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...

• 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 cellosic (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

<table>
<thead>
<tr>
<th>Year</th>
<th>Ethanol Yield</th>
<th>Corn to Ethanol</th>
<th>Ethanol bu/ac</th>
<th>Other</th>
<th>Ethanol Use</th>
<th>Use</th>
<th>Needed</th>
<th>Acres Needed</th>
<th>Add'l to 05/06</th>
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<td>2006</td>
<td>5.61</td>
<td>2.15</td>
<td>149.00</td>
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<td>6.73</td>
<td>2.58</td>
<td>152.51</td>
<td>9.7</td>
<td>12.28</td>
<td></td>
<td>80.52</td>
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<tr>
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<td>3.10</td>
<td>155.08</td>
<td>9.8</td>
<td>12.90</td>
<td></td>
<td>83.15</td>
<td>8.05</td>
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<tr>
<td>2009</td>
<td>8.89</td>
<td>3.41</td>
<td>157.70</td>
<td>9.9</td>
<td>13.31</td>
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<td>84.37</td>
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<td>160.35</td>
<td>10</td>
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<td>85.72</td>
<td>10.62</td>
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<tr>
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<td>10.75</td>
<td>4.12</td>
<td>163.06</td>
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<td>4.53</td>
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<td>14.73</td>
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<td>88.86</td>
<td>13.76</td>
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• 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

<table>
<thead>
<tr>
<th>Year</th>
<th>B100 Reqd m gal</th>
<th>Reqd bn lbs</th>
<th>Non BD Use</th>
<th>Total Use</th>
<th>Crush Req’d</th>
<th>Total Yld</th>
<th>Trend Yld</th>
<th>Acres Req’d</th>
<th>Acres vs. 05/06</th>
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<td>2006</td>
<td>150</td>
<td>1.13</td>
<td>19.08</td>
<td>20.2</td>
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<td>21.8</td>
<td>1.88</td>
<td>3.13</td>
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<td>74.63</td>
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<td>3.38</td>
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<td>23.4</td>
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<td>2012</td>
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<td>9.00</td>
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<td>31.1</td>
<td>2.68</td>
<td>3.93</td>
<td>44.75</td>
<td>87.89</td>
<td>16.49</td>
</tr>
</tbody>
</table>

• 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.
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