Renewable Energy Newsletter

AgMRC agricultural marketing resource center

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prices, profitability and supply/demand

The following spreadsheets have been updated on the AgMRC Renewable Energy web site, http://www.agmrc.org/renewable_energy/.

prices

- midwest ethanol prices
- ethanol basis
- fuel vs. grain (annual)
- fuel vs. grain (monthly)

profitability

- ethanol profitability
- corn profitability
- biodiesel profitability

supply/demand

- corn/ethanol balance sheet
- soy oil biodiesel balance sheet
- soybean balance sheet
- distillers grains balance sheet

Corn and Soybean Oil Supplies -- Adequacy for Biofuels Production

by Dr. Robert Wisner, Ag Marketing Resource Center, biofuels economist

Barring damage from an early frost, U.S. corn supplies should be fully adequate for foreseeable ethanol processing needs in the year ahead as well as domestic livestock feeding and exports. Very good yield prospects in much of the western Corn Belt more than offset less than ideal conditions in parts of the Midwest east of the Mississippi river and some southern producing areas, where weather problems and late plantings restricted the yield potential. However, final 2009 production numbers will not be known until early January 8, 2010. At this writing, corn maturity lags well behind the 5-year average, making the risk of possible frost damage somewhat higher than normal and creating a modest degree of uncertainty about the final total supply. On September 13, only 66% of the corn crop in the 18 major corn-producing states was reported to be dented, compared with 76% a year earlier and a 5-year average of 86%. When the corn is dented, it still needs a few more weeks before reaching physiological maturity. As this is being writing, extended forecasts show the potential for frost over a sizeable part of the Midwest a few days before the end of September. If significant frost damage occurs at that time, corn production could be somewhat lower than indicated in the USDA September 11 crop forecast. More precise readings on prospective supplies will be available with USDA's October 9 and November 10 crop production estimates. Current expectations range from fully adequate to more than ample supplies, depending on final yield data after the crop is harvested.

U.S. corn processing for ethanol is expected to expand modestly in the 2009-10 marketing year. Several bankrupt ethanol plants have come back on line in the past two to three months and more are expected to follow that path. Lower corn prices have pushed ethanol processing returns modestly into the black, and several new plants have begun operations this year including four in Iowa. Also, early indications are that the Environmental Protection Agency (EPA) may increase the allowable ethanol-gasoline blend for non-flex-fuel vehicles to 12 to 15 percent, up from the current 10 percent maximum. That would boost the potential market for ethanol by approximately 20 to 50 percent from current levels. EPA is scheduled to make its decision by December 1 of this year.

Non-Ethanol Corn Demand

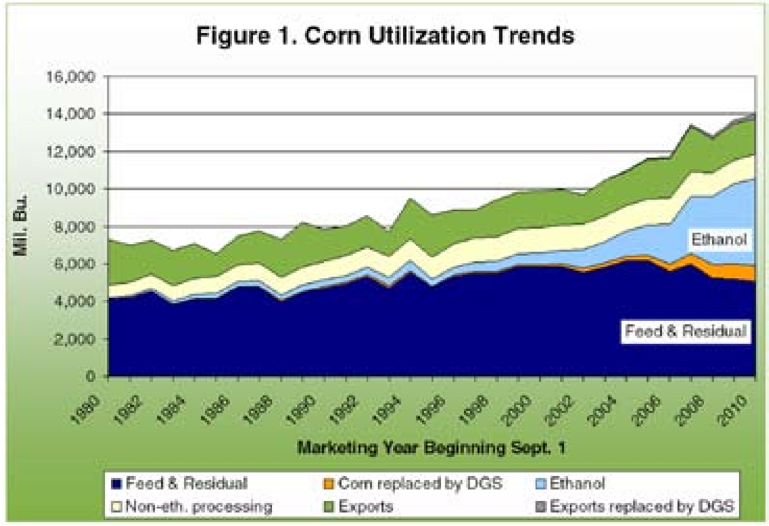
Other sources of demand for corn also will influence the adequacy of supplies for ethanol. Domestic livestock and poultry feeding traditionally has been the largest source of demand for the U.S. corn crop although it is rapidly being overtaken by corn processing. For more than a year, the domestic pork, beef, poultry, and dairy industries have been under severe economic stress as this sector has attempted to adjust to the higher level of feed costs than in previous years. Sooner or later, severe losses are likely to bring reduced livestock feeding, with resulting tighter meat supplies pushing up livestock product prices at both the farm and retail levels. At this writing, a slight reduction in aggregate grain-fed livestock and poultry numbers appears to be developing. However, reduced numbers are expected to be slightly more than offset by reduced feeding of grain sorghum and possibly less wheat feeding next summer as well as potential increases in marketing weights for some animals. Reduced availability of grain sorghum likely will have a slight positive impact on demand for corn for feed. The long-term upward trend in U.S. corn feeding ended in 2005-06, and has since turned downward (See Figure 1, below). A portion of the decline in the last three years has been offset by increased distillers grain feeding.

Exports are the other major source of demand for U.S. corn, and typically have been the most volatile demand component. Major competitors of U.S. corn in world markets are feed wheat and South American corn. Major sources of feed wheat exports include the EU and former Soviet republics. These competing supplies of wheat and corn both are likely to be down substantially from last season. Even so, U.S. supplies are expected to be adequate to meet increased export market demand, with ending carryover stocks (reserve supplies) of corn next summer remaining near this year's level.

More Detail on Developments affecting Feed & Export Demand for U.S. Corn

Figure 1 shows the trend in corn feed and residual use as well as other uses of U.S. corn. Residual use is handling losses and a possible small amount of unknown statistical error. Feed use is not measured directly, but is a residual after subtracting processing and exports from production plus carryover stocks and imports. When replacement of corn by distillers grain is included, equivalent corn use for feed has declined slightly in the last four years. That's a sharp contrast to the long-term upward trend of previous years.

The nation's corn exports have been in a very slight downward trend since reaching the previous record high in 1980-81. Exports of distillers grain are expanding and have replaced a small amount of corn



in international markets. The slight downward trend was interrupted temporarily in 2007-08. Note that U.S. corn exports also have shown a long term pattern of periodic one-year increases in response to temporarily reduced foreign production, followed by a sharp decline the next year. The 2007-08 marketing year was one of those occurrences, generated in part by major reductions in wheat production and wheat feeding because of adverse weather in Australia, Europe, former Soviet republics, and other areas. Global wheat feeding normally is about 4.2 to 4.4 billion bushels (corn equivalent). In 2007-08 because of widespread adverse weather in major wheat-growing areas, it dropped to an estimated 3.79 billion bushels. That was a drop of about 400 million bushels from the previous year, thus contributing strongly to the surge in U.S. corn exports. With a record world wheat crop the following year, U.S. corn exports declined sharply in 2008-09.

Stronger U.S. Corn Exports Likely in 2009-10

For the year ahead, U.S. corn export demand may again increase sharply. The catalyst this time is an extremely sharp decline in the spring 2009 South American corn harvest. Reduced 2009 corn production in that region was due largely to adverse weather, but high fertilizer costs were a contributing factor as well as credit availability issues, an adverse exchange rate in Brazil, and Argentine government policies discouraging exports. Current estimates indicate combined Brazil and Argentina corn production last spring was down approximately 680 million bushels from the previous year. These two countries are the major competitors of the U.S. in world corn export markets. The decline in their production last spring was equivalent to 37% of 2008-09 U.S. corn exports. Additionally, wheat exports from the EU and former Soviet republics are projected to decline by about 425 million bushels (corn equivalent) from last season's level. A significant part of that decline is likely to be feed wheat, thus also tending to strengthen the demand for U.S. corn. Other factors adding uncertainty to potential U.S. corn export demand are

- drought this past summer in parts of China's Corn Belt,
- an emerging El Niño weather pattern that increases the Australian Wheat Belt's risk of drought,
- uncertainty over the potential size of South America's spring 2010 corn harvest, and
- the global economic recession.

The recession is expected to slow the long-term growth in demand for corn in overseas markets. In Mid-September, a sizeable part of the Brazil and Argentina Grain Belt was still in a drought situation. These indicators point to a sizeable increase in export demand for U.S. corn through late winter, although the exact amount is uncertain.

Corn Supply-Demand Balance

Early projections of U.S. corn supplies, use, ending carryover stocks and possible prices with alternative yields can be seen in our corn/ethanol balance sheet (http://www.extension.iastate.edu/agdm/crops/outlook/cornbalancesheet.pdf). Using USDA's September corn production forecast (the medium yield column for 2009-10), our projections show U.S. corn carryover stocks (supply remaining at the end of the marketing year) at a 6.3 week supply, down from a 7.3 weeks supply in the marketing year that ended on August 31, 2009. Normal minimum working stocks needed for feed, processing, and exports at the end of the marketing year would be 4.7 to 5.0 weeks, to supply needs until the new crop is readily available in marketing channels. Corn harvesting in the Corn Belt states typically begins about the end of September or early October, and a short time lag is needed before the new supply is dispersed throughout the marketing system.

Our balance sheet also shows a very early and tentative look at the potential corn supply and demand for the 2010-11 marketing year with alternative yields. Early projections indicate that with a decline in August 31, 2010 carryover stocks and increased demand for corn for ethanol, a modest amount of additional corn acreage is likely to be needed next spring to meet prospective demand, unless the U.S. 2009 and/or 2010 average yield is significantly above the long-term upward trend. Figure 2 shows alternative long-term U.S. corn yield trends and the September USDA forecast of this year's yield.

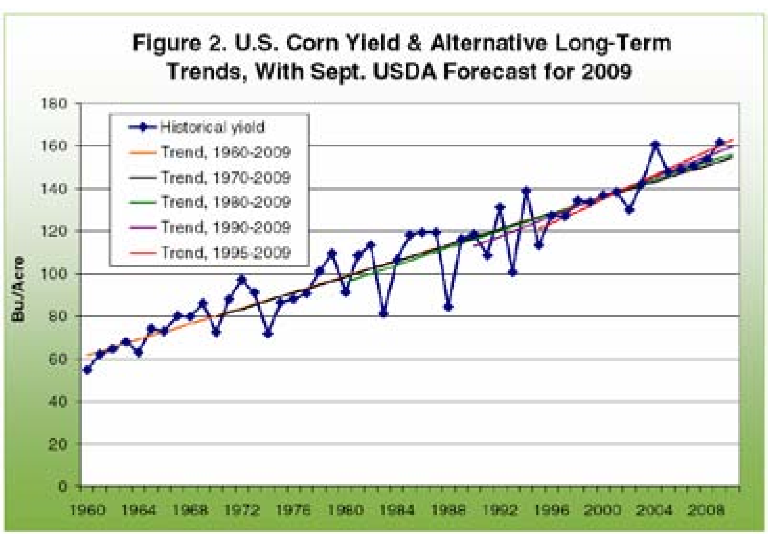


Figure 2. U.S. Corn Yield & Alternative Long-Term Trends, With Sept. USDA Forecast for 2009

Adequacy of Fats and Oils for Biodiesel

Adequacy of vegetable oils and re-cycled cooking fats and grease supplies for biodiesel production is somewhat more uncertain than availability of corn for ethanol. Adequacy of supplies will depend on the final size of the U.S. soybean crop and foreign competition from soybeans and other oilseeds, as well as global petroleum prices. U.S. policies that influence the biofuel market also will be very important.

World Situation and U.S. Soy Export Demand Potential

In recent years, South America has been the world's largest exporter of soybeans and soybean products and the major alternative source of supply in world markets. Last spring's soybean harvest in this region declined by an estimated 710 million bushels or approximately 19.3 million metric tons, due to severe drought. That's equivalent to 55% of U.S. soybean exports for the marketing year just ended. Brazil and Argentina will be able to offset a small portion of this drop in production by drawing down carryover stocks to bare minimum levels. Sharply reduced production in these two countries and in Paraguay sets the stage for strong U.S. soybean and soybean product exports during the October 2009-February 2010 period, although world demand may be tempered some by the economic recession. Exports from this region from March through September of next year will depend on the size of the crop to be harvested from late February through early April. Early USDA projections indicate the region's production will be 5% higher than two years earlier, with a large part of the increase in Argentina. However, recent developments indicate the size of the spring 2010 crop is still quite uncertain. As noted above, much of the Soybean Belt in Argentina and southern Brazil is still experiencing drought. Its major planting season is from October to December, so there is still time for improved weather. Also, it was hoped that the Argentine government would lower its 35% export tax on soybeans as a result of a change in the composition of its Congress, but so far that has not happened. When farmers are forced to turn over approximately 35% of the price of their soybeans to the government, their incentives for increasing production are greatly reduced.

Chinese Demand for Soybeans

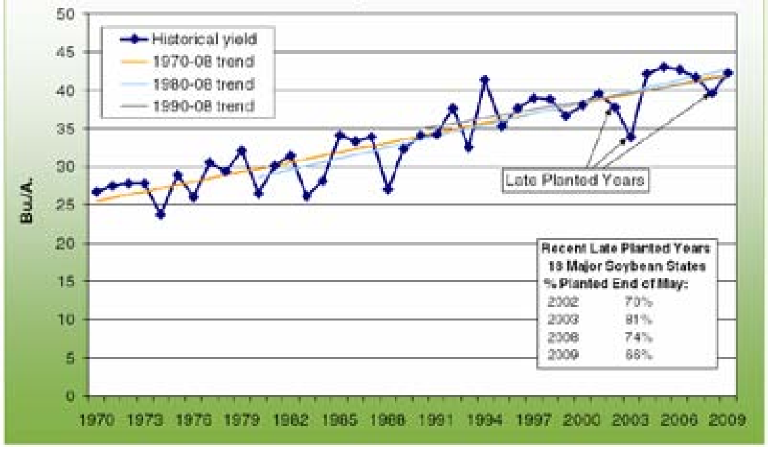
Another important factor is potential Chinese demand for soybeans. China is by far the world's largest importer of soybeans. In the marketing year ended August 31, 2009 it accounted for approximately 56% of U.S. unprocessed soybean exports. Despite the global recession, Chinese purchases of U.S. soybeans increased sharply in the past year. Its reasons for increased purchases included sharply reduced South American supplies, expanding domestic demand for meat, poultry, and dairy products, and a desire to build up reserve soybean stocks as protection against possible future crop problems. Expectations of a weakening U.S. dollar provided further incentives for China to increase its reserve stocks. USDA data indicate China's imports of soybeans from all sources increased by a modest 5% in the marketing year ended August 31, 2009, although imports from the U.S. increased by 40%.(1)

For the first half of the current marketing year, Chinese demand for U.S. soybeans is expected to remain strong. Parts of China's major soybean producing area in key northeast provinces experienced drought this past summer, and that could reinforce its need for continued large soybean imports. By early September, China had already purchased 58% of the amount of U.S. soybeans that it had imported during the entire 2008-09 marketing year.

Biodiesel Demand Prospects

Since the European Union's implementation of restrictions on imports of U.S. biodiesel, demand for soy-based biodiesel in the U.S. has fallen sharply. In the 2007-08 marketing year, USDA reports that the U.S. used 3.245 billion pounds of soybean oil for biodiesel. For 2008-09 the amount used for biodiesel has dropped to an estimated 1.85 billion pounds, a decline of 43%.(2) For the calendar year 2009, the Energy Independence and Security Act of 2007 (3) mandated that 500 million gallons of biodiesel was to be blended into the U.S. diesel fuel supply. If 70% of the biodiesel came from soybean oil, that would create demand for about 2.6 billion pounds of soybean oil. However, the mandate has not been enforced. For the calendar year 2010, the mandate calls for 650 million gallons of biodiesel blending with diesel fuel. With 70% produced from soybean oil, that volume would create a potential demand for about 3.4 billion pounds of soybean oil, nearly double the amount being used this year. Whether this magnitude of demand emerges will depend partly on whether the mandate is enforced and whether RINs generated this year can be used as substitutes for biodiesel blending next year. For an explanation of RINs, see our article earlier this year, Renewable Identification Numbers (RINs) and Government Biofuels Blending Mandates. (http://www.agmrc.org/renewable_energy/biofuelsbiorefining_general/renewable_identification_numbers_rins_and_government_biofuels_blending_mandates.cfm). Whitehouse sources reportedly have indicated that the un-enforced 2009 biodiesel mandate volume will be added to the 650 million gallon mandate for 2010, and will be enforced.(4) If so, with soybean oil supplying 70% of the feedstock for biodiesel, demand for soybean oil for biodiesel could be as high as 6.04 billion pounds in calendar year 2010. However, most analysts are taking a wait-and-see attitude about whether the mandates will actually be enforced in that way. USDA September 14 projections place soybean oil use for biodiesel in the 2009-10 marketing year at only 2.1 billion pounds, up 13.5% from last season. If the mandates are enforced as some Washington sources have indicated, soybean oil supplies could be much tighter and prices much higher than now indicated.

Figure 3. U.S. Soybean Yield & Alternative Long-Term Trends, With Sept. USDA Forecast for 2009



Competing International Vegetable Oil Supplies

At the global level, competition from other vegetable oils may increase modestly this season, depending on the size of next spring's South American soybean crop. USDA's Foreign Agricultural Service projects that world production of palm oil and rapeseed oil will both increase by about 5% in the year ahead. Demand for vegetable oils for food has a long-term upward trend, especially in eastern Asia where consumer incomes have grown rapidly in recent years. Modest growth in foreign biodiesel production and use appears also likely, assuming that crude petroleum prices gradually increase as the world economy begins to show signs of recovery. If so, that and the long-term upward trend in consumption for food in developing nations will contribute to modestly increased global demand for soybean oil and other vegetable oils.

USDA projects that global carryover stocks of palm oil, rapeseed oil, and soybean oil will decline slightly by the end of the current marketing year.

Uncertainty on U.S. Soybean Crop Size

A major part of the U.S. soybean crop was planted unusually late this year, especially in the northern Great Plains and the Midwest east of the Mississippi River. An unusually cool summer, including record or near-record low July temperatures and a cool August in most of the Midwest contributed to slower than normal growth. On August 10, only 55% of the crop in major producing states was setting pods, compared with the 5-year average of 72% and 57% last year. For much of the Midwest, that left only about 3 to 4 weeks to complete the reproduction cycle before changing length of daylight pushed the crop into maturity. Last year's U.S. average soybean yield was placed at 39.6 bushels per acre. Based on field observations and a large-scale farmer survey at the end of August and the first few days of September, USDA's National Agricultural Statistics Service forecast this year's U.S. yield at 42.3 bushels per acre, up 2.7 bushels per acre or 7% from last year.

Last year's August USDA forecast of the U.S. soybean yield (also a late-planted crop) was 40.5 bushels per acre. Its September estimate was 40.0 bushels per acre, but the final yield estimate was 39.6 bushels per acre. Last year's exceptionally late first frosts across the Midwest kept yields from being lower.

With the lateness of the crop again this year, the final potential yield is a bit more uncertain than usual. If the yield would be 1.0 to 1.5 bushels per acre below the current USDA forecast, U.S. soybean and soybean oil supplies could be quite tight for the year ahead. That, in turn, would tend to support soybean oil prices and might limit the amount of soybean oil being used for biodiesel unless biodiesel mandates are strictly enforced.

In each of the last three late-planted years, the soybean yield was well below a long-run trend yield, which is 42.1 bushels per acre for 2009 (See Figure 3 above).

Export Demand Uncertainty

Demand for U.S. soybeans is heavily influenced by the size of foreign crops -- primarily in South America -- and the rate of growth in consumer incomes in major soybean markets. The most important of these markets is China, which in the marketing year just ended is estimated to have accounted for 53% of global soybean imports. As we noted earlier, China's purchases of 2008-crop U.S. soybeans increased by about 40% from a year earlier, although its imports from all sources increased by a much more modest 5%. The most important reason for the increase in U.S. purchases appears to have been due to the decline in availability from South America.

Figure 4 indicates that in recent years it has been a challenge to anticipate the growth rate for U.S. soybean exports. The dashed line shows USDA's August forecast of U.S. soybean exports for the upcoming marketing year and the solid line shows the final export numbers for the marketing year. The final 2008-09 data are not yet available, but based on export shipments through the end of August, they are expected to substantially exceed last year's August forecast.

Soybean Balance Sheets

U.S. soybean supply-demand projections for the year ahead and very tentative alternative projections for 2010-2011 are available on our soybean balance sheet (http://www.extension.iastate.edu/agdm/crops/outlook/soybeanbalancesheet.pdf). The medium-yield supply projections use the USDA September crop forecast. Our export projections are modestly higher than those from USDA's World Agricultural Outlook Board. If our projections materialize, August 31, 2009 U.S. soybean carryover stocks will be at about a 3.3 weeks' supply vs. a preliminary figure of 1.4 weeks for the marketing year just ended.

Conclusions

It looks almost certain that U.S. corn supplies will be fully adequate to meet expanding ethanol demand in the year ahead as well as a possible small increase in corn use for livestock feed and a probable sharp increase in U.S. corn exports. Whether supplies are just adequate or ample will depend on the timing of the first killing frosts this fall in the Midwest, the size of the South American corn crop harvested next spring, and whether EPA allows intermediate ethanol-gasoline blends of E-12 to E-15 to be used for non-flex-fuel vehicles. A modest amount of additional corn acreage may be needed next spring to meet expanding demand for ethanol.

Soybean supplies at this writing look adequate to meet foreseeable food, feed, industrial, and export demand for the year ahead while allowing for a modest expansion in biodiesel production. However, there appears to be more uncertainty in the soybean supply-demand balance than for corn, due to lateness of the U.S. crop, historical challenges in predicting export demand, uncertainty about the degree of recovery in next spring's South American crop, and uncertainty about how U.S. government biodiesel mandates will be enforced in 2010. One or more of the following three developments could significantly tighten soybean and soybean oil supplies for the year ahead:

- significant frost damage to the U.S. crop,
- continuing drought in South America into January 2010, and/or
- aggressive enforcement of U.S. government biodiesel mandates, including combining the 2009 un-enforced volume with the mandated 2010 volume.

In the months ahead, we will continue to monitor the U.S. supply-demand balance for corn, soybeans, distillers grain, and soybean oil and provide updated information on our balance sheet web site locations.

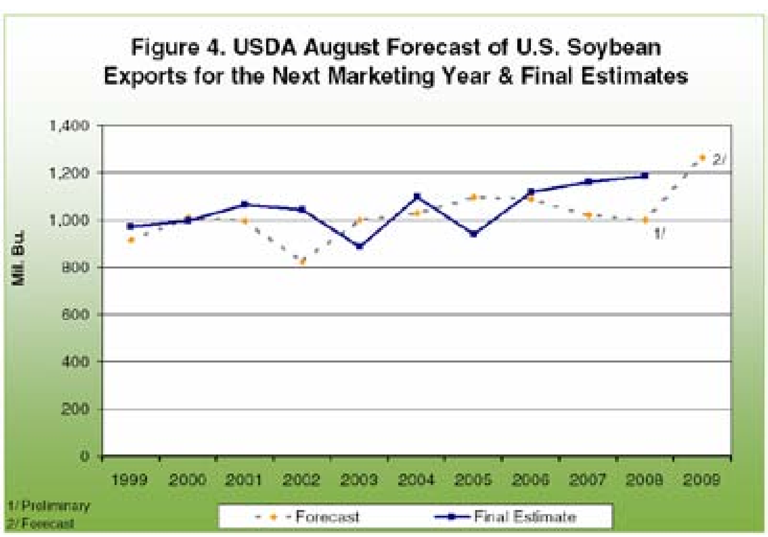


Figure 4. USDA August Forecast of U.S. Soybean Exports for the Next Marketing Year & Final Estimates

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[2] Economic Research Service, U.S. Department of Agriculture, Oil Crops Outlook, OCS-09i, September 14, 2009: http://usda.mannlib.cornell.edu/usda/current/OCS/OCS-08-13-2009.pdf

[3] Energy Independence and Security Act of 2007, PL 110-140, December 19, 2007, Sub-title A, Renewable Fuel Standard, Sections 201-210.

[4] Ann Davis and Russell Gold, "US Biofuel Boom Running On Empty", Wall Street Journal, August 27, 2009.

Crop Residue – A Valuable Resource

by Don Hofstrand, Co-director, Agricultural Marketing Resource Center, dhof@iastate.edu

Crop residue, traditionally considered as "trash" or agricultural waste, is increasingly being viewed as a valuable resource. Corn stalks, corn cobs, wheat straw and other leftovers from grain production are now being viewed as a resource with economic value. If the current trend continues, crop residue will be a "co-product" of grain production where both the grain and the residue have significant value.

The emergence of crop residue as a valuable resource has evolved to the point where there are competing uses for it. In this article we will discuss these competing uses and recent research on the topic.

Cellulosic Ethanol Production

With the emergence of the ethanol industry, considerable attention is focused on utilizing crop residues as a feedstock for cellulosic ethanol production. It is often referred to as Phase 2 of the biofuels industry with corn ethanol being Phase 1. Cellulosic ethanol has been highly touted as superior to corn ethanol due to its improved energy balance (more Btus produced per Btu of fossil fuel used in the process), lower carbon emissions and less direct competition with food production.

Cellulose to ethanol requires an additional step in the production process that is still being investigated and developed. In addition, the high processing cost, difficulty, and cost of gathering, storing and transporting crop residues is problematic. Regardless, the push to develop commercially viable cellulosic ethanol processes is moving forward. This has been intensified by the cellulosic ethanol mandates outlined under the Energy Independence and Security Act (EISA) passed by congress in 2007. The act mandates that, starting in 2010, 100 million gallons of cellulose-derived ethanol will be blended in the nation's gasoline supply. The mandate increases annually with blending in gasoline to reach 16 billion gallons in 2022. This is more than the corn-starch ethanol mandate of 15 billion gallons in 2022.

Although a variety of biomass sources can be used for cellulosic ethanol production, a significant portion of the feedstock is expected to come from crop residues, especially in Iowa and surrounding states where the bulk of the corn-starch ethanol production exists. More information on the current state of the cellulosic ethanol industry is available in AgMRC Renewable Energy Newsletter Article, Cellulosic Ethanol: Will the Mandates be Met? (http://www.agmrc.org/renewable_energy/ethanol/cellulosic_ethanol_will_the_mandates_be_met.cfm)

Other uses

Crop residues have traditionally been used for animal feed. In many parts of the country, beef cows are placed in corn fields after harvest to graze on the residue and any grain remaining in the field. Also, crop residues are harvested, stored and fed to livestock during the winter. Crop residues, especially straw from small grains, are used for livestock bedding.

A variety of commercial uses for crop residues are in various stages of development. Crop residues can be a feedstock for composite products such as fiberboard, paper, liquid fuels and others. Several straw-to-fiberboard business ventures have emerged in recent years with mixed success. Likewise, crops residues have been investigated as a feedstock for pulp for making paper. Conservative estimates indicate that there are enough crop residues to expand the supply of papermaking fiber by up to 40 percent.

Crop residues can be used as a feedstock in the gasification (thermo-chemical) process for making syngas (synthetic gas) which contains carbon monoxide (CO) and hydrogen (H_2). Syngas can be used for several purposes including producing electricity, producing certain chemicals and making ethanol, gasoline and diesel.

Biomass can be used in the production of biogas, which is composed mainly of methane (CH_4) and carbon dioxide (CO_2). Biogas can be used in many parts of the world for low-cost heating and cooking. It can also be used to generate mechanical or electrical power. Biogas can be compressed, much like natural gas, and used to power motor vehicles. Crop residues can also be burned directly to produce heat and steam.

The investigation of alternative uses for crop residues to make commercial products will continue to grow as traditional feedstocks become limited and the need for renewable sources of feedstocks expands.

Carbon Sequestration

Forests are often discussed as vehicles for storing or sequestering large amounts of carbon. However, we should not underestimate the potential of our soils to sequester carbon. Global storage of soil organic carbon is more than two times the amount stored in either vegetation or the atmosphere (1). In addition, increasing soil organic matter (stored carbon) has the additional benefit of improving soil productivity (discussed below).

A variety of methods are being examined as ways of sequestering additional soil carbon. A price placed on carbon through a cap-and-trade system or a carbon tax would create an additional income stream for landowners. So, utilizing crop residues to enhance the sequestration of soil carbon is a competitor to enterprises designed to remove crop residues for commercial uses.

The original breaking of the native grasslands started the process of releasing enormous amount of sequestered carbon as discussed below. Programs to reduce soil tillage are designed to increase and sequester soil carbon. For example, no-till farming has been touted as sequestering soil carbon when compared to moldboard plowing. The programs are designed to provide an income stream to no-till farming based on the value of the carbon sequestered. However, there is uncertainty as to the amount of carbon sequestered from no-till farming. Recent research studies show that soil carbon may not increase due to no-till compared to moldboard plowing (2, 3, 4, 6). These studies show that no-till farming increases soil organic carbon in the upper layers of many soils. However, these same studies show that the soil organic carbon is higher in lower layers of many soils from moldboard plowing. When both layers are taking into account, there is little difference in soil organic carbon from no-till compared to moldboard plowing. Additional research is needed to increase our understanding of the impact of various tillage practices on soil organic carbon.

Other ways of sequestering carbon in our soils are being investigated. An especially promising method is with the use of "biochar" which has the potential to sequester large amount of carbon for long periods of time while also improving soil productivity. Biochar will be explored further in an upcoming article.

Soil health and productivity

Are crop residues really a renewable resource? Or, are there trade-offs when crop residues are removed? Our soils are an amazingly complex, diverse and valuable resource. Examining the impact on soil health and productivity from the removal of crop residues is critical before another use for crop residue is implemented.

Soil Erosion **–** Soils are degraded due to the movement of soil caused by the erosive action of wind and water erosion. For example, it is estimated that China currently loses 18 tons of farmable soil through erosion for every ton of food consumed (5). Much of the eroded soil ends up in streams and waterways that reduce water quality and deposits soil sediments. Eroding soil takes with it important crop nutrients that need to be replaced to maintain crop yields. These nutrients further degrade water quality in lakes and streams and contribute to environmental problems such as the "dead zone" in the Gulf of Mexico.

Leaving crop residues on the soil surface is critical for protecting soils from wind and water erosion. Soil erosion decreases exponentially as soil cover increases (5). So minimizing soil erosion to tolerable levels limits the amount of crop residue that can be removed. The Revised Universal Soil Loss Equation (RUSLE2) (http://www.ars.usda.gov/research/docs.htm?docid=6010) can predict the amount of crop residue required to reduce soil erosion to a tolerable level under various soil types, topographical conditions, etc.

Soil Organic Matter **–** Productive soils are the critical resource behind U.S. agriculture's enormous production capacity. Many of these soils are black because they contain generous amounts of organic matter that accumulated over centuries when lush native grasses grew and decomposed. Similarly, productive brown colored soils developed in the eastern Corn Belt from decaying forest vegetation.

Maintaining adequate levels of organic matter is directly related to the health and productivity of soils. Soil organic matter retains and recycles nutrients, improves soil structure, enhances water exchange characteristics and aeration, and sustains microbial life within the soil.

When native prairies were broken, organic carbon was released into the atmosphere and reduced the amount of soil organic matter. It is believed that 30 to 50 percent of our soil organic matter has been lost since the time of the native prairies. The rate of loss was greatest when the prairies were first plowed. Over the years the rate of loss has decreased to the point where organic matter levels in the soil have become somewhat stabilized. However, it is believed by many authorities that organic matter loss under current crop production practices is still occurring, although at a much slower rate.

Removing crop residues will increase the rate of organic matter loss from soil. Changing from just corn harvest to the harvest of both corn and residue results in a loss of organic carbon, especially in year right after the change (1). Removing as little as 25 percent of the residue results in the loss of soil organic carbon (1). The greater the amount of corn residue removed, the greater the loss of soil organic carbon. It is believed that removing crop residues reduces soil organic matter which reduces crop yields in subsequent years and, will in turn, lead to further reductions of soil organic matter.

However, growing temperate-zone perennial grasses such as switchgrass, miscanthus and native grasses sequesters soil organic carbon (1). Growing perennial grasses on carbon depleted soils provides immediate carbon accumulation (1). This also provides the economic benefit of generating an income stream from the harvest of perennial grasses (e.g. cellulosic ethanol) on degraded agricultural soils.

The amount of crop residue required to maintain soil organic carbon is greater than the amount required to limit soil erosion to tolerable levels. So, soil organic carbon is the factor that should be used in determining the amount of crop residue that can be removed. RUSLE2 can predict the amount of crop residue required to reduce soil erosion to a tolerable level under various soil types, topographical conditions, etc. A similar methodology for computing the amount of crop residue to maintain organic matter does not exist. Further research is required to develop a methodology for maintaining soil organic matter.

Healthy soils are critical in meeting the food needs of the world's expanding population. In 2008, the world population stood at 6.7 billion, up from 2.5 billion in 1950. It is expected to be 8.9 billion in 2050 (33 percent increase) and 9.7 billion in 2150 (45 percent increase). Population growth, along with expanding diets as millions of people move from poverty to the middle class, will put enormous pressure on food production systems.

Increasing soil organic matter could increase global food grain production by about one billion bushels per year (5). As a comparison, the U.S. produced about 2.5 billion bushels of wheat in 2008. So, in 2.5 years the increase in annual global food production would be equivalent to the entire U.S. wheat production.

Below are the benefits of using crop residues to maintain healthy and productive soils:

1) Soil benefits:

- Increases soil productivity (yields).
- Sustains soil organic matter.
- Improves soil structure.
- Controls soil erosion by buffering the soil against forces of raindrop impact and wind shear.
- Increases water infiltration rates.
- Conserves soil moistures.
- Recycles plant nutrients.
- Provides habitat and an energy source for soil organisms including earthworms and microorganisms.

2) Environmental benefits:

- Mitigates flooding by holding water on the land rather than allowing it to run off into streams and rivers.
- Reduces surface runoff and decreases sedimentation.
- Improves water quality by denaturing and filtering of pollutants.
- Reduces nonpoint source pollution.
- Minimizes risks of anoxia and dead zones in coastal ecosystems (e.g. Gulf of Mexico).

Soil Fertility

Crop residue returns fertility back to the soil. In Iowa, it is estimated that the removal of corn residue removes 20 pounds of nitrogen, 2.9 pounds of phosphate and 25 pounds of potash per ton of dry matter (7). So, the nutrients need to be replaced, probably with commercial fertilizers. Although commercial fertilizer prices are quite volatile, recent prices indicate approximately $21.02 of commercial fertilizer is needed to replace the nutrients removed with the corn stover.

20 lbs. nitrogen x $.35 per lb. = $7.00
5.9 lbs. phosphate x $.30 per lb. = $1.77
25 lbs. potash x $.49 = $12.25
Total = $21.02

Implications

Using crop residues as a feedstock for producing renewable energy and other valuable products has received considerable attending in recent years. However, these uses must be balanced against the long-term benefits of maintaining and improving the productivity of our soils. Our soils are a valuable resource critical for meeting the challenges of the next century.

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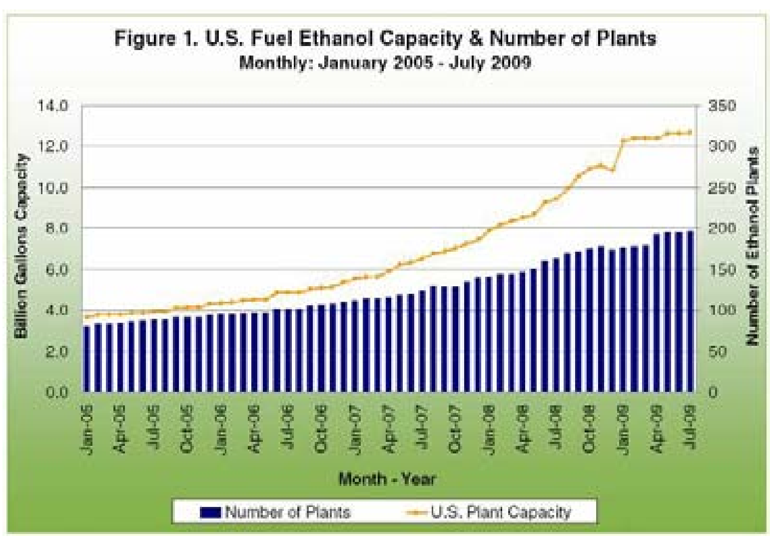
Trends in U.S. Fuel Ethanol Production Capacity: 2005-2009

by Daniel O'Brien, dobrien@ksu.edu and Mike Woolverton, mikewool@agecon.ksu.edu, Extension Agricultural Economists, K-State Research and Extension

Since early 2005 the fuel ethanol industry in the United States has gone through a period of expanding capacity which only began slowing in late 2008 – early 2009. Several factors provided the impetus for this ethanol industry expansion, including U.S. government support for blending ethanol with gasoline, adherence by the U.S. gasoline industry to renewable fuels standard requirements, protective ethanol import tariffs, and favorable relationships between the prices of blended fuels (including ethanol products) and ethanol feedstock (i.e., feedgrains) during the 2005 through mid 2008 period. The trend in ethanol plant expansion leveled off in early 2009 because of



declining ethanol profitability and due to expansion of U.S. ethanol production to levels approaching the U.S. government's renewable fuels standard mandate in year 2015 of 15 billion gallons.

This article examines the growth of the U.S. fuel ethanol industry from January 2005 through July 2009 using data collected on a monthly basis from the Renewable Fuels Association by the state of Nebraska (www.neo.ne.gov/statshtml). This article's focus is on growth in plant numbers, of nameplate plant capacity in production and planned, and growth in estimated feedgrain use needed to supply these ethanol plants.

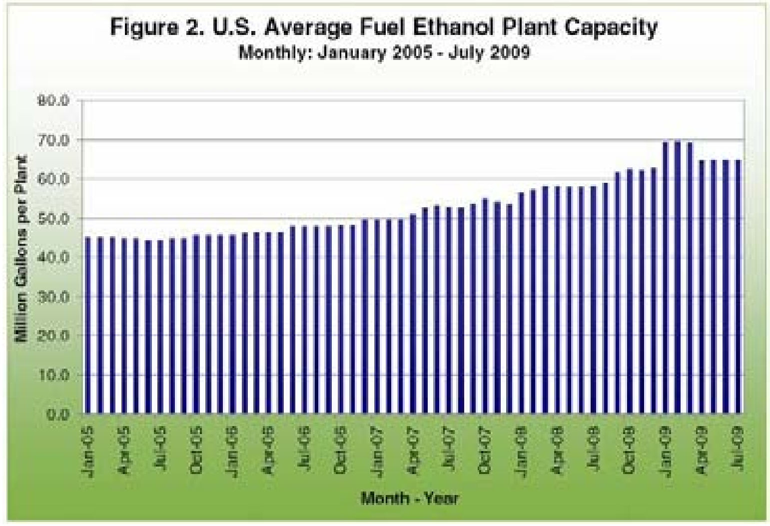
Trends in Plant Capacity and Number of Plants

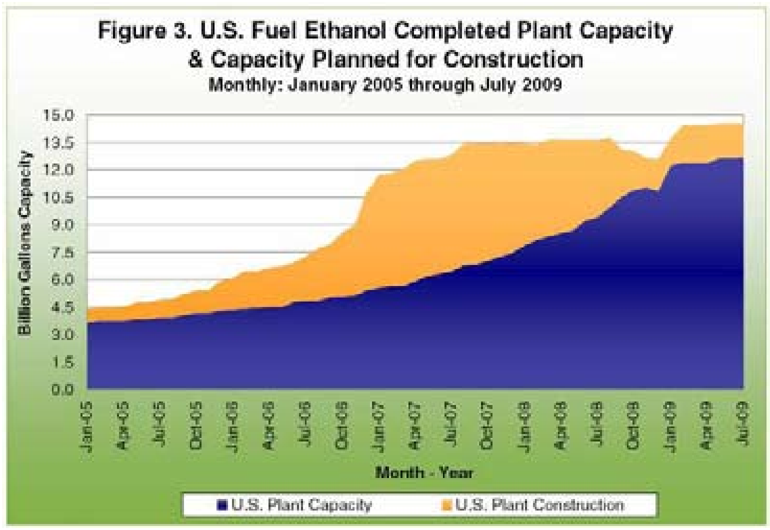
Total nameplate production capacity for United States ethanol plants grew from 3.64 to 12.7 billion gallons from January 2005 through July 2009, an increase of nearly 250% (averaging of 4.6% growth per month) (Figure 1).

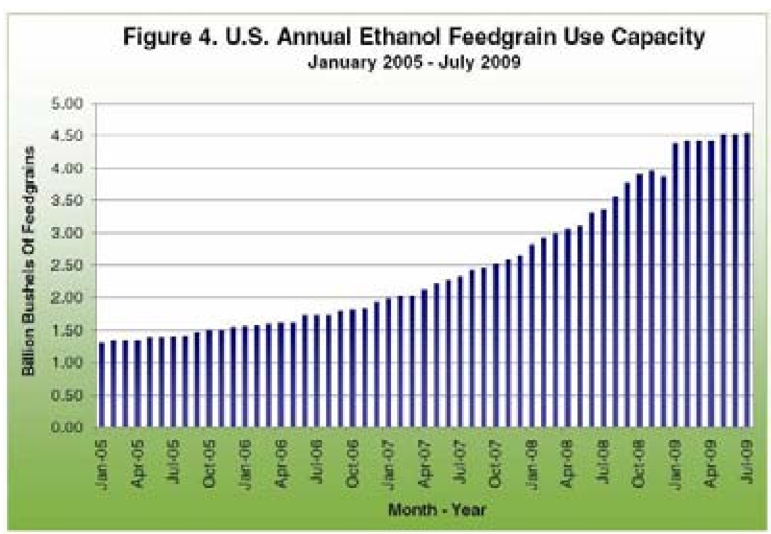
After increasing to 12.25 billion gallons in January 2009, the rate of expansion in ethanol production capacity slowed considerably, averaging less than 1% (0.6%) per month.

The expansion in the number of U.S. ethanol plants had been steady throughout the 2005-2009 period until December 2008. Challenging economic conditions in the U.S. ethanol industry both leading into and during the December 2008 through March 2009 period lead to a number of either temporary or permanent ethanol plant closures. A return to earlier trends in plant number resumed beginning in April 2009 (Figure 1). The average nameplate capacity of on-line U.S. ethanol plants has steadily increased from approximately 45 million gallons per plant in year 2005 to 65 to 70 million gallons per plant during January – July 2009. A short term spike in average nameplate ethanol plant capacity occurred during January – March 2009, likely due to the dynamics of ethanol plant closures, the opening of new plants, etc. (Figure 2).

Trends in Planned Ethanol Plant Construction







The total amount of existing and planned U.S. ethanol industry production capacity never exceeded the 2015 renewable fuels standard goal of 15 billion gallons (Figure 3). In fact, the amount of the renewable fuels standard is calculated by the U.S. government on a linearly trending basis from the current time to year 2015. It is likely that that the sum of total ethanol production capacity both in place (i.e., already built) and the amount planned (i.e., intended to be built) was somewhat close to the linear trending U.S. renewable fuels standard at that time. The lower level of total existing and planned ethanol production capacity that occurred in late 2008 – early 2009 was likely due to changing expectations and prospects for profitability in the ethanol industry during that time. Since February 2009, total built and planned U.S. ethanol production capacity has stayed in the range of 14.4 to 14.6 billion gallons, below the renewable fuels standard of 15.0 billion gallons by 2015.

Total U.S. Feedgrain Use for Fuel Ethanol

U.S. usage of corn or grain sorghum (i.e., feedgrains) as feedstock for fuel ethanol has increased in a manner mirroring the development of U.S. ethanol production (Figure 4).

Assuming that 1 bushel of corn or grain sorghum produces 2.8 gallons of ethanol, the amount of feedgrains needed to keep U.S. ethanol plants running at 100% capacity increased from 1.3 billion bushels in January 2005 to 4.535 billion bushels in July 2009. If expansion of U.S. ethanol production remains at or slightly below the 15 billion gallon fuel standard and is the efficiency of converting feedgrains to ethanol remains the same, then U.S. feedgrain use (both corn and grain sorghum together) would be approximately 4.5+ billion bushels.

Trends in Plant Capacity and-Plant Numbers by State

Trends by state in ethanol plant capacity (Figure 5) and plant numbers (Figure 6) mirror those for the overall United States. As of July 2009, the top 9 rated states in terms of ethanol plant capacity, with number of plants and average plant capacity are listed in Table 1.

As of July 2009 Iowa had the largest share of U.S. ethanol production capacity (3.286 out of 12.698 billion bushels or 26%) and the most plants (40 out of 197 plants) of any state. Nebraska, Illinois, Minnesota, South Dakota and Indiana followed Iowa in terms of plant capacity with a range of 908 million to 1.523 billion gallons per state. In terms of number of plants, Nebraska (25), Minnesota (21), South Dakota (15), Kansas (12), Indiana (11), Illinois (10), and Wisconsin (9) followed Iowa.

Average plant capacity was largest in Illinois (118 mln. gl.), Indiana (83 mln. gl.) and Iowa (82 mln. gl.), but smallest in Kansas (41 mln. gl.), and in the other states not specifically identified in Table 1 (45 mln. gl.). These trends in the location

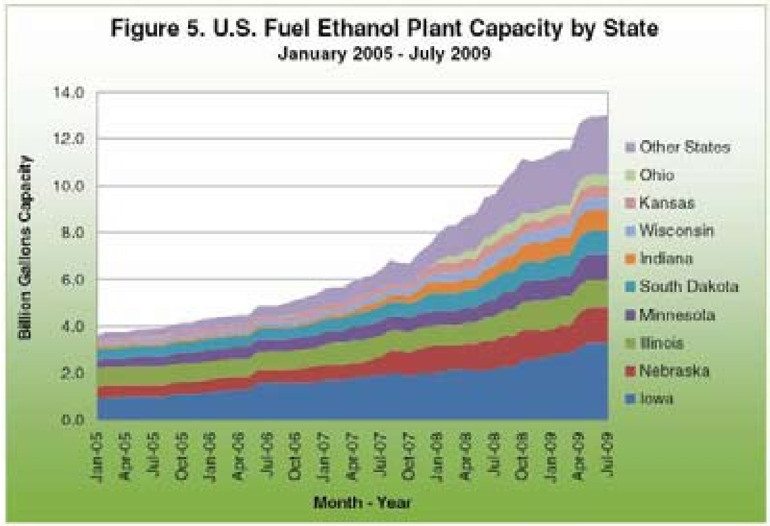


Figure 5. U.S. Fuel Ethanol Plant Capacity by State
January 2005 - July 2009

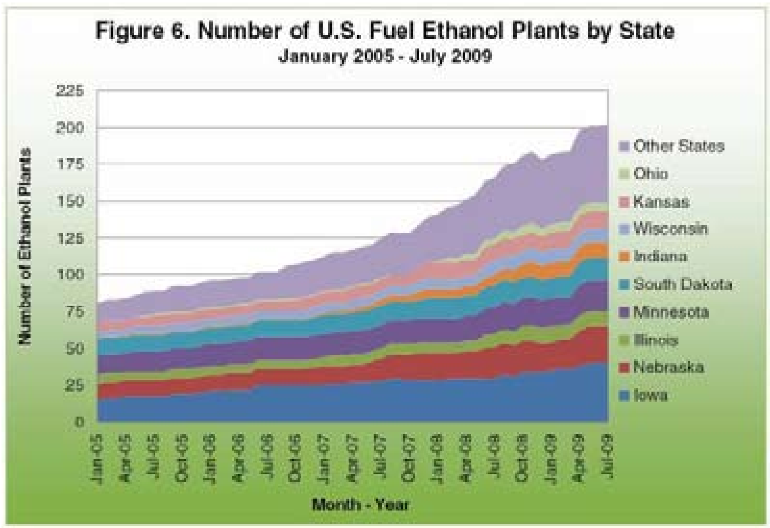


Figure 6. Number of U.S. Fuel Ethanol Plants by State
January 2005 - July 2009

Table 1. State Level Ethanol Production Capacity, Number of Plants, and Average Capacity per Plant

1)	Iowa	3.286 bln. gl. ethanol,	40 plants,	82 mln. gl. / plant
2)	Nebraska	1.523 bln. gl. ethanol,	25 plants,	61 mln. gl. / plant
3)	Illinois	1.183 bln. gl. ethanol,	10 plants,	118 mln. gl. / plant
4)	Minnesota	1.082 bln. gl. ethanol,	21 plants,	52 mln. gl. / plant
5)	South Dakota	1.016 bln. gl. ethanol,	15 plants,	68 mln. gl. / plant
6)	Indiana	908 mln. gl. ethanol,	11 plants,	83 mln. gl. / plant
7)	Wisconsin	498 mln. gl. ethanol,	9 plants,	55 mln. gl. / plant
8)	Kansas	492 mln. gl. ethanol,	12 plants,	41 mln. gl. / plant
9)	Ohio	470 mln. gl. ethanol,	6 plants,	78 mln. gl. / plant
10)	Other States	2.596 bln. gl. ethanol,	48 plants,	45 mln. gl. / plant

of ethanol plants and their production capacity likely reflect both local and state feedgrain production capability as well as whether or not ethanol plants in a particular state were built earlier in the construction rush for ethanol plants (pre 2006) when smaller (30 – 40 mln. gl.) ethanol plant capacities were more common.

Figures 5 and 6 indicate that over time a greater proportion of ethanol production capacity and plants has been built outside of the Corn Belt region where the 9 largest ethanol producing states are located. The proportion of ethanol production capacity in the U.S. located outside of these three primary states is sizable (2.596 out of 12.698 billion bushels), and would be ranked second only to Iowa in production capacity and plant numbers if counted as one geopolitical entity. It is noteworthy that the plants located in these other regions are relatively small in comparison to those in the primary states, perhaps reflecting somewhat limited local feedstock supply capabilities.

Summary

Trends in U.S. ethanol plant capacity are reflecting a leveling off of expansion in 2009 after a period of rapid, strong growth from early 2005 through late 2008. Future expansion in ethanol production capacity will likely depend on the role of and support for fuel ethanol in U.S. energy and environmental policy the future. Absent an increase in renewable fuels standard or the approval of an increase in the proportion of ethanol that can be blended into gasoline, further expansion of ethanol capacity and implicitly feedgrain usage by ethanol may be limited.

Electric Vehicles - How Close are They to Making Major Contributions to Greenhouse Gas and Petroleum Use Reductions?

by Dr. Robert Wisner, Ag Marketing Resource Center, biofuels economist

Future greenhouse gas (GHG) emissions regulations proposed by the California Air Resources Board (CARB) rate electric vehicles as the most effective technologies in controlling GHG emissions.(1) Actual GHG reductions will vary, depending on the vehicle and energy source used to generate electricity. At least 13 other states are considering adoption of the proposed California GHG standards. As we have noted in a previous article, these standards would place ethanol at a substantial disadvantage in the California motor fuel market.(2) If these standards are adopted, electric-powered vehicles could conceivably become a significant competitor with ethanol and biodiesel, depending on the effectiveness of the technology in meeting consumers' needs and how quickly it moves into the market place. At this writing, it appears that electric vehicles may be emerging a bit more quickly than cellulose ethanol. Cellulose ethanol has been one of the major anticipated keys to reducing GHGs and petroleum consumption. However, the electric vehicle technology is still at a very early stage and time will tell whether quality, durability, initial and maintenance costs, reliability and other features will be attractive enough to generate a large-scale national market for such vehicles. Availability of infrastructure for charging batteries of such vehicles also will influence the speed of their acceptance.

Emerging and Currently Available Electric Vehicles

At this writing, at least 27 U.S. manufacturers are either developing or already making electric-powered vehicles. A number of those firms are headquartered in California. Factors contributing to the California locations likely include that state's concern about air quality and its reputation for having a critical mass of technology research firms that could contribute to development of the technology, especially high-efficiency batteries needed for such vehicles. Well-known manufacturers with current or soon to be released electric or gas-electric automobiles include Ford, General Motors, Toyota, Chrysler, Nissan, Honda, and Renault. Most of the currently available electric vehicles from these manufacturers are hybrid gasoline-electric vehicles, in which a battery powers the vehicle for limited distances and slow speeds, with a gasoline engine providing additional power for an extended range and higher speeds. Additional changes and improvements in hybrid vehicles of these firms are likely in the next few years. If sales volumes increase, lower prices might be possible on some models. New versions of electric vehicles expected to be released soon that will run for substantial distances on electric battery power alone include the Chevrolet Volt and a Chrysler mini-van.

There are other companies and vehicles we have missed in this article. In part because of space limitations, we have been able to focus on only a limited number of prospective all-electric or plug-in vehicles to give the reader a perspective on the emerging technology. A number of firms also make electric vehicles smaller than typical U.S. automobiles although space limitations prevent us from discussing them. Iowa State University has several such vehicles it uses for maintenance, delivery, and related functions.

Heavy-Duty Electric Vehicles

Azure Dynamics Corporation of Oak Park, Michigan has developed a version of a two-ton hybrid gasoline-electric van that is being tested by the U.S. Postal Service.(3) Balqon Corporation of Harbor City, California makes heavy-duty all-electric trucks capable of hauling 30 to 90 tons of payload. These trucks have mileage ranges from 40 to 150 miles per charge, depending on the model and whether the truck is loaded or empty. Balqon indicates trucks with the shorter mileage range can be recharged in 30 to 45 minutes. These trucks have speeds of up to 45 kilometers per hour (about 28 miles per hour).(4) Thus, they are designed for use in harbors, warehouses, and urban applications where speeds will be relatively low. In these applications, the zero emissions factor also is a strong positive feature. Because of their slow speeds and limited mileage range before requiring a recharge of batteries, these trucks would not be suitable for long-distance hauling. The company indicates maintenance costs for its trucks are more than 60% less than those of conventional trucks. Initial prices are not available to us for either of these trucks.(5)

Anticipated Features of Selected Soon-to-be-available Plug-in Electric Cars

The Chevrolet Volt is expected to begin production in late 2010. It is a small 4 to 5 passenger car with capability of having its lithium-ion battery charged by plugging it into a 110-120 volt AC electrical outlet. Company specifications indicate it will have a range of 40 miles without use of its gasoline engine. When the battery charge is low, the alternative source of power is a small 3 cylinder super-charged gasoline engine that runs a generator to charge the battery. Estimates of fuel mileage when used for longer distances are as shown in Table 1.(6)

Table 1.

Distance Traveled	Estimated Miles Per Gallon
Forty miles or less	No fuel used
Sixty miles	150
Eighty miles	100

Actual mileage of course would vary with the terrain, traffic conditions, and other factors. The car is to be powered by a lithium-ion battery with 320 to 350 volts. Acceleration is estimated at 0 to 60 mph in 8.0 to 8.5 seconds. Weight of the vehicle was not available at press time, but light weight composite panels likely will be used for the exterior and roof.

***Economic Considerations for Consumers*-**-The Volt's price is yet to be determined but is currently expected to be in the $35,000 to $40,000 range.(7) That may restrict the demand. For example, driving the car for seven years at 12,000 miles per year when compared with a conventional car getting 32 miles per gallon might save a maximum of 2,625 gallons of gasoline if the car is never driven beyond 40 miles per day or is used for a longer commute but is recharged during the day before returning home. Cost of the conventional version might be in the $12,000 to $14,000 range. Using the lower end of the two price ranges, the Volt's extra cost would be about $23,000. At that rate, a rough calculation would suggest gasoline would need to be priced at about $8.75 per gallon to justify the additional investment.

These calculations assume maintenance costs would be about the same for the two types of vehicles. For electric vehicles, as well as hybrid gasoline-electric vehicles, a potentially important maintenance and resale value issue is the life expectancy of the battery. Information we have seen suggests the anticipated battery life may be about 10 years, although there has not been enough experience with them to know the exact life expectancy. With an expected 10-year battery life and a large potential expense to replace it, one would expect the resale value of electric vehicles to drop sharply, starting at about six to seven years of age. This could also be a factor influencing consumer acceptance.

Toyota Reported Plans for Plug-in Vehicle

Reports at this writing indicate Toyota will produce a small number of 3rd-generation Prius Hybrid cars in 2010, with 150 to be put into service in the U.S. for test purposes. The new version will have a lithium-ion battery, to replace its current nickel-metal hydride version. The new version is expected to significantly increase its fuel mileage per gallon. Toyota reportedly will produce only a limited number of these cars at first to make sure there are no defects in their new battery technology.(8) These same reports indicate Toyota plans to provide a plug-in version in 2011.(9) At this writing, we have not found an anticipated price range for the plug-in version of the Prius.

Mercedes Plug-in Concept Car

Mercedes has developed a concept version of a compact electric plug-in car that uses a liquid-cooled lithium-ion battery. The concept car version is called Blue Zero E Cell Plus, with the zero signifying zero emissions. Its new battery powers a 136 horsepower electric motor and provides a maximum driving range of 362 miles on a tank of fuel. The vehicle reportedly can be driven up to 62 miles on battery power alone. The gasoline power unit is a three-cylinder super-charged engine.(10) Industry sources believe a version of this vehicle could be brought on the market within the next year.

Chrysler's Planned Electric Mini-van and Other Vehicles

Chrysler Group LLC is planning to offer a plug-in electric-powered version of its Town and Country mini-van in 2011 that has a 40-mile all-electric driving range, with a small gasoline engine to charge the battery after that range is exceeded. The braking system also is to be used for charging the battery. Over-night charging is done by plugging into a 110-120 AC or 220-240 appliance outlet. Charging time is cut in half with 220-240 current. The total driving range per fill-up of the fuel tank is expected to be about 400 miles.

Chrysler reports that the acceleration will be 0 to 60 miles per hour in 8 seconds, with a top speed of over 100 miles per hour. The company is planning to offer several additional electric vehicle models by 2013, some of which it expects will have an all-electric driving range of 150 to 200 miles. Its Chrysler and Dodge mini-vans will be 7-passenger vehicles, the same size as the current gasoline versions. At this writing, no estimates of likely prices are available.

Tesla Motors, A Currently Available Plug-in Electric (11)

Tesla Motors in San Carlos, California is a young company that currently manufactures a high-end plug-in electric sports car and a more conservative sedan-roadster. At this writing, it appears that the company has produced between 700 and 1,000 vehicles, which have been marketed in the U.S. and Europe. Many of the components reportedly are manufactured outside the U.S. and assembled in the EU, although the company is headquartered in the U.S. The sports car version's acceleration as reported by the company is from zero to 60 miles per hour in 3.9 seconds on its sports roadster model and in 5.8 seconds on another model. Tesla reports that its cars use an innovative 375-volt lithium-ion battery pack that stores enough electricity to power the vehicle for more than 200 miles on a single charge, based on the Environmental Protection Agency's City-Highway driving cycle. Its braking system is used to provide partial battery charging. The Tesla battery pack has numerous and extensive safety features. It consists of 2800 individual cells, each only slightly larger than a AA battery, with the individual cells packaged into 11 battery modules. Presumably these separate battery modules would make it possible to replace individual units rather than the entire battery if a few but not all cells reached the end of their useable lives. The total battery unit weighs about 990 pounds. While that is substantial weight, it is much less than would be needed for the same power storage capability from other battery technologies.

One Tesla model that is available for delivery in 2012 is currently listed on their web site with a base price of $49,900, after a $7,500 tax credit. Other models all begin at a price over $100,000. The average car-buyer would probably find this vehicle to be very interesting but well beyond his/her price range. For the immediate future, Tesla cars are expected to serve a niche market. However, the company's technology is very impressive. Perhaps with future modifications and a lower-end version using similar technology, a larger-volume could be manufactured at a lower price that would significantly expand its market potential.

Potential Impacts of Electric Vehicles on Biofuel Demand

Since electric vehicle technology is in its infancy, it is far too early to assess the probable future impact of these vehicles on biofuel demand. For the next few years, the impact is likely to be quite small. However, if the technology evolves rapidly to a stage that substantially reduces the up-front cost, extends battery life, and reduces the expense of future battery replacements, these cars may develop a sizeable market in areas where air quality is a major concern. Another international oil crisis, brought on by war, terrorism, or other events also could quickly accelerate future demand for these vehicles. As demand grows, the need for battery recharging infrastructure will become more important. At some future time with widespread use of these vehicles in urban transportation, one could envision the need for widespread availability of re-charging facilities at parking ramps and other locations. Impacts this would have on demand for electricity and on the electrical grid are unknown at this time. However, these issues are potential areas for research and development.

Concluding Comments

Electric vehicle technology is in its infancy but is evolving rapidly, with new manufacturers as well as long-standing car makers developing hybrid and plug-in cars. For the immediate future, electric vehicles appear unlikely to have a significant influence on the demand for biofuels. However, it will be important for the entire motor fuel industry to monitor future trends in design and production of these vehicles. If costs can be lowered, it is conceivable that the market for electric vehicles could begin to grow rapidly several years from now. Researchers and designers hope that a later generation of these cars will be able to be powered by fuel cells, thus further increasing their efficiency and reducing consumption of fossil fuels.

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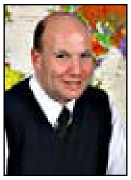


Fertilizer Price Volatility and its Impact on Producers

by Michael Boland, agricultural economist, Kansas State University, mboland@agecon.ksu.edu

In the past few years there has been a great amount of volatility in agricultural commodity prices. This has caused a great deal of stress within the agricultural input industry. A great deal has been said about upheavals in the ethanol industry, but less has been written about the need for financing requirements caused by the frequent margin calls and need for capital. The fertilizer industry holds no exception and had historically high prices in the early fall of 2008 followed by a large decline almost immediately afterwards. This article looks at the components of the fertilizer industry, its major players and impacts to producers.

Phosphates are an important fertilizer input used in production agriculture. These include monoammonium phosphate (MAP) and diammonium phosphate (DAP) products produced by Mosaic and PCS. Almost 35% of this is exported from the U.S. into India and Latin America. The U.S. imports phosphate rock from Morocco to use with existing supplies in Florida to create these products. Potash is another form of phosphorus and the two large firms in that industry are PCS and Mosaic. The U.S. imports almost 80% of its potash from Canada. Phosphate plants are built to utilize imported and domestic supplies of phosphate rocks, ammonia and sulfur (Florida and Texas coast).

Nitrogen includes ammonia, urea and urea and ammonium nitrate solution (UAN). Ammonia is manufactured by Mosaic, PCS, Agrium, CF, Terra and Koch. Almost 50 percent is imported through Trinidad and Tobago in the Caribbean which are close to a supply of natural gas. Urea is manufactured by CF, Agrium, Terra, Mosaic and PCS and 70 percent is imported from Canada, Eastern Europe, China and Venezuela. Finally, UAN is manufactured by Terra, CF, PCS and Koch and almost 30 percent is imported from Canada, Russia and Eastern Europe. Nitrogen plants are built near natural gas supplies (near Gulf ports) and transported to consumption points (corn, wheat and other crops). The price of energy is a major source of price volatility.

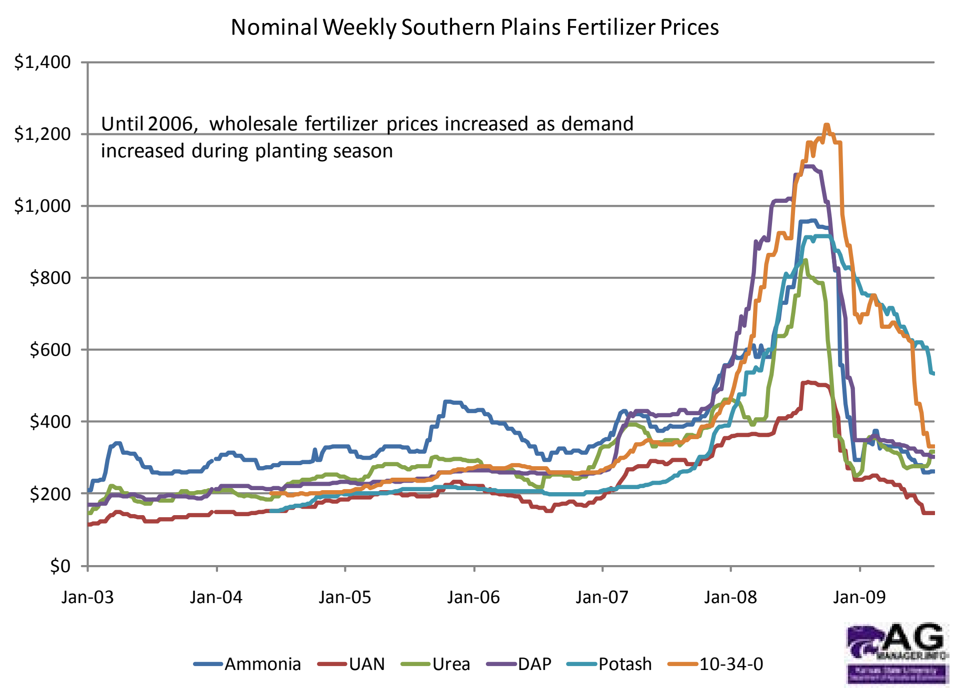
The key inputs in fertilizer manufacturing are globally traded products and are affected by transportation costs, exchange rates, policy decisions and other uncontrollable factors. They are also increasingly becoming concentrated. Agricultural retailers have little or no negotiating ability with wholesalers who are pushing risk back onto the retailer. Vertically integrated operations have advantages in transfer pricing.

The number of firms continues to decline nationally according to USDA. USDA data suggests that market share of cooperatives is increasing in retail agribusiness industry (agronomy, energy, feed, grain) for farmer-owned cooperatives (CHS, MFA, TN Farmers, Growmark). Non co-ops include Agrium (Crop Production Services-east coast, Eastern Corn Belt, Southwestern Kansas), Simplot (Upper Midwest and Pacific NW), Helena Chemical (national), and Wilbur Ellis (Western US, ND, MI, TX). CPS is a product of three mergers.

Because of recent price volatility, some large producers are trying to go direct to the wholesaler. However, barriers to entry exist in services (cost of application equipment, labor, cost of compliance), facilities (regulations, volume) and learning curve (not an industry with significant entry and exit patterns). New entrants in retail agronomy operations are not likely to surface except through existing firms who are increasing their footprint and trying to obtain economies of size.

Purdue University data suggest that there are two typical distribution channels to producers. The first is a wholesaler-retailer-producer channel that is not as transaction oriented, but more attuned to timeliness of service and individual solutions. The second is a wholesaler-distributer-producer channel where producers require simpler solutions and are more transaction-oriented, which puts more pressure on margins. This channel includes distributers who do not provide services, but simply aggregate large vol-

Figure 1.



umes of inputs in a warehouse or similar facility. A wholesaler-producer channel exists for some large producers.

Regardless, fertilizer application is intensely seasonal with short periods in the fall and spring and producer decision-making is often close to planting time. Retailers must buy six to nine months in advance with no opportunity to hedge. Producers desire a local solution which is often decided upon in a short window of time. Retailers must anticipate demand six to nine months ahead.

Price discovery occurs in this industry with a transaction occurring six to nine months prior to a producer actually buying and using the product. The retail fertilizer dealer has some negotiating ability (based on volume and product formulation) and has more than one buyer to select from. Various price sheets exist from industry associations but no information on volumes is given for those prices. Exchange rate risk has increased in the last five years due to weakening of the U.S. dollar, which made imports more expensive and increased volatility in energy prices. There is no way for a retail dealer to hedge the transaction. The lender requires collateral for the purchase and when inventory values change, the "margin" requirements change.

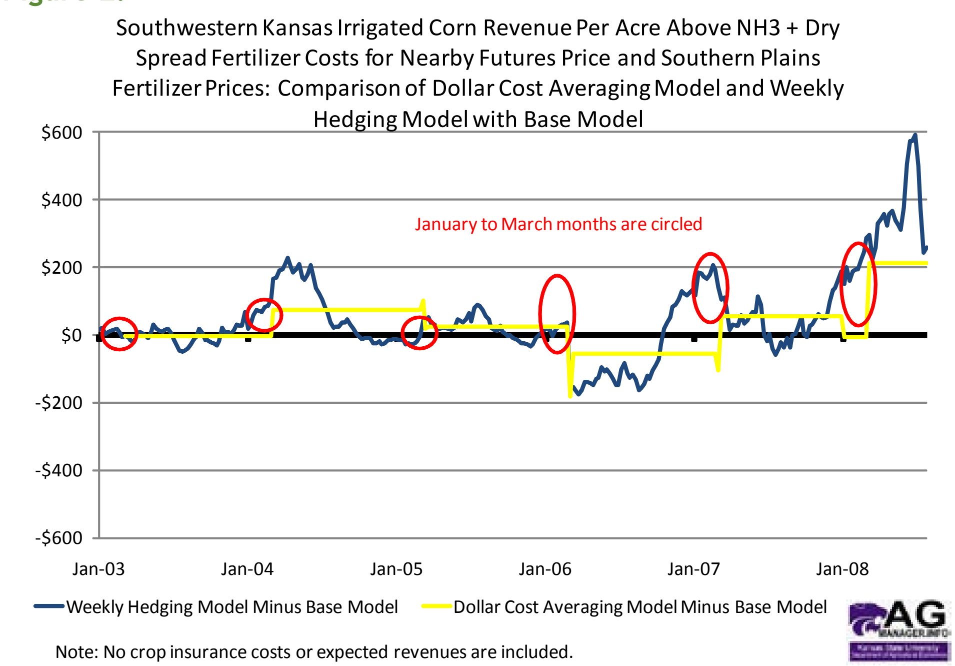
Figure 1 shows the changes in fertilizer in the past five years. For managing risk in this industry a retailer would like to find a way to hedge fertilizer but no futures market exists. Forward contracting at some price is difficult because the key input in manufacturing is extremely volatile due to factors beyond the control of the wholesaler and unlikely to devise a "fair" contract and significant premium for basis risk would be included. Consequently, many firms take a position and then aggressively try to sell fertilizer as quickly as possible using prepays.

Three models were used to analyze the risk in this industry. The first was a hedging weekly model (not available) using weekly wholesale fertilizer prices and CBOT (corn) and KBT (wheat) futures. The second model is a base model of buying fertilizer during planting season and selling grain at harvest which is widely used by many producers as it provides flexibility and easily understood. The third is the dollar cost averaging model where a producer pays for 1/12 of the fertilizer used and sells 1/12 of the grain each month. This is a proxy to hedging weekly.

The dollar cost averaging model starts with a producer determining an amount of grain and fertilizer needed for that grain that you want in that program. This is placed into a "margin" account which is needed by the retailer because the fertilizer is collateralized with their lender and the collateral is lost once it is applied by the producer. Each month the producer pays 1/12 of the fertilizer costs and receives 1/12 of the grain revenue. The price of fertilizer that day is multiplied by 1/12 of the fertilizer volume applied and the price of grain that day multiplied by 1/12 of the expected grain volume. An example is provided for a Southwest Kansas irrigated corn operation. Three agronomy options were considered: custom dry (urea, MAP), custom liquid (UAN, MAP) and NH3 + dry spread (anhydrous ammonia, MAP). An expected return per acre above each fertilizer costs for each agronomy option was calculated for the 2003 to 2008 time period using nearby corn price, Garden City cash price, an estimated yield of 200 bushels per acre, and Southern Plains fertilizer prices for ammonia, UAN, urea, and MAP (no potash was recommended in these three agronomy options) adjusted for delivery into Garden City. Government program payments were not included. The dollar cost averaging model assumes you start in first week in March and proceed over the year while the base model assumes you buy fertilizer in first week in March and sell grain in mid-October. There is little difference in return above fertilizer costs between the three agronomy options and only the NH3 + dry spread option is presented in Figure 2.

As you would suspect, the weekly hedging model and dollar cost averaging model are closer to one another. The traditional

Figure 2.

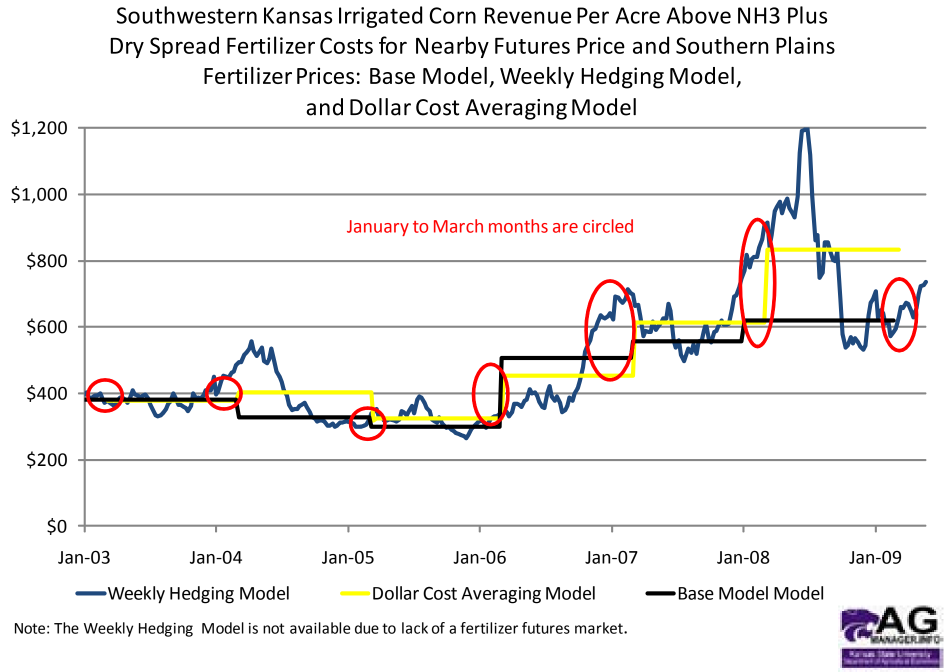


Model	Mean	Standard Deviation	Coefficient of Variation
Traditional	$447.21	$120.74	26.86%
Dollar Cost Averaging	$497.22	$174.55	34.86%
Weekly Hedging	$500.72	$196.85	39.59%

model has a lower mean and less risk as measured by the CV. None of this is surprising. The dollar cost averaging model is patterned after the weekly hedging model. There is no statistical difference among the three models. The mean deviations are greater because of the great increase in volatility especially during periods outside the March and October time periods. The weekly hedging model has the most variability and most profit.

The dollar cost averaging mimics some of the patterns one sees in the weekly hedging model.

Figure 3.



Model Statistics	Weekly Hedging Less Traditional	Dollar Cost Averaging Less Traditional
Sum of Deviations	$14,848.73	$8,859.69
Mean Deviation	$51.03	$31.42
Standard Deviation	$127.21	$68.98
Coefficient of Variation	249.31%	219.57%

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