

## **Utilization of Farm Land in Ethanol Production: Corn Derived Feedstocks versus Switchgrass**

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Corn grain is the primary feedstock for ethanol production in the United States, while lignocellulosic biomass (e.g., crop residues and energy crops such as switchgrass.) is a potentially enormous feedstock for ethanol production. Large scale conversion technologies for lignocellulosic feedstocks may become available in the near future. We are interested in possible tradeoffs between utilizing land for corn production versus switchgrass production when considered in an integrated biorefinery context generating multiple products, particularly ethanol, from each raw material.

Both corn grain and corn stover are harvested in the corn cultivation system. Corn stover is collected at tolerable levels to minimize soil erosion. Ethanol is derived from corn grain via wet milling, and from corn stover and switchgrass via a hypothetical lignocellulose biorefinery, in which the ammonia fiber explosion (AFEX) process is used as a pretreatment to increase sugar yields from biomass. Protein is an important coproduct from both corn and switchgrass processing in the biorefinery.

The functional unit is defined as 1 hectare of farm land. The system boundary includes upstream processes, biomass production, the biorefinery, transportation and distribution of ethanol, and E10 fueled vehicle operation. The allocation procedures for external functions are done by the system expansion approach. Thus, the system boundary is expanded to include the avoided product systems (e.g., gasoline fueled vehicle operation, etc.). The potential impact categories considered here are nonrenewable energy consumption, natural resource use (e.g., coal, crude oil and natural gas), climate change, photochemical smog, acidification, and eutrophication. Crude oil displacement by the overall system is also calculated. Environmental impacts are estimated by characterization factors given by the United States Environmental Protection Agency (EPA-TRACI).

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