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Prospects for Producing Ethanol from Sugar in the United States

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Texas A&M System



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/EthanolSugarFeas ibilityReport3.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 | 1.22* |
| * It was \$0.89/gal with x-rate a | t R\$3/\$US |
| | |
| | US |
| Cane (\$/gal) | 0.91 |
| Adm, Processing, Interest | 0.72 |
| Total | 1.63 |

Source: AFPC estimate used in 2007 and 2008 analyses

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