Estimating Producers' Willingness to Supply Switchgrass as a Bioenergy Crop

Mustapha Alhassan, Richard Perrin, and Lilyan Fulginiti

Department of Agricultural Economics, University of Nebraska – Lincoln

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Introduction

- **Cellulosic biofuel:** The Energy Independence and Security Act (EISA) of 2007 mandated consumption of about 36 billion gallons of biofuel by the year 2022.
- **Cellulosic biofuel feedstocks:** The three major cellulosic ethanol plants now in operation utilize corn stover as feedstock. Dedicated grass crops could also be used but they are more expensive.
- **This project:** We wish to identify where switchgrass feedstock supplies in the upper Midwest would support the lowest feedstock costs.
- **This report:** We report the results of a survey to estimate producers' willingness to produce switchgrass as a bioenergy feedstock.

Objective

The main objective of the research reported here is to estimate potential producers' willingness to accept (WTA) for switchgrass production in terms of revenue per acre

Analytical Method

- We assume the utility of the potential producer remains the same in both contingent valuation (CV) states:

$$v(p, q^o, m+WTA) = v(p, q^1, m) \qquad (1)$$

- where q^o is the original acreage when the producer does not produce switchgrass.
- q^1 is the new acreage when the producer produces switchgrass.
- v is the indirect utility.
- m is the income of the producer
- p is the price of the private good

Methods

- Using Hanemann (1984) utility difference approach, we expressed (1) as:

$$v(m+WTA, z_i'\beta_o)+u_o = v(m, z_i'\beta_1)+ u_1 \qquad (2)$$

  - Where z_i' is a vector of independent variables.
  - β is the vector of coefficients to be estimated.
  - u_i (i = 0, 1) is the zero-mean error term.
- Following Alberini (1995), (2) is expressed as (3) below:

$$y_i^* = z_i'\beta + u_i \qquad (3)$$

  - where y_i^* is the producers' true WTA
- We assume y* is distributed normal and used maximum likelihood estimation approach to obtain the parameters, β.
- We calculated the mean WTA across all respondents using:

$$E(WTA/\alpha, \beta, \bar{\mathbf{Z}}) = [(\alpha/\sigma)/(\beta/\sigma)]\bar{\mathbf{Z}} \qquad (4)$$

  - where (α/σ) represents the normalized coefficient of the bid,
  - (β/σ) is the vector of normalized coefficients of the other covariates.
  - and $\bar{\mathbf{Z}}$ is the mean vector of the covariates

Survey Data

- The data were obtained from a contingent valuation survey mailed to 2500 potential switchgrass producers in the regions identified in figure 1, conducted for this study by USDA-NASS from October to December, 2014.
- One of three bids was assigned randomly to each respondent in each region.
- The bid levels and percentage of yes responses for each region are presented in table 1.
- The response rate was 54.36%

Survey Regions

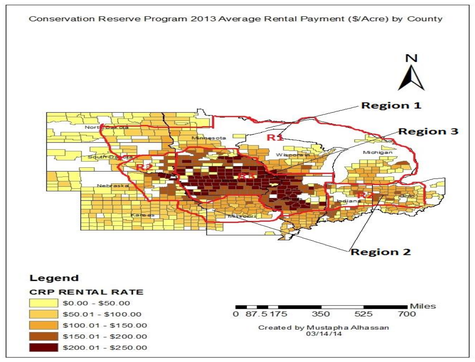

Figure 1. The survey regions

Results

Table 1. Bid Levels and % Yes Responses

	% of Yes Responses	
Bid ($/acre)	Produce	Lease
Region 1		
25	21	13
100	25	28
180	36	34
Region 2		
50	20	13
130	32	24
225	32	31
Region 3		
85	26	6
150	23	23
260	36	31

Table 2. Summary of analytical results

	Region 1	Region 2	Region 3
WTA to *produce* switchgrass for biomass:			
Mean WTA ($/acre)	**315**	**462**	**452**
Marginal effect of $1 bid on probability to accept	**0.0009****	**0.0006***	**0.0007**
Mean WTA to *lease* for switchgrass for biomass:			
Mean WTA ($/acre)	**258**	**384**	**355**
Marginal effect of $1 bid on probability to accept	**0.0014*****	**0.0009*****	**0.0013****

Estimated from equation (4) using STATA *probit* and *margins* commands. Coefficients for other variables not shown here.

***significant at 1% level, ** significant at 5% level, * significant at 10% level

Conclusions

- The mean WTA is higher than the 2013 CRP average rental rates in the regions.
- Mean WTA to *produce* is highest in the corn belt, lower in the fringes of the corn belt
- Mean WTA to *lease out production* is lower than WTA to produce, as expected.
- A $100/acre increase in bid value would increase the probability of acceptance by 6 to 14%.

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Contact Information

Mail Address: 303E Filley Hall, University of Nebraska - Lincoln, Lincoln, NE 68585

Email: malhassan@huskers.unl.edu

Phone: 402-617-0153