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Factors affecting farmers' willingness to grow alternative biofuel feedstocks across Kansas

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ABSTRACT

Energy conservation has emerged as one of the biggest challenges of the world in the XXI century, and not different from many countries, the US has created plans and policies to stimulate renewable energy alternative. Among the important alternatives for energy conservation is the use of biomass energy. Despite these stimuli production predictions are not confident that production would achieve the planned target for the U.S. Consequently, the predictions raise questions about farmer's willingness to grow bioenergy crops or produce alternative cellulosic feedstocks. In other words, farmers and landholders may not be willing to grow bioenergy crops. With this concerns in mind, the study advances previous research about bioenergy production by evaluating farmer's and landholder's willingness to produce different varieties of biofuel feedstocks. To achieve our goals, we used a mail survey of Kansas farmers conducted from January to April of 2011. The survey contained questions related to how farmers make their land-use decisions covering a wide array of topics. Through this survey, we evaluate the effect of farm characteristics, farm management practices, farmer perceptions (such as risk aversion), physical variables (such as soil, weather, and the availability of water for irrigation) on farmers' willingness to produce value-added feedstocks (e.g., corn stover), dedicated annual bioenergy crops (e.g., energy sorghum), and dedicated perennial bioenergy crops (e.g., switchgrass) for biofuel production in Kansas, though the use of logistic regressions and marginal effects.

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1. Introduction

Renewable energy production has emerged as one of the significant challenges of the 21st century. Among the important options for renewable energy production is the production of biofuels using alternative cellulosic biomass feedstocks. Biomass resources include crop residues, herbaceous crops, and dedicated energy crops. In recent decades, bioenergy production has increased more broadly as a substitute for imported oil in nations with the objective of ensuring a secure supply of energy [1].

Not different from many countries, the United States has responded to its increasing dependency on imported oil by stimulating bioenergy production. Bioenergy is a small but growing fraction of total energy supply in the United States. Renewable energy represents 6.6% of the total U.S. energy consumption, with biomass energy sources among the most promising with a 45% share of renewable sources. However, only a small portion (about 10% of biomass resources) is used to produce biofuels [2]. Nevertheless, the production of biofuel has the potential to increase due to biofuels policies, regulations and incentives. In fact, numerous policies have been developed to stimulate renewable energy alternatives, such as biomass energy. For instance, the Energy Policy Act of 2005 created a Renewable Fuel Standard (RFS) that mandated minimum annual biofuel production levels for the U.S. In addition, in 2006 and 2007, the Advanced Energy Initiative (AEI) and the 20-in-10 Plan were introduced to overcome the United States dependence on oil and to promote the development of energy biotechnologies. In this context, the Energy Independence and Security Act of 2007, which is set to take effect in 2015, has the objective of increasing the production of advanced biofuels (from cellulosic sources) by 36 billion gallons by 2022. Despite this law, only 20,000 gallons of cellulosic was produced by late 2012 [3]. In response to this low level of production, the Environmental Protection Agency expects approximately 17 million gallons of cellulosic biofuel to be produced in 2014, significantly less than the original goal of 1.75 billion gallons [4].

In spite of these policies, the above prediction that cellulosic biofuel production will not increase as expected seems a paradox [5]. While biomass feedstock technology and production for biofuels have potential, especially in the Midwestern United States, several challenges must be overcome to realize the benefits. In particular, farmers and landholders may not be willing to grow bioenergy crops. Thus, in order to develop strategies and guidelines to stimulate bioenergy crop production, policy makers must have information about farmers' willingness to produce alterative biomass feedstocks [5] and [6].

With these concerns in mind, our study advances previous research by evaluating farmers' and landholder's willingness to produce different varieties of cellulosic biofuel feedstocks. However, it is important to note that the basic assumptions governing decision-making models of farm household behavior argue that farmers make decisions about production in relation to available human and natural resources; balance opportunities against constraints; and with consideration of uncertainty and risk. Nevertheless, existing studies are not comprehensive enough in analyzing all these factors due to a lack of data. Thus, taking this into consideration, this paper fills a gap in the literature by examining the effect of farm characteristics, farm management practices, farmer perceptions (such as risk aversion), physical variables (such as soil, weather, and the availability of water for irrigation) on farmers' willingness to produce value-added feedstocks (e.g., corn stover), dedicated annual bioenergy crops (e.g., energy sorghum), and dedicated perennial bioenergy crops (e.g., switchgrass) for biofuel production in Kansas.

2. Data collection and study method

2.1. Data collection

The data used for analysis in the paper was obtained from a mail survey of Kansas farmers conducted from January to April of 2011. The survey contained questions related to how farmers make their land-use decisions covering a wide array of topics. The survey asked respondents to address their goals in farming; participation in conservation programs; use of irrigation; willingness to grow biofuel crops; views related to price, yield, and weather risk; usage of insurance and marketing options; and characteristics of the farming operations.

After designing the initial draft of the survey, two focus groups were conducted in central and western Kansas in January 2011. The survey was redesigned and utilizing a database of over 23,000 Kansas farmers obtained from FarmMarket ID (a marketing technology company, www.FarmMarketID.com), a pilot study was drawn at the end of January 2011. The final survey consisted of an eight-page survey with 43 questions, leading to more than 400 distinct variables in the survey dataset.

The target population for the survey was all Kansas farmers operating 50 or more acres of arable land and over $10,000 in gross farm annual income in 2010. For the full mailing of the survey, we drew a random sample of 10,000 farmers from the FarmMarket ID database. A total of 2317 surveys with usable data were ultimately received with an overall response rate of approximately 25% after taking into account bad addresses and farmer retirements. Due to missing data (either from questions not answered or entry of an implausible value), 1984 surveys were usable for the analysis in this study.[1]

The dependent variables for the study are pulled from a question in the survey asking about biofuel feedstock production. The question first indicates that in the future there may be a market for cellulosic materials, such as corn stover or switchgrass, to produce ethanol. Then the respondent is asked if they would consider a number of different feedstocks on the farm. These feedstocks included: (i) crop residues such as corn stover; (ii) a perennial bioenergy crop such as switchgrass; and (iii) an annual bioenergy crop such as forage

[1] The response rate matches those for other similar agricultural farmer surveys that did not provide an incentive by the USDA – National Agricultural Statistics Service. In addition, an analysis of nonresponse was not possible as demographic or farm data was not available from nonrespondents to the survey.

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