Letter from the Desk of David Challinor
February 2007

In this morning's *New York Times* (1/5/07) there was an article that raised concerns about the future availability of corn as an animal fattening food. The U.S. Corn Belt, I believe, is still the world's center for corn production, thanks to good soil, favorable hot summers and the development of hybrid corn by Henry Wallace and his contemporaries. Even after feeding enormous volumes of corn to our livestock, the U.S. still has plenty left to export. Part of the reason for the huge corn surpluses is the generous government subsidies paid to farmers to grow corn. The picture, however, is changing now that more farmers are planning to grow corn for ethanol production rather than for animal feed; Brazil has done well producing ethanol from sugar cane. This month's letter will consider the reasons for this switch and the implications that may follow.

Corn (*Zea mays*) has been domesticated since pre-Columbian times and was developed over centuries from teosinte, a perennial grass that still grows in Central America. Teosinte produces single seeds, not on a cob, that shatter easily. Today's corn has been genetically modified through selective breeding and each plant produces one ear. Hybrid corn revolutionized corn cropping by genetically controlling the plants to grow to a uniform size and produce ears at roughly the same level, thereby making the ears easily machine-harvestable. Corn grows best where springtime is wet enough to trigger germination, followed by a hot summer. In the deep loam soils of Iowa, it is said you can "hear" the corn growing in midsummer.

Corn is one of numerous crops still subsidized by the U.S. government. The subsidy is in the form of a government guaranteed base price. If the domestic or international market price drops below the level of the support price, the farmer can either store his crop and wait for the price to rise, or sell it to the government at the support price. The current budgeted amount for crop support is about 15 billion dollars. The U.S. produces nearly 40% of all the corn grown in the world and is certainly the most efficient grower.

The question our country faces is what is the best way to use this crop? We do not seem to have a national energy policy; rather, we (Congress and the Administration) merely react to strong political pressure for short-term solutions by large agricultural and energy corporations, wind turbine manufacturers, etc. In my view, corn-based ethanol or soy-based biodiesel are not the panaceas that their advocates so publicly extol.

In 2004, almost a quarter (23%) of the nation's cultivated land was in corn. Currently, the commodity futures market (2007's crop) anticipates a steep rise (perhaps as much as 25%) in the price of corn triggered by the scheduled opening in 2008 of some 79 new ethanol plants. To meet this demand, farmers can apply more fertilizer to increase yield on existing corn land, thereby increasing the demand on natural gas to produce it, or they can substitute corn for other crops. The first option, more fertilizer, is not worth taking because any increase in yield per acre would be marginal and farmers have almost reached the maximum. The second option, planting other crops, is a tougher decision—much would depend on the other crop subsidies.

In 2005, the U.S. produced just under 4 billion gallons of ethanol. This sounds like a lot, but it is a mere drop compared to roughly 150 billion gallons of gasoline used annually in the U.S. The ethanol produced was generally combined with gasoline to increase octane rating and thus reduce engine knocking. One should also remember that ethanol is not nearly as efficient as gasoline in powering cars. It takes about a gallon and a half of ethanol to power a car the same distance as a gallon of gas does. Thus, ethanol is nowhere near competitive with gasoline today. Its wholesale price is about $2.65/gallon, so it is nearly a third more expensive than gasoline.

Although some states have passed laws ordering gasoline sold there to contain ten percent ethanol, it is unlikely that ethanol will drop in price for some time. Unlike gasoline or oil, it cannot be piped from the corn-producing states to the two coasts because it absorbs water that can condense in the pipes. Thus, it can only be moved in expensive, completely watertight tanks and barrels.

Currently, Brazil is the world's largest producer of ethanol, a position it was forced into by the precipitous rise in cost of imported petroleum in the 1970's. With virtually no domestic petroleum source, it had to find an alternate energy source. Rather than using corn, Brazil produced ethanol auto fuel from sugar cane. When using cane to manufacture sugar, the stalks are crushed, the juice collected and evaporated, and raw brown sugar remains. To make ethanol, the sugars (sucrose) in the resulting liquid are fermented to produce the volatile fuel. However, the crushed 8 -10'-long cane stalks, known as bagasse, are burned to evaporate the water in the cane juice, a major energy requirement in the process to manufacture either ethanol or sugar. Brazil has been doing very well with its sugar-based ethanol.

Current technology enables cane, corn and soybeans to be used as either fuel or food. Thus in the long run, these crops would have to compete with either of the two end-uses, with priority being determined by the Brazilian government through subsidies. Ethanol has long been subsidized in Brazil, but its export surplus was offset by a U.S. tax of 54¢/gallon on imported ethanol, plus a stiff import duty, and even more by a rapid increase in Brazil's own needs. Bolstering the local consumption is the fact that 80 to 90% of Brazil's cars are computer programmed to adjust the mixture of ethanol to gas according to driving conditions. However, even in Brazil more gasoline is consumed than ethanol in powering non-diesel cars and trucks.

The next big step needed to expand the production of synthetic fuel from vegetation is to find a simple economic solution to splitting cellulose from lignin. The latter is the chemical substance in trees and plants that strengthens their stems to support upright growth. The sugars to be fermented are in the cellulose, but there is yet no efficient way to remove them. Once developed, however, synthetic fuel could then be produced from fast-growing trees (willow, poplar, catalpa, etc. in the temperate zone) and prairie grasses such as switch grass (*Panicum virgatum*), a native perennial that is common in the Great Plains. President Bush even mentioned the potential of this species as a synthetic fuel source, but it, too, must await technical advances before it can be exploited economically.

Meanwhile, we do have a global warming crisis that even the President has now acknowledged. The exact contribution to this warming by human activities has not and probably cannot be precisely calculated, but most scientists agree it is considerable. What can be done now? The simplest and fastest step would be to cut consumption of petroleum products. A 10% reduction in gasoline use would save 14 or 15 billion gallons/year—about double the 7.5 billion gallons/year of ethanol we hope to produce by 2010. Such a reduction, however, would be politically challenging and require a drastic shift in American lifestyle and culture; the U.S. consumes about a quarter of the globe's petroleum-based energy. Our success in exporting our cultural lifestyle is already exacerbating excessive greenhouse gas release to the atmosphere through the incredibly rapid growth in global demand for cars, air conditioning, commercial planes and other high-energy users in places such as China and India. Many argue that it is our burden to lead the way in reducing both local and international energy use. We are, however, currently stymied in any national effort to do so by the inordinately high cost of our losing battle in Iraq.

It will take massive Federal funding to finance economically efficient ways to produce energy from non-polluting sources such as wind, solar, tidal, etc. Such funds will not be available for decades, but initial significant steps are currently available and could be implemented with courageous political leadership not beholden to the petroleum industry. Most obvious are graduated taxes on high fuel-consuming cars and trucks, a return to the 55-mph speed limit, generous rebate incentives on gas and electric household utility bills for decreased consumption, tax incentives for efficient house insulation and double-paned windows to lower heating and cooling costs, and the list goes on and on with a multitude of available actions available to everyone to reduce energy consumption.

At my age, whatever action is taken will affect my family only slightly. I am concerned, however, how my grandchildren will fare. Their living conditions assuredly will be dramatically different from that of my generation, but it is our responsibility to start seriously planning our future energy paths. We should do so while cheap petroleum is still available rather than desperately floundering as the country did during the gasoline

and fuel oil crisis of the 1970's. We are all in this together and the prudent planner almost always gains most—or at least suffers less.

David Challinor
Phone: 202-633-4187
Fax: 202-673-4686
E-mail: ChallinorD@aol.com

P.S. Much data for this letter came from an excellent article by Professor Michael B. McElroy of Harvard, *The Ethanol Illusion*; *Harvard Magazine*, Nov.-Dec. 2006, pp. 33-35 and 107.