



Biofuels, Food & Feed Tradeoffs

April 12-13, 2007 St. Louis, Missouri



Local Biomass Feedstock Availability for Fueling Ethanol Production

Evert Van der Sluis (presenter)
Richard Shane
Larry Stearns


Study Funded by VeraSun Energy

Corn Ethanol Production Process

- Disadvantage: relies on fossil fuel
 - Mostly natural gas
- Alternative fuel source: biomass
- This study: use biomass to fuel ethanol plant expansion
 - VeraSun Energy ethanol plant
 - Aurora, South Dakota



Aurora Facility



- Corn use: 43 million bu / yr
- Output:
 - Ethanol production: 120 mln gallons / yr
 - Distillers grains: 390,000 tons / yr

Overall Objective

- Assess biomass availability & costs of delivery to central location
 - Use biomass as fuel source in ethanol plant expansion

Specific Objectives

- Assess biomass types & amounts
 - Corn stover
 - Wheat straw
 - Perennial grasses
- Gauge impact of biomass removal on
 - Soil productivity
 - Ecological sustainability
- Estimate costs:
 - Harvesting
 - Storing
 - Transport to plant

Study Area Around Aurora, SD



Study area:
50 mile radius
from production
facility

County Types

- Two groups of counties
 - Tier 1: within 50 mile radius
 - Tier 2: partially outside of 50 mile radius

Cost Considerations: Biomass Production

- Sources:
 - Corn stover, grains straw, grass hay
 - Based on local cropping system
- Production
 - Yields
- Availability
 - Comply with minimal NRCS needs
 - For erosion control
 - Technical ability to remove

Cost Considerations: Other

- Soil productivity losses
 - Nutrients
 - Fertilizer replacement
 - Other
 - Organic material
 - Soil compaction
 - Soil erosion
- Competing biomass uses
- Producer incentive

Cost Considerations: Collection, Handling, Transport

- Collection
 - Flail mowing, raking, baling
- Loading & unloading
- Transport
 - In-field
 - To plant

Production

- Plant residue
 - 1 ton of corn grain → 1 ton of corn stover
 - 1 ton of wheat grain → 1.4 tons of straw
- Meet minimum NRCS requirements
 - ≥ 35% of residue must remain on field
- Harvesting equipment limitations
 - Collect about 45 percent of available corn stover
 - With yields of 130-150 bu/acre

Results: Corn Stover

Operations	Per Unit (\$)	Per Bale (\$)	Per Ton (\$)	Per Acre (\$)
Operations				
Flail Mowing per acre	7.75	1.72	4.92	7.75
Baling per Bale (Lg Sq)	6.50	6.50	18.57	29.25
Transport to Field Edge	1.00	1.00	2.86	4.50
Return to Producer				
Fertilizer Replacement	14.76	3.28	9.37	14.76
Incentive to Producer	10.00	2.22	6.35	10.00
Transport to plant				
Loading	40.00	0.56	1.59	2.50
Transport to plant	75.00	1.04	2.98	4.69
Unload	40.00	0.56	1.59	2.50
Total Transportation		2.15	6.15	9.69
Total Costs		16.88	48.22	75.95

Results: Wheat Straw

Operations	Per Unit (\$)	Per Bale (\$)	Per Ton (\$)	Per Acre (\$)
Flail Mowing per acre	0.00	0.00	0.00	0.00
Baling per Bale (Lg Sq)	6.50	6.50	21.67	21.67
Transport to Field Edge	1.00	1.00	3.33	3.33
Return to Producer				
Fertilizer Replacement	10.56	3.17	10.56	10.56
Incentive to Producer	10.00	3.00	10.00	10.00
Transport to plant				
Loading	40.00	0.56	1.85	1.85
Transport to plant	75.00	1.04	3.47	3.47
Unload	40.00	0.56	1.85	1.85
Total Transportation		2.15	7.18	4.18
Total Collection & Transport Costs		15.83	52.71	55.27

Results: Grass & CRP Hay

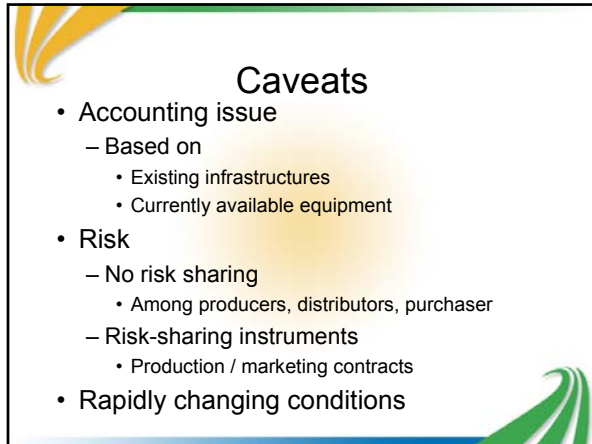
Operations	Per Unit (\$)	Per Bale (\$)	Per Ton (\$)	Per Acre (\$)
Flail Mowing per acre	0.00	0.00	0.00	0.00
Operations		Per Bale	Per Ton	Per Acre
Swathing	9.75	2.17	5.48	9.75
Baling per Bale (Lg Sq)	6.50	6.50	18.57	29.25
Transport to Field Edge	1.00	1.00	2.86	4.50
Return to Producer				
Per Acre	30.00	6.67	16.85	30.00
Haul to plant				
Loading	40.00	0.56	1.59	2.50
Transport to plant	75.00	1.04	2.98	4.69
Unload	40.00	0.56	1.59	2.50
Total Transportation		2.15	6.15	9.69
Total Collection & Transport Costs		18.49	49.91	83.19

Alternative Biomass Sources

- Switchgrass
- CRP land
- Other residue-producing crops

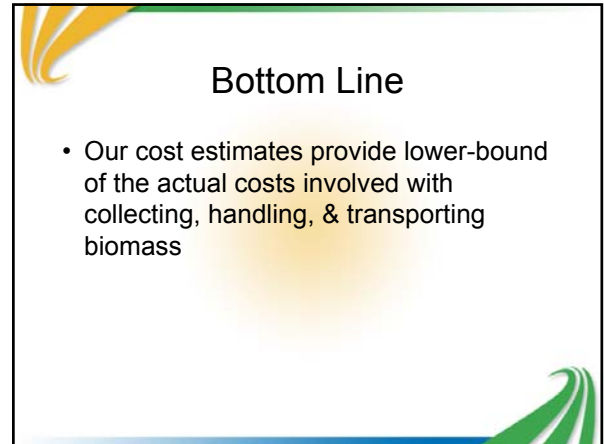
Factors Affecting Biomass Availability

- Technical
- Weather conditions
- Producer willingness to sell crop residues
- Time constraints
- Equipment availability
- Plant residue fertilizer value
- Farmer compensation
 - Labor
 - Capital
 - Financial incentives



Caveats

- Accounting issue
 - Based on
 - Existing infrastructures
 - Currently available equipment
- Risk
 - No risk sharing
 - Among producers, distributors, purchaser
 - Risk-sharing instruments
 - Production / marketing contracts
- Rapidly changing conditions



Bottom Line

- Our cost estimates provide lower-bound of the actual costs involved with collecting, handling, & transporting biomass

