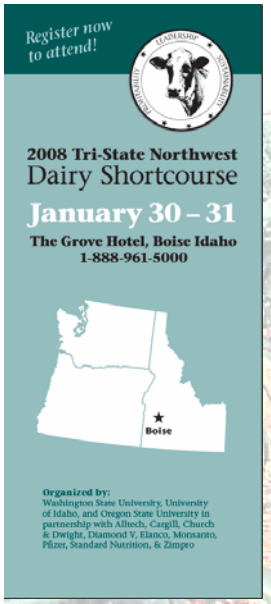

Ethanol Industry –

What Impact Will it Have on Corn and DGS Production

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Department of Agricultural Economics
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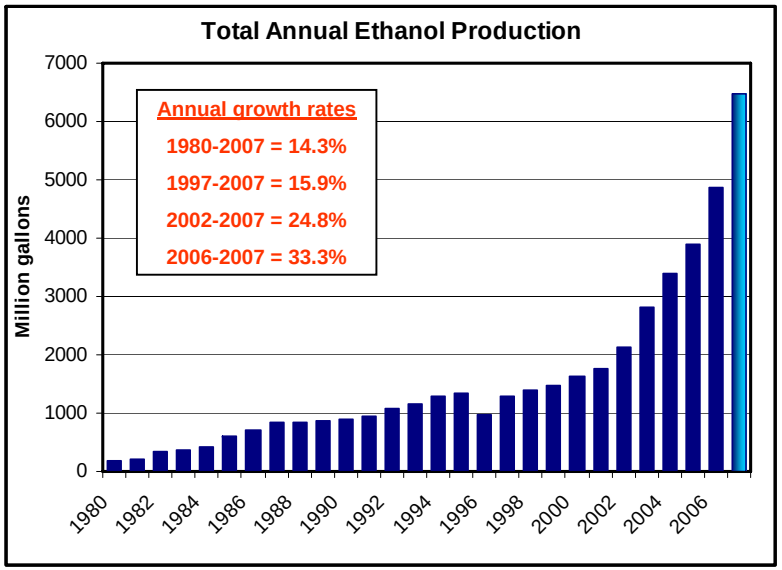
AGMANAGER.INFO
Kansas State Research & Extension
www.agmanager.info

Drivers of the Biofuels Industry

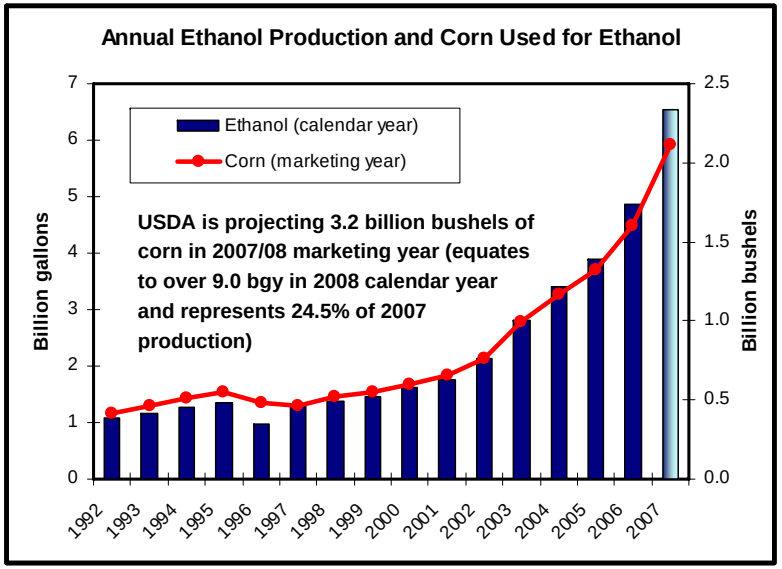
- **Ethanol**
  - States ban or restrict MTBE
  - States mandate ethanol inclusion
  - Subsidies
  - High energy prices
- **Bio-diesel**
  - Low sulfur requirements for diesel
  - Subsidies
  - High energy prices

Rapid rates of expansion last several years…



Source: Energy Information Administration (EIA) and Renewable Fuels Association (RFA)

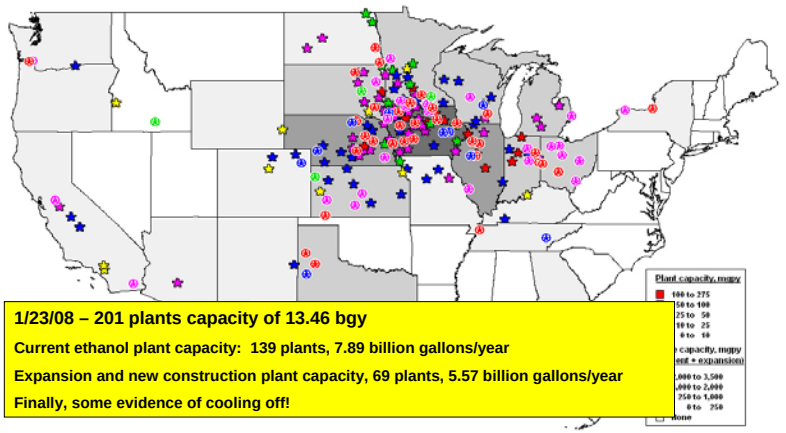
Increases the demand for corn…



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

Existing and new ethanol plants

Source: Renewable Fuels Association (RFA)



1/23/08 – 201 plants capacity of 13.46 bgy

Current ethanol plant capacity: 139 plants, 7.89 billion gallons/year

Expansion and new construction plant capacity, 69 plants, 5.57 billion gallons/year

Finally, some evidence of cooling off!

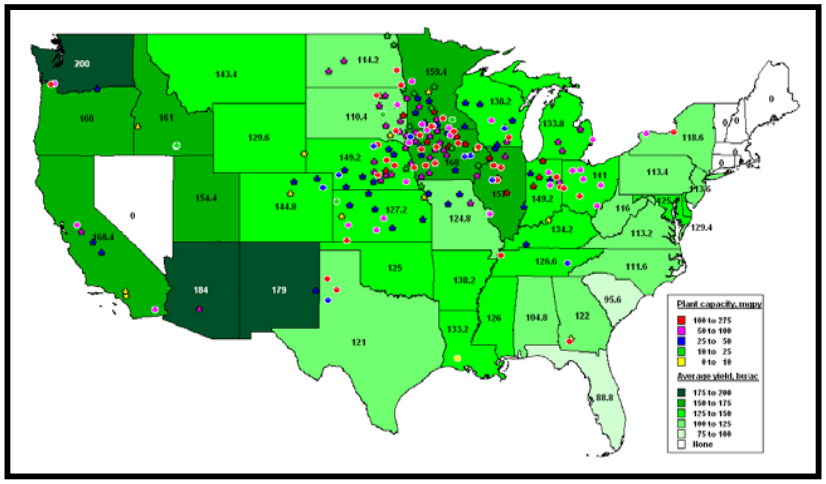
10/9/07 – 202 plants / capacity of 13.45 bgy

Current ethanol plant capacity: 132 plants, 6.93 billion gallons/year

Expansion and new construction plant capacity, 80 plants, 6.48 billion gallons/year

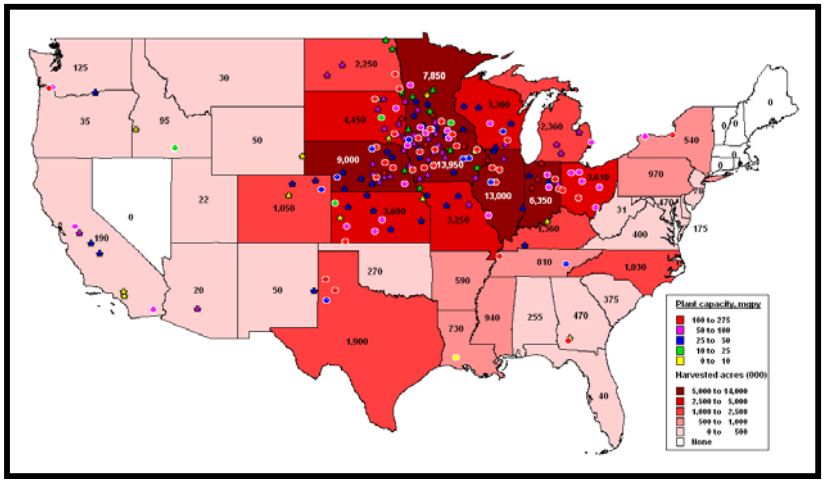
2002-2006 Average Corn Yield by State

Source: USDA NASS and KSU



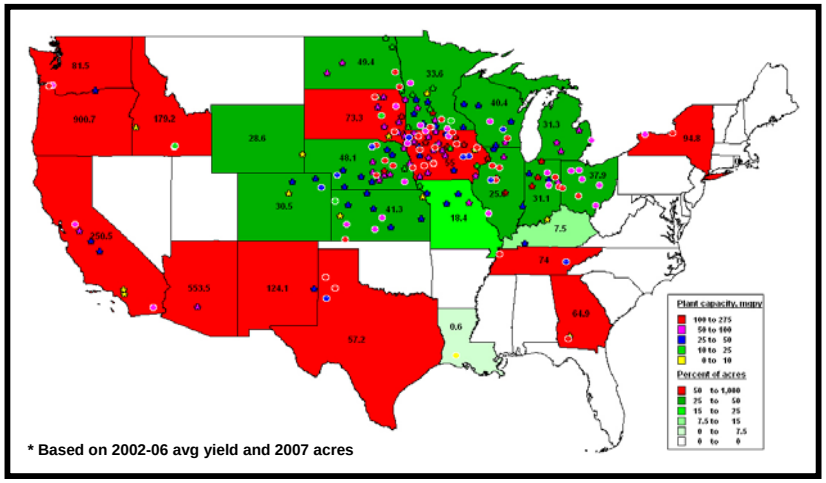
2007 Harvested Corn Acres by State

Source: USDA NASS and KSU



% of Acres Needed for Current + Expansion Production*

Source: USDA NASS and KSU (based on 10/09/07 data)

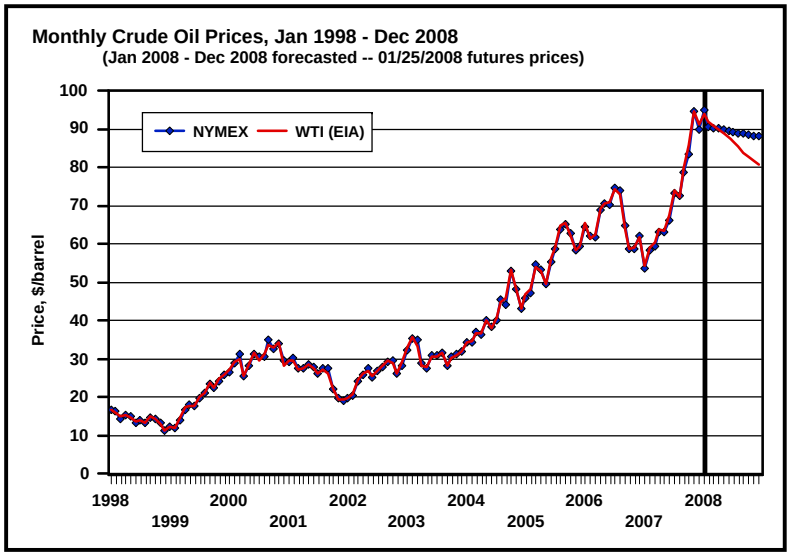


*** Based on 2002-06 avg yield and 2007 acres**

Ethanol expansion is going to create some interesting dynamics…

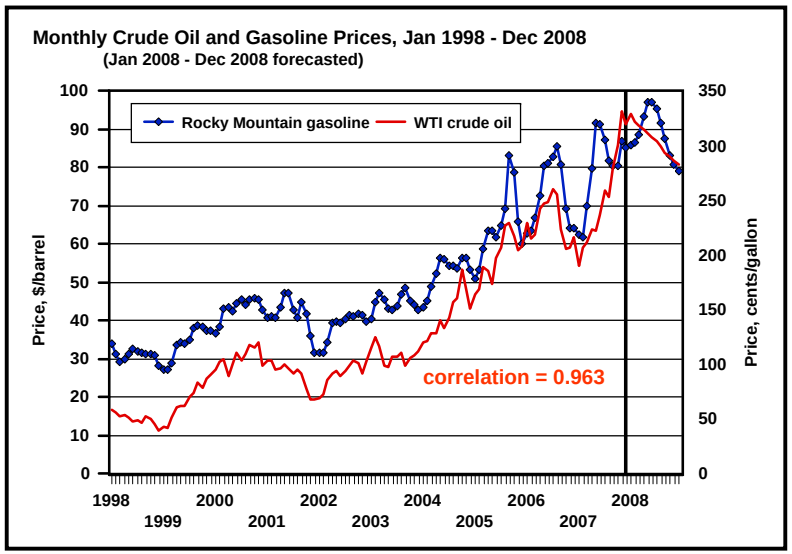
Prices, profitability, etc.

Crude oil prices are at historically high levels…



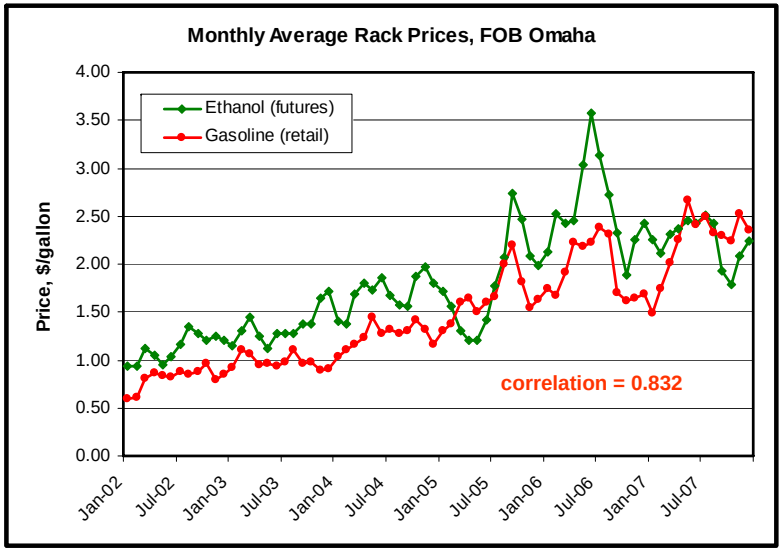
Source: Energy Information Administration (EIA) and KSU

High oil prices translate into high gas prices…

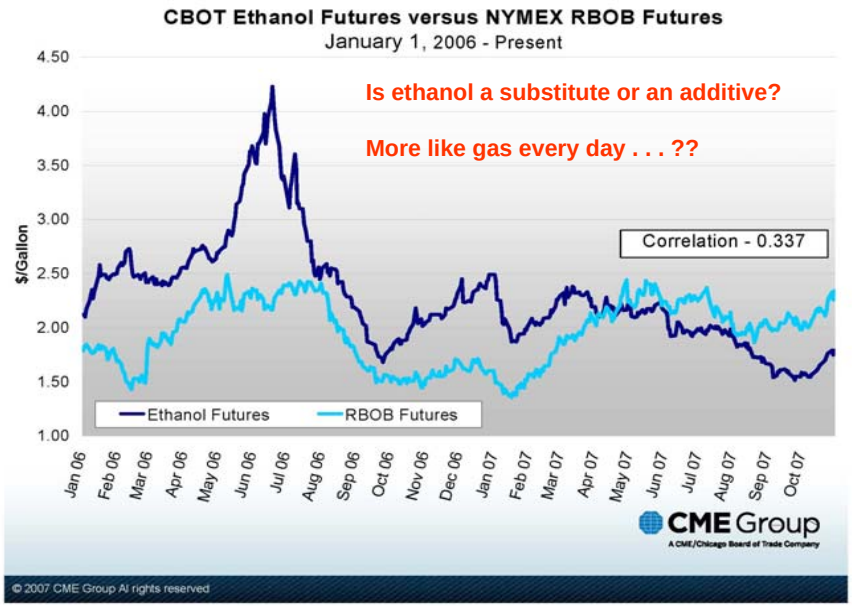


Source: Energy Information Administration (EIA)

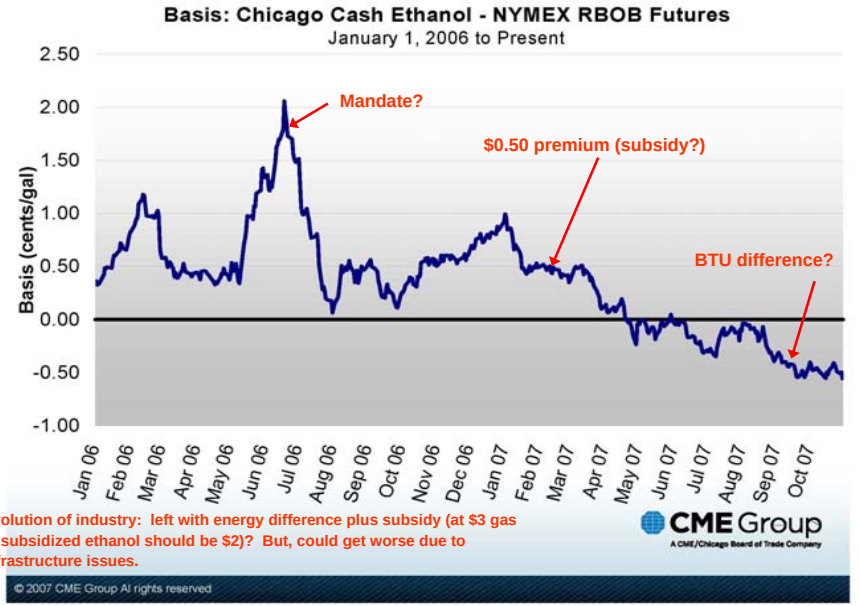
Positive correlation ➔ higher gas prices leads to higher ethanol prices…



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

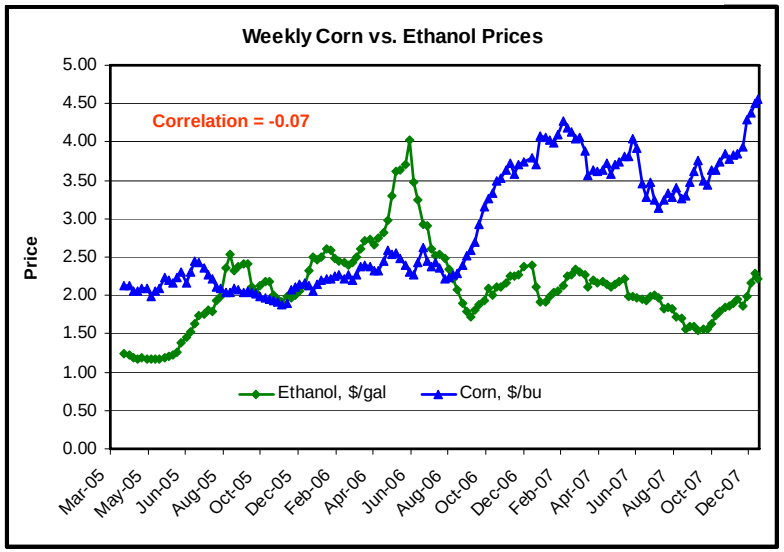


RBOB (reformulated blendstock for oxygenate blending)

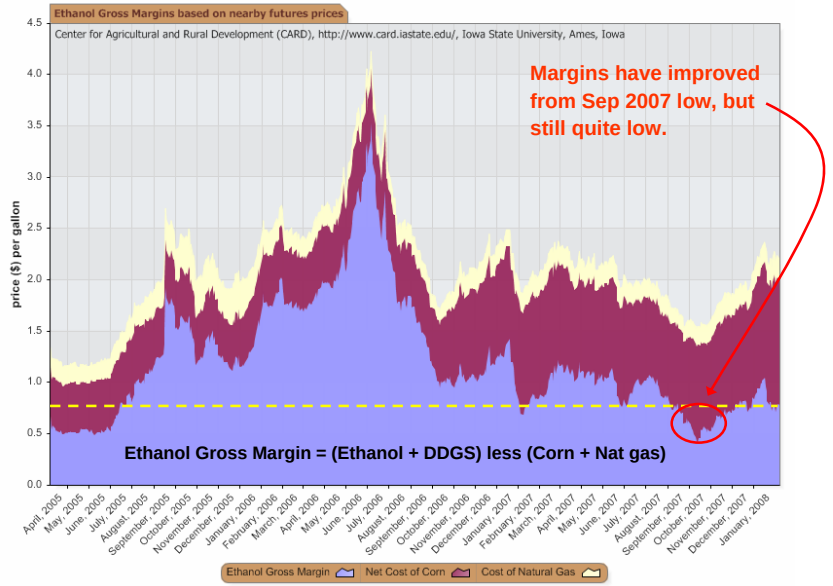


Evolution of industry: left with energy difference plus subsidy (at $3 gas unsubsidized ethanol should be $2)? But, could get worse due to infrastructure issues.

No connection with corn price in the short run…

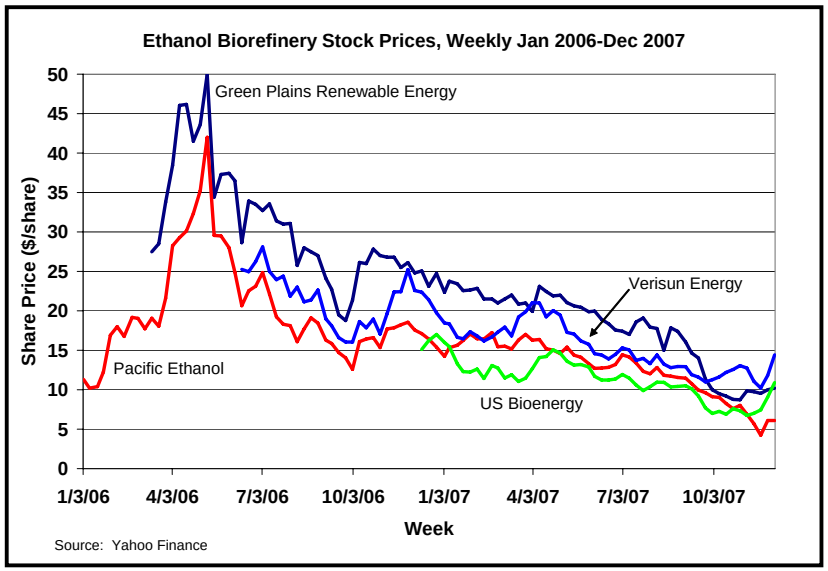


Historical ethanol margins



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

Ethanol company share prices ➔ Expansion?

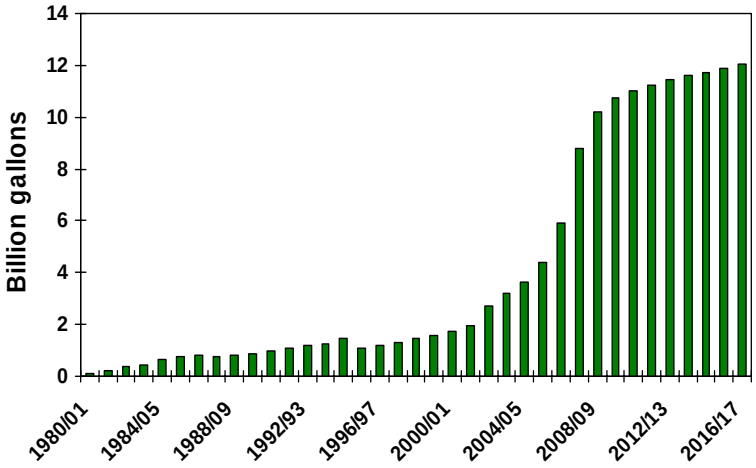


Source: Yahoo Finance

How much ethanol will be produced going forward?

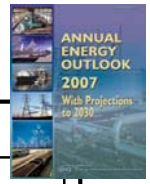
Projected Corn Ethanol Production

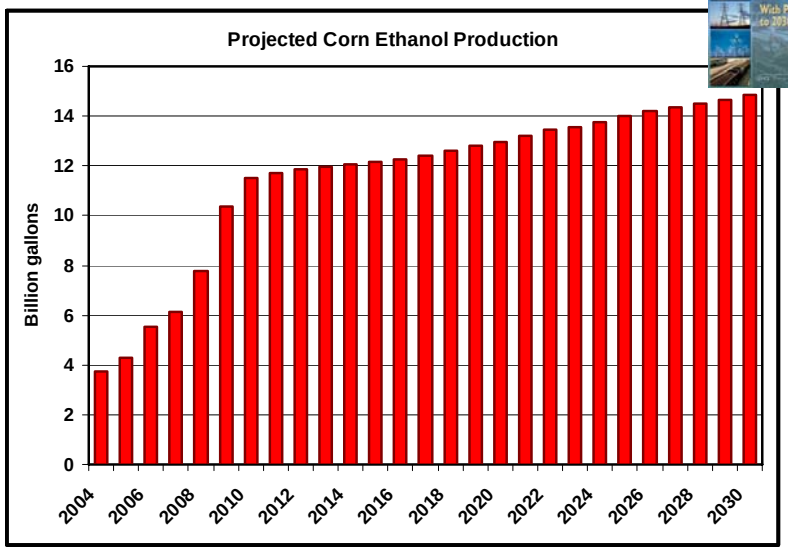
expect 12 bil. gal. in 2016/17– 30% of corn crop



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

Energy Information Administration
Official Energy Statistics from the U.S. Government

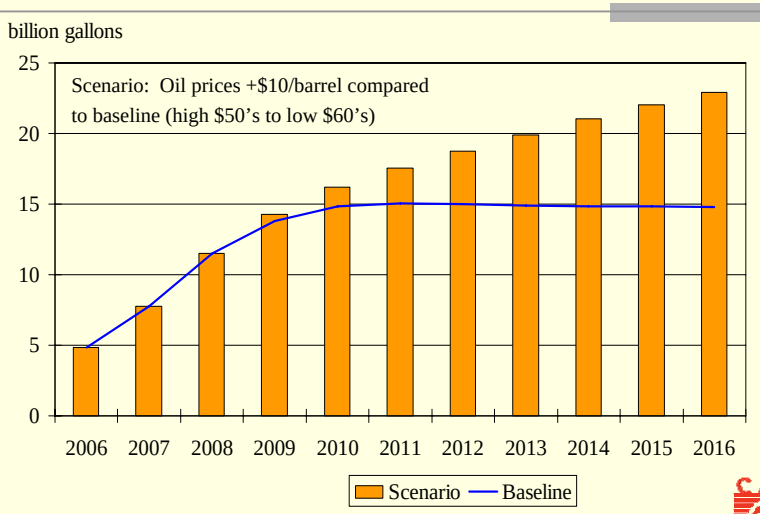




Source: Energy Information Administration, Report #DOE/EIA-0383(2007), February 2007

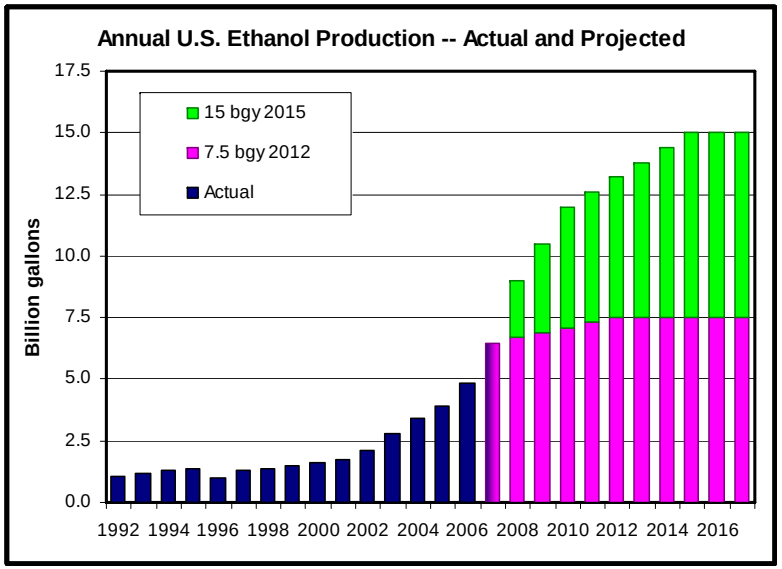
Projected U.S. Ethanol Production

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



IOWA STATE UNIVERSITY

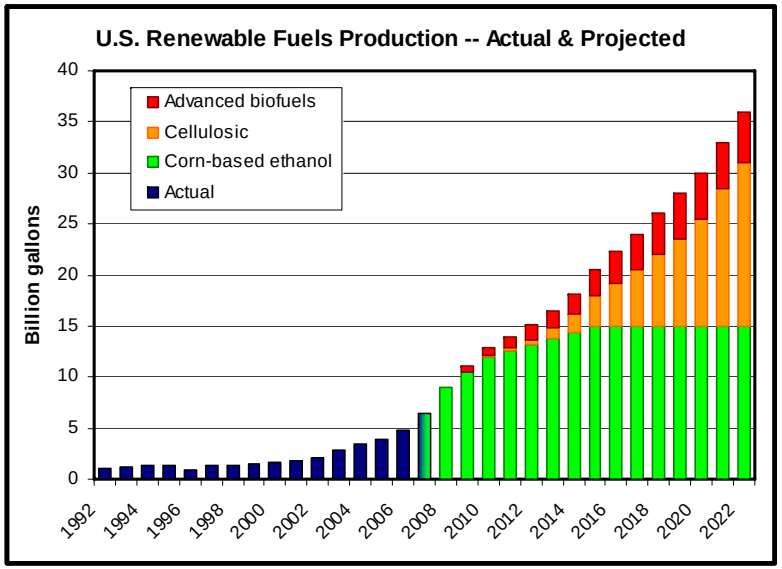
CARD



Projections based on levels in Energy Bill (December 2007)

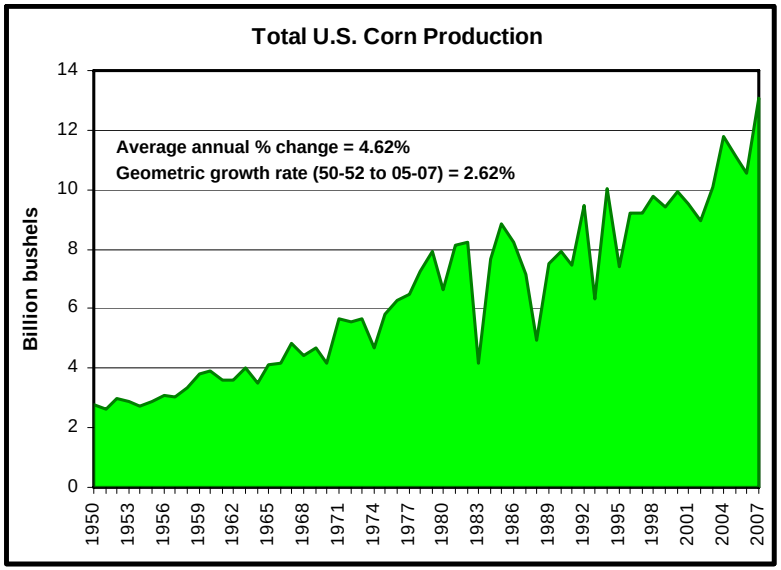
Future ethanol production?

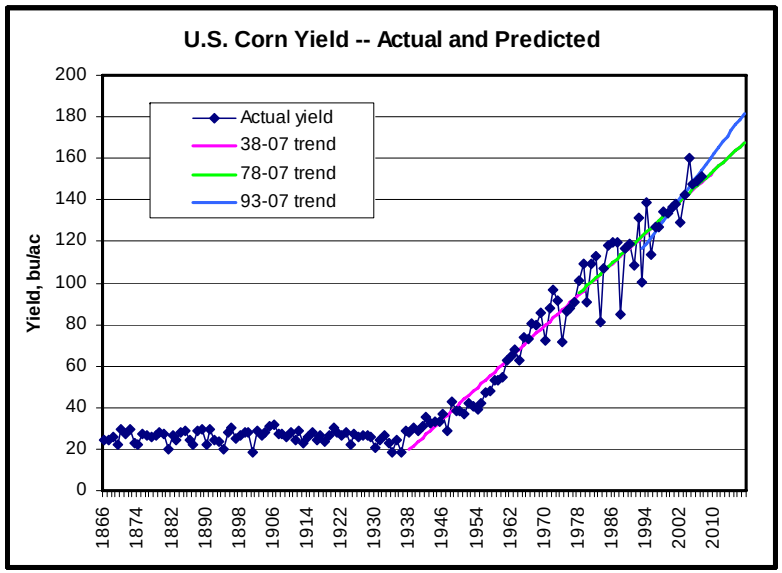
- **Not sure who's crystal ball to believe**
  - **Hard to predict politics**
- **Most predictions in the 11-15 bgy range over the next 3-6 years**
  - **Reflects current capacity**
  - **Approximates E-10 nationwide**
  - **What does this mean for corn acres?**
- **Impact of cellulosic ethanol?**



Total of 36 bgy of renewable fuels by 2022 – feedstocks for cellulosic?

Corn acres, yields, etc.



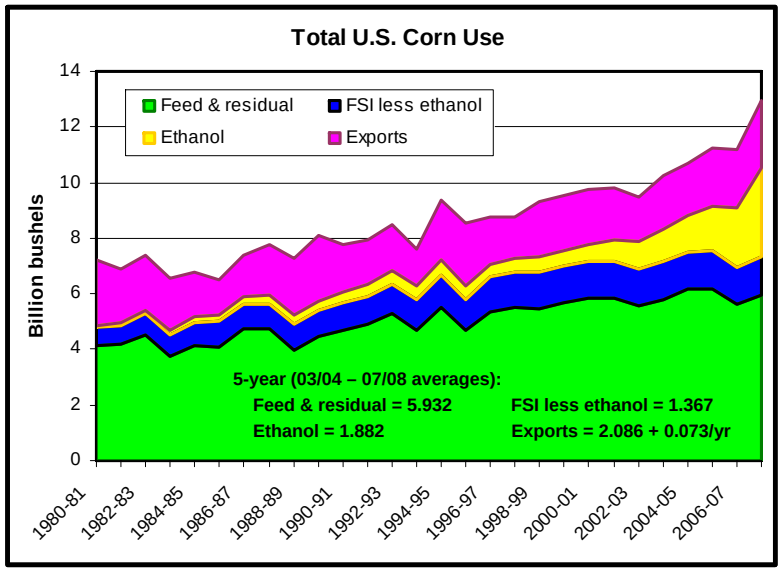


Corn conversion to ethanol and distillers grains…

56 lbs.

2.8 gallon

17-18 lbs.

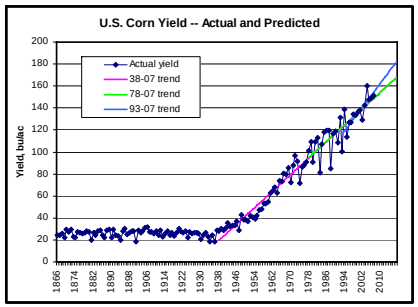


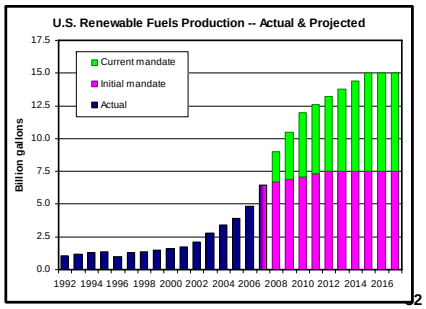
Source: USDA WASDE and KSU, 2006-07 is an estimate and 2007-08 is projection

Corn acres needed…

Assumptions:

- Trend yield equal to average of 15- and 30-year trend lines (158.4 in 2010 174.4 in 2017)
- Ethanol production consistent with green bars (below)
- FSI less ethanol and Feed & Residual held constant at 5-year average, Exports 5-year average + 73M bu/year
- Maximum of 35% of corn bushels displaced with DDGS

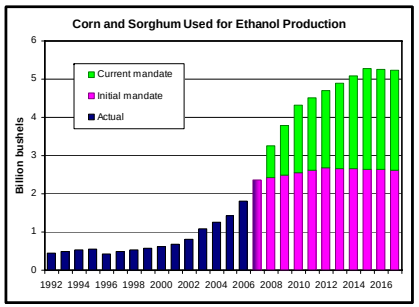


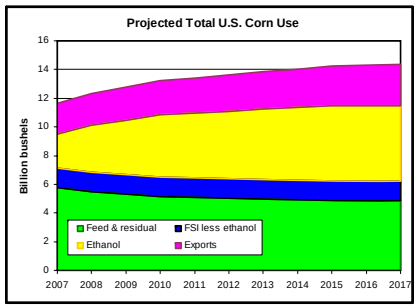


Corn acres needed…

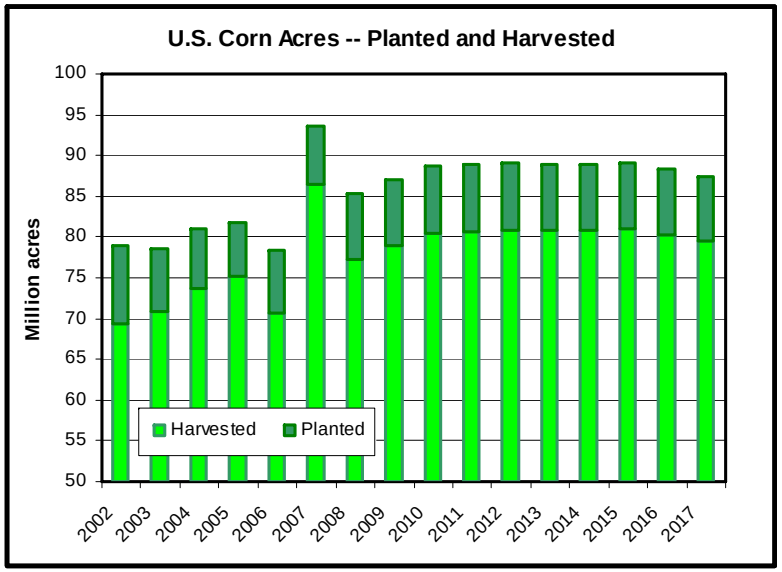
Intermediate results:

- 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 12.35 billion bushels in 2008 to 14.35 billion bushels in 2017





Yield growth does not quite cover corn needs in short term…

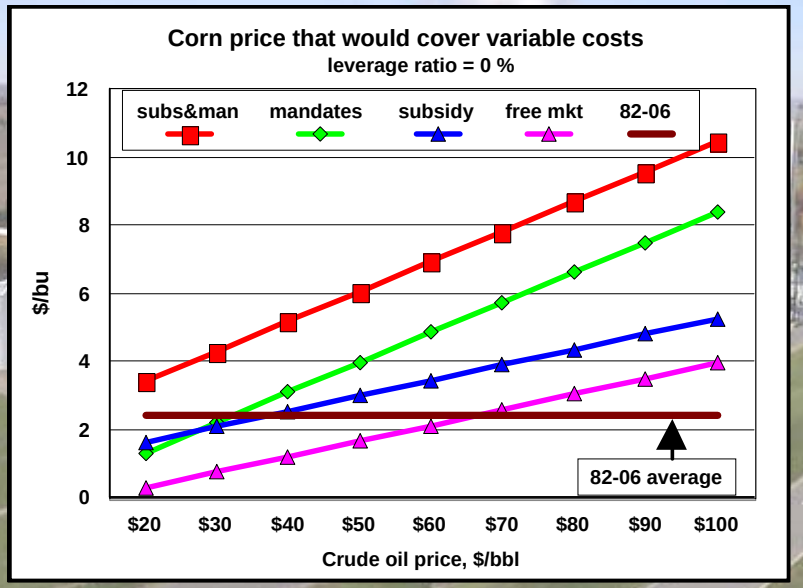


Source: 2002-07 USDA, 2008-2017 KSU projections

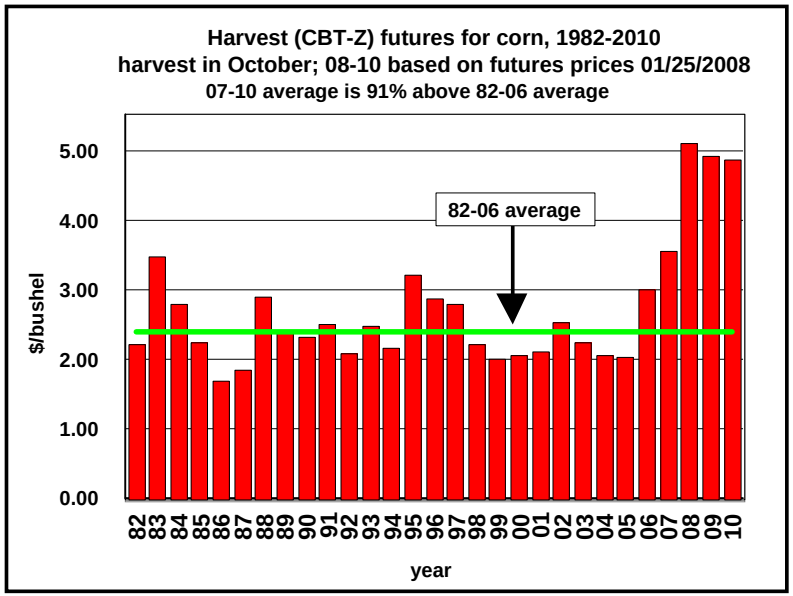
Can the ethanol industry continue to pay high commodity prices?

Put another way, how long will high prices last?

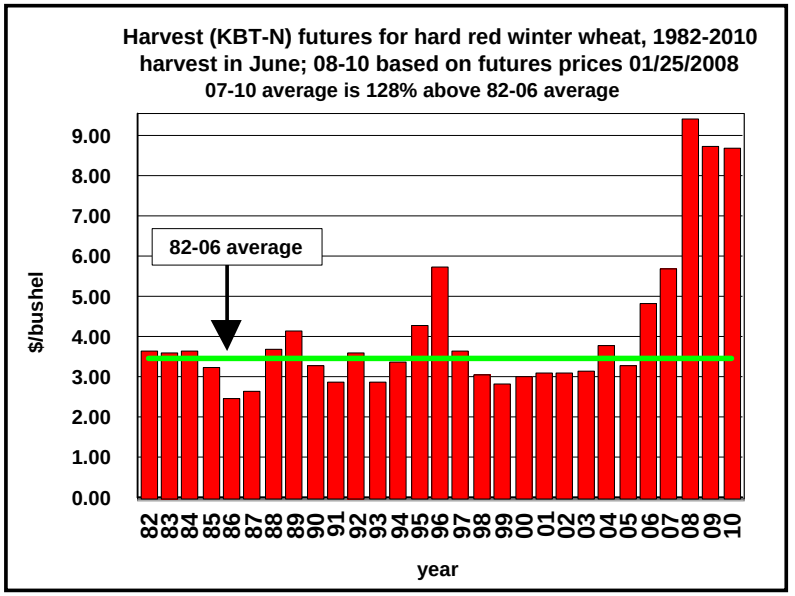
Ethanol Profitability…



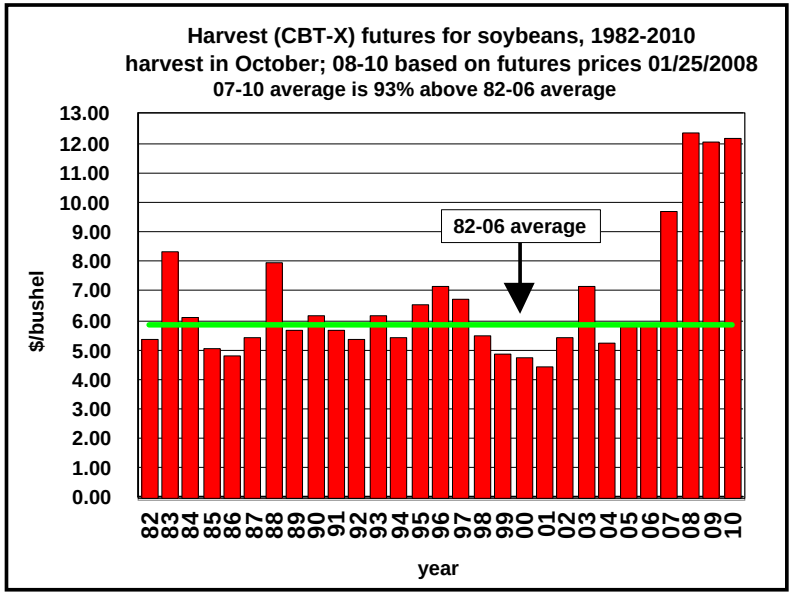
If mothballing costs are high, effective breakeven prices are higher



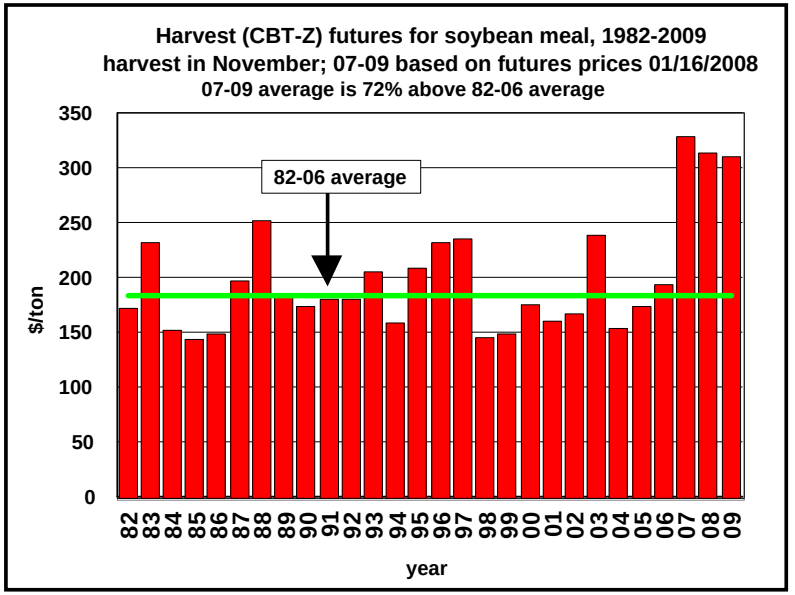
Unprecedented opportunity in corn production – even 4 years out!



But, wheat will be impacted as well . . .

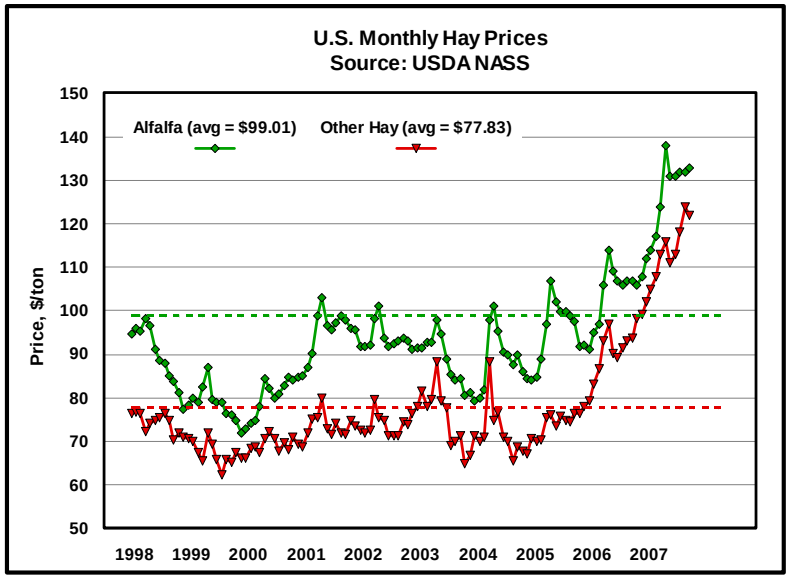


As will be soybeans . . . as acres are drawn to bio-fuel crops



As soybean price is impacted, so will soybean meal prices . . .

Strength in crop markets impacts hay prices…



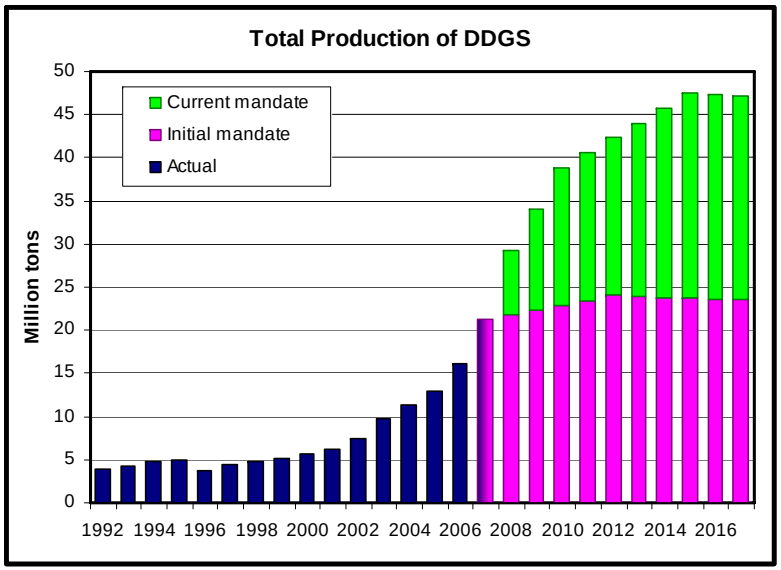
It's not just grains!

Distillers grains

Distillers Grains…

- Current versus future production
- Potential consumption
- Prices and their relationship to corn prices

DDGS production…



Potential DDGS consumption

Source: Kansas State University estimate (Nov 2005)

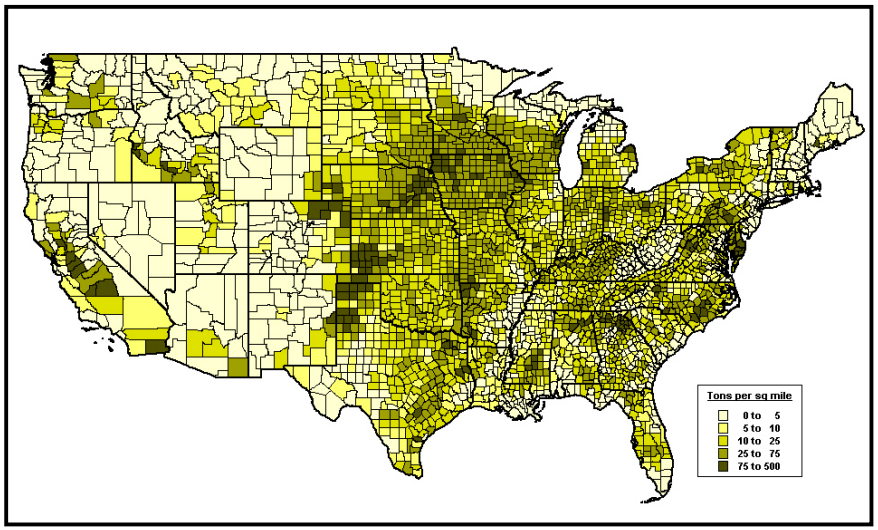
Livestock numbers and potential DDGS consumption[1]

Livestock class	Number[2] (000 head)	DDGS consumption[3] (lbs/animal)	Total DDGS (tons)
Beef cows	33,253	650.0	10,807,372
Dairy cows	9,099	1520.8	6,918,618
Other cattle	43,396	375.0	8,136,699
Cattle on feed	13,332	2027.8	13,517,097
Breeding swine	6,113	374.0	1,143,213
Market swine[4]	33,742	171.6	2,895,074
Breeding sheep	4,770	45.1	107,562
Market sheep	2,962	34.1	50,506
Broilers	8,545,305	1.1574	4,945,168
Layers	337,968	11.8625	2,004,573
Pullets	98,093	3.6135	177,230
Turkeys	270,746	6.3539	860,146
Total			51,563,259

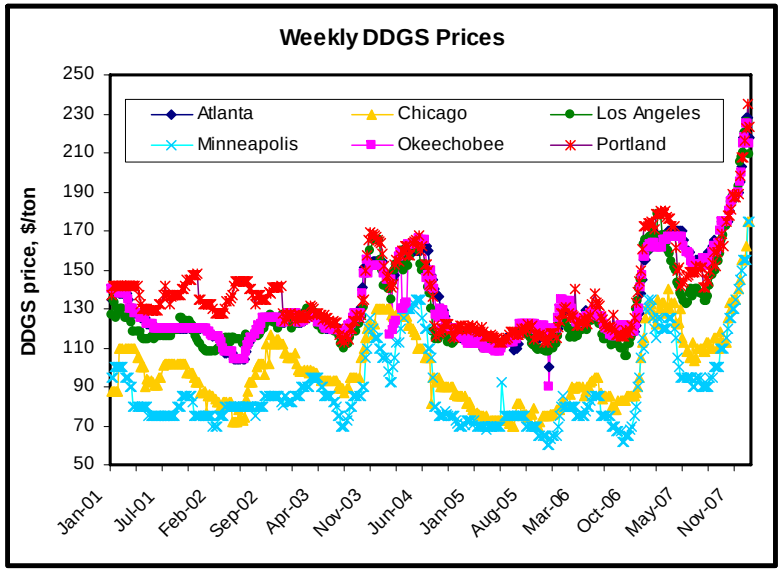
[1] As fed basis of feeding dry distillers grains (DDGS)
[2] Average inventory for all classes except broilers and turkeys which are annual production
[3] Annualized lbs per animal -- broilers, pullets, and turkeys are pounds/bird over their life
[4] Market swine only include hogs 60 pounds and above

Potential DDGS consumption (51.56 million tons)

Source: Kansas State University estimate (Nov 2005)



Potential demand > projected supply, but logistical issues need to be resolved.



Prices vary both temporally and spatially…

Summary Statistics of DDGS Prices by Location

	N*	Average	Minimum	Maximum	Range	Standard Deviation
Atlanta	370	133.07	100.00	228.00	128.00	22.69
Chicago	370	98.77	70.00	175.00	105.00	19.52
Los Angeles	370	128.98	106.00	226.00	120.00	21.95
Minneapolis	370	88.83	60.00	175.00	115.00	20.69
Okeechobee	370	132.27	90.00	225.00	135.00	21.90
Portland	370	137.91	112.50	235.00	122.50	21.03

* Number of observations, weekly data Jan 2001 through Jan 2008.

Prices vary both temporally and spatially…

Summary Statistics of DDGS Prices by Location

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Okeechobee	370	132.27	90.00	225.00	135.00	21.90
Portland	370	137.91	112.50	235.00	122.50	21.03

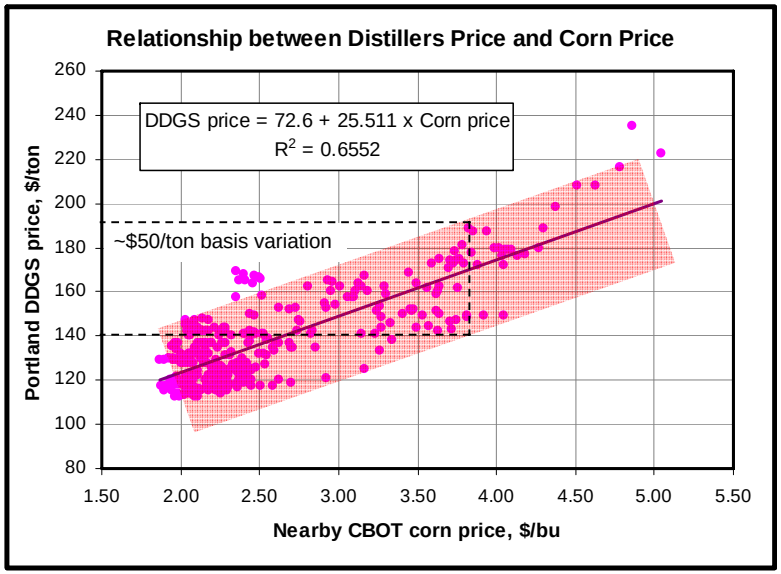
* Number of observations, weekly data Jan 2001 through Jan 2008.

Correlation of DDGS Prices Between Locations

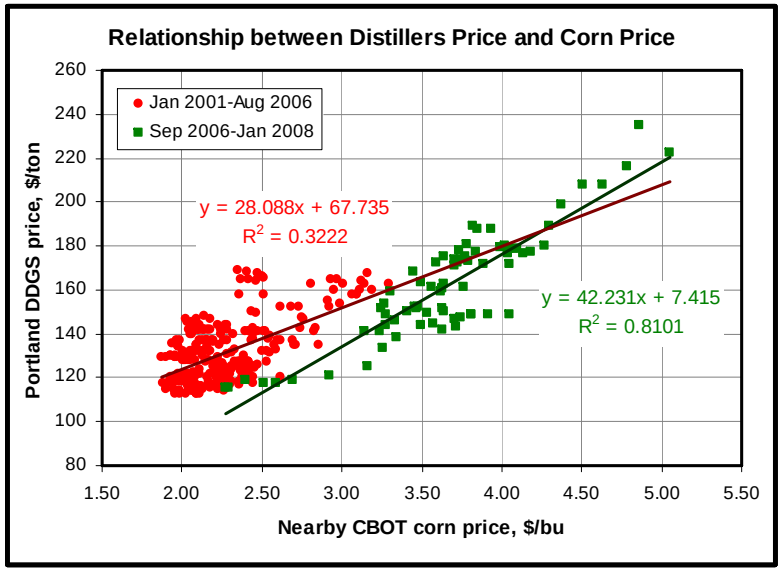
	Atlanta	Chicago	Los Angeles	Minneapolis	Okeechobee	Portland
Atlanta	1.0000	0.8794	0.9402	0.9033	0.9776	0.8827
Chicago		1.0000	0.8738	0.8675	0.8341	0.8718
Los Angeles			1.0000	0.9456	0.9206	0.9307
Minneapolis				1.0000	0.8748	0.9176
Okeechobee					1.0000	0.8655
Portland						1.0000

* Weekly data Jan 2001 through Jan 2008.

Prices are related between locations, but strength of relationship also varies between locations ➔ Shop around



Ability to cross hedge DG prices with corn futures?



Ability to cross hedge DG prices with corn futures improving?

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**
- **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)**
- **Distillers grains**
  - **Potential demand > supply, but logistical problems exist**
  - **Considerable temporal and spatial price variability**
  - **Ability to cross hedge DDGS appears to be improving**