

Ethanol Production and its Impact on Corn Production

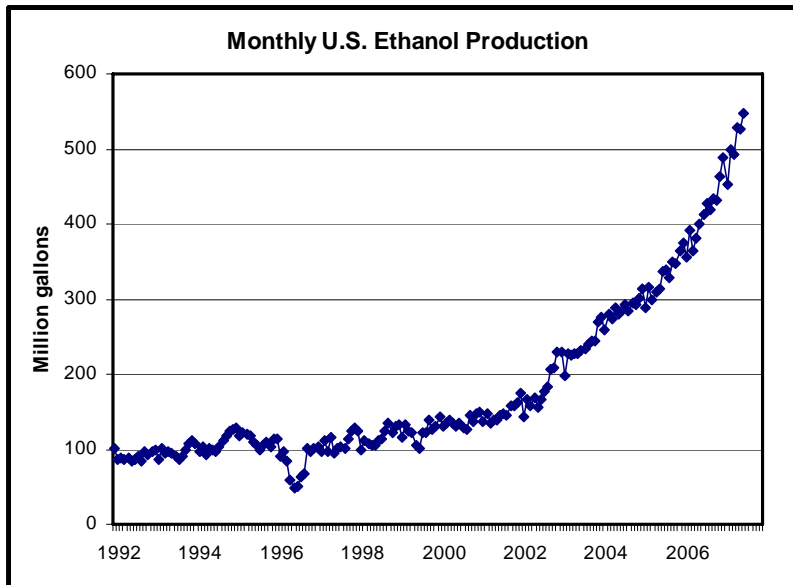
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www.agmanager.info

Presentation at Tessengerlo Kerley Agronomy Update
Phoenix, AZ. October 24, 2007

Drivers of the Biofuels Industry

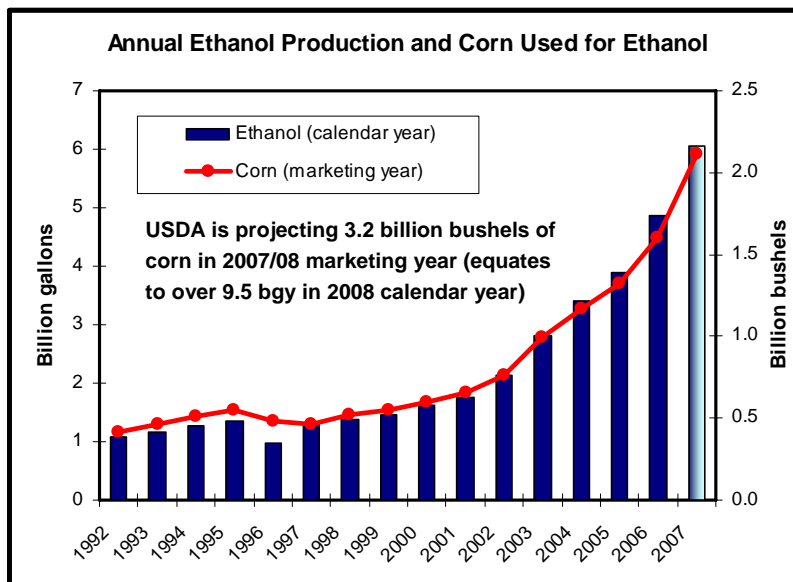
- **Ethanol**
 - States ban or restrict MTBE
 - States mandate ethanol inclusion
 - Subsidies
 - High energy prices
- **Bio-diesel**
 - Low sulfur requirements for diesel
 - Subsidies
 - High energy prices

Rapid rates of expansion last several years...



Source: Energy Information Administration (EIA)

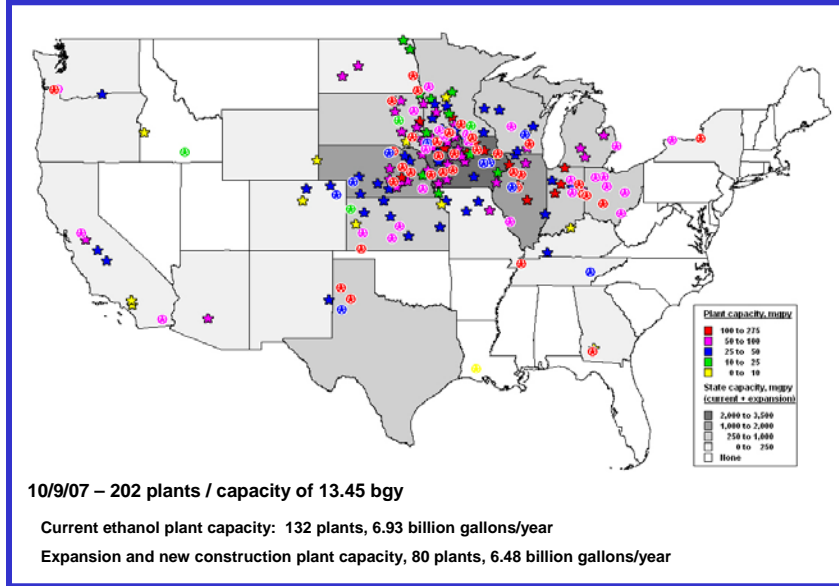
Increases the demand for corn...



Source: Energy Information Administration (EIA), USDA NASS, and KSU

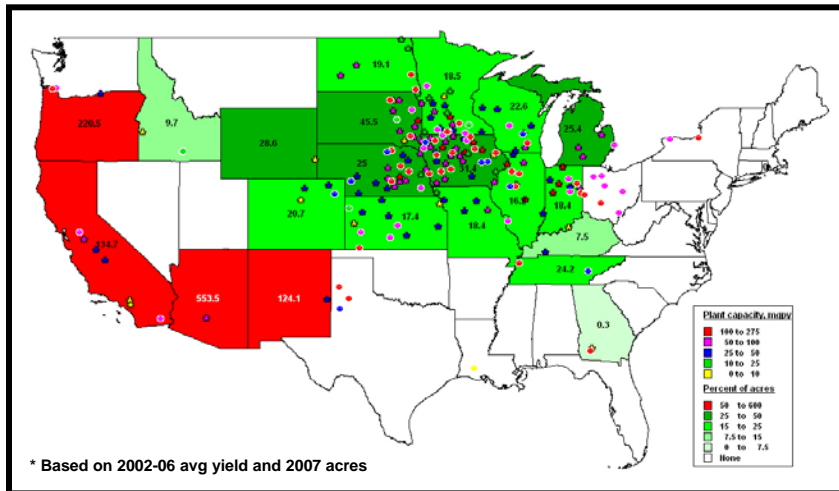
Existing and new ethanol plants

Source: Renewable Fuels Association (RFA)



% of Acres Needed for Current Ethanol Production*

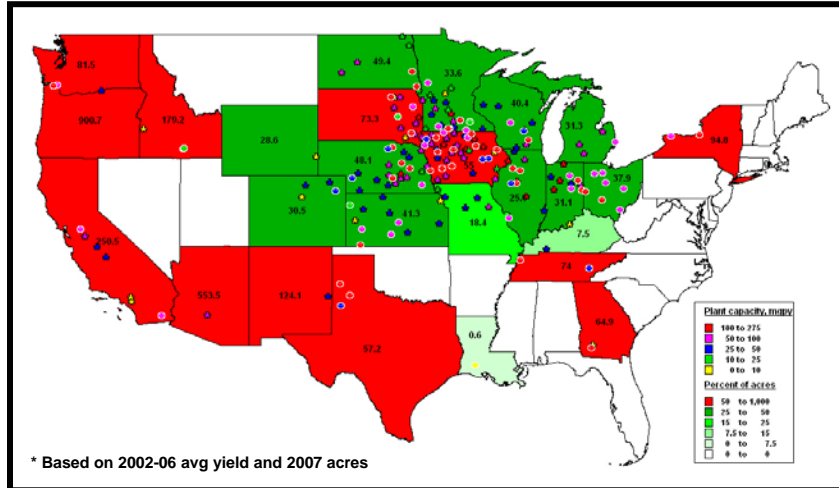
Source: USDA NASS and KSU



Some states clearly are relying on importing corn

% of Acres Needed for Current + Expansion Production*

Source: USDA NASS and KSU



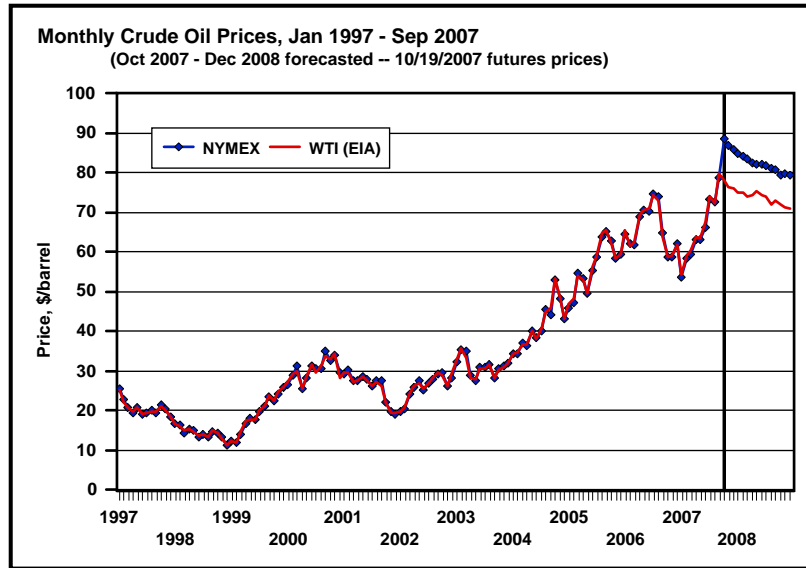
Ethanol expansion is going to create some interesting dynamics...

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Prices, profitability, etc.

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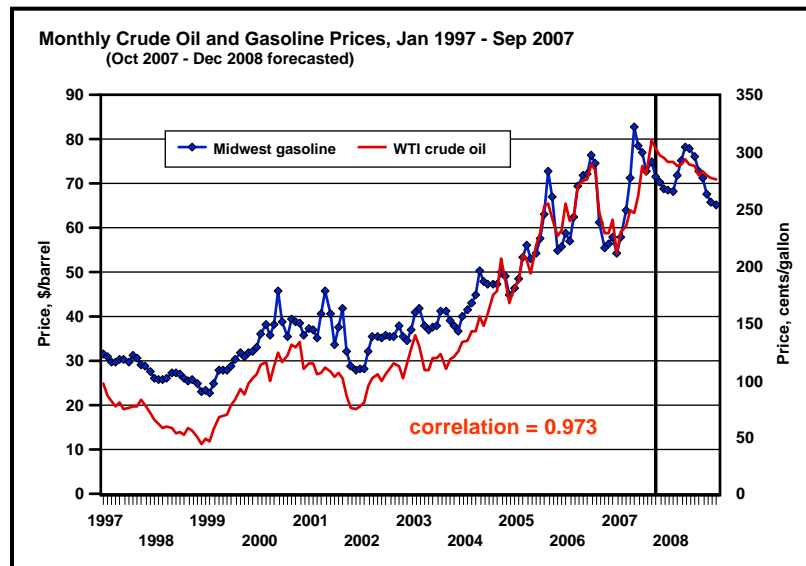
Crude oil prices are at historically high levels...



Source: Energy Information Administration (EIA) and KSU

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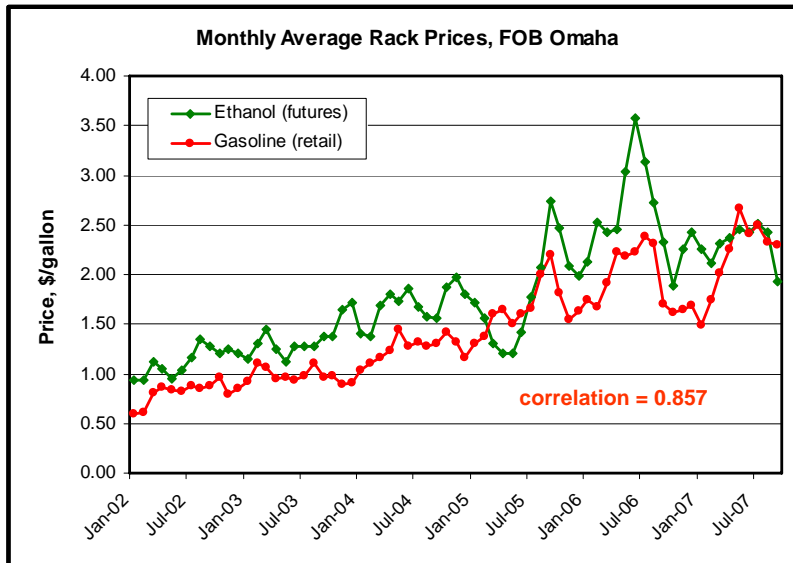
High oil prices translate into high gas prices...



Source: Energy Information Administration (EIA)

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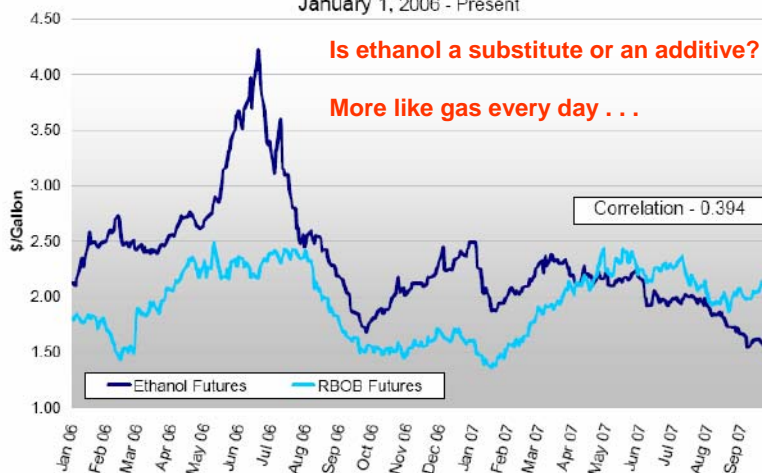
Positive correlation → higher gas prices leads to higher ethanol prices...



Source: Nebraska Ethanol Board and Nebraska Energy Office, <http://www.neo.ne.gov/statshtml/66.html>

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CBOT Ethanol Futures versus NYMEX RBOB Futures
January 1, 2006 - Present

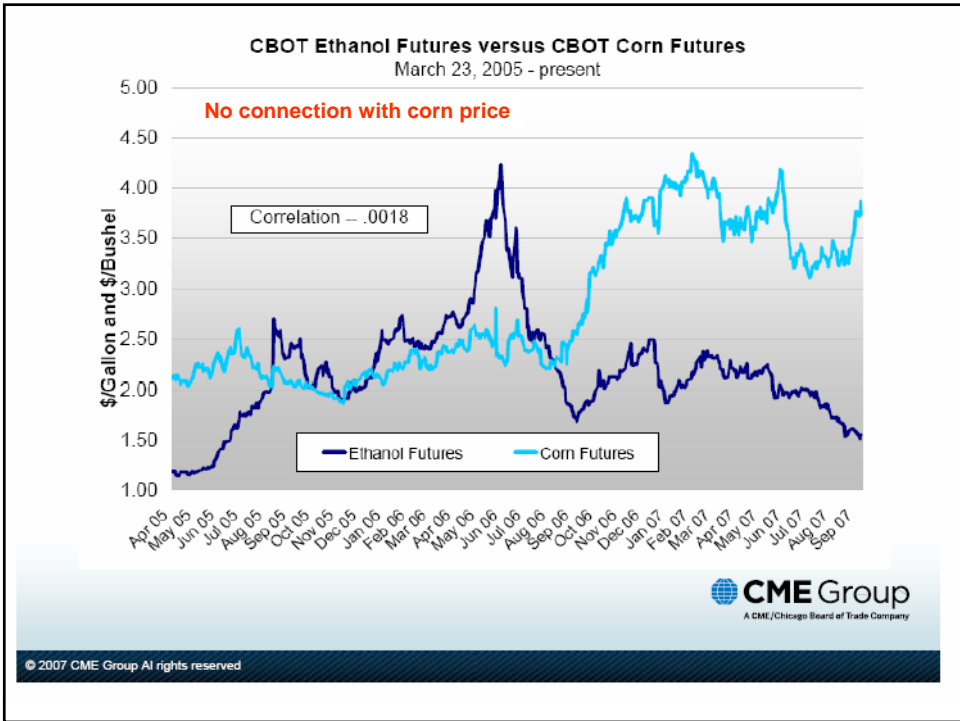
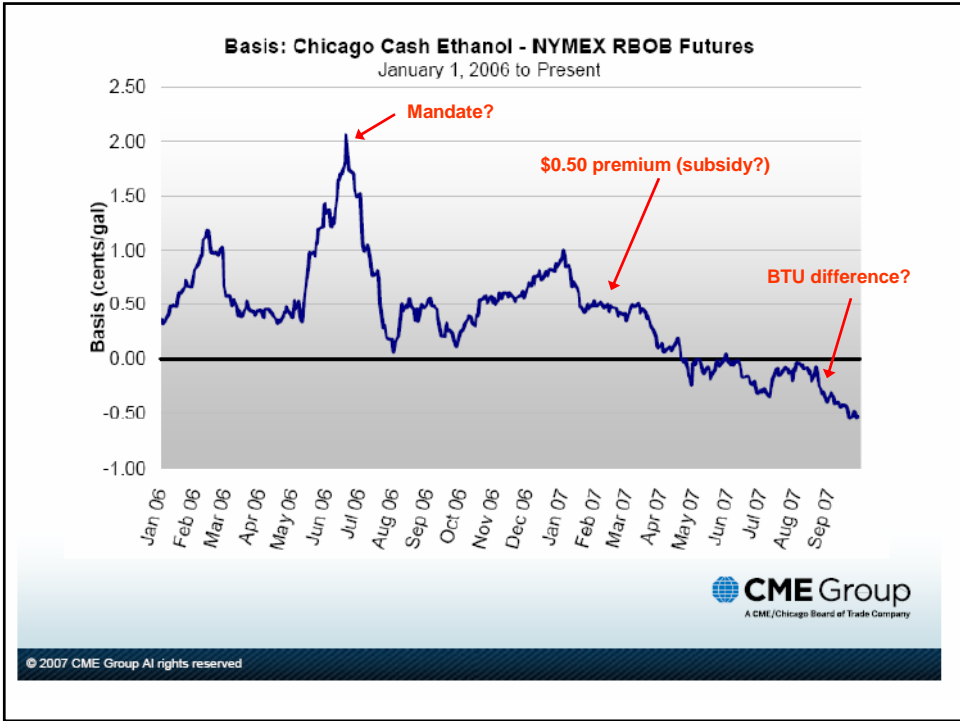


But, prices can be much less correlated in the short run...

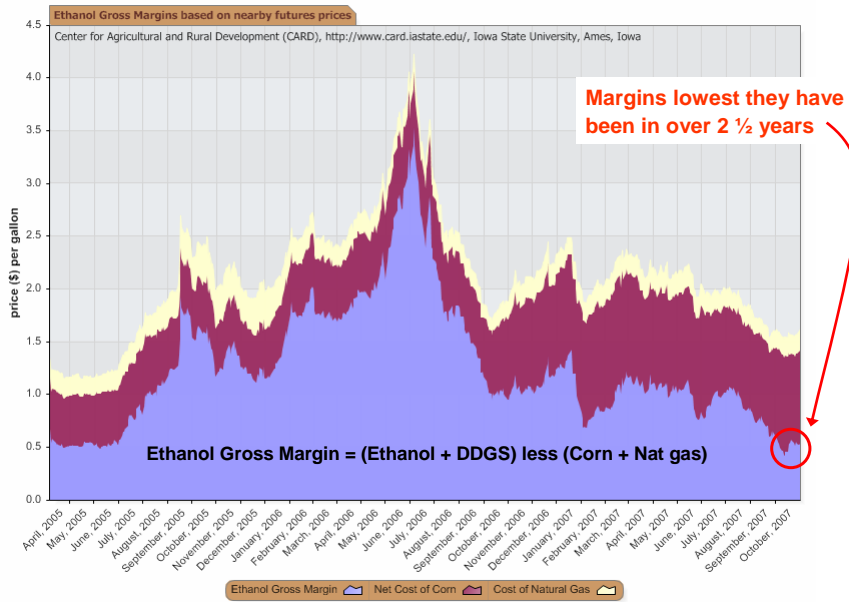


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RBOB (reformulated blendstock for oxygenate blending)



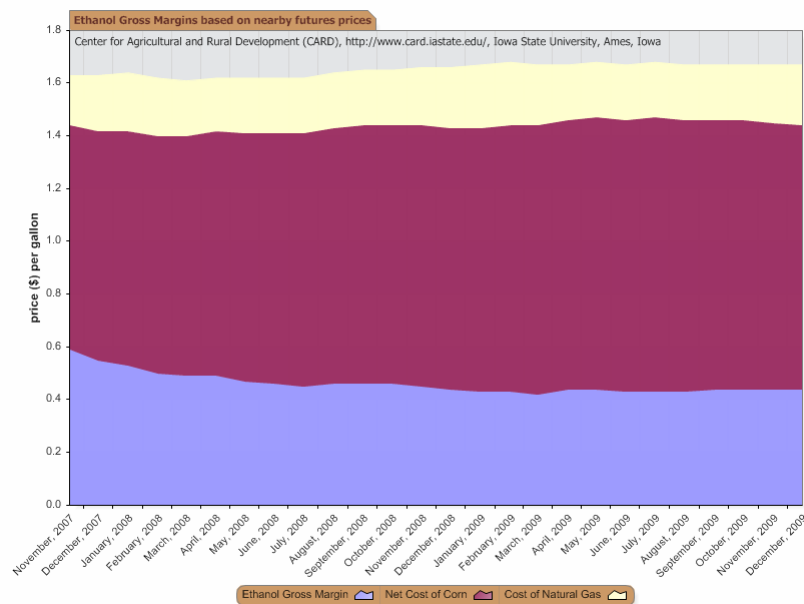
Historical ethanol margins



http://www.card.iastate.edu/research/bio/tools/proj_eth_gm.aspx

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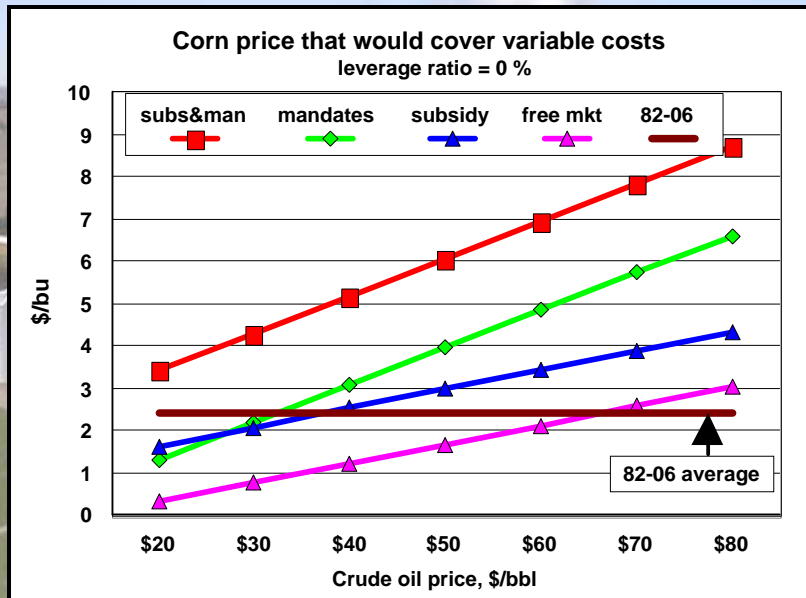
Ethanol margin forecasts → Expansion?



http://www.card.iastate.edu/research/bio/tools/proj_eth_gm.aspx Updated 10/17/07

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Ethanol Profitability...

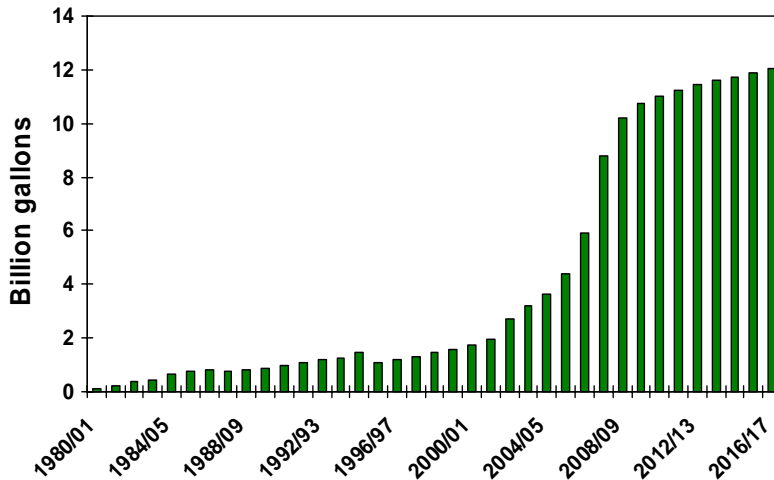


If morthalling costs are high, effective breakeven prices are higher

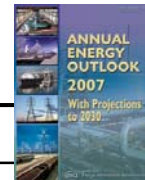
How much ethanol will be produced going forward?

Projected Corn Ethanol Production

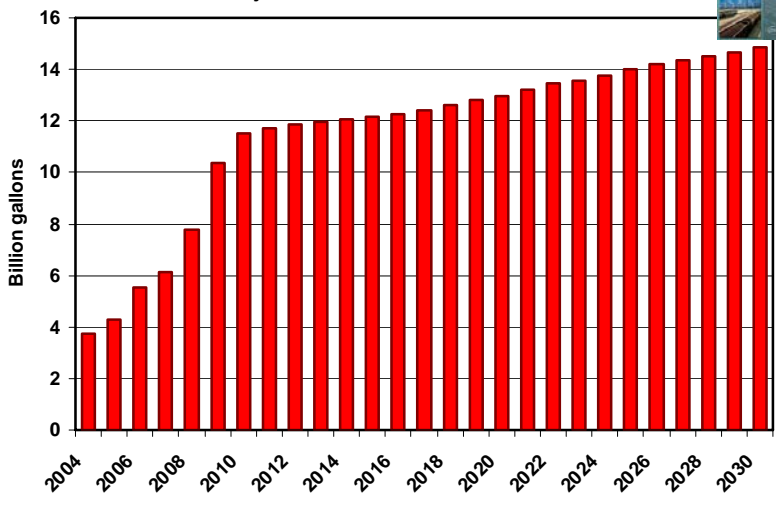
expect 12 bil. gal. in 2016/17– 30% of corn crop



Source: Collins, K. "The New World of Biofuels: Implications for Agriculture and Energy." EIA Energy Outlook, Modeling, and Data Conference, March 28, 2007



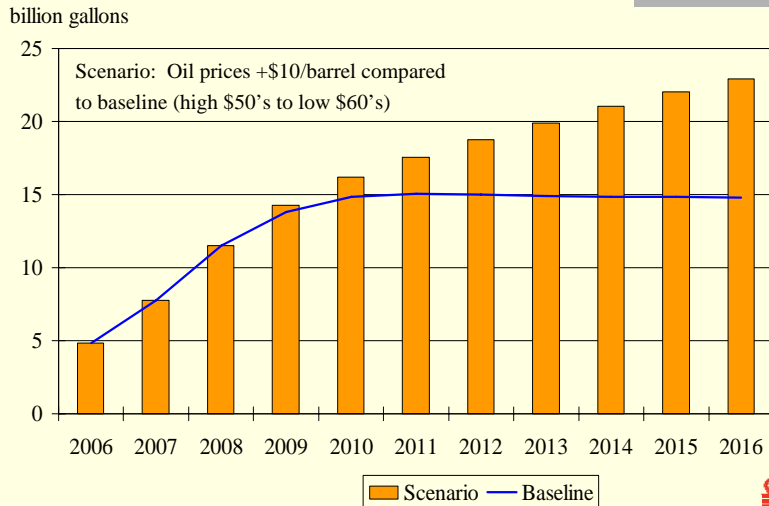
Projected Corn Ethanol Production



Source: Energy Information Administration, Report #DOE/EIA-0383(2007), February 2007

Projected U.S. Ethanol Production

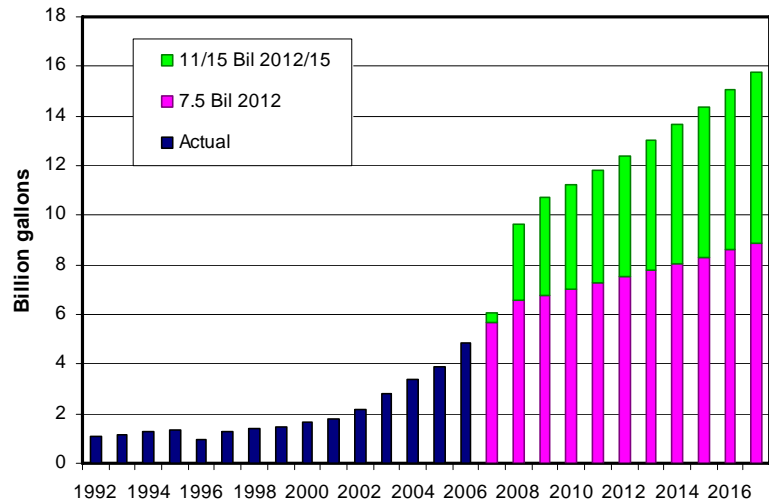
Source: Chad Hart, CARD, Iowa State University – Spring 2007

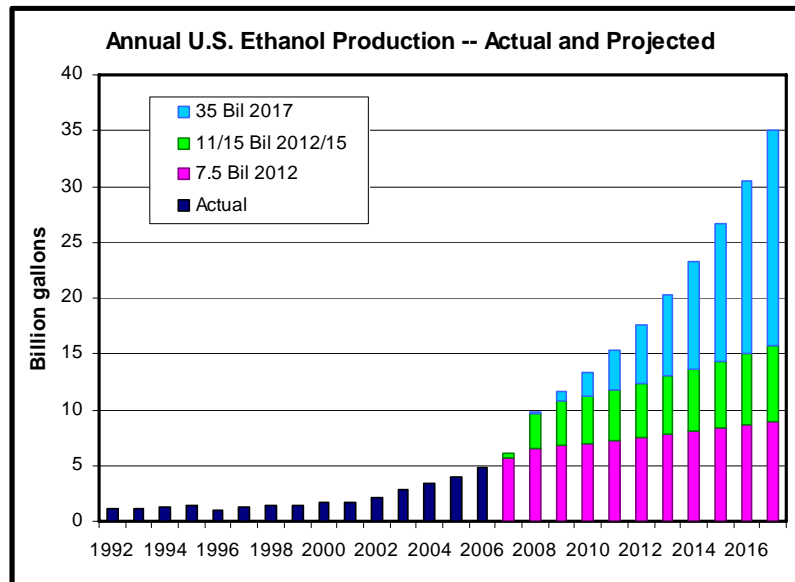


IOWA STATE UNIVERSITY



Annual U.S. Ethanol Production -- Actual and Projected





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Future ethanol production?

- **Not sure who's crystal ball to believe**
 - Hard to predict politics

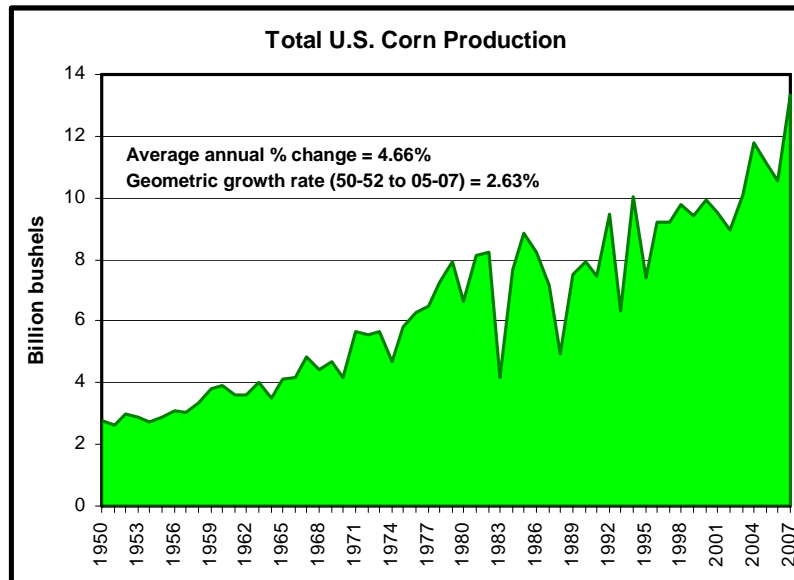
- **Impact of cellulosic ethanol?**

- **Most predictions in the 11-15 bgy range over the next 3-5 years**
 - Reflects current capacity
 - Approximates E-10 nationwide
 - What does this mean for corn acres?

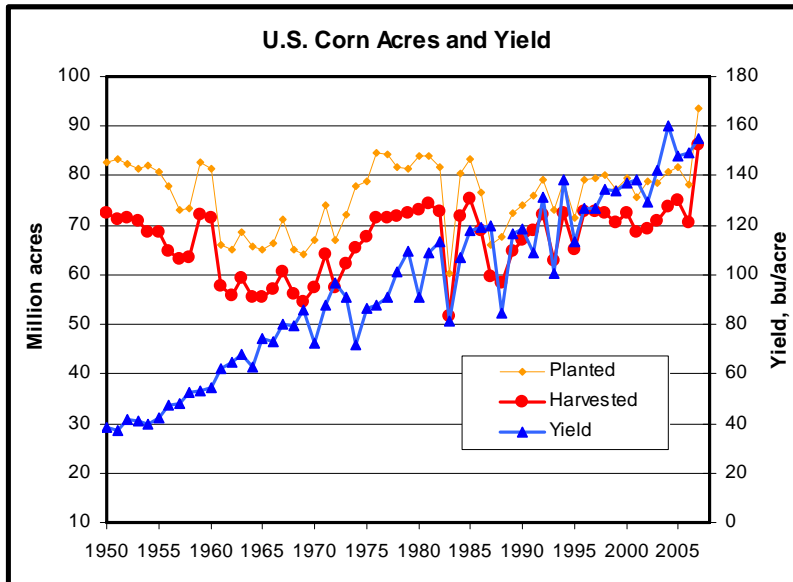
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Corn acres, yields, etc.

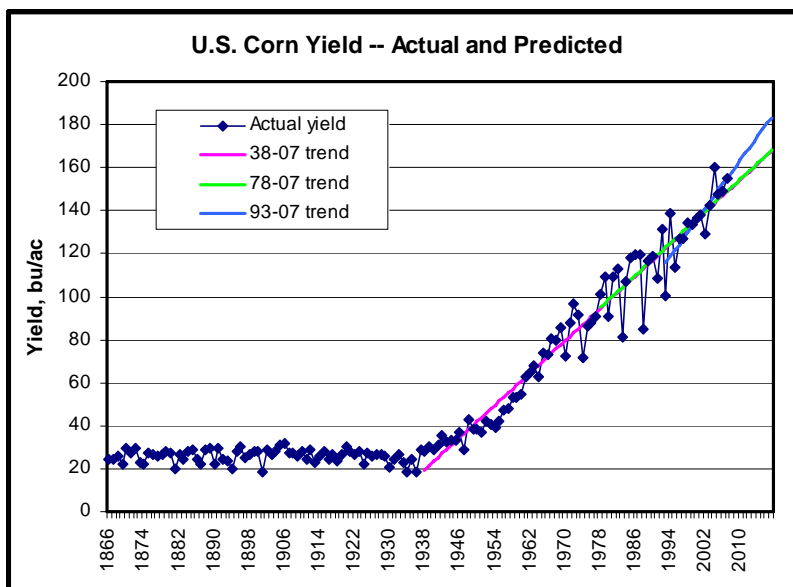
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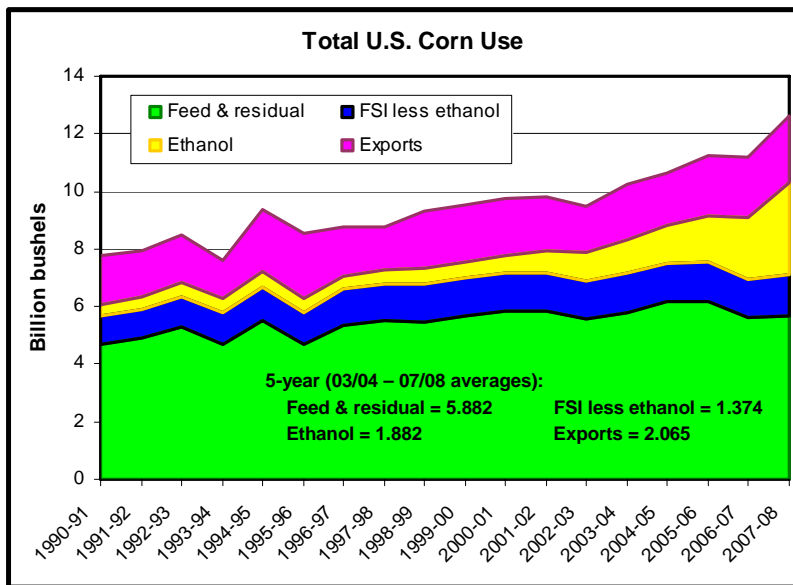


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Average annual % change = 0.49% (planted); 0.64% (harvested); 3.37% (yield)
 Geometric growth rate (50-52 to 05-07) = 0.04% (planted); 0.14% (harvested); 2.49% (yield)



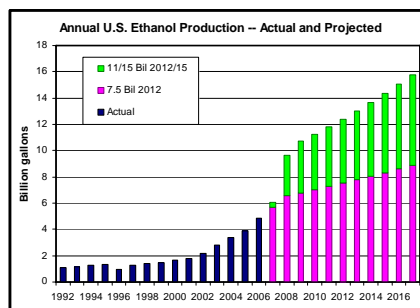
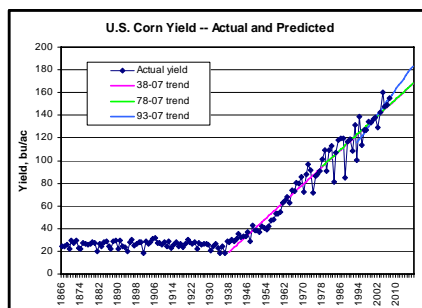


Source: USDA WASDE and KSU, 2006-07 is an estimate and 2007-08 is projection

Corn acres needed...

Assumptions:

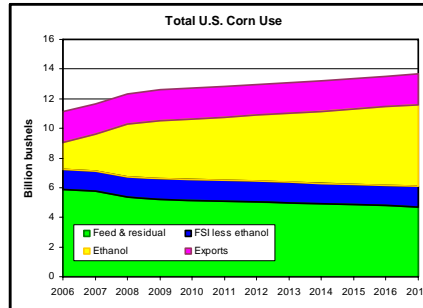
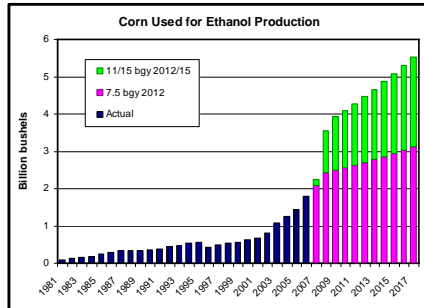
- Trend yield equal to average of 3 different trend lines (157.5 in 2010 173.0 in 2017)
- Ethanol production consistent with green bars (below)
- Exports, FSI less ethanol, and Feed & Residual held constant at 5-year average
- Maximum of 35% of corn bushels displaced with DDGS



Corn acres needed...

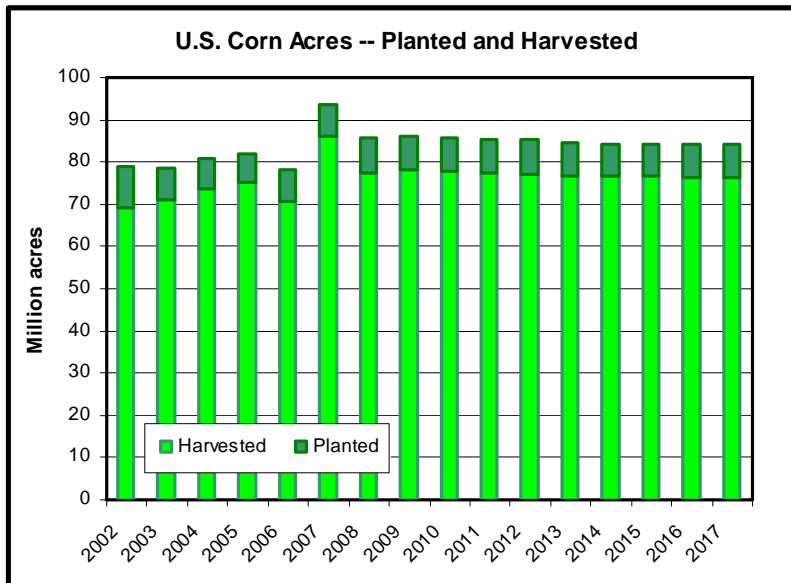
Intermediate results:

- Corn used for ethanol based on total ethanol production and conversion rate of 2.7-2.9 gallons per bushel
- Corn used for Feed & Residual falls as more DDGS are fed to livestock
- Total corn use grows from 12.3 billion bushels in 2008 to 13.7 billion bushels in 2017



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Yield growth covers increased ethanol needs...



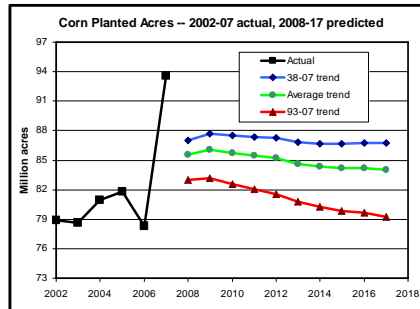
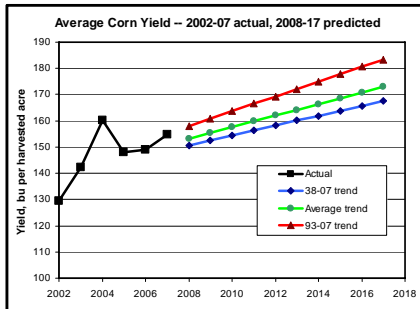
Source: 2002-07 USDA, 2008-2017 KSU projections

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Corn acres needed...

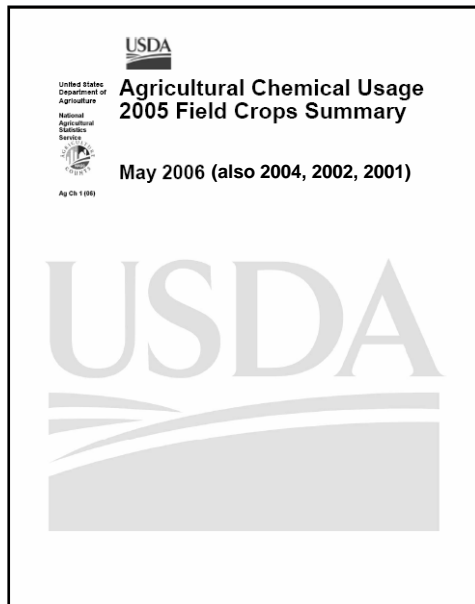
Results are sensitive to yield trend assumptions

- Recent trend suggests planted acres can drop back to more "normal" levels (i.e., 79-82 million acres)
- Longer-term trend suggests the need to consistently plant 86-87 million acres
- Average trend suggests the need for 84-86 million acres – above historical levels, but below 2007



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Corn acres and fertilizer demand...



USDA NASS surveyed 19 states (18 two of the years) regarding chemical usages on corn acres

Report the following:

- Acres planted to corn
- Million pounds of N,P,K applied to corn

Calculated the following:

- Acre-weighted pounds applied per planted acre
- Bushel-weighted pounds applied per bushel

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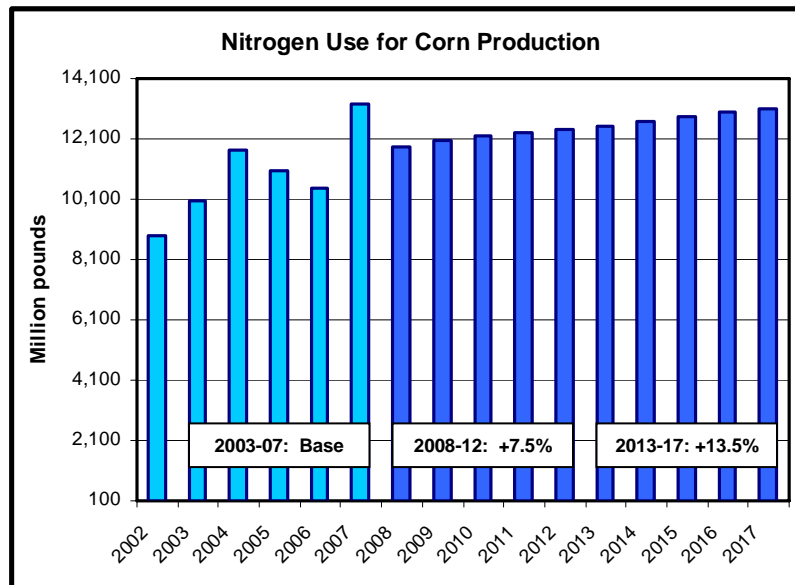
Estimated nutrient use/demand for corn...

Year of survey	2005	2003	2001	2000	Average
States in survey	19	18	19	18	
Weighted Averages					
Nitrogen					
Lbs/ac	132.3	131.9	127.3	131.6	130.8
Lbs/bu	0.953	1.004	0.992	1.027	0.994
Phosphate					
Lbs/ac	47.0	46.6	44.0	47.0	46.2
Lbs/bu	0.338	0.351	0.341	0.364	0.349
Potash					
Lbs/ac	54.1	53.8	53.6	51.5	53.3
Lbs/bu	0.390	0.401	0.412	0.392	0.399

Source: USDA Agricultural Chemical Usage – Field Crops Summary (various years) and KSU

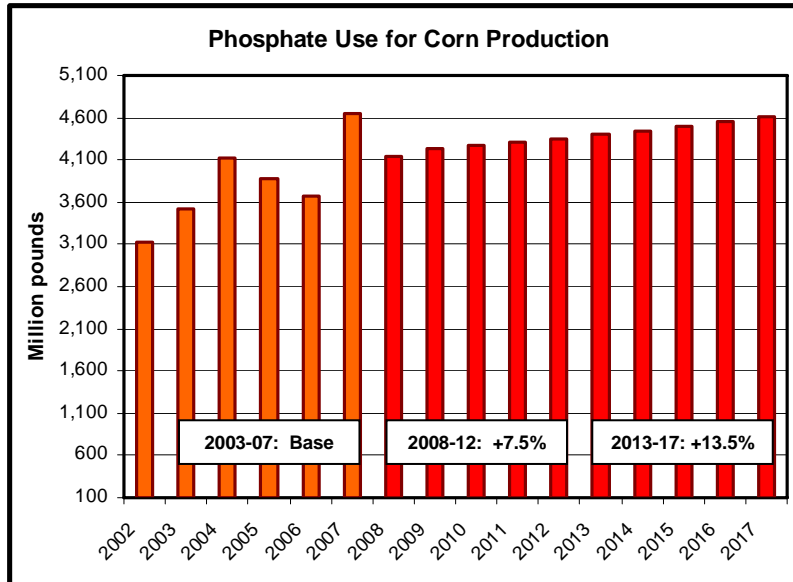
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Nitrogen demand for corn...



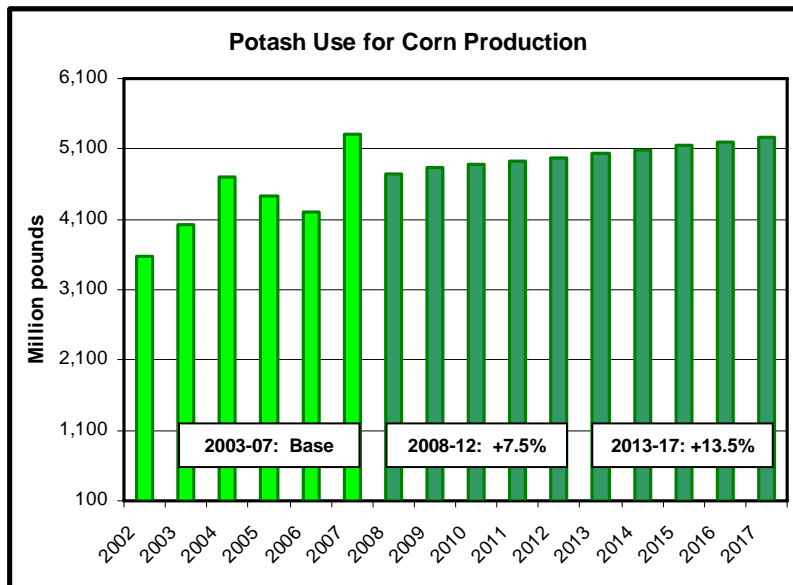
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Phosphate demand for corn...



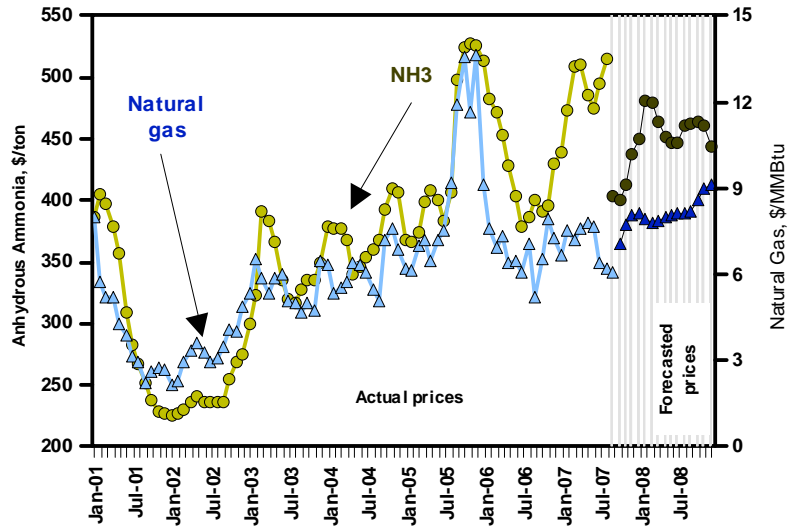
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Potash demand for corn...



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Monthly anhydrous ammonia prices, Corn Belt basis.



Currently, prices of NH3 are not tied very close to cost of production (i.e., natural gas prices)...

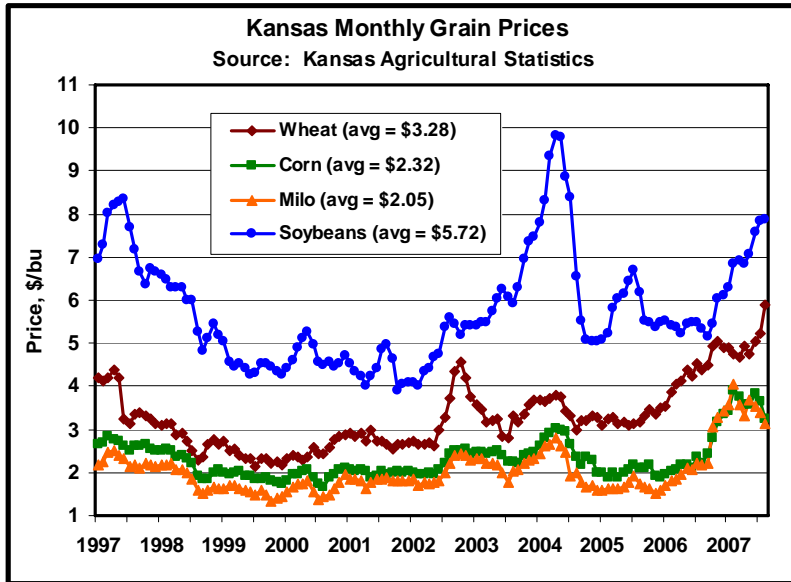
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Can the ethanol industry continue to pay high commodity prices?

Put another way, how long will high prices last?

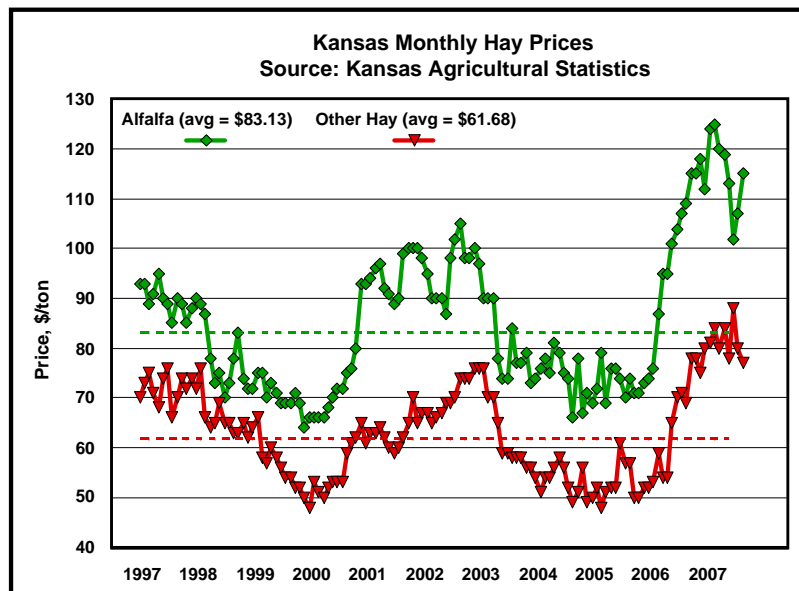
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Crop prices are strong by historical standards...



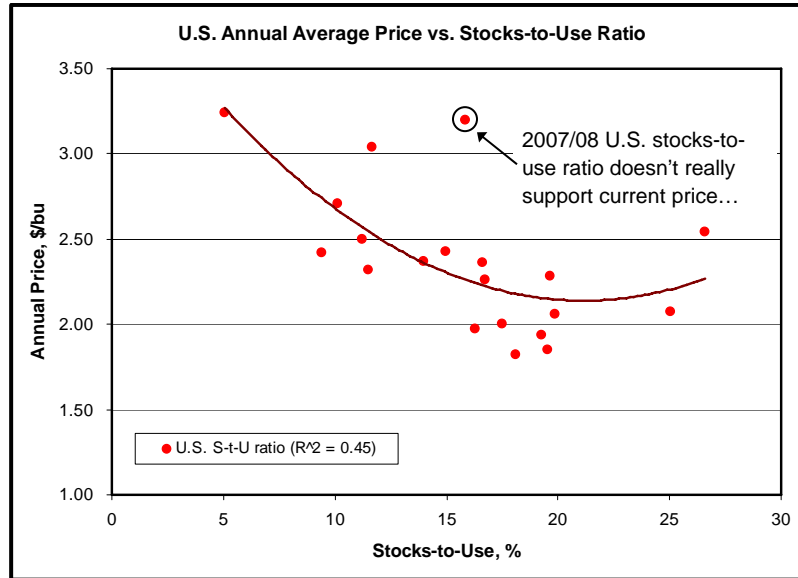
It's not just corn!

Strength in crop markets impacts hay prices...



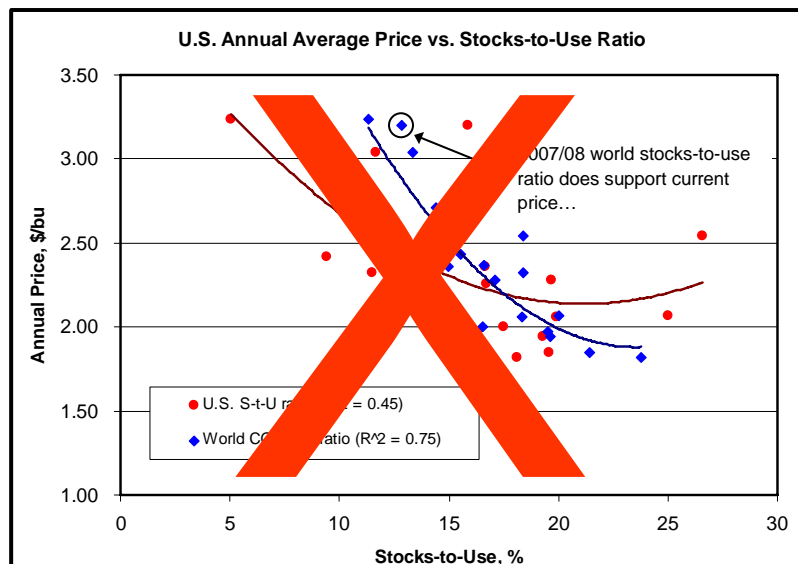
It's not just grains!

Relationship between stocks-to-use ratio and prices...



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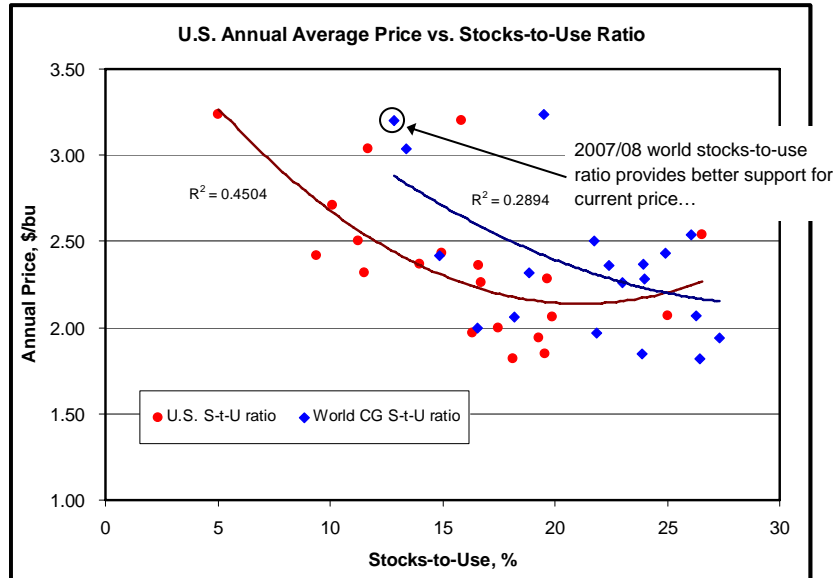
Relationship between stocks-to-use ratio and prices...



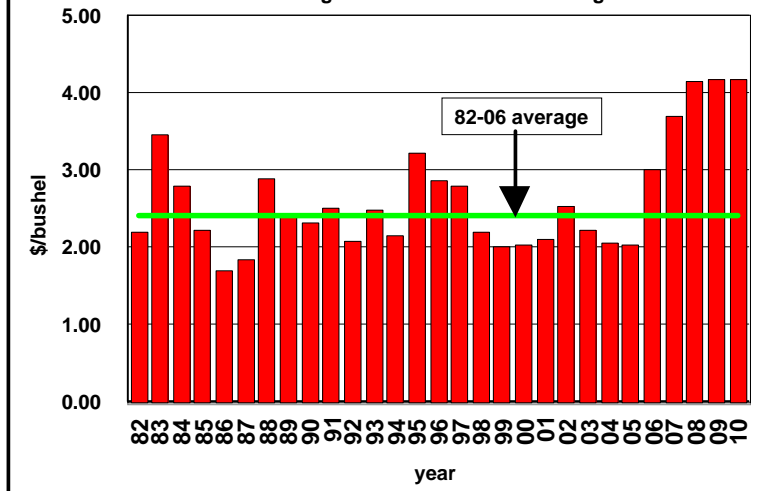
This is the slide presented at meeting, but world stocks-to-use ratio series has been revised and thus following slide is more appropriate.

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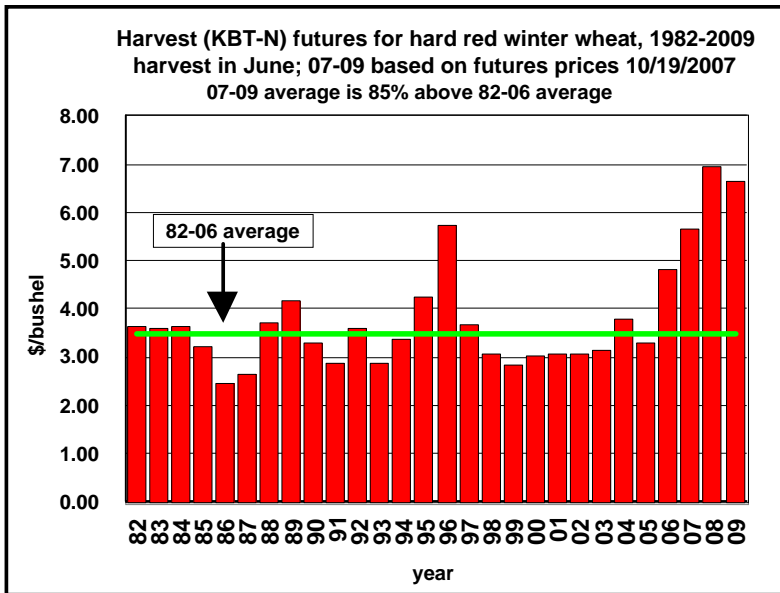
Relationship between stocks-to-use ratio and prices...



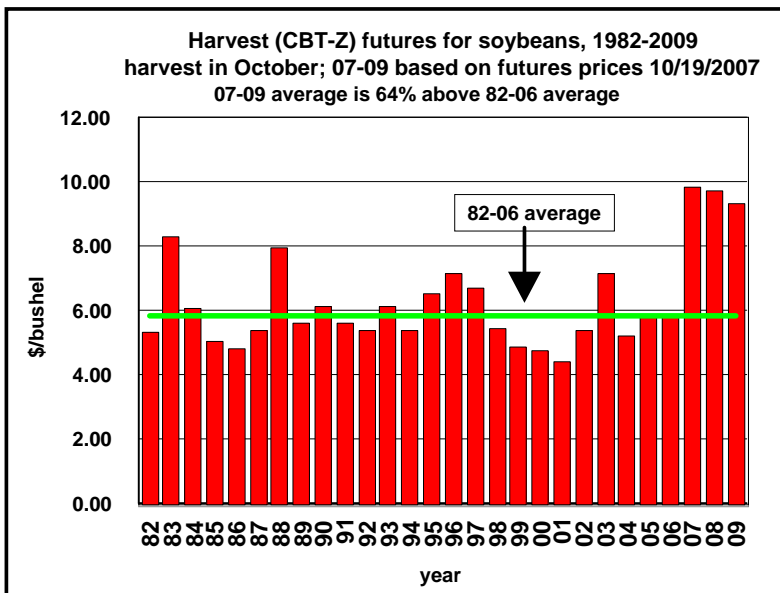
Harvest (CBT-Z) futures for corn, 1982-2010
 harvest in October; 07-10 based on futures prices 10/19/2007
 07-10 average is 68% above 82-06 average



Unprecedented opportunity in corn production – even 4 years out!



But, wheat will be impacted as well . . .



As will be soybeans . . . as acres are drawn to bio-fuel crops

Summary...

- Ethanol production likely to stabilize around 12-15 bgy over next several years (limited “new” expansion)
- Corn acres to support ethanol production
 - Increase from historical levels
 - With trend yields can be less than 2007
- Fertilizer
 - Use on corn will increase 7.5% in 2008-12 and 13.5% in 2013-17 compared to 2003-07
 - Strong demand will support high fertilizer prices
- Futures prices suggest commodity prices will remain at historically high levels for next several years (more of a world S&D issue than domestic one)

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- Water Quality Indices and Net Returns for Corn**