

Energy Impacts on Traditional Cropping Relationships

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Stephen Colbert's Tips on Being an Expert

(Wired Magazine, August 2006)

- Pick a field that can't be verified
- Be sure to use lots of abbreviations and acronyms
- Don't be afraid to make things up
- Don't limit yourself to current knowledge
- Get an honorary PhD
- Make a habit of name-dropping

Is Energy Pushing or Pulling Acres?

- Pushing:
 - Corn:
 - Higher N Costs
 - Higher Diesel → Higher Transport Costs
 - Wheat:
 - Higher N, but matters less than corn
 - Lower transport costs than corn
 - Soybeans:
 - N Fixing: even more attractive
 - Also low transport costs...

Is Energy Pushing or Pulling Acres?

- Pulling:
 - Corn:
 - Ethanol Demand
 - 30%/year growth; 15bn g by 2015???
 - Soybeans:
 - Biodiesel production forecast to double annually for at least next 2-3 years, 600m g by 2008?
 - Switchgrass, etc
 - If cellulosic (ever) becomes economic, how many acres to grassy crops? Where will they come from?

Effects of Energy Prices on Cost of Corn Production

- Nitrogen prices: +\$25/acre
- Drying costs (LP): +\$3/ac
- Diesel costs: +3c/bu
- Total increase in production cost: +20.5c/bu

Effects of Energy Prices on Cost of Soybean Production

- Higher Diesel costs: +3c/bu
- Higher N costs: -\$12.00/ac
- Total impact: cost of soybean production 12c *lower* for corn-soybean rotation

Effects of Energy Prices on Cost of Wheat Production

- Higher Nitrogen costs: +\$15/ac
- Higher Diesel costs: +3c/bu
- Higher Energy costs result in a 21c/bu cost increase

Pushing: Who's the big winner?

- Soybeans, when rotated with corn.
- Effect on historical 2.5:1 soybean:corn price ratio?
 - Soybean costs reduced by 2.5% of LDP
 - Corn costs increased by 10% of LDP
 - ⇒ Implies a 2.68 price ratio

Pulling: Ethanol From Corn

| | Ethanol | Corn to | E(Yld) | Other | Total | Acres | Add'l to |
|------|---------|---------|--------|-------|-------|--------|--------------|
| Year | bgpy | Ethanol | bu/ac | Use | Use | Needed | 05/06 |
| 2006 | 5.61 | 2.15 | 149.00 | 9.6 | 11.74 | 78.758 | 3.66 |
| 2007 | 6.73 | 2.58 | 152.51 | 9.7 | 12.28 | 80.52 | 5.42 |
| 2008 | 8.08 | 3.10 | 155.08 | 9.8 | 12.90 | 83.15 | 8.05 |
| 2009 | 8.89 | 3.41 | 157.70 | 9.9 | 13.31 | 84.37 | 9.27 |
| 2010 | 9.77 | 3.75 | 160.35 | 10 | 13.75 | 85.72 | 10.62 |
| 2011 | 10.75 | 4.12 | 163.06 | 10.1 | 14.22 | 87.21 | 12.11 |
| 2012 | 11.83 | 4.53 | 165.80 | 10.2 | 14.73 | 88.86 | 13.76 |

- Where does the DGS go?
- Where do we get all of these acres?
- Where will get all of this N & P?
- When does cellulosic matter?

Pulling: Biodiesel

| | B100 | Reqd | Non BD | Total | Crush | Total | Trend | Acres | Acres vs. |
|------|-------|--------|--------|-------|-------|-------|-------|-------|--------------|
| Year | m gal | bn lbs | Use | Use | Reqd | Use | Yld | Reqd | 05/06 |
| 2006 | 150 | 1.13 | 19.08 | 20.2 | 1.74 | 2.99 | 41.39 | 72.27 | 0.87 |
| 2007 | 300 | 2.25 | 19.55 | 21.8 | 1.88 | 3.13 | 41.93 | 74.63 | 3.23 |
| 2008 | 450 | 3.38 | 20.04 | 23.4 | 2.02 | 3.27 | 42.48 | 76.94 | 5.54 |
| 2009 | 600 | 4.50 | 20.54 | 25.0 | 2.16 | 3.41 | 43.04 | 79.21 | 7.81 |
| 2010 | 750 | 5.63 | 21.06 | 26.7 | 2.30 | 3.55 | 43.60 | 81.42 | 10.02 |
| 2011 | 1000 | 7.50 | 21.58 | 29.1 | 2.51 | 3.76 | 44.17 | 85.06 | 13.66 |
| 2012 | 1200 | 9.00 | 22.12 | 31.1 | 2.68 | 3.93 | 44.75 | 87.89 | 16.49 |

- SBO has much more competition
- Unlikely to exceed 2.5-3bn lbs of virgin SBO for a long time.
- Major substitutes:
 - Corn Oil (reduces DGS volume.)
 - White/Yellow Grease
- Future of relative value of SM vs. SO?

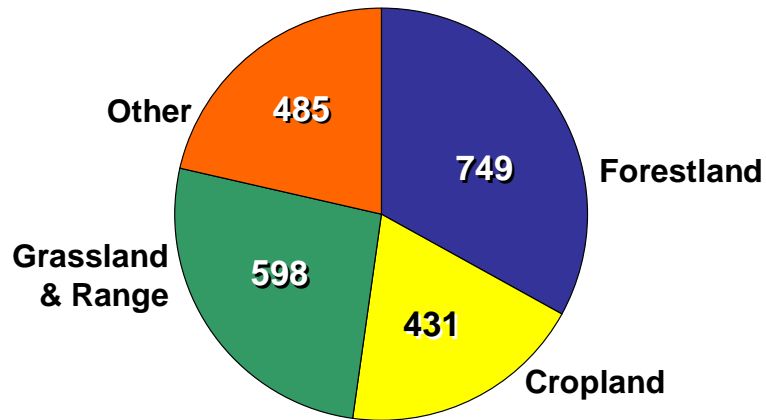
Pulling: Ethanol From Cellulose

- Still early & uneconomic: ~5.50/gal cost
 - NREL: “One breakthrough away”
- At least 5 years away, likely 10 for major production.
- How do we move and store it? Especially in large quantities?

How much land and from where?

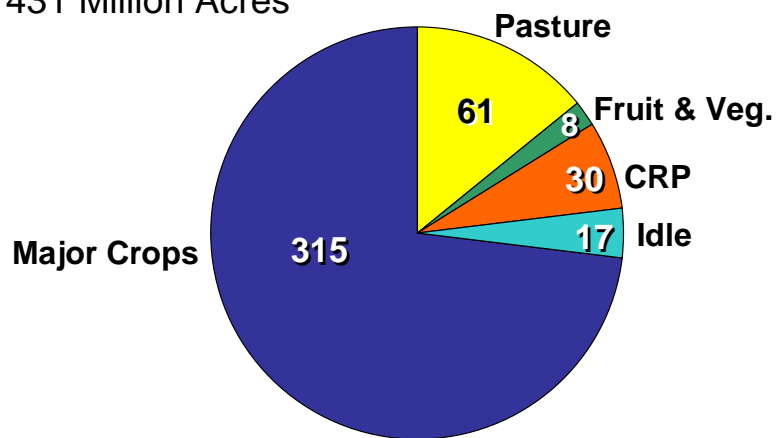
- At Trend Yield Growth
 - Corn: By 2012, we'll need 13.76m add'l acres
 - Soybeans: By 2012, we'll need 3.5m add'l acres
- These also assume:
 - Most B100 is produced from sources other than virgin SBO.
 - Exports/Other use increases relatively slowly.

Total Landmass U.S. 2263 Million Acres



(All values in millions of acres)

Cropland 431 Million Acres



(All values in millions of acres)

To meet these demands:

- Corn is more geographically sensitive.
- Energy prices will inhibit major irrigation expansion
- Brazil will eventually resume expanding soy area

Therefore:

- The Corn Belt will grow corn more intensively—
 - Increased corn/corn rotation (4-6m acres)
 - Some CRP returns to production (2-4m acres)
 - Marginal lands (w/ marginal ylds) go to crops from pasture at edges of CB. (4-5m acres)
- W plantings in/near CB will reduce (~2m acres).
- Soybeans will be pushed toward periphery of CB, displacing some W and more CT in the South, but we may ultimately cede market share to Brazil. (At what price?)
- Increases in price reduce export demand, reducing pressure for more land. (~5-7m acres?)

Before 2012?

- Import tariffs?
 - Strong political support.
 - Difficult (impossible?) to defend at WTO.
 - But Brazil would need years to supply any great quantity—we will outproduce them in 2006.
 - In long run, would be politically difficult for Brazilian politicians, too, due to domestic fuel price increases.
- Where does the DGS go?
 - We are nearing saturation.
 - More wet mills w/ oil to B100?
- What happens when yields fall by 10 or (gasp!) 20 bushels?
 - Consequences to domestic animal industries?
- How are we going to store and move these harvests?

Beyond 2012?

- 15x15x15
 - By 2015:
 - 15bn bushels of corn
 - We're on track now...
 - 15m gallons of ethanol
 - If only from corn, we're going to need more than 15bn bushels of corn!
- 25x25 (www.25x25.org)
 - By 2025:
 - 25% of all energy from renewable sources
 - Probably requires greatly increased efficiency.
 - Requires cellulosic—but then what happens to the corn market?
 - Huge amounts of grassy products—what will this do to acreage allocations? Especially out west? Other residues: stover, straw, etc.

Price Implications

- Remember, only relative prices matter.
 - If corn:soy equilibrium at 1:2.6
 - What are equilibria for:
 - corn/corn:corn/soybean
 - soybean:cotton
 - corn/soy/wheat:corn/soy or corn/corn