

# Sustaining Corn to Ethanol

*AACC Green Technology Workshop  
October 24, 2010*

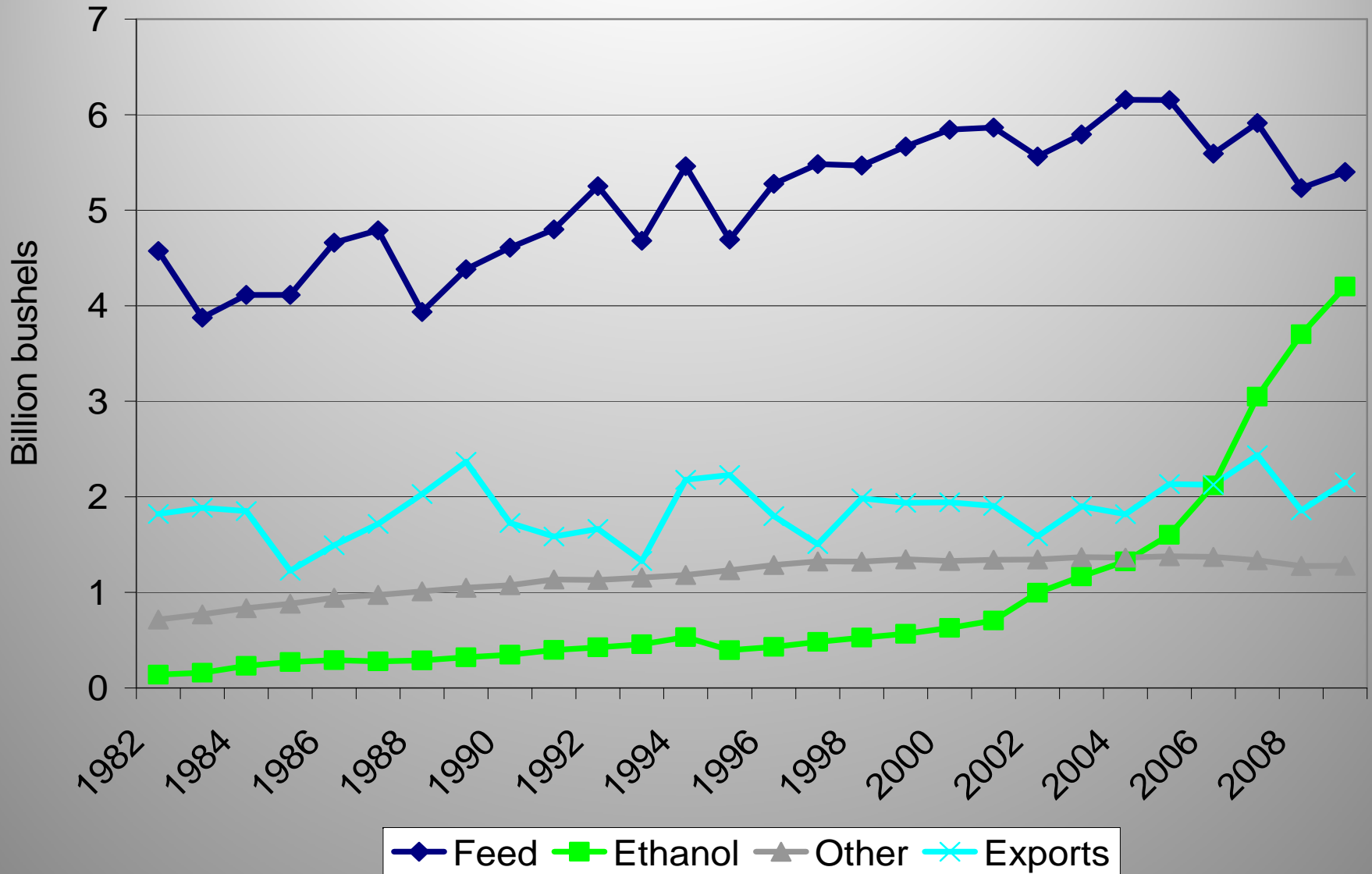
*Charles Hurburgh, Iowa Grain Quality Initiative  
Connie L. Hardy, Extension Specialist  
Chad Hart, Extension Grain Economist*



**IOWA STATE UNIVERSITY**  
University Extension



# Corn Use

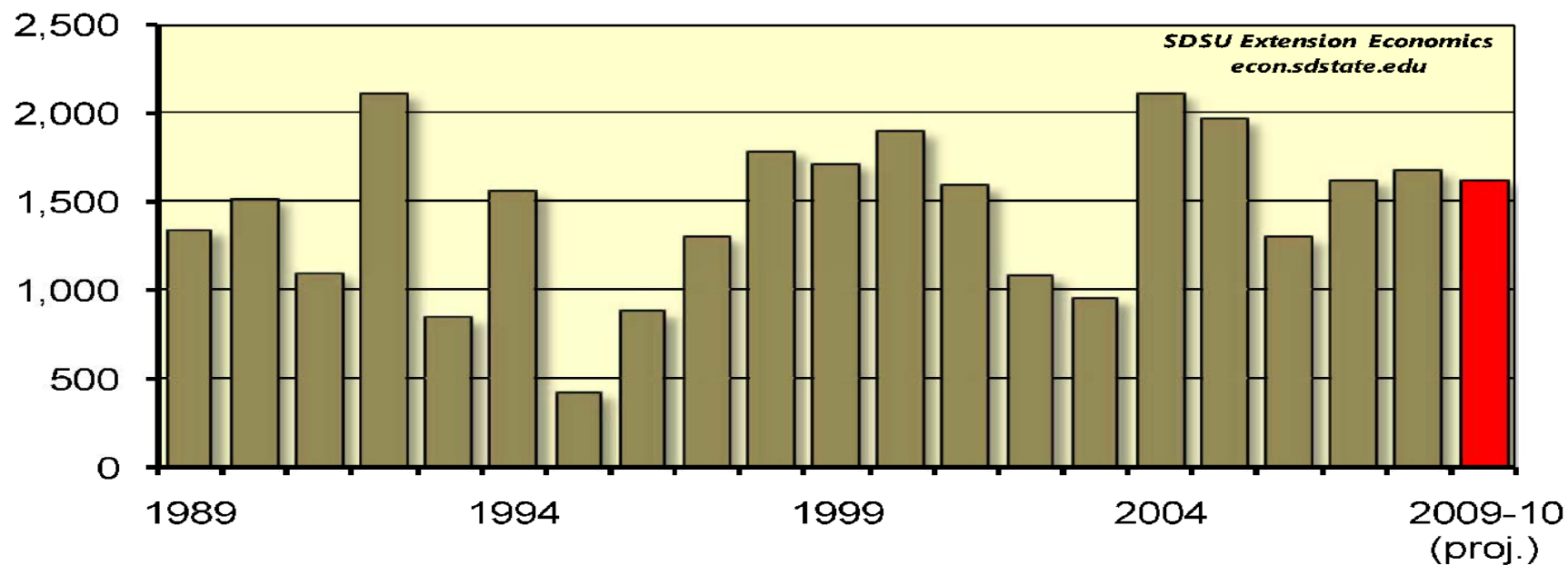


# Are We Running Out of Corn?



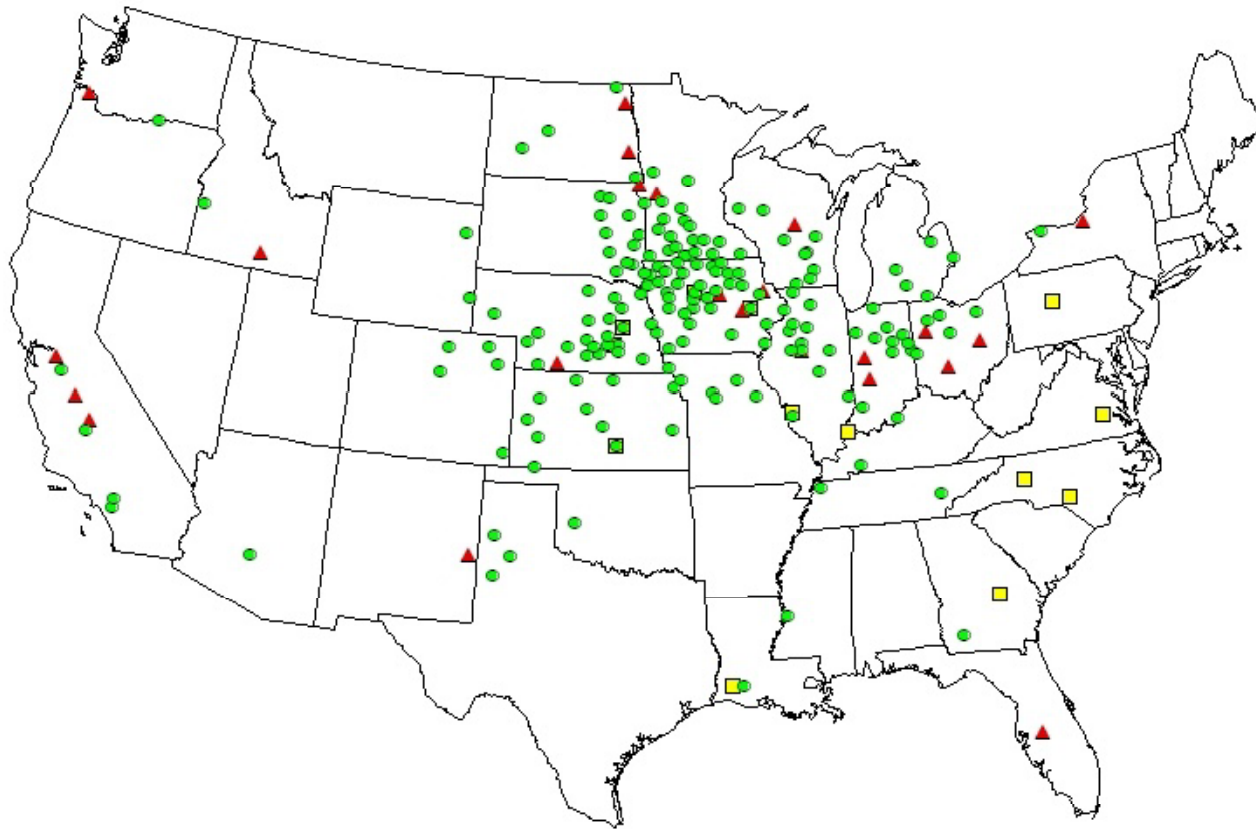
South Dakota  
Cooperative Extension Service

## U.S. Corn Ending Stocks (million bushels)



Sources: USDA - National Ag Statistics Service and Economic Research Service

# US Ethanol Plants



Operating plants  
184 Plants in USA  
in 26 states 11.7 BGY  
40 Plants in Iowa 3.2 BGY

Construction/expansion  
21 Plants in USA 1.4 BGY  
2 Plants in Iowa 0.4 BGY

● Operating   ▲ Not Operating   ■ Under Construction

# Iowa Ethanol Production and Corn Usage

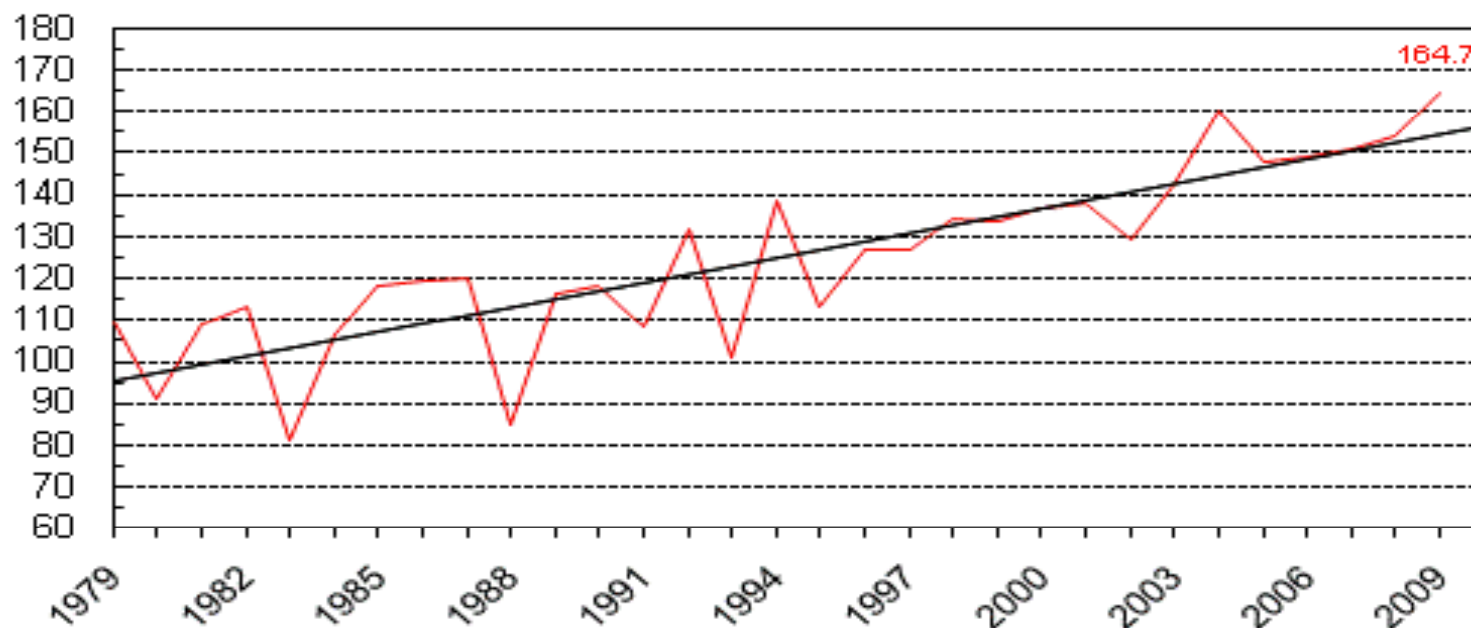
<i>Summary Statistics May-2010</i>	<i>n</i>	<i>Ethanol Produced mil gal/yr</i>	<i>Corn Used mil bu/yr</i>	<i>DGS 000 tons/yr</i>
<i>Current Dry-grind Plants</i>	<i>34</i>	<i>3,280</i>	<i>1170</i>	<i>10,237</i>
<i>Expansions and new construction</i>	<i>1</i>	<i>277</i>	<i>98</i>	<i>857</i>
<i>Wet Mills</i>	<i>4</i>	<i>500</i>	<i>178</i>	<i>1,557</i>
<i>Nearby Iowa</i>	<i>11</i>	<i>636</i>	<i>227</i>	<i>1,986</i>
<i>Total</i>	<i>50</i>	<i>4,693</i>	<i>1,673 (69% of 2009)</i>	<i>14,637</i>



## U.S. Corn Yield



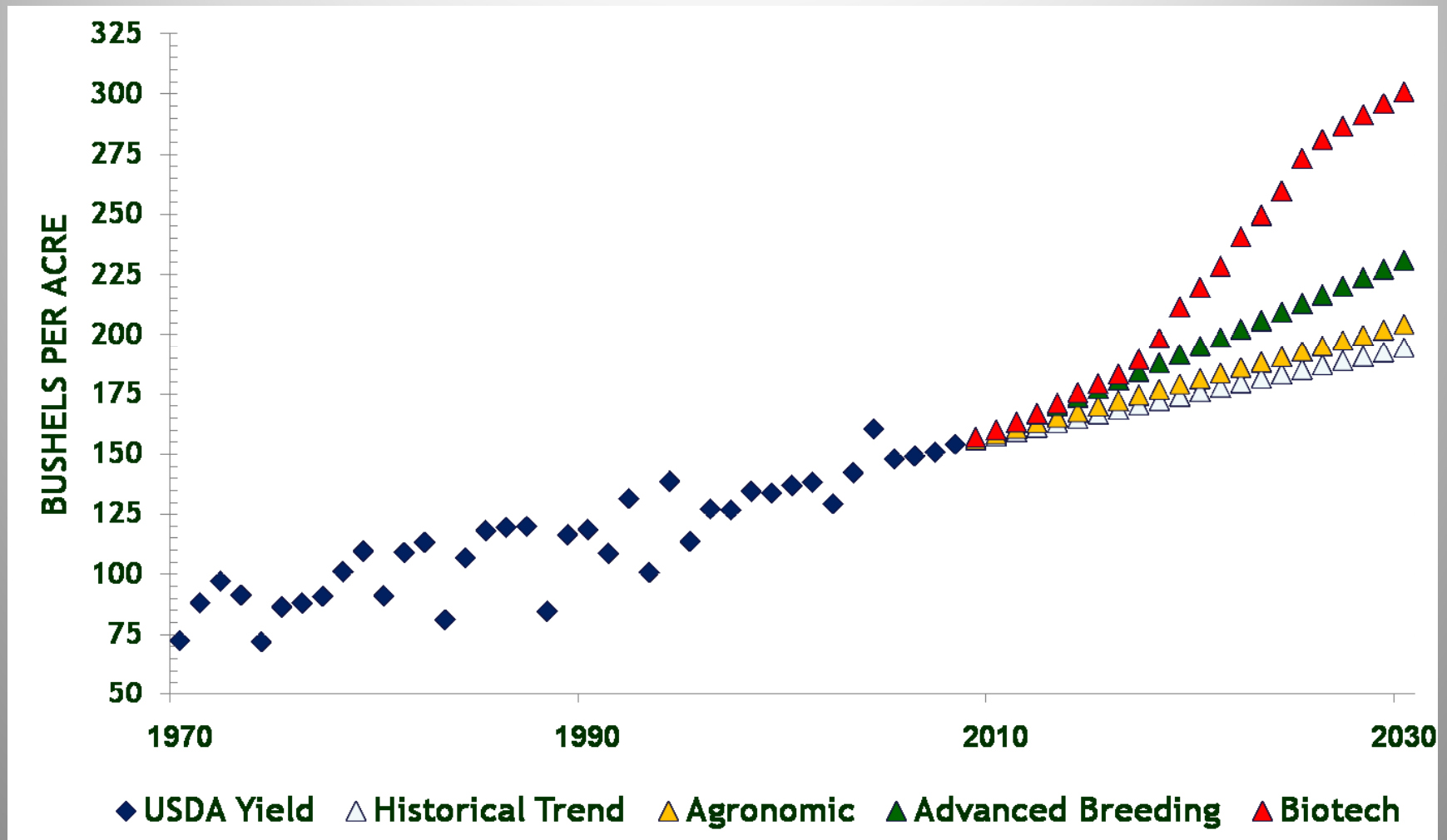
Bushels/Acre



USDA NASS  
5-11-10

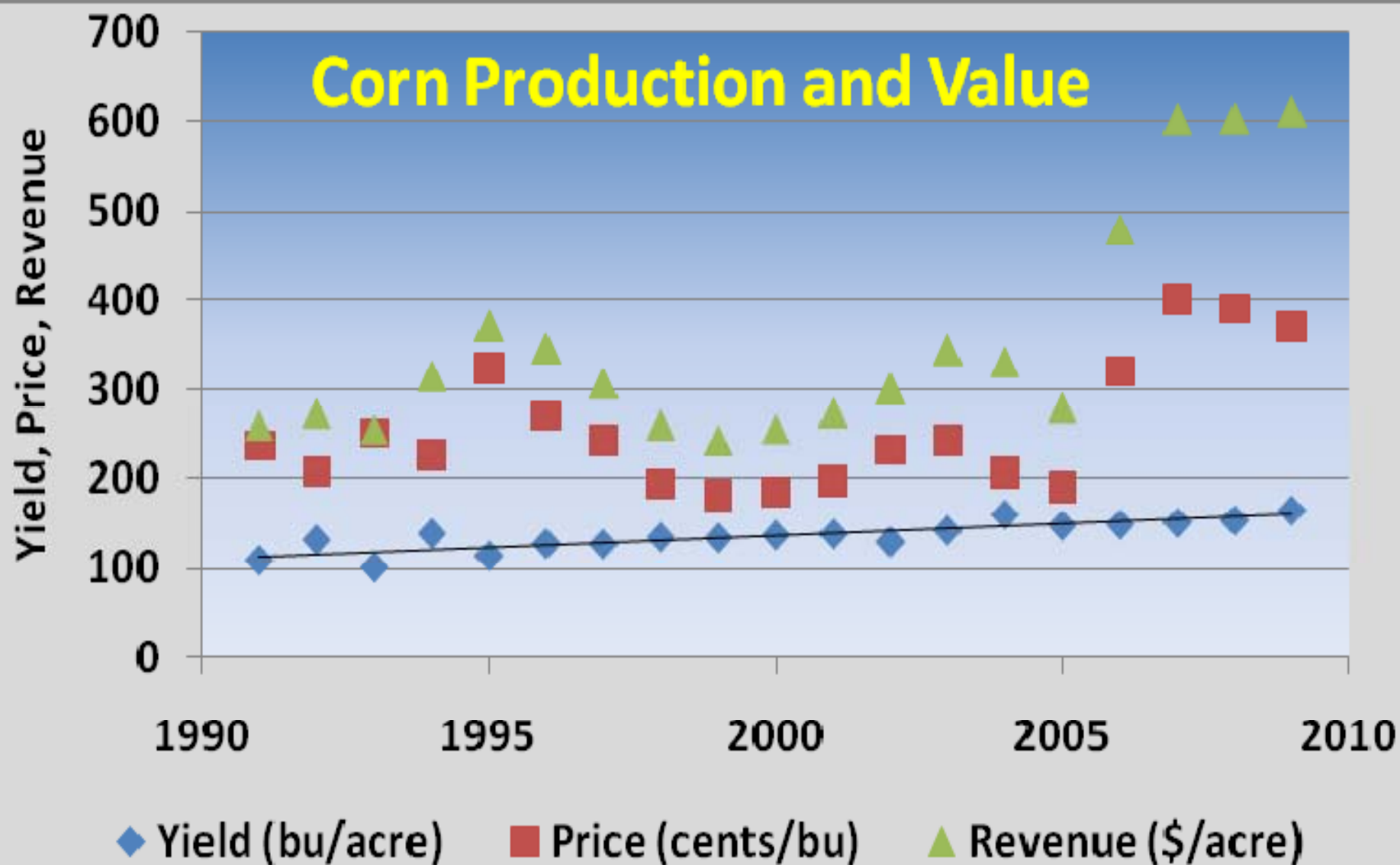
**Overall = 2.1 bu/a/yr; Last 10= 3.5 bu/a/yr; Seed industry = 4-6 bu/a/yr (forward)  
~400-500 million bu/year increase  
Nitrogen use: 1.0-1.1 lb/bu down to 0.7-0.8 lb/bu**

# Corn Yield Potential

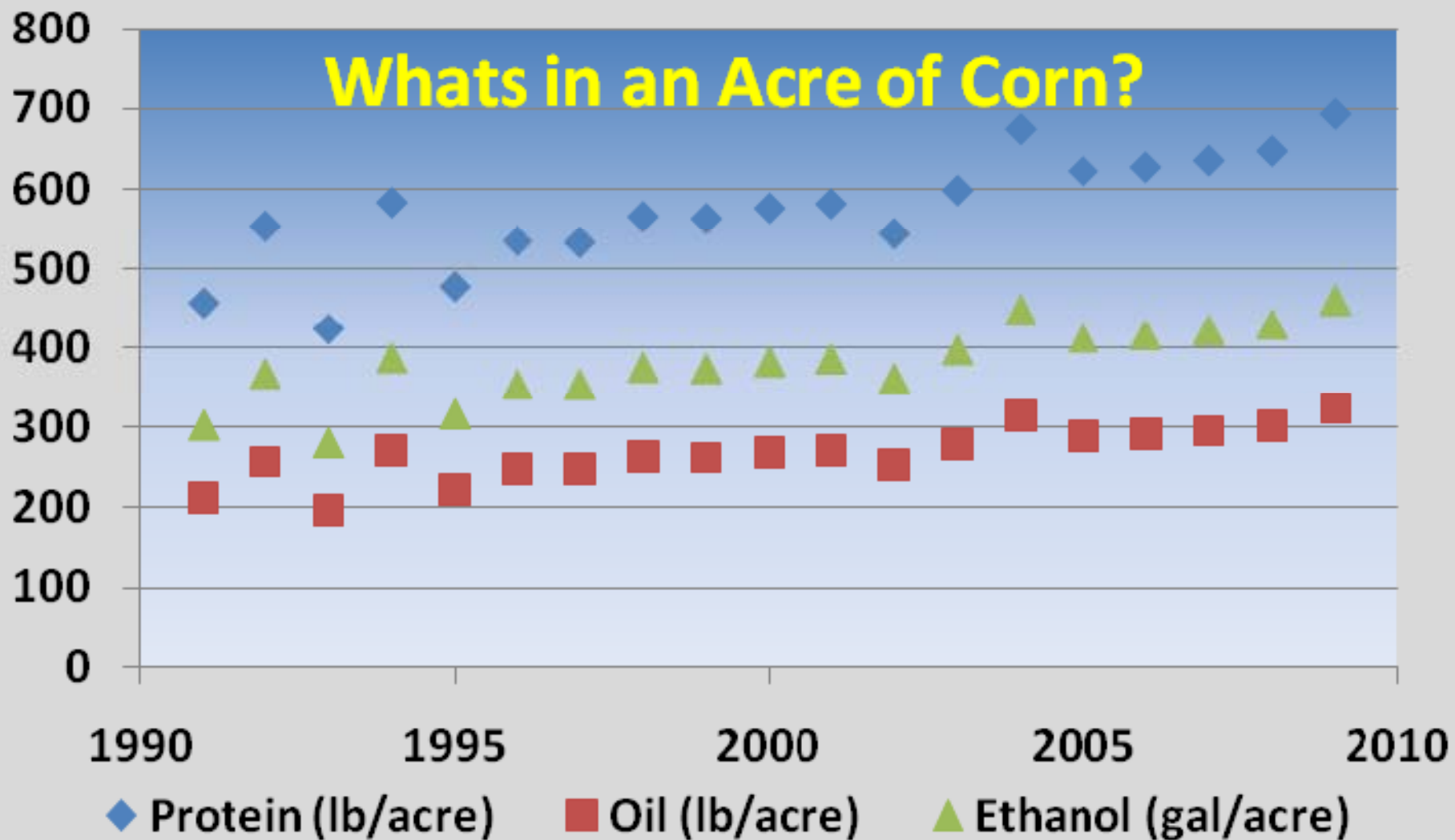


Source: Monsanto, June 2010

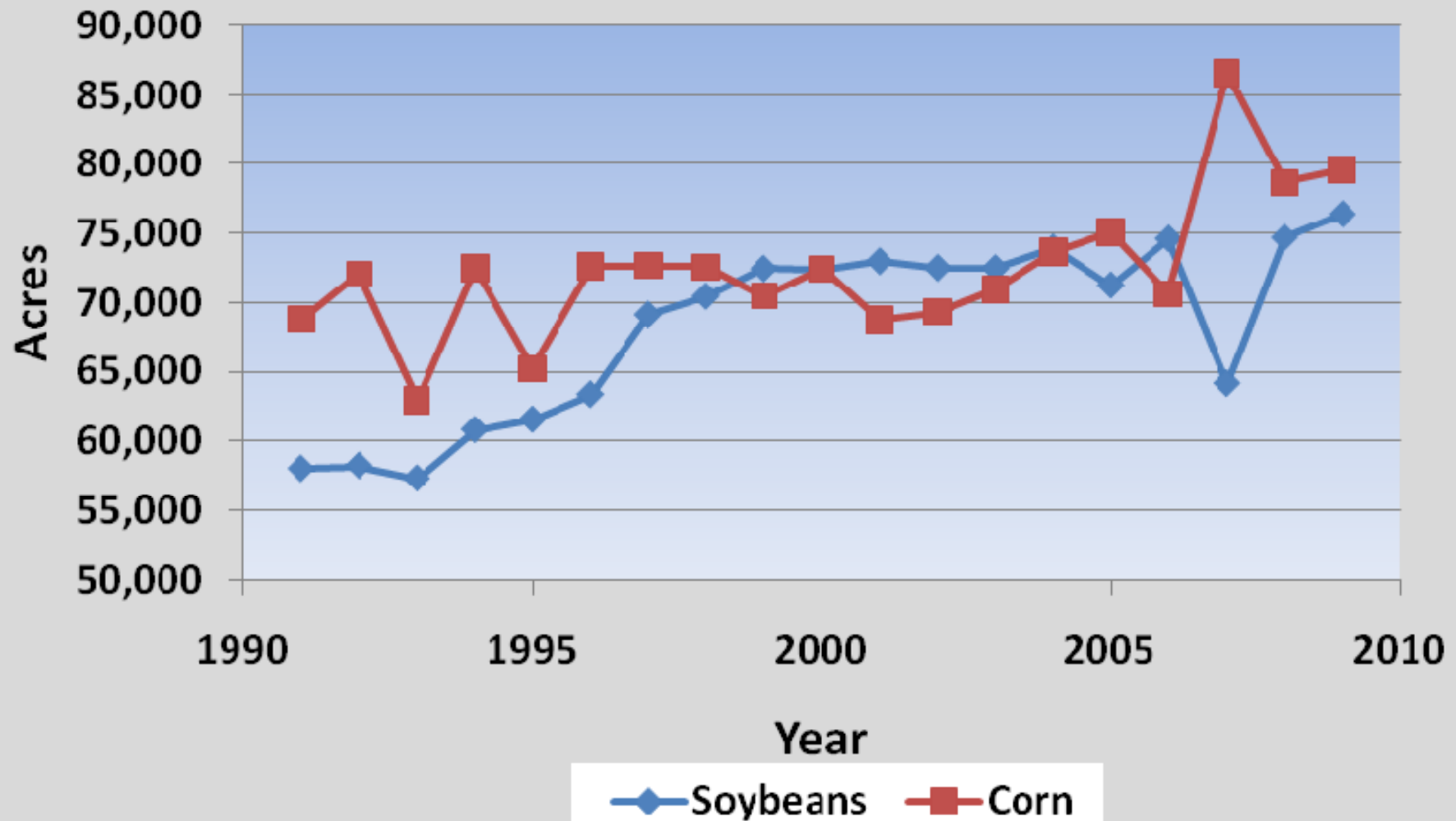
## Corn Production and Value



## Whats in an Acre of Corn?

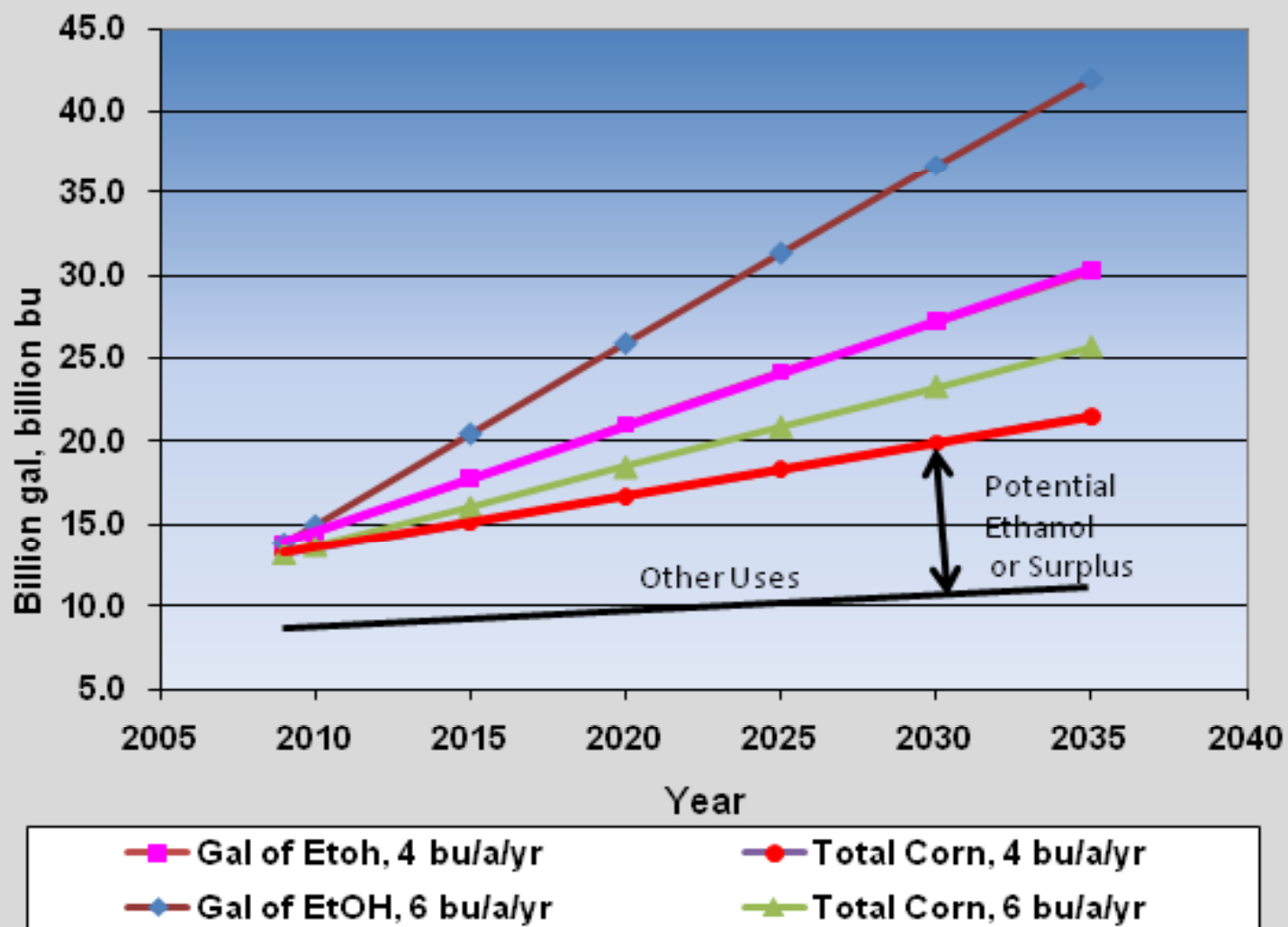


## Corn and Soybean Acreage, USA



## Potential Corn and Ethanol Production

Feed, Food Export @ +1%/yr, 80MM Acres of Corn



# Infrastructure Investments

- 4-8 new 100mg/y plants per year (\$200MM/plant)
- Storage and Handling (\$3-\$4/bu cap'y)
- Drying (\$250K/dryer)
- Related support
  - Railcars, trucks
  - Roads, other...

**\$100 Bln+ is conservative**

# Corn Ethanol Production

		<u>2001</u>	<u>2008</u>
Energy	BTU/gal	36,000	25,920
Electricity	Kwh/gal	1.09	0.70
Yield	Gal/bu	2.64	2.78
Water	Gal/gal		2.72

Source: Mueller, FEW, June 2010

(BBI Survey)

(Mueller, 2010)


# Corn Ethanol vs. Gasoline

Configuration	Avg GHG, % red of gasoline
Basic, Dry DDGS	-17%
Frac, Membrane, Cold Cook	-36%
Above plus Wet DGS	-46%

From EPA RFS2 analysis, presented by Moss, FEW, June 2010

**Advanced Biofuel = -50% except corn which is defined as not advanced**

# Typical Fractionation Products

- Ethanol (less); 2%  =0.06 gal/bu
- DDGS @42-47% protein; lower quality but more digestible (IL, SD studies)
- Bran
- Oil; ~1.4 lb/bu @ 80% extraction of germs (up to 0.6 -0.7 bgy of biodiesel @ 80% conversion on 4 bln bu of corn)

# Drying Costs

- EPA estimates (2007): 32,300 BTU/gal
- Equates to 2636 BTU/lb of water
  - 70% moisture DDGS dried to 12%

## Impact of Fractionation

Lb DDGS/ bu	BTU/bu	% of Ethanol
17.8	90440	43%
13.5	68785	33%

# Capital Costs

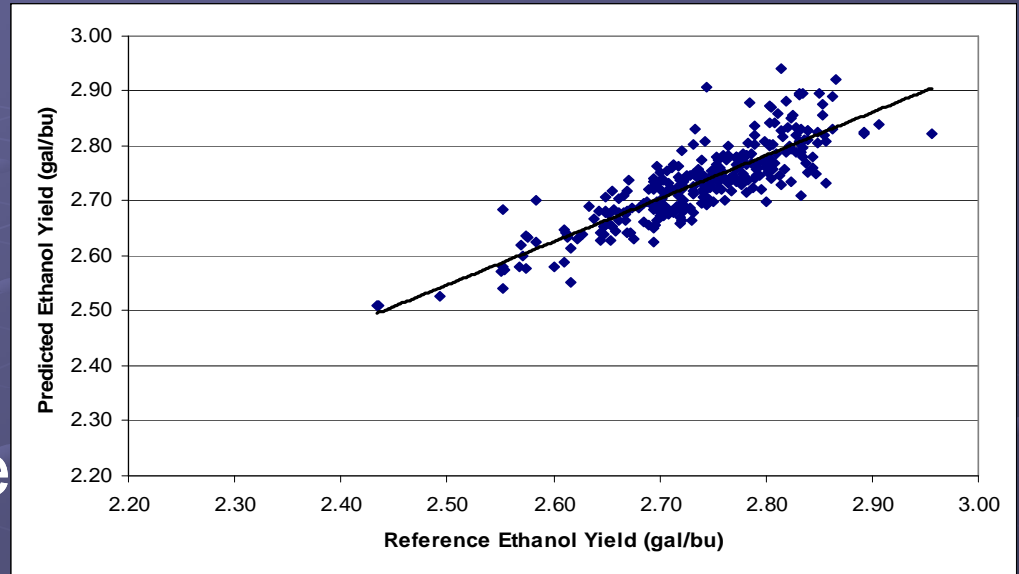
- Range from \$10 million to \$40 million for a 50 million gallon ethanol plant
- The inclusion of corn oil extraction technologies moves costs to the higher end of the spectrum
- Most vendors point to a payback period of under 3 years

# Variable Costs

- Decreased energy needs per gallon for:
  - Liquidification and cooking
  - Distillation
  - Drying of distillers grains and solubles
  - Possible energy generation from bran
- Could reduce energy demand by nearly 50%

# Supply Chain Agronomics: Ethanol Yield

- 0.1 gal/bu =  
\$6,000,000/yr  
(100 mgy plant)  
Also 4% yield increase



Predicted ethanol yield against reference ethanol yield for final Protein-Oil-Density equation



Protein, Oil and Density measured by Near-Infrared; about 1 minute/sample

Component	Final Equation Coefficients
B0	3.23
Protein	-0.062
Oil	-0.030
Density	0.104

# Summary

- **Corn production is increasing faster than traditional uses can absorb.**
- **Increase 4-6 bu/a/yr = 350-500MM bu**
- **Huge surpluses very quickly if .....**
- **Process improvements approach “advanced” category**
- **Capital investment in plants and grains infrastructure are the limiting factor.**
- **So why aren't we putting R and D support into corn?**

# Where To Find Us...



[www.iowagrains.org](http://www.iowagrains.org)  
[www.grainlab.org](http://www.grainlab.org)

**Analytical Programs  
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