Detours on the Road to Sustainable Feedstock Production for Cellulosic Biofuel: Assessing Multidimensional Policy Approaches

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Cellulosic Biofuels: A Promising Approach to Achieve Energy Security and Reduce Greenhouse Gas Emissions

Biofuel Yield: Gallons per Acre

Can reduce Food vs Fuel competition for land
Second Generation Feedstocks: Energy Crops

- Productive on low quality land
- Low input requirements; rainfed
- Non-invasive varieties
- Reduce soil erosion and nitrate run-off
- Establishment lag: 1-3 years
- High upfront cost of planting and establishment
- Long term commitment: 10-15 years
Cost of Production and GHG Savings with Various Feedstocks in Rainfed US

Cost of Cellulosic Ethanol ($ per gallon of energy equivalent gasoline)

% Reduction in GHG Emissions Relative to Energy Equivalent Gasoline

All prices in 2010 dollars
Biomass Crop Assistance Program (BCAP)

- 50% cost share of establishment cost and annual payment to cover cost of land during establishment (capped at $500 per acre)
- Up to $20 per ton matching price subsidy for collection, harvest, storage and transportation
- $25M budget per year for 5 years
- Eligibility requirements
  
  • No explicit mechanism for selecting land to be enrolled
  
  • Does not address price and yield risks
  
  • Cap on establishment cost-share creates disincentives for crops with high establishment costs
Key Issues

• Current level of BCAP funding $125 Million is inadequate to achieve Billion Ton vision

• Need for a mechanism to competitively select enrollment in BCAP

• Expanding the current program alone may be ineffective if farmers are risk averse and expect high rates of return

• Supplementing BCAP with a crop insurance program for energy crops and establishment cost loans may be more cost-effective at inducing production of cellulosic biofuels
Yield per acre with 30 years of Weather Data Using DAYCENT Model

- **Miscanthus (tons per acre)**
- **Switchgrass (tons per acre)**
- **Corn (bushels per acre)**
- **Soybean (bushels per acre)**

Maps showing yield distribution across the US.
Cost of Producing Energy Grasses in Marion, IL

Switchgrass on Good Quality Land
- Fertilizer: 13%
- Establishment: 2%
- Preharvest: 1%
- Harvest: 24%
- Land Rent: 46%
- Transport: 14%

$118/Ton

Switchgrass on Poor Quality Land
- Fertilizer: 19%
- Establishment: 16%
- Preharvest: 2%
- Harvest: 33%
- Land Rent: 26%
- Transport: 19%

$84/Ton

Miscanthus on Good Quality Land
- Fertilizer: 4%
- Establishment: 16%
- Preharvest: 1%
- Harvest: 36%
- Land Rent: 20%
- Transport: 23%

$89/Ton

Miscanthus on Poor Quality Land
- Fertilizer: 3%
- Establishment: 12%
- Preharvest: 1%
- Harvest: 28%
- Land Rent: 38%
- Transport: 18%

$69/Ton
Breakeven Prices of Miscanthus and Switchgrass $ per ton

**Miscanthus**

- On Marginal Land
- On Cropland

**Switchgrass**

- On Marginal Land
- On Cropland

Price based on $100 per barrel oil
Barriers to energy crop production in addition to low biomass price

- Chicken and egg problem
- High establishment cost, high discount rate and credit constraints
- Risk aversion
Riskiness of Corn, Miscanthus and Switchgrass Yield

Miscanthus yields are LESS risky than corn
Switchgrass yields are MORE risky than corn
What would the current level of BCAP funding achieve?

- Depends on a number of factors
  - Price of biomass offered by a refinery/processor
  - Availability of marginal land
  - Degree of risk aversion
  - Expected rate of return
  - Credit constraints
  - Riskiness of energy crop relative to existing use of land
    - Crop insurance coverage for conventional crops
  - Type of crop it is used for
    - Crops differ in establishment cost and lags, yields and risks
  - Selection mechanism for enrolling land in BCAP
Potential Acres of Miscanthus Likely to be Induced by BCAP@$125M

- 118,000 acres
- Can produce 95 million gallons of miscanthus based ethanol*
- 10 cents per additional gallon of ethanol

*Assuming a baseline price of $47 per ton of biomass
Impact of Expanding BCAP Funding

- Greater availability of Marginal Land
- Low Risk Aversion Low Discount Rate
- High Risk Aversion Low Discount Rate
- No Credit Constraint High Risk Aversion High Discount Rate
- Low Risk Aversion High Discount Rate
- High Risk Aversion High Discount Rate
Additional Gallons of Biofuel Induced by Existing BCAP and Supplementary Policies

- BCAP: $125 M
- BCAP with Establishment Loans: $125 M
- BCAP with Establishment Loans and Energy Crop Insurance: $125 M
- BCAP with Establishment Loans and Subsidized Crop Insurance: $192 M
With Credit Constraint and no Crop Insurance

With Establishment Loans and Crop Insurance

Legend
-acres-
< 250
250 - 500
500 - 750
750 - 1000
> 1000

BCAP Acres
Summary

- Cellulosic biofuels from energy crop have high yields per acre and low carbon intensity

- Credit constraints, risk aversion, high rates of discount and low price likely to be key barriers to growing energy crops

- Very limited incentives to produce energy crops under current policy incentives and oil prices

- Mix of policy incentives and larger funding levels needed for
  - establishment cost share, price subsidy, low interest credit and crop insurance to induce large scale energy crop production
Questions?

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