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Identifying Farmers' Interest in Growing Switchgrass for Bioenergy in Southern Virginia

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Abstract: Several factors are generating interest in growing switchgrass for energy. To understand farmers' perspectives on possible switchgrass cultivation, Cooperative Extension conducted a survey in south-central and southwestern Virginia. The survey found that 66% of respondents had heard of using switchgrass for bioenergy, yet only 43% indicated they would be interested in cultivating switchgrass even if the enterprise were profitable. Reluctance to consider growing a potentially profitable crop is likely due to an underdeveloped market and lack of familiarity with switchgrass culture. The results indicate an important role for Extension in conveying technical information to producers as biofuel markets develop.

Introduction

Switchgrass is a native, warm-season, perennial grass with potential as a low-cost bioenergy feedstock (Kaylen, 2005; McLaughlin, Kiniry, Taliaferro, & Ugarte., 2006; Parrish & Fike, 2005). In the mid-1980s, agronomists from Virginia Tech proposed switchgrass as a benchmark energy crop to the US Department of Energy's (DOE) Herbaceous Energy Crops Program (HECP) (McLaughlin & Kszos, 2005). Switchgrass emerged from the 5-year, five-state HECP study as the most productive species across several sites including Virginia (Fike et al., 2006). As a result, DOE focused entirely on switchgrass for the next ten years of their herbaceous energy crop work (McLaughlin & Kszos, 2005).

Currently, most research on switchgrass for bioenergy purposes focuses on breeding, conversion technologies, and logistics (McLaughlin & Kszos, 2005; Fike, Parrish, Alwang, & Cundiff, 2007). A major component missing in developing biomass-based energy enterprises is an understanding of feedstock production from the farmers' perspective. The biofuel production systems rely upon conversion facilities, or "biorefineries" scattered across the countryside, with the land surrounding each facility providing biomass feedstock on a continuous, reliable basis (Fike et al., 2007).

Because of the economics (and energy costs) associated with biomass transportation, the land-base from which the feedstock would be drawn should be small (≤ 20 -mile radius). As much as half or more of the agricultural land within that radius might need to be dedicated to energy crop production on a long-term (≥ 5 years) contractual basis (Fike et al., 2007). This is a different model for most farmers, but necessary to guarantee a continuous supply of feedstock before investors might build a biorefinery. How willing might farmers be to enter into such arrangements? Could enough farmers within a suitable radius be found?

Work in Alabama (Bransby, 1998) and Tennessee (Jensen et al., 2007) has assessed farmer interest in the cultivation of switchgrass. However, no information has been collected in Virginia. The objective of the study reported here was to fill this gap and discover if there might be farmer-driven constraints to developing switchgrass-based energy cropping as a viable enterprise in Virginia. The reports and survey instruments used in Alabama and Tennessee studies served as valuable tools for the development of this work.

Methodology

A two-step approach was used. We first conducted two focus-group sessions with farmers in south-central and southwestern Virginia. Then, the focus-group information was refined to develop a survey instrument to be mailed to farmers throughout southern Virginia. This region of the state was selected due to the high percentage of tobacco farmers in the area who are seeking to transition into new crops.

Step One: Focus Groups

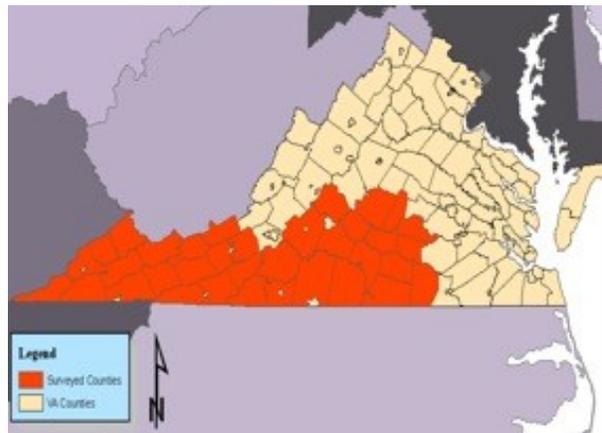
Two focus-group sessions, with a total of 10 hay producers and current or former tobacco producers, were conducted during July 2007 in Gretna and Keysville, Virginia. The sessions included: (1) a pre-survey of the participants' views, knowledge, and opinions on switchgrass-to-energy (Table 1); (2) a 15-minute presentation describing the basics of switchgrass agronomy (establishment, yields, fertilization, and management); (3) a 15-minute presentation on likely energy-cropping contracts and logistics (farm-gate-to-industry interface and contract scenarios); (4) open discussions to spur candid conversation; and (5) a post-survey to refine the mailed survey instrument.

Step Two: Development of a Mailed Survey Instrument

The results from the focus-group sessions were analyzed to condense, simplify, and clarify a mailed survey instrument. The final survey instrument was reduced to 21 items (Appendix). Items 1 to 9 were used to gauge farmers' interest in and capacity to grow switchgrass. Items 10 to 18 were designed to obtain information on specific farming practices. Items 19 to 21 provided socioeconomic demographics of respondents. Because our purpose here is to gauge farmers' overall interests in growing switchgrass, the analyses of respondents' farming practices and the socioeconomic demographics are not included in this article.

The mailed survey included a cover letter, the survey form, and a USDA fact sheet on switchgrass. The surveyed area including two distinct physiographic regions: the Piedmont of the "Southside" and the Ridge and Valley region of "Southwestern Virginia" (Figure 1). The mailing lists were created and managed by the Virginia Cooperative Extension (VCE) regional offices. A total 10,616 surveys were sent out on October 18-19, 2007. Each mailing included a preaddressed return envelope with prepaid barcode postage. Two weeks later, the entire mailing was repeated, with a reminder cover letter included in the survey packet.

Figure 1.
Switchgrass Survey Study Area



Completed surveys began arriving within one week of the first mailing and continued for 62 days when the survey was closed. In total, 618 surveys were returned. Survey responses were entered into an Access database and statistically analyzed through Microsoft's Excel.

Results

Focus Group Sessions

Responses by the ten participants in the pre-survey focus groups are listed in Table 1. Most of the participants had heard of switchgrass and were willing to grow switchgrass for bioenergy purposes. However, most participants did not feel ready to grow it, and several regarded governmental subsidy or other incentives as an important factor in their decision.

Table 1.
Focus Group Pre-survey Responses on Switchgrass

	Opinion Statement (1=Strongly Agree; 2=Agree; 3=No Opinion, 4=Disagree; 5=Strongly Disagree)	Average Response
1	I've heard of switchgrass and have an idea of what it looks like and used for	1.7
2	I'm interested in growing switchgrass	2.0
3	I'm interested in switchgrass for FORAGE purposes	2.1
4	I'm interested in switchgrass for WILDLIFE purposes	3.1
5	I'm interested in switchgrass for EROSION purposes	3.0
6	I'm interested in switchgrass for BIOENERGY purposes	2.2
7	I would consider signing long-term contracts (3-5 years) to grow switchgrass	2.5
8	Markets for switchgrass are NOT adequately developed for me to begin growing it	2.3
9	Our nation needs to produce more energy from biomass (like switchgrass) to become more energy independent	1.3
10	Switchgrass use in producing energy should be subsidized by the government	2.6

During the discussion, the common and recurring issues fell into four categories: 1) economics, 2) agronomics, 3) management, and 4) logistics. Producers compared estimated returns with their next best land use (cattle operations, row crops, Conservation Reserve Program, etc.) and discussed the pros and cons of signing long-term producer contracts with a biorefinery. Many farmers equated these contract scenarios with tobacco grower contracts, familiar to many producers in southern Virginia.

Several participants were aware of switchgrass' reputation for being difficult or slow to establish. They expressed concerns over the length of time required to develop a productive stand and the opportunity cost during this conversion period. Due to the wide variety of potential uses of switchgrass (forage, bioenergy, wildlife, riparian buffers, etc.), farmers were curious about how management strategies and practices would change with different objectives.

Participants expressed concern about farmers' relationship with a biorefinery. Many asked how far and how often they might need to haul switchgrass bales. Others were concerned whether a third party would need to collect the bales and, if so, what requirements would be needed to allow access to their fields (hardened surfaces and turn-around areas for large equipment, lighted staging areas, year-round access, 24-hour-a-day access, liability issues).

After the discussion, participants completed a 35-question post-survey and a "Participant Feedback" form to provide comments about the upcoming mail survey. The focus group participants were encouraged to identify proposed survey questions they felt too personal or otherwise inappropriate. As might be expected, most comments focused on the financial returns of switchgrass cultivation. One producer said: "I think that

farmers in this area will be willing to look at any farming enterprise that will create a large enough net farm profit; biomass will not be any different."

Mailed Survey

Survey Items Indicating Farmer Interest in and Capacity to Produce Switchgrass

Table 2 summarizes survey data relating to farmers' interest in and capacity to grow switchgrass. Almost 90% of the respondents to the mailed survey currently farmed, while the others were retired or landowners with idle or rented land. Two-thirds of the respondents had previously heard of switchgrass as a crop for energy production.

Table 2.

Responses to Mail Survey Items That Indicate Farmers' Level of Interest in and Capacity to Produce Switchgrass. (n=618)

Currently farm	89%
Heard of switchgrass for bioenergy	66%
Interested in cultivating switchgrass if profitable	Yes 43%; No 28%; Don't know 25%
Minimum net profit needed to grow switchgrass - Average (\$/acre/year)	\$454
Minimum net profit needed to grow switchgrass - Response range (\$/acre/year)	\$ 0 - 4,500
Response rate to question about profit needed	36%
Acreage that might be convert to switchgrass, if profitable	66 acres

When asked if they would be interested in growing switchgrass if it were profitable, 43% of respondents indicated they would be interested, while 28% percent would not, 25% were undecided, and 4% provided no response. For the minimum net profit (\$/acre/yr) needed to grow switchgrass, 36% of the respondents provided a value, 7% fewer than the 43% who indicated they would grow switchgrass. Among the respondents who provided a value, the average number was \$454/ac/yr. However, these values varied widely from a maximum \$4,500 to a minimum of \$0, with a standard deviation of \$587 and median of \$300. This wide range is likely due to the survey instrument lacking a common system for computing profit and unknowns associated with bioenergy feedstock production.

Considering a wide range of response, we further processed the data by taking a subsample of the responses within one standard deviation from the original sample and calculated a revised average desired return of \$339, a median value of \$250, and a standard deviation of \$270. Finally, the respondents who were interested in growing switchgrass indicated they would consider converting an average of 66 acres, for a total of 18,430 acres. In 2006, those 618 farmers managed a total of 184,483 acres.

Survey Items Characterizing Potential Constraints and Incentives for Switchgrass Cultivation

In item 8 of the mailed survey, farmers responded to 10 qualitative opinion statements characterizing factors that might affect their decision to grow switchgrass for bioenergy. Table 3 summarizes the responses.

Table 3.

Farmers' Perceived Constraints or Incentives for Growing Switchgrass (1=Strongly agree, 2= Agree; 3=No opinion, 4=Disagree; 5=Strongly disagree)

Statement	Average Response
Currently, I do not know enough about the cultivation of switchgrass to consider it as a future option on my land	2.3
The planting period for switchgrass will conflict with the planting period for my other crops	3.3
The harvesting period for switchgrass will conflict with the harvesting period for my other crops	3.3
Markets for switchgrass are NOT developed enough to attract my interest	2.4
Production risk for switchgrass is lower than the other crops I produce	2.9
I would consider signing a long-term contract (around 5 years) with a company to grow switchgrass for energy	2.9
I need technical assistance to learn how to grow and harvest switchgrass	2.0
Our nation needs to produce more energy from biomass (like switchgrass) to become more energy independent	1.8
I would like to provide more habitat for native wildlife on my land	2.5
I would need government payments to produce switchgrass	2.6

Discussion

It is important to note the response rate for the mailed survey was 5.8 %. We do not propose to extrapolate the information from the 618 returned surveys to characterize the views of all farmers throughout the entire survey region. However, these 618 respondents provide insight into the views of these farmers who evaluated the feasibility of switchgrass cultivation on their land.

In the mailed survey, the response to the question "If profitable, would you be interested in growing switchgrass?" was surprising, with only 43% of the respondents indicating they definitely would. Why would the remaining 57% of respondents be negative or uncertain about growing a crop that promised to earn them a profit? One supposes that entrepreneurs would be quite open to a hypothetical profit-making venture.

The results in the "opinion statements" (Table 3) may explain why producers seem reluctant to adopt what was being proposed as a profitable crop. For example, farmers generally agreed with the statement that "Currently, I do not know enough about the cultivation of switchgrass to consider it as a future option on my land" and expressed uncertainty about its culture and management (Table 3). Although farmers were in favor of developing greater energy self-sufficiency and appreciated that growing switchgrass could provide other benefits such as wildlife habitat, they did not feel knowledgeable enough to grow switchgrass. Their relative unfamiliarity with switchgrass cultivation and the start-up nature of the biomass-to-energy industry create uncertainties (and thus, a risk) in the eyes of many producers. We believe this is why 57% of responding farmers were either negative or uncertain about growing a crop that might promise to earn them a profit.

Furthermore, some farmers who perceived switchgrass cultivation as risky but expressed an interest in growing switchgrass likely chose to mitigate their risk by increasing their potential reward and responded with an average desired net profit of \$454/acre/year. Some farmers who are experienced at managing hay land would likely opt for biomass production if or when it proves to generate greater net returns for their operation.

With the caveat that our survey is limited in its application and implications, it is still important to note that the respondents collectively indicated they would allocate only about 10% of the land they controlled (~18,000 of ~180,000 acres) to switchgrass production. To the extent that it might be truly representative, that level of buy-in to energy cropping will not provide the acreages (or feedstock) needed within a small enough radius for investors to build biorefineries (Fike et al., 2007). And without the conversion facilities, it is not likely that markets for biomass will develop. It is an obvious chicken-and-egg conundrum we feel VCE can help address.

Conclusion and Implication

The study suggests that more than 40% of the farmers who responded to our survey would be interested in growing switchgrass if it were profitable. However, the relative newness of switchgrass cultivation and the emerging bioenergy industry likely creates uncertainties in the eyes of many producers, and often this uncertainty equates to risk. A variety of factors could contribute to farmers' reluctance to adopt a new and potentially profitable crop, including lack of a local market, previous poor experiences with new crops, high investment in current production systems, and unfamiliarity with the cropping system. The results indicate Cooperative Extension can play an important role in the biofuel arena by providing technical assistance and educational outreach to increase farmers' familiarity with a range of matters. A greater shift in farmers' willingness to grow energy crops could likely occur when producer contracts are offered locally at prices that justify this use of their land.

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APPENDIX: Mailed Survey Instrument

1. Do you currently farm?

Yes <input type="checkbox"/>	No <input type="checkbox"/>
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2. What county is most of your land located in? _____

3. Before this survey, have you heard of growing switchgrass as a crop for energy production?

Yes <input type="checkbox"/>	Don't Know <input type="checkbox"/>	No <input type="checkbox"/>
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4. If profitable, would you be interested in growing switchgrass?

Yes <input type="checkbox"/>	Don't Know <input type="checkbox"/>	No <input type="checkbox"/>	#8)
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5. What is the minimum NET PROFIT per acre needed to interest you in growing switchgrass? \$ _____
 _____ Acre

6. If you could get the return you wrote in question #5, how many acres of switchgrass would you consider planting? _____ Acres

7. Please list what is produced on the land you might consider converting into switchgrass and the acreage.

	Current Use (Type of Crop, Pasture, Fallow, etc.)	# Acres
<i>Example</i>	<i>Pasture</i>	<i>17</i>
A		
B		
C		
D		

8. Please circle your response to each statement below....

Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
Currently, I do NOT know enough about the cultivation of switchgrass to consider it as a future option on my land	1	2	3	4	5
The planting period for switchgrass will conflict with the planting period for my other crops	1	2	3	4	5
The harvesting period for switchgrass will conflict with the harvesting period for my other crops	1	2	3	4	5
Markets for switchgrass are NOT developed enough to attract my interest	1	2	3	4	5
Production risk for switchgrass is lower than the other crops I produce	1	2	3	4	5
I would consider signing a long-term contract (around 5 years) with a company to grow switchgrass for energy	1	2	3	4	5
I would need technical assistance to learn how to grow and harvest switchgrass	1	2	3	4	5
Our nation needs to produce more energy from biomass (like switchgrass) to become more energy independent	1	2	3	4	5
I would like to provide more habitat for native wildlife on my land	1	2	3	4	5
I would need government payments to produce switchgrass	1	2	3	4	5

9. How many acres did you farm in 2006?
 _____ Acres Owned
 _____ Acres Rented
 _____ Acres Other (Please describe: _____)
)

