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Update on Costs of Producing Fuel Alcohol from Small-Scale Plants

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Interdisciplinary research with the small-scale fuel alcohol research plant at South Dakota State University (SDSU) has now been underway for three years. The SDSU pilot plant has undergone major modifications during that time. Until recently, most of the researchers’ attention has been focused on the use of corn as "feedstock" for the plant. A recent Agricultural Experiment Station publication authored by Randy Hoffman and Thomas Dobbs details the cost analysis findings of this research. Those findings are summarized in this issue of the Newsletter.

In this study, the data used for estimating the capital and operating costs of producing fuel alcohol were derived from experience with the SDSU pilot plant. The pilot plant data were adjusted, as briefly explained below, so as to reflect as carefully as possible 1981 costs of production under cooperative or commercial conditions.

Two plant sizes were examined. The first plant represented physical facilities and an operational structure very similar to the SDSU pilot plant. This type of system can produce alcohol of approximately 180-proof; in other words, the alcohol is not anhydrous, or water-free. Such a plant would be capable of producing nearly 50,000 gallons of alcohol and 378 tons of distillers wet grain (DWG), as a feed byproduct, annually. The second plant was structured for analysis by hypothetically expanding the SDSU pilot plant--primarily by assuming the addition of a great deal more fermentation capacity. Approximately 175,000 gallons of 185-proof alcohol and 1,356 tons of DWG per year could be produced from this plant.

Total costs of production for the first, or smaller, alcohol plant were estimated to be $2.99 per gallon. Subtracting a feed byproduct credit of $.30 per gallon left a net cost of $2.69 per gallon. For the larger plant, net costs were estimated to be $1.78 per gallon, $0.91 less than the estimated costs for the smaller plant. The $1.78 figure is comprised of $.33 in capital and other fixed costs, $1.75 in operating costs, and a $.30 credit for the feed byproduct.

Certain baseline assumptions on key cost components were made in the above estimates. In further analyses, the assumptions for some of the cost components were changed. The objective of these further analyses was to determine the impact of the changed assumptions on the estimated costs of producing fuel alcohol. The larger (175,000-gallon per year) plant was used in this part of the study.

Alcohol yield per bushel of corn

In the baseline analysis, alcohol yield per bushel of corn was assumed to be 2.6 gallons (on a 185-proof basis). Dropping the assumed yield to 2.3 gallons increased per gallon net costs from $1.78 to $2.01. Further decreasing the alcohol yield to 2.0 gallons resulted in net costs of producing alcohol of $2.30 per gallon.

Price of corn

The baseline analysis involved an assumed corn price of $2.50 per bushel. Dropping the price of corn to $2.00 resulted in a reduction of alcohol fuel costs from $1.78 to $1.59 per gallon. Increasing the corn price to $3.00 caused alcohol net costs to reach $1.97 per gallon.
Interest rates

In the baseline analysis, a 15% interest rate was used in amortizing equipment costs and "paying for" capital tied up for operating costs. Lowering the interest rate to 10% reduced net costs per gallon of alcohol from $1.78 to $1.72. Increasing the rate to 20% and 30% caused alcohol net costs to rise to $1.85 and $1.98 per gallon, respectively.

Conclusions

Fuel alcohol production costs ranging from $1.59 to $2.69 per gallon have been cited in this Newsletter. Economic feasibility involves a comparison of costs and returns, which has not been done here. A report now in preparation by SDSU economists will contain a full treatment of returns from small-scale fuel alcohol production. As a preliminary comment, however, one can definitely note that costs of producing 185-proof alcohol—with corn as the feedstock—are currently quite high in relation to returns one might expect in the near future. Alcohol of this proof has approximately 60% as many BTU's per gallon as gasoline. By that measure, a gallon of 185-proof alcohol would be worth $.78 when gasoline sells for $1.30 per gallon. Addition of the $.30 income tax credit available for use of 150 to 189-proof fuel alcohol brings the "return" to $1.08 per gallon, still considerably less than the per gallon costs cited here. As technology evolves and price relationships change over time, the prospects for economic feasibility could change, of course. Also, fuel alcohol research currently underway at SDSU with feedstocks other than corn may lead to different conclusions.

More details on fuel alcohol production costs are contained in SDSU Agricultural Experiment Station Bulletin 686 (A Small-Scale Plant: Costs of Making Fuel Alcohol, Sept. 1982), available at County Extension Service Offices in South Dakota or from the author of this Newsletter issue.