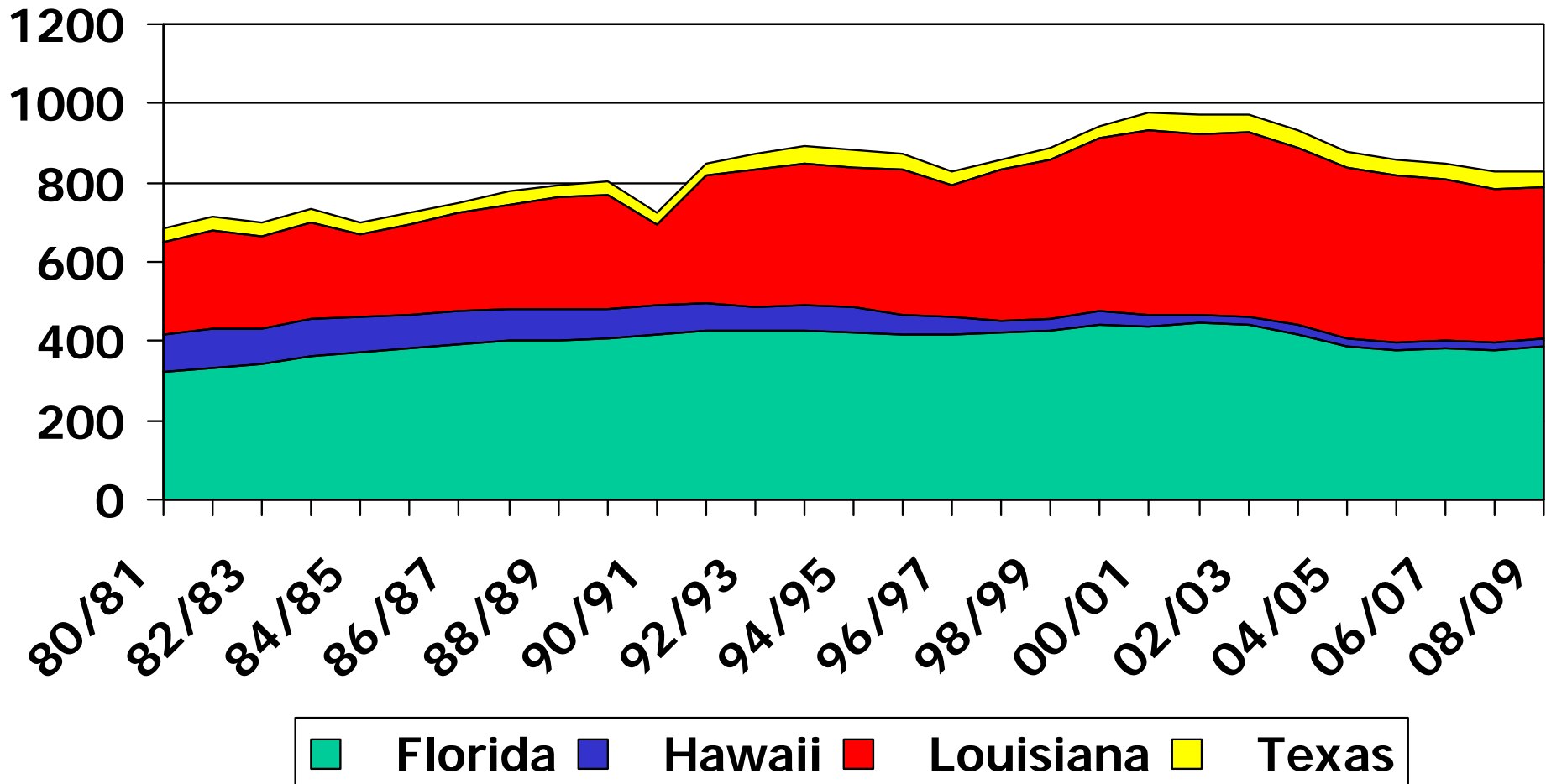


Source: AFPC Estimates

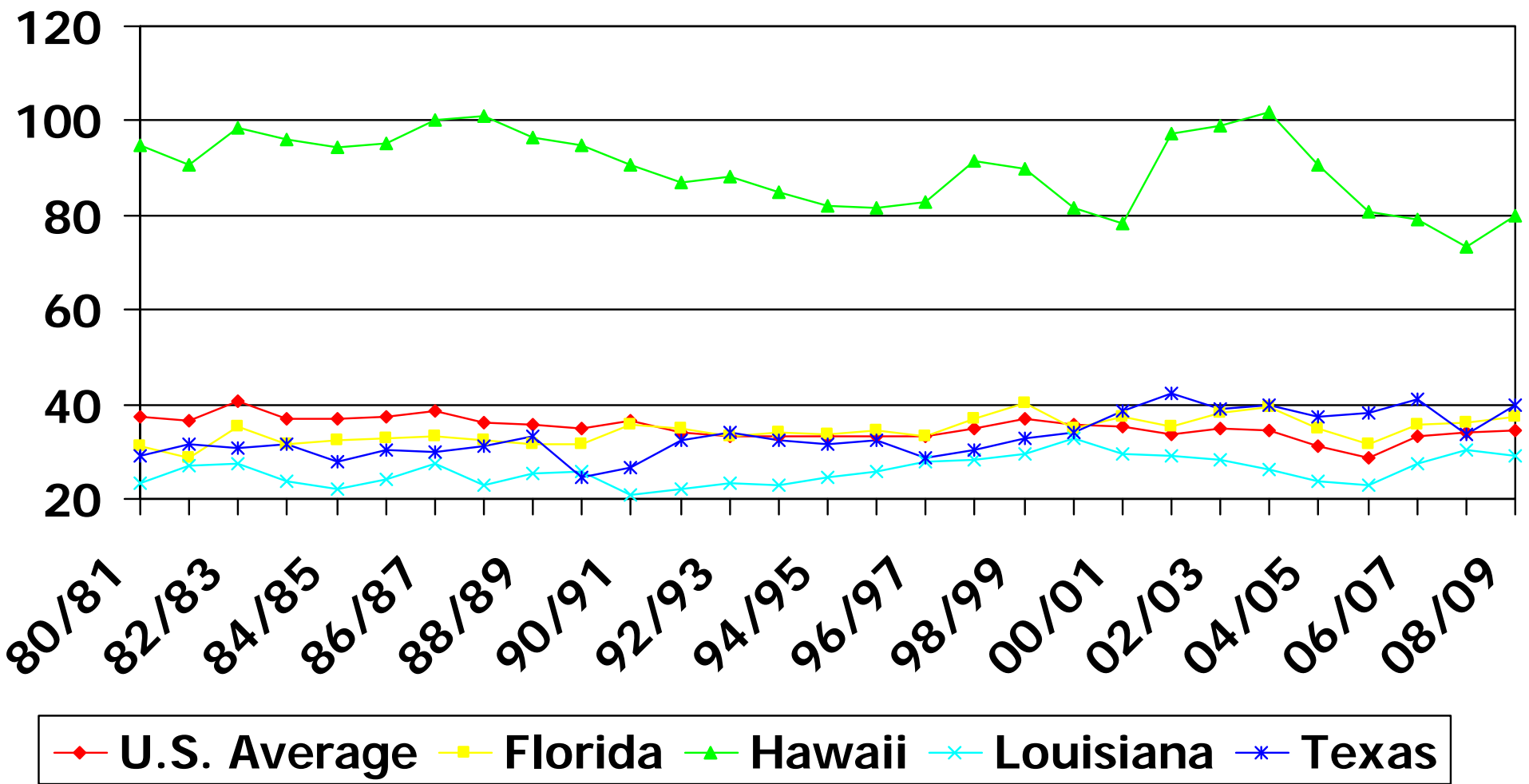
U.S. Sugarcane Producing States



Sugarcane Harvested Acres, By State, 80/81 to 08/09



Sugarcane Yields (Short Tons/Acre), By State, 80/81 to 08/09



Previous Studies

- Bryan and Bryan International. "Economic Impact Assessment for Ethanol Production and Use in Hawaii." Golden, CO: Bryan and Bryan International, November 2003.
- Gallagher et al. "The International Competitiveness of the U.S. Corn-Ethanol Industry: A Comparison with Sugar-Ethanol Processing in Brazil." *Agribusiness* 22,1(2006):109-34.
- Shapouri, Salassi, and Fairbanks. "The Economic Feasibility of Ethanol Production from Sugar in the United States." 2006
www.usda.gov/oce/reports/energy/EthanolSugarFeasibilityReport3.pdf

AFPC Sugarcane to Ethanol Research

- Ribera, Luis A., Joe L. Outlaw, James W. Richardson, Jorge da Silva, and Henry Bryant. "Integrating Ethanol Production into a U.S. Sugarcane Mill: A Risk Based Feasibility Analysis." Texas Agricultural Experiment Station, Department of Agricultural Economics, Texas A&M University, Agricultural and Food Policy Center Research Paper 07-1, February 2007
- Outlaw, et al. "Economics of Sugar-Based Ethanol Production and Related Policy Issues." *Journal of Agricultural and Applied Economics* 39,2(August 2007):357-63. ageconsearch.umn.edu/bitstream/6515/2/39020357.pdf
- Ribera, et al. "Mitigating the Fuel and Feed Effects of Increased Ethanol Production Utilizing Sugarcane." Chapter in *Biofuels, Food & Feed Tradeoffs*, the proceedings of a Farm Foundation Conference, 2007.
- Outlaw, Burnquist, and Ribera. "Bioenergy-Agricultural Issues and Outlook." in *Contemporary Drivers of Integration*, Fourth Annual North American Agrifood Market Integration Workshop, Huff et al eds., July 2008.

Feasibility of Cane/Sorghum Plant

- Issues to Overcome:
 - Seasonal use of plant
 - Sugar program
 - Food vs Fuel
- Have looked at this several different ways:
 - Stand alone sugarcane to ethanol
 - Brazilian style joint sugar/ethanol production
 - U.S. style joint sugarcane and feedgrain ethanol production
 - Will provide an example of this approach using worst case scenario (no established sugarcane production)

Assumptions

- 100 mil gallon nameplate so 105 mil gallons sold
 - Approx 6 mo of year grind cane and 6 mo of year use dry mill process with grain
 - Plant buys and owns all harvesting equipment
 - Plant loans growers initial start-up costs for 3 years to be paid back from Yrs 1-3
 - Feedstocks
 - Sugarcane
 - Grain sorghum (could use corn if wanted to)

Assumptions (Continued)

- Goal of 50 mil gallons from sugarcane requires:
 - 85,000 acres of sugarcane
 - Initial establishment cost \$650/acre
 - Annual production costs \$350/acre
 - Average yield 28 tons (approx the same as Louisiana)
 - Producers receive \$17/ton for cane and have \$0 harvesting costs
 - 19.6 gallons of ethanol/ton of sugarcane**
 - If sugarcane production is short – will maintain 100 mil gallon production with grain

Assumptions (Continued)

- Plant and equipment would be financed:
 - 50% equity – return 15%/year dividends
 - 50% debt at 9% over 10 years
- Total Investment Costs - \$276 mil
 - \$196 mil plant
 - \$10 mil vinasse handling
 - \$13.2 mil (20 harvestors, 50 tractors, 20 buggies, and 60 semi trucks w/ trailers, 15 pickups, 2 suburbans)
 - \$1.7 mil (office and shop equipment)
 - \$55.3 mil (cane establishment)

Results

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Producer										
Receipts (\$/ac)	476.00	476.00	476.00	476.00	476.00	476.00	476.00	476.00	476.00	476.00
Cost (\$/ac)	216.66	566.66	566.66	350.00	350.00	650.00	350.00	350.00	350.00	350.00
Net Income (\$/ac)	259.34	-90.66	-90.66	126.00	126.00	-174.00	126.00	126.00	126.00	126.00
Plant										
Net Income (million \$)	74.84	74.79	74.90	56.96	56.01	55.22	53.86	52.42	50.88	50.02

Assumptions:

- 28 tons/ac yield
- \$17/ton to grower
- \$650/ac establishment cost, loaned to grower and paid back years 1-3 (\$216.66/ac)
- \$350/ac annual cost

Sensitivity Analysis

Varying Producer Cane Price

Sorghum Price (\$/bu)	2.17	2.17	2.17	2.17
Cane Price (\$/ton)	15.00	17.00	19.00	21.00
Avg. ROI	15.5%	13.7%	11.9%	10.1%
Producer Avg. NR (\$/acre)	10.00	66.00	122.00	178.00

Sensitivity Analysis

Varying Ethanol Price

Ethanol Price (\$/gal)	1.40	1.60	1.80	2.00	2.20
Avg. ROI	-10.8%	-1.6%	6.1%	13.7%	21.3%

Sensitivity Analysis

Varying Sugarcane Yield

Cane Yield (ton/acre)	24	26	28	32
Avg. ROI	14.5%	14.1%	13.7%	12.9%
Producer Avg. NR (\$/ac	-2.00	32.00	66.00	134.00

Comparison of Ethanol Production Costs of Corn/Sorghum and Sugarcane

Grain Sorghum

Costs per Gallon of Ethanol @\$3.50 Corn/Sorghum	
Corn/Grain Sorghum	\$1.28
Processing	\$0.53
Total	\$1.81
Less DDG Credit	\$0.25
Net Cost	\$1.56

Source: AFPC estimate

Comparison of Ethanol Production Costs of Corn/Sorghum and Sugarcane

Sugarcane

Cost per gallon of ethanol

	Brazil
Cane (\$/gal)	0.84
Administrative	0.10
Processing	0.28
Total	<u>1.22*</u>

* It was \$0.89/gal with x-rate at R\$3/\$US

	US
Cane (\$/gal)	0.91
Adm, Processing, Interest	0.72
Total	<u>1.63</u>

Comparison of Ethanol Production Costs of Corn/Sorghum and Sugarcane (Updated)

Sugarcane

Feedstock	\$0.85
Harvest & Hauling	\$0.25
Administrative Costs	\$0.10
Ethanol Processing	\$0.28
Denaturant	\$0.08
Capital Cost & Depreciation	\$0.33
Total Cost/gallon	\$1.89

Source: AFPC estimate, February 2009

The Producer Return

- Current estimated costs of production/ton = \$14.95 (35 tons/ac, 5 yr production)
- Our estimated \$17/ton to producer would yield about \$70/ac
 - Not bad compared to other program crops (and eligible for direct payments on base acres)
- With the sugar program the estimate is \$26/ton (assuming 11% sugar) which would yield \$386.75/ac

U.S. Sugar Policy?

- Sugar Price Support
 - Operates as intended
 - Little economic incentive to switch on their own
- Import Quotas
 - Operates as intended
 - From fuel point of view inhibits growth of industry if all intermediate sugar products are prohibited as well
- Feedstock Flexibility Program for Bioenergy Producers (Sugar for Ethanol Program)
 - Hard to see working since an extra \$0.70/gallon will be expended to refine to sugar then process into fuel

Summary and Conclusions

- Ethanol Production from Sugarcane is Possible
 - Significant Impediments from Sugar Program (for existing sugar producers)
 - We expect ethanol from sugarcane to happen “outside” the current sugar program/allotment system
 - Sugarcane a feasible alternative especially given high feedgrain prices
- Could be sugarcane only plant but more likely joint production due to seasonal production