

# 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 CO<sub>2</sub>
- 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

Tons Per Acre	Production cost per ton	Per Acre Values		
		Production Costs	Income from sale of biomass	Profit/loss biomass sales
5.5	\$40	\$220		\$55
	\$50	\$275	\$275	\$0
	\$60	\$330		(\$55)
3.25	\$40	\$130		\$33
	\$50	\$163	\$163	\$0
	\$60	\$195		(\$33)
1.45	\$40	\$58		\$15
	\$50	\$73	\$73	\$0
	\$60	\$87		(\$15)

## 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 CO<sub>2</sub> as a commodity with a cost
- Two main types under discussion
  - Carbon Tax
  - Cap and Trade system

# Carbon Tax

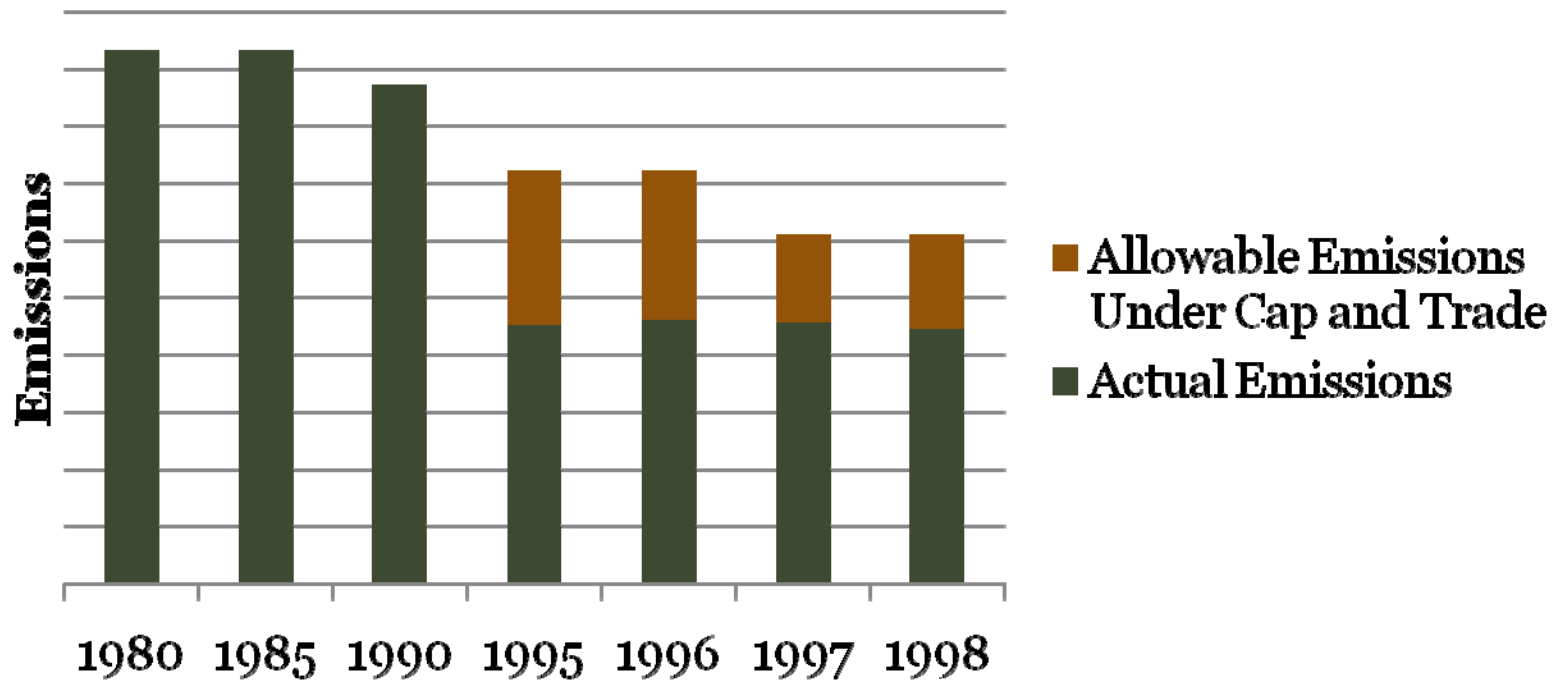
- Put a set price on every ton of CO<sub>2</sub> a firm emits
  - Set by the government (EPA)
- Benefits:
  - Transparency
- Drawbacks:
  - Too low, and no net change will occur
  - Tax will increase price consumers pay for fossil fuels
    - Makes this legislation a hard sell to consumers



# Cap and Trade

- Cap would be set at the amount of CO<sub>2</sub> 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<sub>2</sub> Emissions Scheme



NOTE: For Demonstration Purposes Only

# Lieberman-Warner Bill

- Proposed a cap and trade system for CO<sub>2</sub> 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<sub>2</sub> NO<sub>x</sub> SO<sub>2</sub>, among others
- Over 350 members, ranging from corporations, to public institutions, to local farmer co-ops
  - University of Minnesota, DuPont, Motorola, Ford, and the National Farmers Union



Chicago Climate Exchange

# Chicago Climate Exchange

- Carbon sequestration projects to landowners
  - Reimburse farmers for using marginal land to capture (sequester) CO<sub>2</sub> out of the atmosphere
    - Credit per ton of carbon captured.

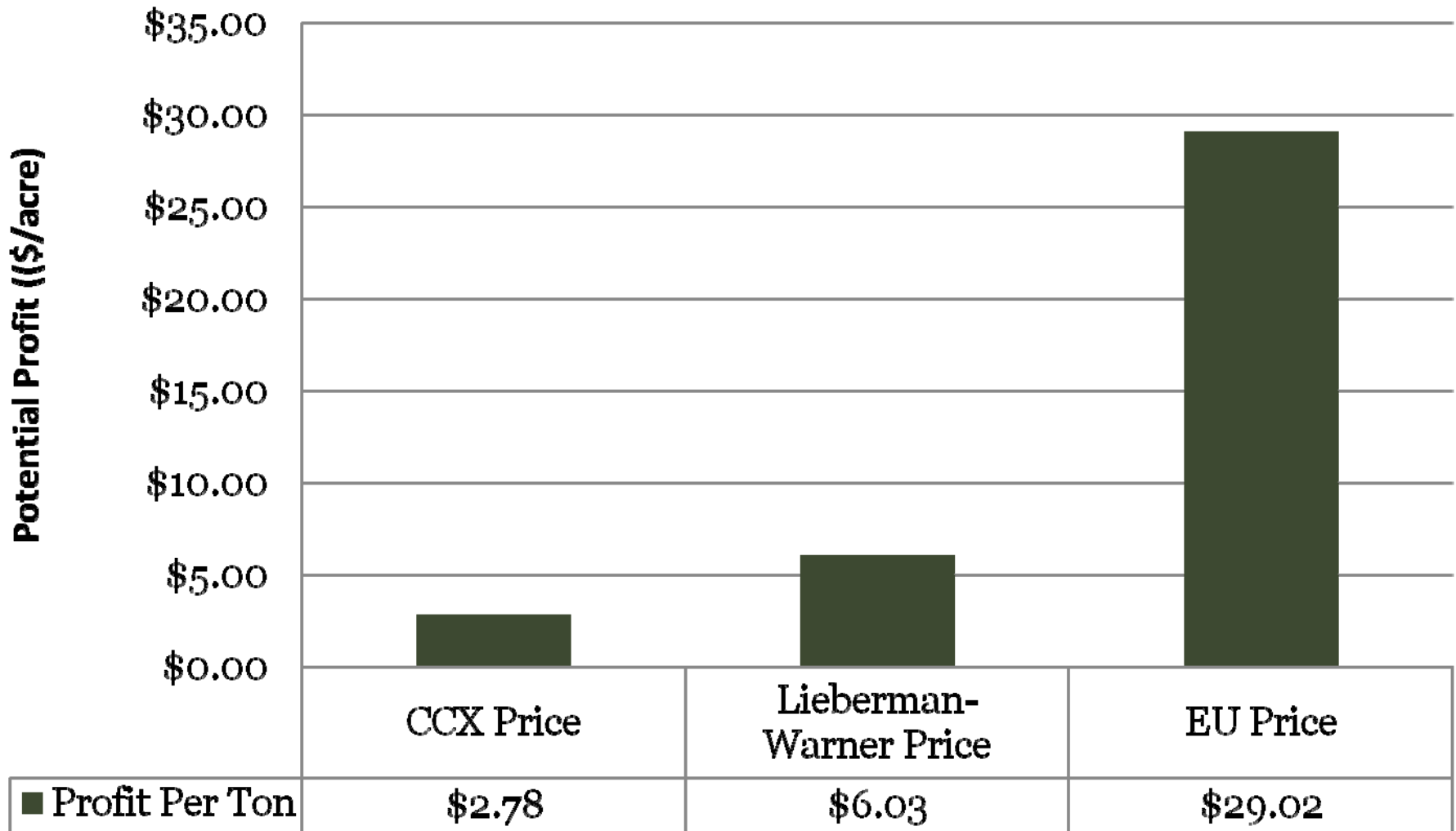
# Programs offered by the CCX when Planting Alternative Feedstocks

- Native grass plantings
  - Native grass plantings sequester 1.0 mT of CO<sub>2</sub> 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





# Switchgrass Production Costs With A EU Style Carbon Credit

Tons Per Acre	Production cost per ton	Per Acre Values				
		Production Costs	Income from sale of biomass	Profit/loss biomass sales	Income from EU style credit	Profit/loss after carbon credit
5.5	\$40	\$220		\$55		\$84
	\$50	\$275	\$275	\$0	\$29	\$29
	\$60	\$330		(\$55)		(\$26)
3.25	\$40	\$130		\$33		\$62
	\$50	\$163	\$163	\$0	\$29	\$29
	\$60	\$195		(\$33)		(\$4)
1.45	\$40	\$58		\$15		\$44
	\$50	\$73	\$73	\$0	\$29	\$29
	\$60	\$87		(\$15)		\$15

## 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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# Acknowledgements

- Lowell Rasmussen
- Mike Reece
- Joel Tallaksen
- Jim Barbour
- USDA
- WCROC Staff