Food and Fuel: Enough Grain but Not Enough Processing

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The rapidly emerging renewable-energy industry has generated a lot of excitement in rural America. Ethanol plants, biodiesel refineries and wind farms are sprouting up across the Midwest as fast as investment bankers and pipe fitters will allow. The people who build and operate these renewable-energy facilities are welcome additions to many rural communities. These renewable-energy sources are land based. Farmers and rural communities are now as attuned to the Energy Bill as the Farm Bill.

However, biofuels have also generated great controversy inside and outside agriculture. In some cases, traditionally allied agricultural interests – livestock and grains – have found themselves publically on opposite sides of policy issues. In general the discussion focuses on the new grain demand generated by biofuels, and whether that demand will outstrip or overbid supply to food uses.

A few years ago, grain surpluses were driving prices to historically low levels in real terms, and government programs were contributing 50 percent or more to grain producers' net income. Grain prices have tripled since 2005 and additional income is flowing into rural communities. Land prices increased 20 percent in the last year, setting record highs in most states and generating new wealth for landowners. Land rents also have risen, with increases of 25 to 40 percent commonly reported – a larger expense for renters, but more annual income for the owner. Economic shifts such as this create opportunities and challenges as they happen.

Opportunities

Biofuels have created several clear benefits in addition to new demand for grain and oilseeds. Some biofuels, such as biodiesel, reduce overall carbon dioxide emissions compared to petroleum. The cost of biofuels continues to drop in comparison to petroleum resulting in lower motor fuel prices for U.S. consumers. Biofuels have spurred investment in rural communities. First-generation biofuels, corn ethanol and soy biodiesel, have demonstrated the feasibility of large-scale biorefining, which has created investment in second generation technology. Farm receipts increased over a billion dollars in Iowa alone on higher crop prices. Equipment sales, housing, building construction and other services have increased sharply. The additional income from crop prices, bioeconomy investments and new employment has spurred economic activity in rural areas.

These gains have come with uneven distribution of benefits and higher risk to producers. Input costs rise to meet revenue with less "safety net" but there is much more income on which to make decisions. This demand driven market represents a reversal of the protected but mediocre income of previous farm programs. The acceptance of additional risk necessary to participate in the potential reward may be difficult. The safety net provisions of the Farm Bill are less relevant today. Previous decision making criteria based on farm programs may not work in the new more volatile market.

Challenges

Beyond the farm gate, a topic getting a lot of media attention is the impact of rising grain prices on consumer food prices. Food prices in the U.S. are increasing faster than the general rate of inflation, and faster than the 2.5 percent rate of recent years.

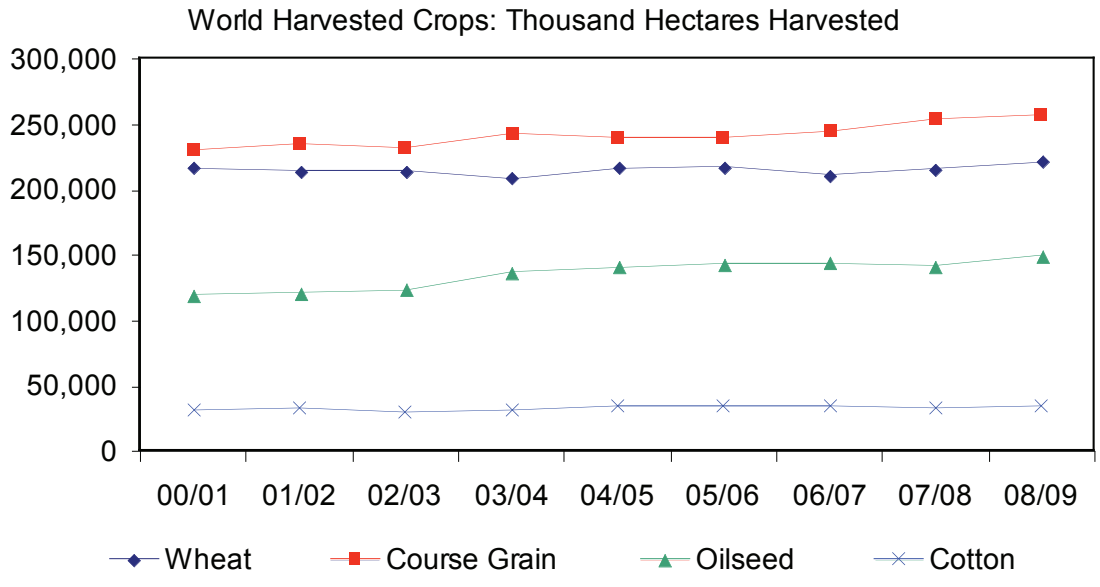
While some would draw a cause and effect linkage between ethanol and higher food prices, the actual linkage is weak at best as is discussed in another article in this series, *Factors that Determine the Cost of Food*. For example, livestock and poultry feed is the largest single user of U.S. corn but Jan. to July retail beef and pork prices increased 1.5 percent while retail chicken and turkey prices rose 6.5 percent. Feed costs have increased to producers of meat, milk and eggs, but through mid-2008 the supply of these commodities was still increasing suggesting that something other than a cost-induced reduction in supply is influencing these prices. One of those factors is exports; the rest of the world saw U.S. prices for these products as a value. In particular, dairy, poultry and pork exports have increased significantly in 2008.

The marketing infrastructure is also adjusting to higher commodity prices. Processors often pass on feedstock price increases as percentage markups. A small change in feedstock price, around 20 percent, creates large increases at the supermarket. While higher energy prices have added to processing and distribution costs, a constant percentage markup on commodity prices that have doubled or tripled may not be warranted.

Where to from here?

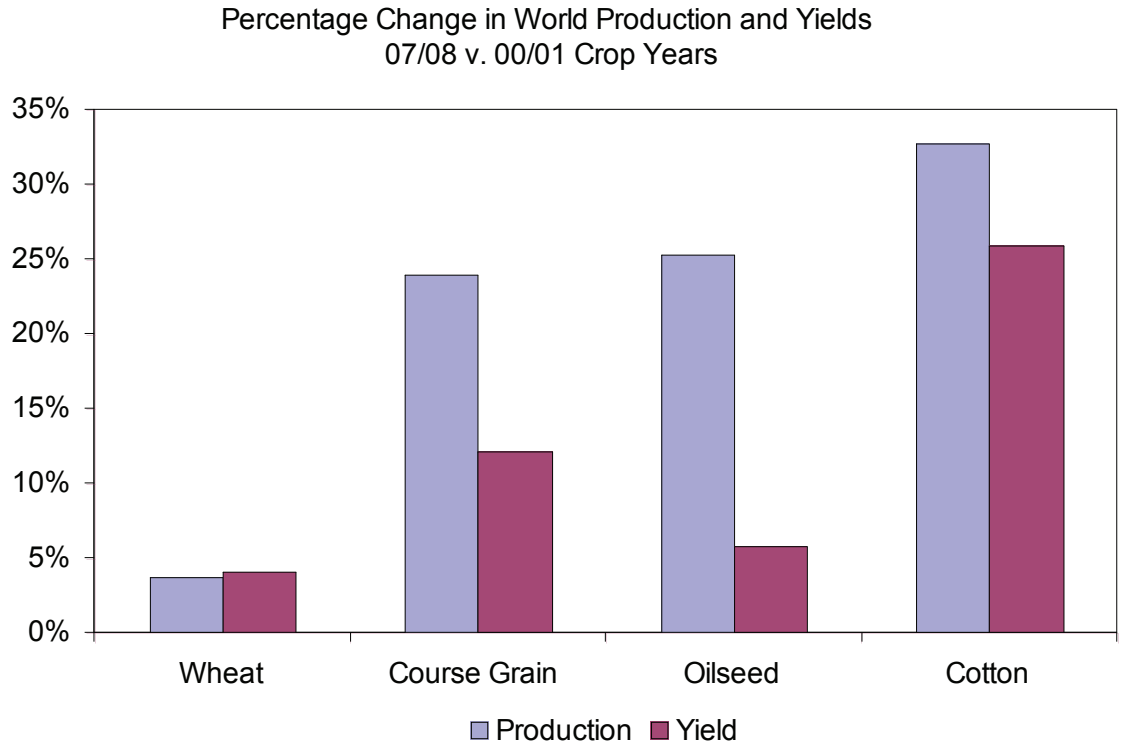
Given the opportunities and challenges of a growing biofuel sector, what might we expect of the future? The higher prices have brought more land acreage into production of carbohydrate crops. U.S. corn acreage increased by nearly 15 million acres in 2007 from 2006 and was the highest since 1944. During 2006 and 2007, sorghum, wheat, barley and oats added 7 million acres. Soybeans and cotton lost acres in 2007, but regained acres in 2008.

Figure 1.



World production in food, feed and fiber crops has also increased (Figure1). Between 2000 and 2008 crop years, harvested area increased 10.6 percent including 2.5 percent from 2007 to 2008. Yields have also increased and combined with acreage to grow production. Wheat and oilseed yields improved approximately 5 percent; course grains more than 10 percent; and cotton 25 percent (Figure 2). The higher prices since 2006 should encourage farms around the world to bring more land into production and to farm existing land more intensively. Technologies such as irrigation, fertilizer, and improved varieties make economic sense even to subsistence farmers as prices increase.

Figure 2.



With the present ethanol plants in operation or under construction, approximately 70 percent of Iowa corn will be processed for ethanol by 2010. This percentage could rise if additional plants now in various stages of planning are actually built. About one-third of the corn weight remains for animal feed after ethanol production. The growing opportunity is to modify the process by fractionation so that protein, oil and fiber streams of value are created for poultry and swine in addition to cattle feed.

At the anticipated level of ethanol processing, recovering feed coproducts to the same utilization flexibility as the original corn could maintain animal nutrient needs. Germ protein, created by the fractionation process is higher in essential amino acids than corn protein as a whole, which means that fractionation could potentially create corn products more applicable to swine and poultry than the present distillers grains.

Technology and policy are pursuing biofuels beyond ethanol. Soy biodiesel is one example. In soybeans the situation is similar, except that biodiesel uses only the oil, approximately 20 percent by weight of the soybeans. Soybean processing plants extract the oil by either solvent or expeller press operations. The resulting co-product with soybean oil is soybean meal, a high protein feedstuff for livestock. Soybean oil is also a food product which had markets before the biodiesel developments. Iowa plants can crush essentially all the soybeans grown in Iowa. The biodiesel plants already on line or under construction could consume 72 percent of the soybean oil produced in Iowa. Announced plans for additional plants, if realized, would more than double the capacity testing the supply of soybeans at a time of increased competition for acres from corn.

Acreage has shifted from year to year between corn and soybeans, but it hasn't changed the supply of nutrients as much as the acreage may suggest. Soybeans are more highly concentrated in oil, protein, and essential amino acids than corn, in about the same ratio as corn but corn has higher yield per acre than soybeans. The acreage shift does not greatly affect total available nutrient supply (Table 1).

Table 1. Nutrient unit production potential from Iowa corn and soybeans from the 2006 and 2007 crops (Millions)

	Acres Corn	Acres Soybeans	Tons DDGS	Tons SBM	Tons Protein	Tons Oil	Tons Lysine
2006	12.35	10.10	17.4	11.3	9.9	4.90	.57
2007	13.85	8.52	20.8	9.8	10.1	4.85	.54

The trade-off between feed and fuel issue may be more one of distribution and processing rather than a total quantity shortage. Processers and end users continue to adjust to the new supply and demand conditions. Farmers are also adjusting to the new costs and returns in the bioeconomy. Higher prices and revenue will encourage adoption of yield increasing technologies that were not practical at lower crop prices. As yields increase, a much greater supply of nutrient components not used by biofuel production could become available (Table 2). Animal nutritionists are rapidly developing diets that rely less on corn starch and more on non-fuel components.

Table 2. Impact of yield on grain component production per acre

Yield (bu/A)	Protein (lb/A)	Oil (lb/A)	Lysine (lb/A)	Fuel (gal/A)
Corn				
150	630	302	21	420
250	1050	504	35	700
Soybeans				
50	1050	555	83	56
80	1680	888	133	89

New demand for corn and soybeans driven by biofuels is expected to bring more land into production and increase yields on existing land. In addition to larger supplies of grain and oilseeds, larger supplies of components of the crop not used for fuel will be available, relieving some pressure on feed and food prices.

Challenges remain

Biofuels are part of a comprehensive energy program. Biomaterials are not a total replacement for all petroleum. The entire U.S. corn crop could only replace 10 to12 percent of gasoline usage. Bringing more land into production and using more intensive farming practices will present challenges that must be addressed. Biofuels are not a replacement for conservation, planning, and a total system energy strategy. The large-scale cultivation of dedicated biofuel crops may lead to significant environmental damages if not done properly. Implementation of best management practices to protect soil and water from erosion and nutrient runoff or leaching is necessary, but much of the science to create these practices is known.

While the current biofuel explosion has focused on corn-based ethanol and biodiesel, the promise and policy is pointed toward cellulosic feedstocks for biofuels. These include crop aftermath, such as cornstalks and wheat straw, perennials like switchgrass and forestry products, and a new generation of energy crops. The goal is to utilize biomass feedstocks for fuel that do not compete with food. Currently, cellulosic ethanol production is technically possible, but it is not commercially feasible, and that is before the harvest, transport and storage of biomass is taken into consideration. Even when those hurdles are crossed, land-based feedstocks will still compete with food commodities for acres.

It is important to recognize that while Iowa and the U.S. are leaders in the emerging bioeconomy, biofuel production is in it infancy. Ethanol production has increased rapidly as has grain prices. As producers and consumers adjust to the new market conditions and evolving technologies prices will also adjust. The transition will not be without challenges, but Iowa is well positioned to capture the opportunities in the years ahead.