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Breaking the Link between Food and Biofuels

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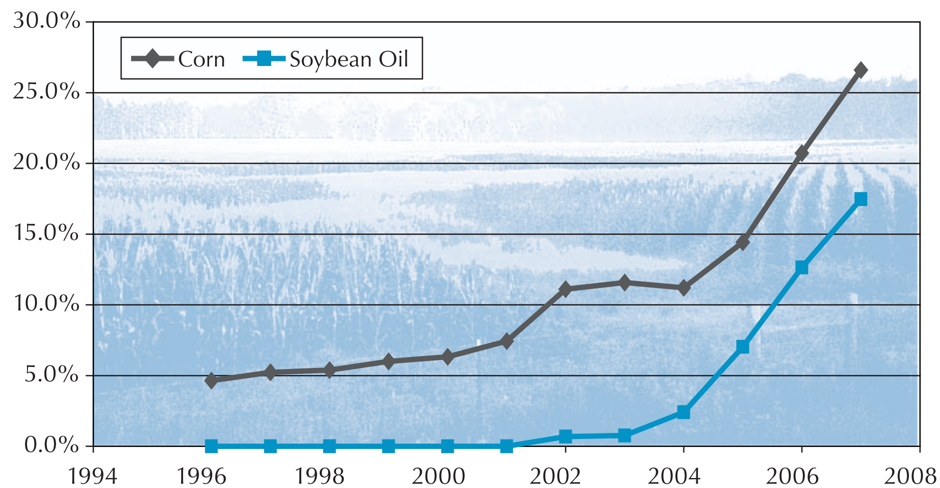
Expansion of biofuel production in the United States, Europe, and South America has coincided with recent sharp increases in prices for food grains, feed grains, oilseeds, and vegetable oils. It is only natural then to associate high food prices with expanded biofuel production. The credibility of this association is heightened by the fact that practically all biofuels in the world are produced from feedstocks that could be used to produce food or that are produced on land that could produce food.

Of course, the truth about food prices and biofuels is more complicated than critics of biofuels may want to believe. The world has consumed more wheat than has been produced in six of the last seven years. Rice consumption has been higher than rice production in five of the last seven years. The resulting drawdown in wheat and rice stocks is largely responsible for the large increase in rice and wheat prices.

However, for corn and oilseeds, a link certainly exists. The graph above shows that the share of the U.S. corn crop that is consumed by the ethanol industry has grown from around 5 percent to more than 25 percent in 10 years. The share of U.S. soybean oil consumed by the U.S. biodiesel industry has grown even more rapidly. Add in the increased use of vegetable oil in biodiesel production in Europe, Asia, and South America and there is no doubt that corn and vegetable oil prices are much higher than they would have been without expansion of the biofuel sector.



Note: 2007 levels are projected by the Food and Agricultural Policy Research Institute.

Share of U.S. corn crop and soybean oil production converted into biofuels

High crude oil prices signal the world that substitute transportation fuels are needed, and for the time being, the primary source of substitute fuel is biofuels. If we continue to rely on biofuel feedstocks that are used directly to produce food or that are produced on land that would be producing food, then we will strengthen the existing direct link between crude oil prices and food prices. That is, food prices will reflect crude oil prices not only in terms of the energy used to grow the crops, manufacture the food, and transport and store the food but also in terms of the cost of raw ingredients such as grain, meat, milk, and vegetable oils.

If we were all wealthy and food expenditures made up a small fraction of our disposable incomes, then there would be nothing wrong with linking food and crude oil prices. It would simply be a choice that we make to spend a bit more on food and a bit less on fuel. But food expenditures make up a large portion of disposable income for billions of people. Higher food prices directly reduce the amount that is available for spending in all other areas. This negative impact of biofuels on nonfood disposable income in much of the world opens U.S. and European biofuels production to valid criticism. One way of countering this disadvantage would be to de-link food and biofuels production. This can be accomplished either through policy initiatives or through development of new technologies that use feedstocks that are not part of the food supply.

Competition between Food and Biofuel Feedstocks

Biofuel feedstocks can have both direct and indirect effects on food supplies. If biofuels are produced from feedstocks that would have been used for food, then biofuels directly reduce potential food supplies. This reduction occurs

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even if feedstock price increases result in an expansion of supply because the expanded feedstock supply will typically reduce the supply of other food crops. For example, U.S. corn used to produce ethanol reduces the amount of feed available for livestock. The large expansion in the supply of corn in response to ethanol's growth reduces the amount of acres planted to soybeans in the United States. In aggregate, there are fewer acres devoted to food production than there would be in the absence of biofuels.

The resulting price increase from the reduction in supply will induce farmers to expand planted acres. If the new acres would not otherwise have been cultivated, then there are greenhouse gas consequences from the newly tilled acres that can be attributed to expanded biofuels. The greenhouse gas emissions from tilling new land can dramatically reduce the net reductions that can be achieved with biofuels.

Even if a feedstock is not directly used to produce biofuels, it can still affect food supplies if the feedstock is grown on land that would otherwise be planted to a food crop. For example, oil from jatropha is not suitable for human consumption. However, if jatropha plantations are sited on prime agricultural land, then biodiesel produced from jatropha will decrease food supplies. If the plantations are located on land that is not suitable for food crop production, then the effects are minimal, perhaps limited to a reduction in some grazing land. Similarly, if dedicated biomass crops such as switchgrass or miscanthus are planted on agricultural ground, then food supplies will be affected.

It would seem that because biofuels require biomass, and because biomass typically requires land, there will always be a connection between biofuel production and food supplies. But a lot of biomass is produced that has little, if any, impact on the amount of land available to produce food. Tapping these sources of biomass for future increases in biofuel production would help to break the link between food and energy prices and would significantly increase the net reduction in greenhouse gas emissions that we can obtain from biofuels.

Feedstocks that Do Not Reduce Cropland

Producing biofuels out of feedstocks that cannot be used directly for food production or do not reduce the amount of land that can be used to produce food can be accomplished in two ways. The most straightforward way is to capture biomass that is currently treated as either waste or that is a co-product of existing production processes with very low or negative current economic value. Examples of waste streams that potentially could be converted into biofuels include a portion of municipal trash and garbage, crop residues, wood pulp residues, and forest residues.

Crop residue, in particular corn stover, has been identified as a waste stream that could be tapped for conversion into cellulosic biofuels. Not all stover, however, is a waste product. On highly erodible land, corn stover is an efficient means of reducing soil erosion. In addition, some fraction of stover likely contributes to maintenance of soil organic content, which helps to maintain soil fertility. But many Corn Belt farms treat a large proportion of corn stover as a waste product needing to be managed. Excess stover in fields can prevent timely planting of the following year's crop, particularly if corn is planted after corn.

Another waste stream that could be tapped is by-products of vegetable oil refining. Nearly all biodiesel is produced from refined vegetable oils. The portion of the vegetable oil that is used for biodiesel is the triglyceride portion, which is the same portion used in food and food preparation. But biodiesel can also be produced from by-products of edible oil production. Biodiesel made from soybean soapstock—a by-product of soybean oil processing that is high in free fatty acid content—is a high-quality fuel. Palm fatty acid distillate is a similar material that is in abundant supply given the large growth in palm oil production. The extent to which existing biodiesel plants can use these by-products is limited to about 10 percent of feedstocks. However, there are second-generation biodiesel plants that are in development that can operate completely on these feedstocks. Diversion of these materials from their current use (or from landfills) will likely add value to them and create highly valuable biofuels without increasing food prices. In addition, because using these feedstocks will not decrease cropland, their contributions to greenhouse gas reductions will likely be far greater than those of feedstocks that displace cropland.

The second way that biomass can be created without competing for food land is to use land that is not suitable for producing food or to grow the biomass without using land. Jatropha is an oil-bearing crop that its backers claim is suitable for growing in arid regions that would not otherwise be used for intensive agriculture. If this claim is borne out, and jatropha is planted on this type of land only, then biodiesel made from jatropha will not compete with food.

Another example of biomass being produced on non-agricultural land is the planting of dedicated biomass crops on land that otherwise would not produce food. There are large areas in the upper Midwest and the Southeast that once produced food crops but have now been given over to pasture or trees. Conversion of these lands to the production of woody biomass to be used for cellulosic biofuels would not affect food prices.

Current policy does not clearly differentiate between biofuels that use feedstocks that affect food prices and those that do not.

A last example is to produce biomass without extensive use of land by producing algae in ponds. PetroSun has evidently begun operation of an algae-producing facility in Rio Hondo, Texas. An estimated 4.4 million gallons of algal oil will be produced on 1,100 acres of ponds. To put this into perspective, 1,100 acres of soybeans produce approximately 70,000 gallons of soybean oil. If the ponds are located on land that is not suitable for crops, then algae as a feedstock will not affect food prices.

Policy Choices

There are many potential objectives one could aim to achieve with biofuel policies including energy security, diversification, and greenhouse gas reduction. By any measure, the incentives given to corn ethanol and biodiesel have been successful at increasing the proportion of the U.S. fuel supply that comes from U.S. biofuels. But one near-term cost of achieving this goal is higher corn and vegetable oil prices, which have increased and will continue to increase food prices. For most U.S. consumers, such a trade-off may make sense. But for the world's poor, there is no trade-off, only loss, because the poor use relatively little fuel and must pay higher prices for some food items. Another problem with diverting food crops for biofuels is that promised greenhouse gas reductions likely will not materialize because new cropland will be brought into production in response to higher commodity prices.

Current policy incentives partly recognize the problems with diversion of food crops. The new Renewable Fuels Standard (RFS) applies to, at most, 15 billion gallons of ethanol made from corn and one billion gallons of biodiesel. Cellulosic and other advanced biofuels account for the remaining 20 billion gallons of biofuels mandated. It seems that the thinking behind the RFS is that moving to cellulosic and advanced biofuels will cap the impact on food prices and greenhouse gas emissions from crop-based biofuels. In addition, the new farm bill reduces the blenders tax credit for corn ethanol from 51¢ to 45¢ per gallon and creates a $1.01-per-gallon tax credit for cellulosic biofuel production.

However, current policies are not so clear-cut in trying to minimize food and greenhouse gas impacts. For example, there is no indication that Congress is prepared to eliminate the blenders tax credit completely once U.S. corn ethanol production reaches 15 billion gallons. And the new tax credit for cellulosic biofuels is awarded regardless of whether the cellulosic feedstock displaces food crops. Furthermore, current policy awards U.S. biodiesel made from virgin vegetable oils twice the subsidy given to previously used feedstocks.

Current policy does not clearly differentiate between biofuels that use feedstocks that affect food prices and those that do not. This lack of focus on food prices is understandable because the rapid increase in commodity prices did not occur until just after the new RFS was passed. If Congress desired to place greater importance on minimizing the impact of biofuel development on food prices, then there are a number of steps that could be taken.

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The New ACRE Program: Frequently Asked Questions

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ACRE, which is an acronym for Average Crop Revenue Election, is a new commodity program included in the Food, Conservation and Energy Act of 2008 (the 2008 farm bill). Farmers can choose to participate in ACRE or they can continue to enroll in traditional commodity programs. ACRE is designed to provide revenue support to farmers as an alternative to the price support that farmers are used to receiving from commodity programs. Here, we answer some frequently asked questions about this new program.

Program Details

Which crops are eligible for ACRE? Corn, soybeans, wheat, cotton, sorghum, barley, rice, oats, peanuts, other oilseeds, dry peas, lentils, and chickpeas.

Does ACRE replace other commodity programs? Farmers who choose ACRE must give up 20 percent of their direct payments and all countercyclical payments. ACRE participants will continue to be eligible for marketing loans but their loan rates are reduced by 30 percent.

Can farmers pick and choose which crops they sign up for ACRE? No. A farmer enrolls either all eligible crops or none.

Can farmers move in and out of ACRE? No. Once ACRE is chosen, the choice applies to all subsequent years covered by this legislation (2009–2012).

When can farmers sign up for ACRE? The USDA has not yet released information about sign-ups. But farmers will be given multiple opportunities to sign up for ACRE.

Does ACRE provide farm-level revenue support? Not directly. ACRE payments are calculated on a crop-by-crop basis at the state level. If actual state revenue falls below the state revenue guarantee, then all farmers who have signed up for ACRE are potentially eligible for payments. All these potentially eligible farmers who also suffer a farm loss will receive an ACRE payment.

What is the ACRE state revenue guarantee? The guarantee equals 90 percent of the product of the ACRE yield and the ACRE price. The ACRE yield is the average of the state yields during the previous five years after the highest and lowest yield in the five years are eliminated. So, for example, if state yields for corn in 2004 through 2008 were respectively 180, 140, 150, 160, and 100 bushels per acre, the ACRE yield for 2009 would be 150, which is the average of 140, 150, and 160. The ACRE price is the average of the two previous years' season average prices as reported by the National Agricultural Statistics Service. So for 2009, the ACRE price used to set the 2009 guarantee will equal the season average prices for the 2007/08 marketing year and the 2008/09 marketing year.

How is actual state revenue calculated? Actual state revenue equals the product of the state average yield and the season average price. For example, in 2009, actual state revenue will equal the state average yield for the 2009 crop multiplied by the season average price for the 2009/10 marketing year.

How are ACRE payments calculated? Per acre ACRE payments equal the difference, if positive, between the ACRE guarantee and actual state revenue. ACRE payments are capped so that if the difference between the revenue guarantee and actual revenue is greater than 25 percent of the ACRE guarantee, then the ACRE payment equals 25 percent of the ACRE guarantee.

Which state average yields are used in ACRE? All ACRE yields are average yield per planted acre.

How fast can ACRE guarantees adjust to changing market conditions? Year-to-year adjustments in the ACRE guarantee are limited to 10 percent.

How can farmers who sign up for ACRE determine if they had a farm-level loss? A farm-level loss is deemed to have occurred for ACRE payment calculations if actual farm revenue is less than expected farm revenue plus the farmer-paid crop insurance premium for those who buy crop insurance. Actual farm revenue equals the product of yield per planted acre and the season average price. Expected farm revenue is calculated analogously to the ACRE guarantee in that the modified five-year average farm yield is multiplied by the two previous years' season average price.

Are ACRE payments paid on base or planted acres? ACRE payments are made on a portion of planted acres (83.3 percent in 2009–2011, 85 percent in 2012) subject to a limit that the sum of planted acres is less than or equal to the sum of base acres on a farm.

Farmer Sign-Up Decisions

Which farmers should sign up for ACRE? Naturally, the most important factor that will determine whether farmers sign up for ACRE will be their expectations about whether their payments will increase or decrease under ACRE. To help farmers make relevant calculations, CARD researchers have put together a spreadsheet calculator that shows the likely payments under ACRE under a wide variety of possible outcomes. The CARD ACRE calculator is available at *www.card.iastate.edu/ag_risk_tools/*.

How can farmers decide if ACRE payments will be higher or lower than payments under traditional programs? Because ACRE payments equal the difference between the state revenue guarantee and actual state revenue, ACRE will generate large payments when state revenue is low. Significant declines in market prices can generate substantial payments for all farmers of a crop in all states. Thus, a situation in which the ACRE guarantee builds to a high level through a series of high prices followed by significantly falling prices will generate substantial payments.

Because nobody can determine what future prices and yields will be, the CARD calculator allows corn, soybean, and wheat farmers in all states to experiment with different scenarios. Users can enter prices and yields for the 2008 crop year that when combined with the 2007 season average price and recent state average yields will determine the 2009 ACRE guarantee. The calculator then allows users to enter either a 2009 market price (the "what if" option) or a 2009 expected market price. The tool then calculates average ACRE payments and the accompanying reduced loan deficiency and direct payments and compares these payments to average loan deficiency, countercyclical, and direct payments from the traditional programs. By changing the 2008 price, farmers can vary the 2009 guarantee. The calculator uses 2009 trend-adjusted actual state yields from 1980 to 2007 to represent the range and likelihood of state yields for each crop.

What situations favor the traditional programs? We could find only one set of circumstances under which traditional programs would provide more payments than ACRE: if market prices in 2009, 2010, 2011, and 2012 remain above the average levels in 2007 and 2008. If prices remain strong or increase throughout this period, then farmers in states with low yield variability would find that ACRE would make few if any payments. Of course, in this situation, the only payments that farmers would receive from the traditional programs would be direct payments because loan rates and target prices would remain far below market prices. If ACRE payments are zero or quite low, then farmers who choose ACRE will not recoup the 20 percent reduction in direct payments.

What situations favor ACRE? If prices fall below their 2007 and 2008 average level, then ACRE payments will be significantly greater than those under traditional programs. The only way that ACRE payments would not be large in this circumstance is if the state average yield was significantly higher than the ACRE yield.

Should farmers choose ACRE? Because nobody can know with certainty what the future holds for prices and yields, farmers should perhaps regard ACRE as an insurance policy. In exchange for an annual insurance premium that equals 20 percent of direct payments, the farmer receives a revenue guarantee for all years covered by the new farm legislation. Given uncertainty about price levels and yields, many corn, soybean, and wheat farmers will find that the high ACRE revenue guarantees will be more valuable to them than the 20 percent loss in direct payments. Even if market prices fall below target prices and loan rates, the size of ACRE payments to most farmers will exceed those of loan deficiency and countercyclical payments.

The graph shows the potential payout from ACRE and current commodity programs for Iowa corn farmers under alternative prices in

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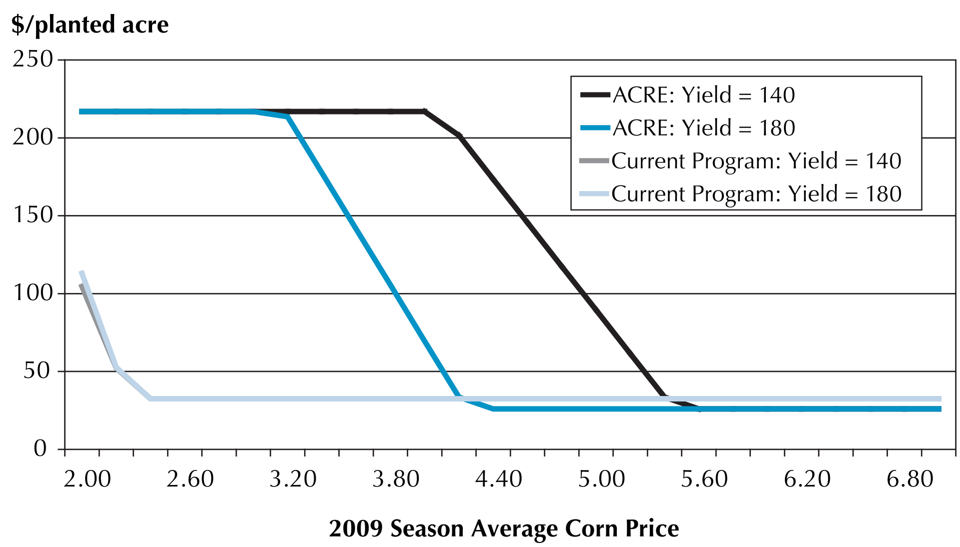

Impact of price and yield on possible Iowa corn payments in 2009 (2008 season average price set to $5.80)

Agricultural Situation Spotlight

New Permanent Disaster Assistance: How It Works and When to Expect Payments

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The issue of disaster assistance for agriculture has been debated on and off for many years. In most years in the past decade, Congress provided ad hoc disaster assistance for various agricultural disasters across the country. The most recent packages have had a difficult time getting through Congress, as the president insisted on budget offsets to pay for them. A few key members of Congress pushed hard and were successful in including a permanent disaster program in the 2008 farm bill. The newly enacted legislation issues a fleet of disaster assistance programs for specialty crop, livestock, honeybee, and farm-raised fish and program crop disasters. The largest title covers program crops and is called the Supplemental Revenue Assistance Program (SURE).

SURE is a new type of disaster program. Most of the past disaster programs made payments based on individual crop losses and were often tied to base acres for either direct payments or countercyclical payments. SURE is a whole-farm disaster assistance program that is tied to crop insurance coverage and farm planted acreage. SURE will cover the 2008–11 crop years, so the recent Midwest flood damage will likely trigger payments under SURE. While the USDA is still developing the rules and regulations for SURE, the farm bill outlined the program guarantees and payment triggers. A review of these guarantees and triggers in general and an example to flesh out the details are offered next.

For the 2008 crop year, there is a special provision for SURE. For all other crop years (2009–11), producers will need to purchase crop insurance in order to sign up for SURE. But because the farm bill was passed after the sign-up for crop insurance in 2008, Congress has waived the requirement for this year. Instead, producers who want to participate in SURE in 2008 but who have not purchased crop insurance can sign up if they pay a fee equivalent to the fee for catastrophic (CAT) crop insurance coverage by August 22, 2008. SURE will then function for these producers as though they had purchased CAT crop insurance.

In general, SURE payments can be triggered by two events. First, if a county is covered by a federal disaster declaration or the county is contiguous to a county with such a declaration, then SURE benefits will be available. Second, if a farm suffers a 50 percent revenue loss, regardless of the disaster status of the county, then the farm qualifies for SURE payments. So SURE can be triggered by county-level and/or farm-level disasters.

The three main variables that determine SURE guarantees and payments are the program guarantee, computed actual revenue, and expected revenue. The farm-specific program guarantee is determined by a complicated formula. First, because SURE provides whole-farm coverage, each crop's contribution to the whole-farm guarantee must be calculated using the following formulas:

For insurable crops: 115 percent × crop insurance coverage level × crop insurance price election × maximum (actual production history [APH] yield or countercyclical program [CCP] yield for the farm) × planted area

For non-insurable crops: 120 percent × the Non-insurable Crop Assistance Program (NCAP) revenue guarantee for the crop × planted area

These crop-specific guarantees are summed across all crops to compute the farm-specific SURE program guarantee. Note that this is a total-farm guarantee, not a per acre guarantee.

The next step is to calculate farm-specific SURE expected revenue. This is accomplished in a similar manner beginning with each crop's contribution.

Insured crops: crop insurance price election × maximum (APH yield or CCP yield for the farm) × planted area

Non-insurable crops: NCAP price guarantee for the crop × NCAP yield guarantee for the crop × planted area

The SURE expected revenue is found by summing each crop's contribution across all crops. The maximum SURE payment equals

90 percent of the resulting whole-farm expected revenue.

SURE computed actual revenue equals the sum across all crops of

- harvested area × farm yield × national season-average price for the crop;
- 15% of the direct payments for the crop received for the farm;
- all CCP or ACRE (Average Crop Revenue Election) payments;
- all marketing loan benefits;
- all crop insurance or NCAP payments; and
- any other disaster assistance payments.

If SURE-computed actual revenue exceeds the farm-specific SURE program guarantee, then there are no payments under SURE. However, if computed actual revenue is below the program guarantee and at least one of the two trigger events (county disaster or 50 percent farm revenue loss) has occurred, then SURE will pay out. The payments will be equal to the minimum of

- 60 percent of the difference between the program guarantee and the computed actual revenue, or
- 90 percent of the expected revenue.

All of these calculations are a lot to digest. An example will help illustrate how these formulas work. Consider a 200-acre farm with 100 acres planted to corn and 100 acres planted to soybeans. The farm has 100 corn base acres and 100 soybean base acres with payment yields equal to the state average payment yield. Suppose this farmer has purchased 75 percent APH insurance (yield insurance) for both crops and has APH yields equal to the trend yields for Iowa (170 bushels per acre for corn and 50 bushels per acre for soybeans). With these settings, the farm's APH yield is higher than its CCP yield, so the APH yield is used in all of the formulas. The APH prices in 2008 are $4.75/bushel for corn and $11.50/bushel for soybeans.

The farm's SURE program guarantee is $119,240.63. The separate corn and soybean contributions are calculated as follows:

Corn: 115 percent × 75 percent × $4.75/bushel × 170 bushels/acre × 100 acres = $69,646.88
Soybeans: 115 percent × 75 percent × $11.50/bushel × 50 bushels/acre × 100 acres = $49,593.75

The farm's SURE expected revenue is $138,250.00, which is calculated as the sum of the following crop-specific calculations:

Corn: $4.75/bushel × 170 bushels/acre ×100 acres = $80,750.00
Soybeans: $11.50/bushel × 50 bushels/acre × 100 acres = $57,500.00

Based on this information, the farm's computed actual revenue will need to be below $119,240.63 in order to qualify for SURE payments and the maximum SURE payment the farmer could receive is $124,425.00, which is 90 percent of the farm's SURE expected revenue. To compute the farm's actual revenue, additional information is needed. At harvest time, suppose that the farmer is able to harvest all 200 acres, but yields are poor because of overly wet conditions throughout the growing season. The farmer gets 90 bushels/acre for corn and 25 bushels/acre for soybeans. The farmer's county had flooding and received a federal disaster declaration, so the farmer is eligible for SURE benefits. Assume that the final season-average prices for corn and soybeans are $5.80/bushel and $11.75/bushel, respectively. So CCP, ACRE, and marketing loan payments are zero. The farm did not receive any other disaster assistance payments. Based on this information, the farm's SURE actual revenue can be calculated. The first part is market revenue, which is $81,575.00 as calculated using the following formulas:

Corn: $5.80/bushel × 90 bushels/acre × 100 acres = $52,200.00, and
Soybeans: $11.75/bushel × 25 bushels/acre × 100 acres = $29,375.00.

The next part of computed actual revenue is 15 percent of the direct payments. The farm received $4,098.36 in direct payments, $2,763.18 for corn and $1,335.18 for soybeans. So 15 percent is $614.75. Finally, the farm would receive $32,187.50 in crop insurance indemnities because of low yields. The corn indemnity would be $17,812.50. The soybean indemnity would be $14,375.00. Adding up market revenue, 15 percent of direct payments, and crop insurance indemnities, the farm's SURE actual revenue is $114,377.25.

Since the county was declared a federal disaster area, all farmers in the county are eligible for SURE payments. The example farm's actual revenue is below the program guarantee, so this farmer will receive a SURE payment. In this case, the payment is $2,918.02, which is 60 percent of the difference between the SURE program guarantee ($119,240.63) and the farm's SURE actual revenue ($114,377.25). SURE payments are affected by many factors: the choice of crop insurance settings, farm yields, national season-average prices, and farm program and other disaster assistance payments. If, in the example, the corn season-average price were $6.50/bushel, holding everything else the same, then the example farm would not receive a SURE payment because actual revenues exceed the SURE program guarantee.

The description and example outline the basics of the SURE disaster assistance program. SURE can provide support when a farm suffers a whole-farm revenue shortfall. One of the complicating factors is that SURE depends on the national

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Charting Growth in Food Demand

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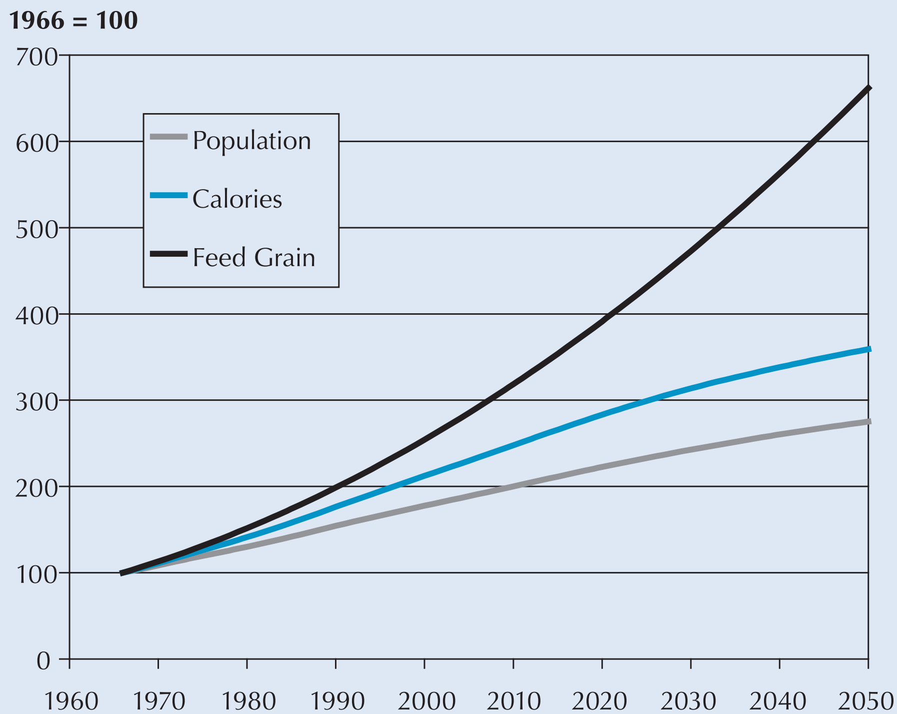
The recent large increases in the prices of agricultural commodities have focused the world's attention on the price and availability of food to an extent not seen for the last 30 years. The low prices that have been with us since the mid-1980s lulled most of us all into forgetting about the urgency of the task that the world faces in expanding agricultural production enough to meet projected food demand.

Although there are large amounts of uncultivated land in Brazil, Africa, and underutilized land in Ukraine, Belarus, and Russia, much of the increase in food production will come about from increased agricultural productivity. Increased crop yields and livestock feed efficiencies are largely responsible for the fact that we have been able to sharply reduce malnutrition rates in the world over the last 40 years. The problem facing the world in the next 40 years is not whether we can produce enough calories for a growing population but whether we can produce the type of food that people with rising incomes will want to eat at an affordable price.

As incomes grow, people move away from a diet consisting largely of staple food crops (such as rice, wheat, corn, vegetable oil, and legumes) into a diet that includes more fish, meat, dairy products, and eggs. This higher-income diet requires the feeding of livestock. Cattle and sheep can be fed grass or grain. Hogs, poultry, and fish must be fed grains and protein meal. Thus, it is likely that the next 40 years will require increasing amounts of grazing land and much higher production of feed grains and oilseeds to meet increasing demands for a higher-protein diet. The accompanying graph shows the implications of this increased demand.



Three indicators of world food demand

The graph shows three measures of the past and likely future growth in food demand. All three measures are calibrated to have a value of 100 in 1966. The bottom line simply measures the increase in food demand from a growing population. This is an accurate measure for food demand if the world's diet stays constant at its 1966 level. As shown, food demand measured by population growth nearly doubled from 1966 to the present. It is projected to increase another 39 percent by 2050.

However, food demand will grow by more than population growth. Many people did not consume an adequate amount of calories in 1966. Per capita calorie consumption increased by 23 percent from 1966 to the present because of higher incomes and lower food prices. This increase in per capita caloric consumption despite a doubling of the world's population is a major success story. Because much of the world consumes an adequate number of calories today, the next 40 years should see only a modest growth in per capita caloric consumption. But a greater proportion of calories will be consumed in the form of animal protein. Because it takes many calories of feed to make a calorie of animal protein, the demand for food as measured in terms of feed grain equivalents will grow much more rapidly than either growth in population or caloric consumption.

If in 2050 people in low-income countries, including China and India, consume as much meat and dairy as was consumed per person in the United States and Europe in 1966, and if feed conversion efficiencies improve at the same rate from 2009 to 2050 as they did from 1966 to 2008, then demand for feed grains will more than double between now and 2050. This last measure is perhaps the most useful indicator of the task that faces us. ◆

A Change in Assignment

Chad Hart first contributed to the *Iowa Ag Review* in September 1995. In the article he examined the merits of revenue insurance as a replacement for yield insurance in the U.S. crop insurance program. His analysis appeared well before any revenue insurance program was available for sale.

Since then Chad has contributed to nearly every issue of the *Review*, providing readers with clear, concise, and timely analysis on a wide variety of topics, including farm policy, agricultural outlooks, World Trade Organization

agreements, biofuels, crop insurance, and trade. It is rare to find agricultural economists who are good at both analyzing complex issues and writing about them in way that increases awareness and understanding. Chad will be using this combination of skills in his new position as an assistant professor in the Department of Economics here at Iowa State University.

Although Chad will no longer be a regular contributor to the *Iowa Ag Review* or head of the Biorenewables Policy Division in the Center for Agricultural and Rural Development, he will continue to provide insights into the issues that are important to Iowa and U.S. agriculture because he will be responsible for conducting grain market research and outreach programs for the department. We look forward to working with Chad in his new position and wish him well. ◆

Breaking the Link
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First, Congress could place a hard cap on ethanol made from corn and on biodiesel made from refined vegetable oil. The current RFS is a floor rather than a cap, and existing tax incentives combined with high crude oil prices could make future production of corn ethanol and biodiesel made from refined vegetable oil increase to unintended levels.

Second, Congress could better target tax credits and fuel standards by basing them on the impact each biofuel feedstock has on food prices. Given the link between land use for food crops and greenhouse gas emissions, such targeting could be set based on full greenhouse gas targeting. This type of greenhouse gas targeting would automatically give a greater incentive to producers who use waste and by-product feedstocks in biofuel production. Thus, for example, biodiesel producers who use the high fatty acid by-products from vegetable oil refining or algal oil would be given as high a tax credit as a biofuel producer who uses corn stover as a feedstock. These producers would all receive a much higher incentive than an ethanol producer who uses corn or a biodiesel producer who uses soybean oil.

And finally, Congress could mandate that the Energy Department and Agriculture Department ramp up research programs for biofuel feedstocks, with priority being given to developing feedstocks that do not affect food prices and that have large greenhouse gas reductions. The justification for this expanded research is that food, energy, and climate change will likely be the three biggest issues facing the United States and the world over the next 10 to 20 years. ◆

Editor's note: This article is adapted from CARD Briefing Paper 08-BP 53 of the same title.

ACRE FAQs
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2009 and for two different state average yields. The 2008 season average price used to set the ACRE guarantee is $5.80/bu, which is the mid-point of the range of corn prices projected by the USDA in the middle of June. As stated earlier, the only situation that favors current commodity programs is that in which ACRE payments are zero. Because ACRE is similar to revenue insurance, the price at which ACRE payments begin to be made depends on the state yield. When the state yield is 180, ACRE payments begin when the price falls below $4.40. When the state yield is 140, ACRE payments begin when the price falls below $5.60.

The second point illustrated by this graph is that ACRE will generate more payments than current commodity programs even at corn prices that trigger countercyclical and loan deficiency payments. ACRE payments will be double the level of traditional programs even if the season average corn price falls to $2.00 per bushel.

The important trade-off to consider when choosing between ACRE and traditional commodity programs is the distinction between the reduction in payments that occurs under ACRE given high prices versus the large potential ACRE payments should prices drop. For corn farmers who believe that ACRE payments will be zero because corn prices are going to remain above $6.00 for the life of the farm legislation and state yields will always be at or above trend levels, it would be better to choose the current programs to avoid a 20 percent cut in direct payments. But for farmers who believe that there is a chance that price or yield will drop unexpectedly, the large payments under ACRE (up to a maximum of $216.90/acre, which includes direct payments) will make the new program the preferred option.

The pattern of payments shown in the graph for Iowa corn is nearly identical to the situation for corn in other states and for wheat and soybeans in all states. This suggests that a large proportion of U.S. farmers will find ACRE much more attractive than current commodity programs. ◆

Authors' note: This information about ACRE is as accurate as possible at this time. However, significant changes to the program could come about as the USDA implements ACRE.

This article is taken from a document meant to accompany the spreadsheet calculator (available at www.card.iastate.edu/ag_risk_tools/) that CARD researchers put together to enable farmers to determine if ACRE makes sense for them.

New Permanent Disaster Assistance
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season-average prices for crops. Because these prices are determined over the course of the marketing year, they may not be known until well after the disaster occurs. For example, the recent flooding affected the 2008 crop year production for corn and soybeans. The 2008 season-average prices for both crops will not be known until October 2009 at the earliest. So while SURE is available for the 2008 crops and could provide support based on the recent flooding, the SURE payments will not reach producers until late in 2009, nearly a year and a half after the disaster.

One final note: another article (page 4) examines the new ACRE program. If crop losses in a state are widespread enough to trigger ACRE payments, then it will be ACRE that compensates farmers for crop losses, not SURE. Furthermore, farmers who suffer farm-level losses in a year that triggers ACRE payments will receive double indemnities because crop insurance indemnities are not subtracted from ACRE payments as they are in SURE. Because most crop losses in Corn Belt states are triggered by widespread drought or excess rainfall, most farmers will find that ACRE will provide more assistance when disaster strikes than the new disaster assistance program. ◆

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