The Impact of Local Soil and Weather Conditions and Transportation Distance on the Net Energy Value of Corn Ethanol in the Southeastern USA

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An increase in the demand for bio-ethanol has sparked a recent increase in corn production in the southeastern USA. The net energy value (NEV), i.e., the energy output minus all energy input required, is crucial to the prospects of bio-ethanol as a substitute for fossil fuels. Factors impacting the NEV of corn ethanol include grain yield and the energy required for crop management and local transportation. Grain yield is largely affected by local weather and soil conditions. Within the corn producing regions of the southeastern USA, there is a large spatial variation in climate, weather, and soil conditions. In addition, the location of the corn field in relation to the ethanol plant affects the transport energy costs and thus also the ethanol NEV. The objectives of this study were to determine the NEV of ethanol produced from corn grown in counties in Georgia that represent different geographic regions with relatively large production of corn and the impact of the spatial variation in soil and weather conditions, and transportation distance of corn grain on ethanol NEV.

The counties that were selected include Bulloch, Floyd, Laurens and Mitchell. Local soil and weather data were obtained from the USDA-National Resources Conservation Service and the Cooperative Observer Program network of the National Climatic Data Center, respectively. Corn yield for three cultivars, including Pioneer 31D58, Pioneer 31G98 and Dekalb DKC 61-72 (RR2), were simulated with the Cropping System Model (CSM)-CERES-Maize model. Soil and weather conditions were simulated according to county specific information and farm management was simulated according to normal practices in the southeastern USA. The simulations were conducted for the period from 1939 to 2006. The simulated corn yield and irrigation requirements were linked to a spreadsheet for the calculation of NEV.

Ethanol NEV was first evaluated for conditions representing the four counties and an ethanol processing in the facility in Camilla, Mitchell County. Preliminary results show that across the three cultivars, the ethanol NEV differed significantly among the counties. In addition, there was also a significant difference in ethanol produced from corn grown in different soils within a single county. Results from comparisons of hypothetical scenarios, in which soils and the distance to the ethanol processing plant were set equal, but with different weather conditions, showed that the climatic variation among the four counties also accounted for some of the variation in NEV. The effects of transport distance on NEV were evaluated by comparing the difference in NEV among the four counties by the corresponding differences with transport distance set equal. Result from these analyses showed a significant impact of transport distances on the differences in NEV among all four counties. The results of this study suggest that the NEV of maize-ethanol can be improved by locating the production in areas with favorable soil and climatic conditions and in proximity of the ethanol plant. Further research will be aimed at identifying areas that are favorable for corn production for ethanol in Alabama, Florida and Georgia.

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