FEEDSTOCK AVAILABILITY

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What is the Food vs. Fuel Issue for Biofuels?

The food vs. fuel debate centers around the negative impact of rising food prices, particularly on the urban poor in developing countries, associated with diverting crops and farmland for biofuel production. In July 2008, for example, a World Bank report concluded that in combination with other factors biofuels produced from food grains had raised food prices between 70 to 75 percent. Other factors cited as contributing to the rise in food prices included the abrupt rise in the price of oil beginning in 2003, greater grain purchases by China and other countries, drought, protectionism and devaluation of the US dollar.

Much of the debate has focused on use of starch and vegetable oil as feedstock for conversion into ethanol and biodiesel. Ethanol from sugarcane initially avoided this problem and was used as evidence that converting food into biofuels was not the cause for increases in food prices, but this situation has changed with recent hikes in sugar prices. The future of this debate, however, does not hinge on the continued use of sugar, starch and vegetable oil as feedstock for biofuel production, but on the use of land formerly in food crops for growing energy crops. The production of second generation biofuels from non-food crops, crop residue, forest products and waste will shift the focus of the debate from food-based feedstock to use of farmland for biofuel production. The first sign of this problem appeared when producers of beer complained about the high cost of barley when land formerly used to produce barely was reduced to increase corn production. Ultimately what really matters is whether plant earth's finite land area can be managed to produce both food and fuel in increasing amounts for the foreseeable future to keep pace with a rising standard of living of an expanding global population. Can this be achieved without compromising the sustainability of planet earth's agro-ecosystem? This essentially is what the food vs. fuel debate is about.

It is estimated that converting the entire grain harvest of the US would produce only 16% of its auto fuel needs. The goal of the Energy Independence and Security Act of 2007 is to annually produce 36 billion gallons (136 billion liters) of biofuel by 2022. To produce this volume of ethanol from corn, every harvested acre of the US corn crop of approximately 80 million acres will need to yield 150 bushels of grain for conversion into 450 gallons of ethanol. This clearly indicates that second generation non-food, perennial fiber crops will need to become the main source of feedstock for biofuel production.

How Can The Air Force Contribute To Technology Development, Organization and Policy That Would Accelerate Biofuel Development?

A plentiful supply of low cost feedstock is the key to development of a sustainable biofuel industry. Tropical regions which enjoy high solar radiation and year-long growing seasons have a comparative advantage over the temperate regions to produce abundant feedstock at low cost.

In the tropics as elsewhere, biofuel crops offer their greatest promise of minimizing global warming if planted on degraded or marginal lands. In the humid tropics, land abandoned because of high soil acidity and depletion of nutrients prevents cultivation of more demanding and delicate food crops, but still enables hardy perennial grasses such as Imperata cylindrica (congograss) to flourish. Congograss may not be the best choice for a biofuel crop, but use of such lands for producing lignocellulosic feedstock minimizes competition with food crops and also minimizes new land clearing to accommodate biofuel expansion. In the semi-arid tropics, degraded lands abandoned from agriculture can also be re-vegetated with deep-rooted, drought tolerant perennial plants capable of producing low cost feedstock. But the use of abandoned, degraded and marginal lands for biofuel feedstock production remains, for the most part, an untested hypothesis. This is where the Air Force can make a major difference.

Bana grass (Pennisetum purpureum) is a high biomass yielding C4 grass capable of yielding over 50 Mg dry matter per hectare per annum, and yields in excess of 100 Mg/ha/yr have been reported in the tropics. At $50/Mg, a hectare of Bana grass can generate more income for the subsistence farm family that abandoned the land than the family can earn from a comparable area of prime agricultural land used for subsistence farming. Unlike fossil fuels that enrich a few, biofuels have the power to benefit those who grow the basic raw material for conversion into biofuels. The equitable sharing of benefits derived from biofuel production can do more good for society as a whole than the capacity of biofuels to lessen the harm from global warming. The Air Force should support efforts to test this hypothesis in the developing countries of the tropics where poverty is widespread and the potential for producing low-cost biofuel feedstock is high.

While Bana grass and other tropical grasses perform well in the humid tropics, what about the semi-arid tropics where lack of water limits biomass production? In Hawaii, for example, high yields of sugarcane can be obtained in arid areas with irrigation. Quite often, you see pineapple growing adjacent to irrigated sugarcane. What is unique about these two contrasting crops is that in this environment pineapple can produce nearly as much biomass on rainfall alone as irrigated sugarcane. Pineapple can produce biomass with less water than sugarcane because like many drought resistant plant, it utilizes the CAM or crassulacean acid metabolism photosynthetic pathway to convert carbon dioxide into biocarbon. While pineapple may not be the best candidate crop for producing biofuels, other species in the Ananas, Agave and other genera need to be investigated for their potential as energy crops in the dry tropics and subtropics. CAM plants offer great promise for utilizing land where shortage of water limits most C4 and C3 plants from performing optimally.

To meet the future demand for biofuels, the land resources of the entire planet need to be properly utilized and the tropics offer opportunities to simultaneously meet this demand and generate new wealth to combat poverty. The Air Force can play a major role in initiating and supporting research on bioenergy in a region of the world where little research capability exists to develop its biofuel production potential. The goal of the Air Force research initiative should be to produce a billion gallon of biofuel for every million acres of degraded land in the tropics rehabilitated to produce fiber for conversion into biofuels, and to double per unit area feedstock yield by 2030.