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# The Producers' Stake in the Bioeconomy: A Survey of Oklahoma Producers' Knowledge and Willingness to Grow Dedicated Biofuel Crops

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**Abstract:** The study reported here found that producers were familiar with the biofuel industry through mass media channels and were willing to convert cropland to energy crops. Producers were motivated by patriotic reasons, but overall profitability was the greater motive for converting cropland to dedicated biofuel crops such as switchgrass. Barriers to energy crop production were a lack of markets (biorefineries) and information about biofuel crop production. It is recommended that an educational campaign regarding biofuel crop production best practices, especially cellulosic crops (switchgrass) and marketing, be implemented. A statewide leadership campaign to attract biorefineries to the state is also recommended.

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## Introduction

Energy from biomass has the potential to revitalize rural America. Producers hold the keys to reducing America's dependence on fossil fuels, reducing carbon emissions, and expanding income through biofuels (Hettenhaus, 2006). These promises will only be realized if producers are able to grow, harvest, store, and transport biomass in a sustainable fashion and if the bioindustry infrastructure develops beyond its current capacity.

Oklahoma has been identified as an "ideal state" for bioenergy production (Tembo, Epplin, & Huhnke, 2003, p. 618); however, the bioenergy industry has not arrived in Oklahoma for a variety of reasons. According to Regan and Kenkel (2007), three ethanol plants (150 Million gallons total capacity) were under construction; however, the feedstock required exceeded Oklahoma's total feed grain production. In addition, biofuel wholesale prices would need to exceed \$3.50 per gallon for acreage currently planted to cotton, soybeans, alfalfa, hay, oats, peanuts, wheat, and rye to shift to energy crops such as corn, sorghum, and barley, and for conservation reserve program (CRP) and hay acreage to be planted to switchgrass for cellulosic ethanol.

It has also been hypothesized that marginal lands, including CRP land, could be converted to switchgrass production to provide feedstock for ethanol plants, reducing competition for land that is currently in production for food. However, Regan and Kenkel (2007) found that feed stock from cellulosic sources such as switchgrass would be planted on crop land, not marginal land such as CRP land, further competing with food and livestock feed supplies and adding to the global food crisis.

The study reported here sought to understand through survey methods how Oklahoma producers will stake their claim in the bioeconomy. The purpose of the study was to determine Oklahoma producers' knowledge, attitudes, and behaviors related to growing biofuel crops as well as to understand motives and barriers for growing biofuel crops such as switchgrass.

## Methods

Survey methods (Dillman, 2000) were used to determine Oklahoma producers' knowledge, attitudes, and behaviors toward biofuels and to collect data regarding producers' motives and barriers for participating in the bioeconomy. The 16-item survey identified nominal statistical information through yes/no and fill-in-the-blank questions.

The population for the study consisted of 6,870 Oklahoma producers who grew one or more of the following crops: cotton, soybeans, field corn, sorghum, or peanuts in 2006. A randomly stratified sample ( $n = 1,899$ ) based on the crop was drawn from the population ( $N = 6,870$ ).

The self-administered mailed questionnaire was developed according to Dillman's (2000) recommendations for survey design. The 16-item survey was checked for face, content, and construct validity by a panel of experts consisting of land-grant university faculty with expertise in entomology, plant pathology, and plant and soil science.

After human subject protections were secured from the Institutional Review Board, a packet was mailed to the sample consisting of a cover letter, the survey, and a postage-paid return envelope. One week later a reminder postcard was mailed. Four hundred seventy-one (471) of the 1,899 surveys were returned. Of the 471 returned surveys, 240 were from people who did not grow any of the five crops in 2006, leaving 224 valid surveys with usable data for a 12% response rate.

The data were cleaned by checking every 10th survey entered to verify accuracy of data entry. Columns were sorted by numbers to look for missing data. The data were analyzed using descriptive statistics in Microsoft Excel®. Non-response error was controlled by comparing late to early respondents (Lindner, Murphy, & Briers, 2001). The early respondents were those who returned surveys from February 12 to March 30, 2007, while the late respondents were those who returned surveys from March 31 to May 16, 2007. No significant differences were found using an independent sample t-test to check for equal variance between early and late responders ( $\alpha=0.05$ ); thus, the results of this study can be generalized to the population.

## Findings

Most producers (75%) were familiar with the biofuel industry, while 22% were not familiar. To understand how producers learned about the biofuel industry, they were asked to indicate their sources of information. Television and news media was the most frequently listed source, with newspapers following (Table 1). Other sources of information used to obtain biofuel industry information included farm magazines (27%), farm publications (15%), Internet (11%), and popular magazines (6%).

**Table 1.**  
Sources of Information Where Producers Learned About the Biofuel Industry

Source	Frequency (f)	Percent (%)
TV/news media	144	34
Newspaper	139	32
Other	58	13
Government source	53	12
Friends or family members	38	9
Total number of responses	432	100

Nineteen (8%) producers indicated that they grew crops for the biofuel industry, while 157 (92%) did not. Producers reported growing grain sorghum/milo, corn, soybeans, and canola for biofuels. Thirteen (6%) respondents noted that they used biofuels in their farm equipment or trucks.

Producers were asked if they would be interested in converting acreage currently used to grow cotton, soybeans, field corn, sorghum, or peanuts to crops that would be dedicated to biofuel, including switchgrass. One hundred and sixty-eight (75%) producers indicated that they would convert acreage from food to biofuel crop production, while 41 (18%) would not. One hundred and ninety (85%) producers indicated that they would grow crops dedicated to biofuels to decrease the nation's dependency on foreign oil, while 19 (9%) answered "no" to this question.

When asked if a tax incentive of 20 cents per gallon of fuel produced would motivate them to produce crops dedicated to biofuels, 87 producers (37%) marked "yes," while 76 (33%) indicated that they would produce crops for biofuels only if it was more profitable than other crops.

Producers who did not grow crops dedicated to biofuels were asked what was preventing them from doing so. The most frequently cited reasons were a lack of markets (38%), a lack of information about growing crops for biofuels (11%), and no tax or profit incentives for growing biofuel crops (10%) (Table 2).

**Table 2.**  
Barriers to Growing Crops for Biofuel

Response	Frequency (f)	Percent (%)
No markets in the area (biorefineries)	55	38
Not enough information/lack of knowledge about growing dedicated biofuel crops; such as switchgrass	16	11
No tax or profit incentive	14	10
Need feed for livestock	11	8

Cost of transportation to biofuel market	7	5
Drought/lack of water	5	3
No demand in my county yet	3	2
Will sell crop (corn) to ethanol plants in future	2	1
Other	32	22
Total number of responses	145	100

When asked "how much greater return per acre is required for you to remove land from CRP and plant it with a biofuel crop?" 148 producers (77%) noted that CRP did not apply to them, while 34 (18%) noted that \$20 or more per acre was necessary.

Forty-two (19%) producers indicated that they were willing to lease their farmland to commercial industries for biofuel crop production. One hundred and sixty-eight producers (75%) noted that they would attend a land-grant university educational program to learn more about biofuels. When asked if they were concerned with the competition of crops for livestock feed, food, and fuel, 127 (57%) said "yes."

One hundred fifty-one producers (67%) indicated that they were aware of the potential impact of the bioeconomy to Oklahoma, and 208 producers (93%) "would appreciate having an additional market option for the sale of [their] crops." One hundred and sixty-seven producers (75%) reported that they would raise crops for biofuels if there was a tax incentive.

## Conclusions and Recommendations

Agricultural producers are part of America's path to energy independence. If the United States is to realize its goal of energy independence through domestic energy production, including biofuels, wind, and nuclear power sources, the producer must grow feedstocks dedicated to biofuel production. The purpose of the study reported here was to determine Oklahoma producers' knowledge, attitudes, and willingness to grow dedicated biofuel crops such as switchgrass.

The adoption of an innovation (in this case, biofuel crops) can be explained by a five-stage model, the diffusion of innovations theory (Rogers, 2003). The potential adopter must move from the knowledge stage (learning about the innovation) to the persuasion stage (becoming convinced of the value of the innovation) to the decision stage (committing to adopting the innovation) to implementation (using the innovation), and finally to confirmation (accepting or rejecting the innovation).

The study documented that Oklahoma producers (75%) were familiar with the biofuel industry and noted that the two sources used most to learn about biofuels were TV/news media and newspapers. A few producers read about biofuels in farm magazines and publications as well as on the Internet. Mass media is an effective tool for communicating national priorities and new innovations. As most producers were aware (knowledge) of the biofuel initiative, the next step in the diffusion process is persuasion, or becoming convinced of the value of an innovation.

The majority of producers (75%) indicated they were interested in converting cropland for biofuel production, in part due to patriotism, but mostly to increase farm profitability. They have been persuaded to adopt the innovation. However, a barrier to adoption was a lack of knowledge about specific biofuel crop

production techniques and a lack of markets for biofuel crops. Producers desired more information about biofuel crop production and how to increase farm profitability by growing biofuel crops (decision stage).

Producers were willing to adopt biofuel crops if they had ready markets for their products. The weakness in the supply and value-added chain lay with the biorefinery industry, not the producers' willingness to adopt bioenergy crops. Government leadership is needed to motivate industry to locate in Oklahoma.

Other crops such as switchgrass (Hipple & Duffy, 2002) are suitable for biofuel crops, yet were not listed as crops grown by the respondents. Land-grant university sponsored events about switchgrass may increase awareness of the diversity of crops that can be grown for biofuels (Fortson, 2006).

The major barrier to increasing biofuel crop adoption in Oklahoma is a lack of markets or biorefineries. Confirmation (accepting or rejecting the innovation) rests on markets for crops. Producers may need to adopt a cluster of technologies, including cooperatives, to assist with increasing profitability of growing biofuel crops as well as to influence political and industry leaders of the importance of investing in the bioeconomy if Oklahoma is to realize its full potential as a bioenergy state.

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