

Could Biodiesel help the Vermont Economy?

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Outline

Part 1: Biodiesel in Vermont, the context

- Markets
- Agricultural Feasibility
- Agricultural Survey

Part 2: Biodiesel in Vermont, feasibility and impact study

- Methodology and Model Components
- Scenario Descriptions
- Results

Vermont Biomass R&D Initiative

Consortium Partners:

Vermont's Alternative Energy, Williston, VT

Intervale Foundation, Burlington VT

Foster Brothers Farm, Middlebury, VT

Center for Sustainable Agriculture at UVM, Burlington,
VT

Funding by:  United States Department of Agriculture

Goal of Study

To organize a group of committed individuals from private, non-profit and educational institutions and devise a plan for utilizing the State's rich and unique agricultural resources in a way that fits the ecological and social landscape.

Work Update

- Completed study on local biodiesel production
- Working on data gathering for other potential biomass projects (gasification, pyrolysis, use of grass and hay)
- Working on improvements to digester technology

Biodiesel Study: Summary

- Plant Size: ~2.5 Mgal/yr
 - Satisfies local demand
 - Locally sustainable (no feedstock imports)
- Mixed feedstock (keeps costs down)
 - Canola (7,000 acres)
 - Soy (15,000 acres)
 - Yellow grease (500,000 gallons)

Market Study

- VT Diesel Market Size (EIA, 2003):
 - Transportation: 33%
 - Heating: 67%
- Potential size of VT market share (assuming B20)
 - Private Transportation: 1-2%
 - Fleets: 5-10%
 - Heating: 2-10% (could be higher)

Fuel Volume (Mgal/y)	Market Share		
	2%	5%	10%
Heating	4.4	11.0	21.9
Transportation	1.3	3.4	6.7
Production needed			
B100	5.8	14.4	28.7
B20	1.2	2.9	5.7
B5	0.3	0.7	1.4

Vermont Agriculture in Transition

Since 1982, the number of farms selling over \$10,000 has decreased by 20% while those selling over \$50,000 have decreased by 38%.

In 2001 Vermont had 153,000 dairy cows which produced \$421 million worth of milk, ~75% of Vermont agriculture production.

Consistently low milk prices in 2002 and 2003 forced many dairies to sell or expand their herds.

Top field crops in 1997:

- Hay (386,000 ac.)
- Corn Silage (96,000 ac.)
- Maple Trees (30,000 ac.)
- Grain Corn (8,000 ac.)



Potential for Oil Crops in Vermont

While there is not much history of oilseed production in Vermont, potential for production is indicated by the following:

Potential Vermont demand for soybean meal over **100 million pounds** annually.

Definite economic benefits to be had from locating seed crushing facility in the state.

Small number of farmers growing soybeans for their own herds.

No findings of canola production in Vermont. However, canola acreage in Maine has been increasing steadily since introduction 5 years ago.

Vermont organic dairies paying high premium for imported organic soy meal.

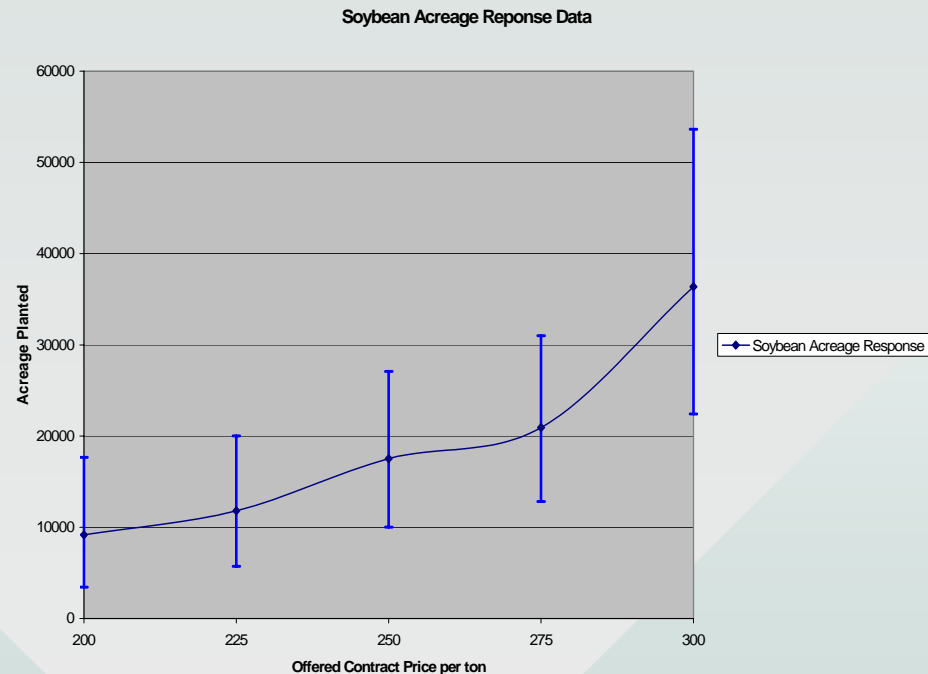


Acreage Response Survey

- Purpose: To estimate acreage response to different contract prices for biodiesel feedstock crops in Vermont.
- Target population: Currently producing dairies in Vermont.
- Production Scenarios:
 - Soybeans and Canola contracted to a biodiesel production facility
 - Soybeans contracted to a biodiesel facility with the meal returned to the dairy farmer.

Survey Results

- 100 respondents, all active dairy farmers
- 40% of responders interested in “next step”
- For average soy prices (\$200-250/ton) between 10,000 and 20,000 acres could be planted



Feasibility and Impact Study - Questions

- Feasibility of Biodiesel Production
 - Under what assumptions could biodiesel profitably be produced in Vermont?
- Macroeconomic Impact
 - What would such a facility contribute to the Vermont economy in terms of output, wages, and taxes?
 - How would such a facility make Vermont more self-sufficient economically?
- Agricultural Impact
 - What would be the effect upon the size and number of farms in Vermont, as well as upon farm income and employment.
- Environmental Impact
 - How would biodiesel production affect the Vermont environment in terms of air and water quality, green house gas production, and quantity of open space?

Components of a Simulation Model of the Vermont Agricultural Economy and a Proposed Biodiesel Plant

- Econometric Model of the Vermont Agricultural Economy
- Regional Input-Output Model of Linkages to Vermont State Economy
- Life Cycle Analysis Model of Environmental Impact

Vermont Agriculture Sector Model

Key Parameters:

Number of Dairy Cows
Price of Milk
Cost of Milk Production
Number of Dairies
Acreage, Prices, Production, and Revenue of Corn, Alfalfa, Hay, Soybeans and Canola
Direct Farm Employment and Income
Agriculture-related employment

Biodiesel Production Model

Key Parameters:

Oilseed Submodule

National prices for soybeans, soy oil, and soybean meal.
National prices for canola seed, canola oil, and canola meal.
Transaction Costs
Expeller capacity
Oil and meal production
Production costs
Expeller employment and revenue

Biodiesel Production Submodule

Plant capacity
Biodiesel Production
Feedstock composition: Vermont oilseeds, imported oilseeds, waste oil
Biodiesel price
Crude oil price
Vermont biodiesel demand
Plant costs and returns



Production Inputs



Revenue and Protein



Ecological Impact Model

Key Parameters:

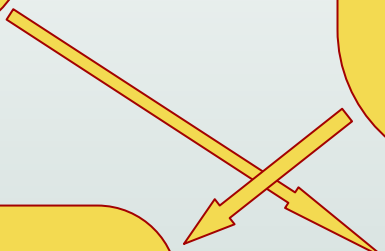
Green house gas emissions
Nutrient production and disposition
Energy consumption and production
Soil erosion
Air emissions



Economic Impact Model

Key Parameters:

Direct and induced output
Direct and induced income
Direct and induced employment
Import Substitution



Key Parameters Affecting Feasibility of Biodiesel Production

- Price of Biodiesel and Price of Oil
 - Currently B20 prices follow diesel prices, largely ignore production costs
- Feedstock Sources and Prices
 - Imported grains and oils vs. VT grains vs. waste oils
- Scale of Production
- Federal and State Support Programs

Simulation Scenarios

- Baseline – VT ag economy given current trends.
- Private Biodiesel Facility – Contracting with VT growers under average and ideal conditions.
- Cooperative Facility – Farmer owned facility under average and ideal conditions.

Scenario Assumptions

Average Case

- Oil prices average \$23-25/barrel
- Waste Oil Supply = 100,000 gallons
- Average grower participation
- No state support

Optimistic Case

- Oil prices average \$30-34/barrel
- Waste Oil Supply = 750,000 gallons
- Maximum grower participation
- \$.50/gal. state incentive

Results: Private Plant, Average Case

- Negligible impact on ag economy
 - ~450 acres VT soy, ~150 acres VT canola
- Plant loses ~\$1 million/year
- Macroeconomic effects:
 - \$21.4 mil. direct and induced output
 - 80 direct and induced jobs
 - \$1.8 mil. direct and induced labor income
 - \$12.5 million in import substitution

Results: Private Plant, Optimistic Case

- Still minimal impact on ag economy
 - ~2000 acres VT soy, ~170 acres VT canola
- Plant profits ~ \$850,000/year
 - Still negative without incentives.
- State and local taxes ~ \$380,000
 - About 30% of incentives.

Results: Cooperative, Average Case

- Significant impact on ag economy
 - ~90,000 acres VT soy
 - Acreage in cultivation increases 26%.
- Coop net revenues of \$2.2 million/year
 - ~ \$25/acre, or \$.08/cwt. of milk
- Macroeconomic effects:
 - 110 direct and induced jobs in biodiesel facility
 - 250 direct and induced jobs in soy production

Results: Cooperative, Optimistic Case

- Significant impact on ag economy
 - ~65,000 acres VT soy
 - Acreage in cultivation increases 16%.
- Coop net revenues of \$3.7 million/year
 - ~ \$55/acre, or \$.13/cwt. of milk
 - Annual Incentives = \$1.25 million
 - State/local taxes = \$1.2 million/yr.
- Macroeconomic effects:
 - Over 200 new direct and induced jobs
 - Labor Income increases 6%
 - Output increase 4%

“Really Optimistic” Cooperative Scenario

- Local production for a 7.5 M gallon plant

- Significant shift in ag economy
 - ~244,000 acres VT soy
 - Acreage in cultivation increases 64%
 - 20 additional dairies
- Coop net revenues of \$13.4 million/year
 - ~ \$55/acre, or \$.46/cwt. of milk
 - Annual Incentive = \$3.75 million
 - State/local taxes = \$5.5 million/yr.

“Really Optimistic” Cooperative Scenario

- Local production for a 7.5 M gallon plant

- Significant Macroeconomic Impact
 - Direct and Induced Labor Income increases 22%
 - Direct and Induced Output increases 20%
 - Additional direct employment of 550 jobs, additional induced employment of 600 jobs
- \$52 million in import substitution
- Energy produced meets ~10% of system energy demand.

Other Results:

- Cooperative using Canola loses money, no ecological benefits.
 - Meal is low-value.
- Hexane-based oilseed processor also loses money for coop.
 - Oil is subsidized by meal production
- Even higher revenue potential from organic oilseeds if sufficient demand.

Conclusions:

- Profitability doubtful without either state support or significant grower involvement
- Growers cooperative model feasible
- Significant economic benefits to be had
- Why does biodiesel makes sense for Vermont...