Recouping Costs of Growing Switchgrass Using a Carbon Market

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Bioenergy

- Currently there has been an increase in demand for alternative energy
  - Increase cost of fossil fuels
  - Global climate change due to increased levels of $\text{CO}_2$
- Uses biomass and, through varying processes, converts it to a usable form of energy
Alternative energy crops

- Can be unsustainable to use typical row crops for energy production
- Miscanthus, big bluestem, switchgrass are all being looked as potential replacements for corn and other crops for biomass production
- Currently, difficult to grow for a number of reasons
  - Lack of demand
  - Switchgrass 3 year growth cycle
  - Miscanthus non-native and rhizomatous
Switchgrass Production

- High end harvest costs were $60/ton (Perrin, et al.), Average $50/ton but as low as $39/ton (Duffy et. al)
- Yields varied with where crop was planted
  - 5.44 tons/acre was the high end yield, and was planted on cropland.
  - 3.28 tons/acre was an average yield taking into account 4 plantings on crop and grassland
  - 1.36 tons/acre was the low end yield, and was planted on grassland
## Switchgrass Production Costs

<table>
<thead>
<tr>
<th>Tons Per Acre</th>
<th>Production</th>
<th>Income</th>
<th>Profit/loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Production from sale</td>
<td>biomass sales</td>
</tr>
<tr>
<td></td>
<td>Per Acre Values</td>
<td>Costs of biomass</td>
<td>sales</td>
</tr>
<tr>
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<td>$40</td>
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<td>$87</td>
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</tbody>
</table>

**Assumptions**

- $50 Per ton sale price for biomass
Future of Alternative Crops

- A demand for alternative crops may increase with increased demand for bioenergy
- With the increase concern over global climate change, a carbon market may make alternative crops profitable in the near future.
  - In order to investigate the future of alternative energy crops, first must have a background on types of mitigation strategies for carbon dioxide
Carbon Mitigation Strategies

- Shift from the science of global climate change to policy options to mitigate the change
  - Treat $\text{CO}_2$ as a commodity with a cost
- Two main types under discussion
  - Carbon Tax
  - Cap and Trade system
Carbon Tax

- Put a set price on every ton of CO$_2$ a firm emits
  - Set by the government (EPA)
- Benefits:
  - Transparency
- Drawbacks:
  - Too low, and no net change will occur
  - Tax will increase price consumers pay for fossil fuels
    - Makes this legislation a hard sell to consumers
Cap and Trade

- Cap would be set at the amount of CO$_2$ emitted. Any over the cap, firms would be forced to buy permits from those willing to sell.
- Benefits
  - Market forces influence price
- Drawbacks:
  - Monitoring and enforcement
Cap and Trade Under SO$_2$ Emissions Scheme

NOTE: For Demonstration Purposes Only
Lieberman-Warner Bill

• Proposed a cap and trade system for CO\textsubscript{2} in the US
  ▫ Complaints
    • Expensive to implement
    • 7 trillion earned from auctioning permits
    • Does too little to protect American manufactures from international competition
  ▫ 48 for (potential for 54) while 36 opposed
Chicago Climate Exchange

- Voluntary carbon credit market in the US
  - When an agreement is signed, legally binding
  - Trades credits for $CO_2$, $NO_x$, $SO_2$, among others
- Over 350 members, ranging from corporations, to public institutions, to local farmer co-ops
  - University of Minnesota, DuPoint, Motorola, Ford, and the National Farmers Union
Chicago Climate Exchange

• Carbon sequestration projects to landowners
  ▫ Reimburse farmers for using marginal land to capture (sequester) CO$_2$ out of the atmosphere
  • Credit per ton of carbon captured.
Programs offered by the CCX when Planting Alternative Feedstocks

- Native grass plantings
  - Native grass plantings sequester 1.0 mT of CO$_2$ per acre per year
  - Switchgrass is considered a native grass in the United States
Price of Carbon Credits

- Currently, mandatory markets are in place in the European Union
  - €25.00 average price of carbon credit
  - $39.64 with a 1.58579 exchange rate
- Under the US voluntary market, CCX
  - $4.00 average price of carbon credit
  - $22.00 proposed price under Lieberman-Warner
- All prices listed here exclude trading fees
  - Cost of an aggregator, and CCX trading fee
Potential Profit of Switchgrass Planting Using Carbon Credits

<table>
<thead>
<tr>
<th></th>
<th>CCX Price</th>
<th>Lieberman-Warner Price</th>
<th>EU Price</th>
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</thead>
<tbody>
<tr>
<td>Profit Per Ton</td>
<td>$2.78</td>
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- CCX Price
- Lieberman-Warner Price
- EU Price
## Switchgrass Production Costs With A EU Style Carbon Credit

<table>
<thead>
<tr>
<th>Tons</th>
<th>Per Acre</th>
<th>Production Cost per ton</th>
<th>Per Acre Values</th>
<th>Income</th>
<th>Profit/loss</th>
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<th>Profit/loss</th>
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<tbody>
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<td>Production from sale</td>
<td>biomass</td>
<td>from EU after carbon</td>
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**Assumptions**

- $50 Per ton sale price for biomass
Conclusions

- Carbon market is in its early stage
  - Profits are therefore small when compared to a European carbon market
- Using a carbon market can offset some costs of production when planting alternative feedstocks
References

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