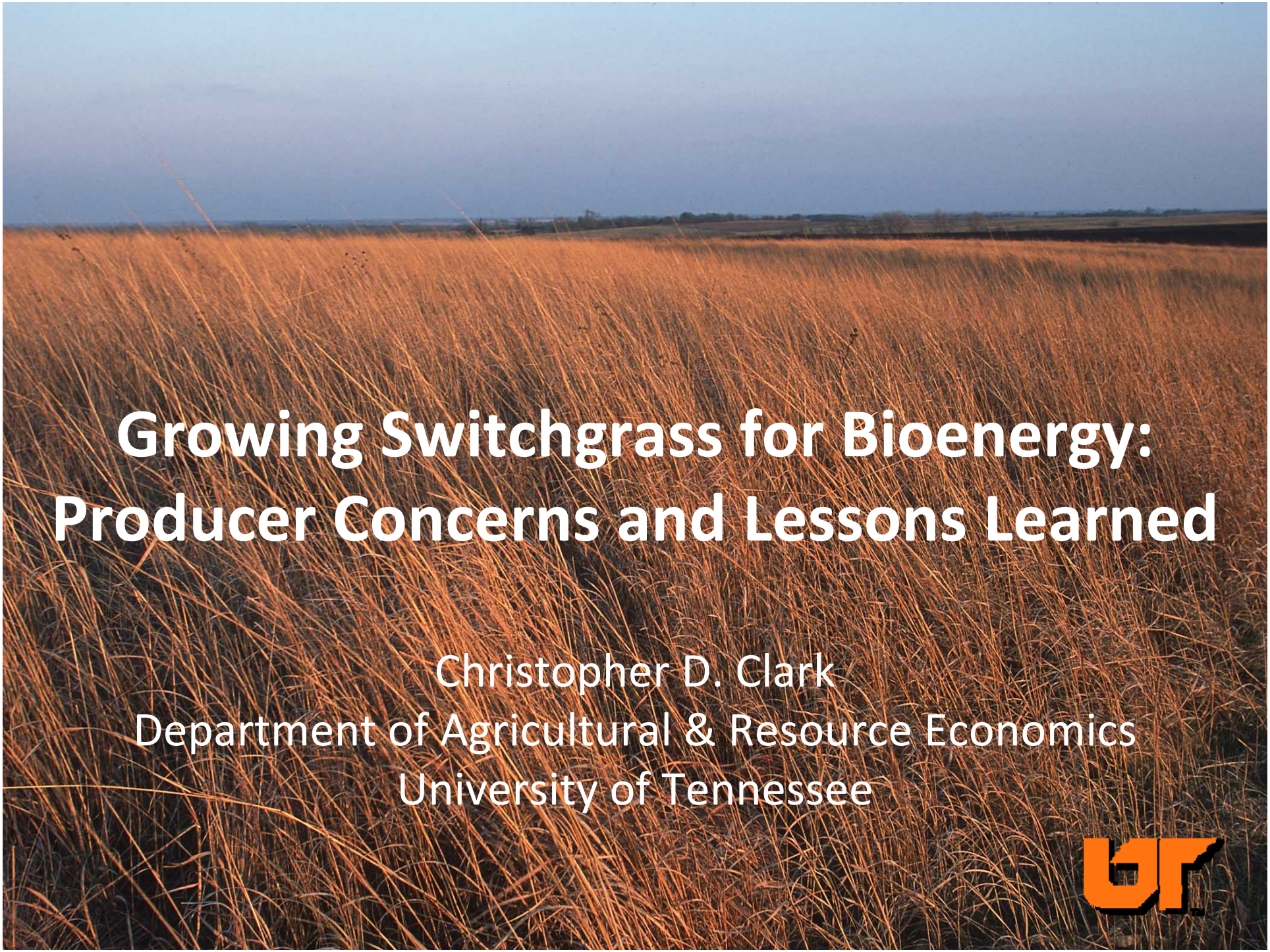

Growing Switchgrass for Bioenergy: Producer Concerns and Lessons Learned

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Projects

- *UT Switchgrass Project*
  - Funding: U.S. Department of Energy
  - Contracted with 10 farmers in West Tennessee to grow 92 acres of switchgrass (Spring 2005)
  - Mail survey of 3,500 Tennessee producers on perceptions of, and willingness to grow, switchgrass (Spring 2005)
  - The “West Tennessee” project

Contract Bidding in West Tennessee

- Divided into *cost* and *non-cost bid*
  - *Non-cost bid* designed to determine suitability for switchgrass production including range of acres willing to devote to switchgrass production
  - *Cost bid* divided into per acre and per ton payments
- Bidders informed that
  - Low cost bids would be favored, but cost alone would not be determinative
  - Total costs would be determined by assuming a yield of 5.5 tons per acre over life of the contract (4 years)
  - Ideal was to have 10 producers with 10 acres each

Table 2. Tennessee Farmer Bids to Produce, Harvest, and Collect Switchgrass

Bidder[a]	Minimum Acres	Maximum Acres	Base Bid ($/acre)	Incentive Bid ($/ton)	Total per Acre Bid (5.5 t/a)	Total per Acre Bid (7 t/a)	Average Bid per Ton[b] (5.5 t/a)	Average Bid per Ton[b] (7 t/a)	Acres Awarded
1	70	100	$200.00	$7.50	$241	$253	$43.86	$36.07	0
2	10	20	$250.00	$0.00	$250	$250	$45.45	$35.71	15
3	8	15	$225.00	$20.00	$335	$365	$60.91	$52.14	15
4	10	50	$200.00	$30.00	$365	$410	$66.36	$58.57	30
5	12	30	$250.00	$25.00	$388	$425	$70.45	$60.71	12
6	20	100	$255.05	$25.00	$393	$430	$71.37	$61.44	20
7	10	50	$250.00	$30.00	$415	$460	$75.45	$65.71	0
8	10	20	$255.34	$30.00	$420	$465	$76.43	$66.48	0
9	16	16	$200.00	$50.00	$475	$550	$86.36	$78.57	0
10	10	15	$62.00	$110.00	$667	$832	$121.27	$118.86	0
11	10	20	$900.00	$30.00	$1,065	$1,110	$193.64	$158.57	0

[a] Farmers whose bids were accepted were contracted to seed switchgrass, fertilize, control weeds, harvest once per year, and collect harvested bales. Seed was provided and farmers were required to load but not transport the bales off the farm.

[b] Weighted-average of the accepted bids is $63.69 assuming an actual yield of 5.5 tons per acre and $54.70 assuming an actual yield of seven tons per acre.

Projects

- *Cellulosic to Biofuels Market Development: Producers' Feedstock Production and Consumers' Willingness to Pay for Cellulosic Ethanol*
  - Funding: U.S. Department of Agriculture (NRI)
  - National online survey of 1,010 fuel consumers on perceptions of, and preferences for, ethanol and ethanol feedstocks (Spring 2009)
  - Mail survey of 3,000 Southern producers on perceptions of, and willingness to produce, switchgrass (Fall 2009)

Projects

- *UT Biofuels Initiative*
  - Funding: State of Tennessee
  - Contracted with 61 farmers in East Tennessee to grow 5,100 acres of switchgrass (2008, 2009, 2010)
  - The “East Tennessee” project

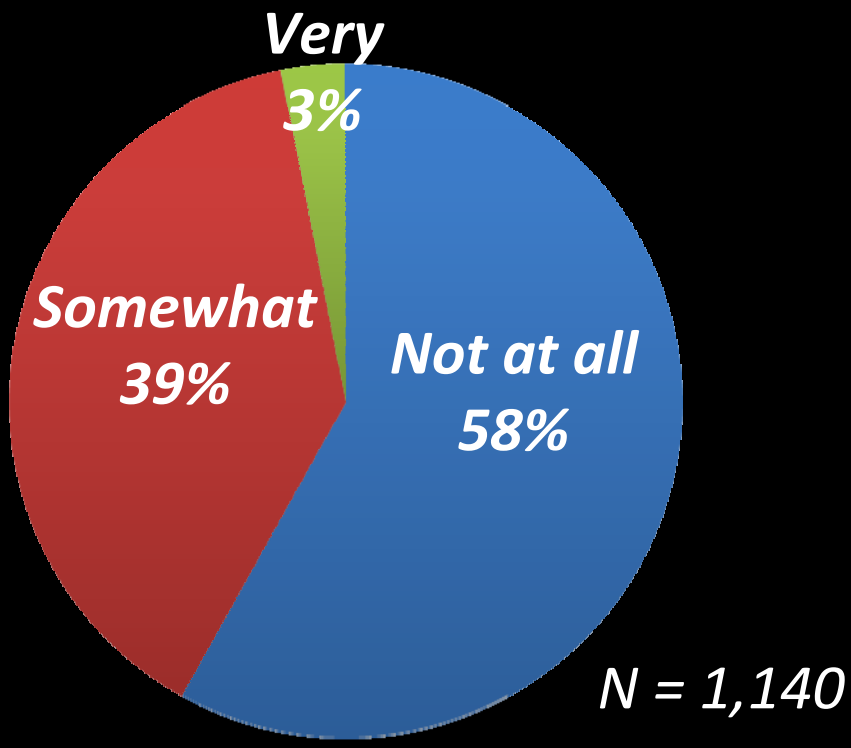
Two Perspectives on Producer Concerns

- 2005 and 2009 producer surveys
  - Concerns of prospective producers
  - How these concerns influence interest in growing switchgrass
- Experiences with bidding, contracting and production processes
  - Extension personnel on producer concerns
- Some lessons learned

Producer Concerns

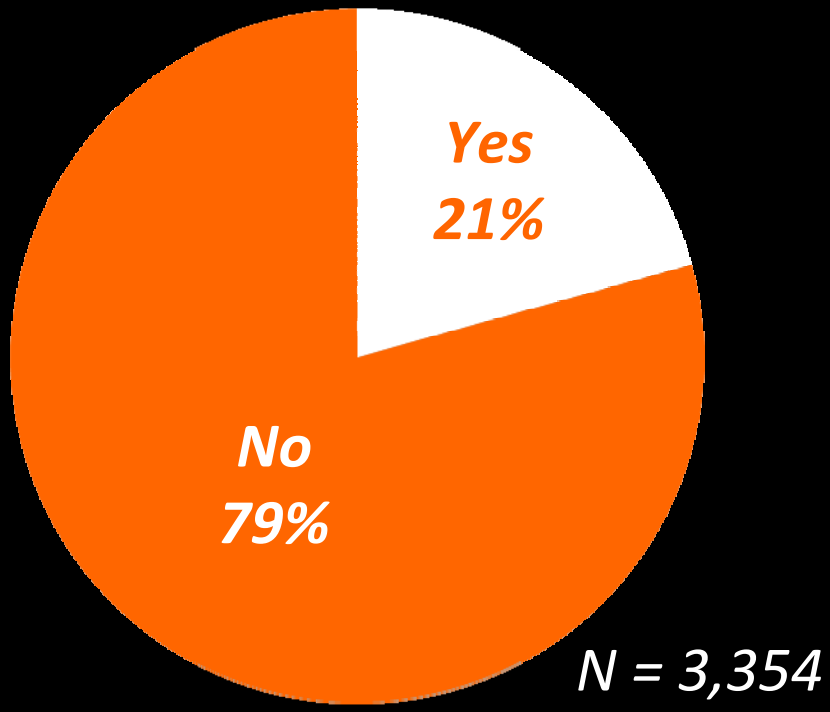
- Unfamiliarity with crop
- Opportunity costs
- Undeveloped market/industry
- Lengthy establishment period
- Yield measurements

How familiar are you with switchgrass as a crop to be used in energy production?



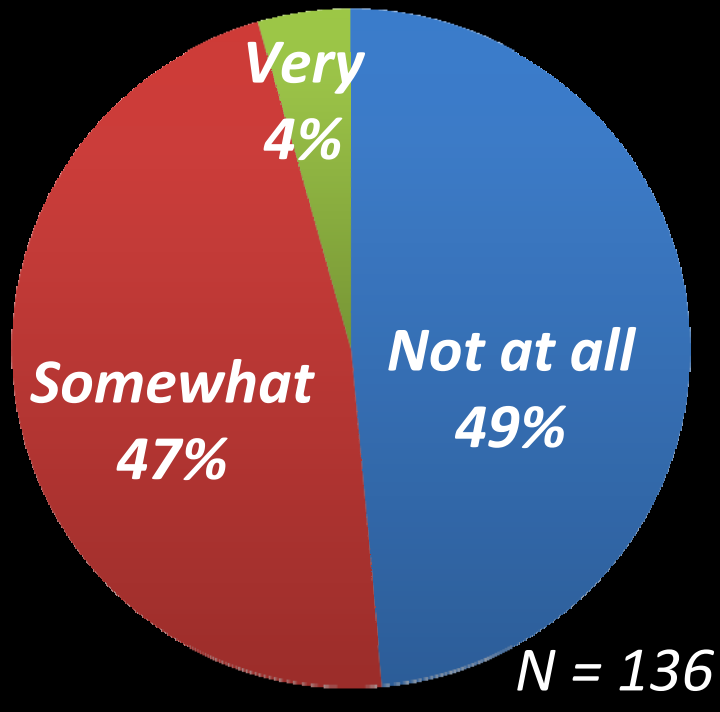
Source: 2009 Survey of Southern Producers

Have you heard of growing switchgrass as crop to be used in energy production?



Source: 2005 Survey of Tennessee Producers

How familiar are you with switchgrass as a crop to be used in energy production?



Source: 2009 Survey of Southern Producers (TN only)

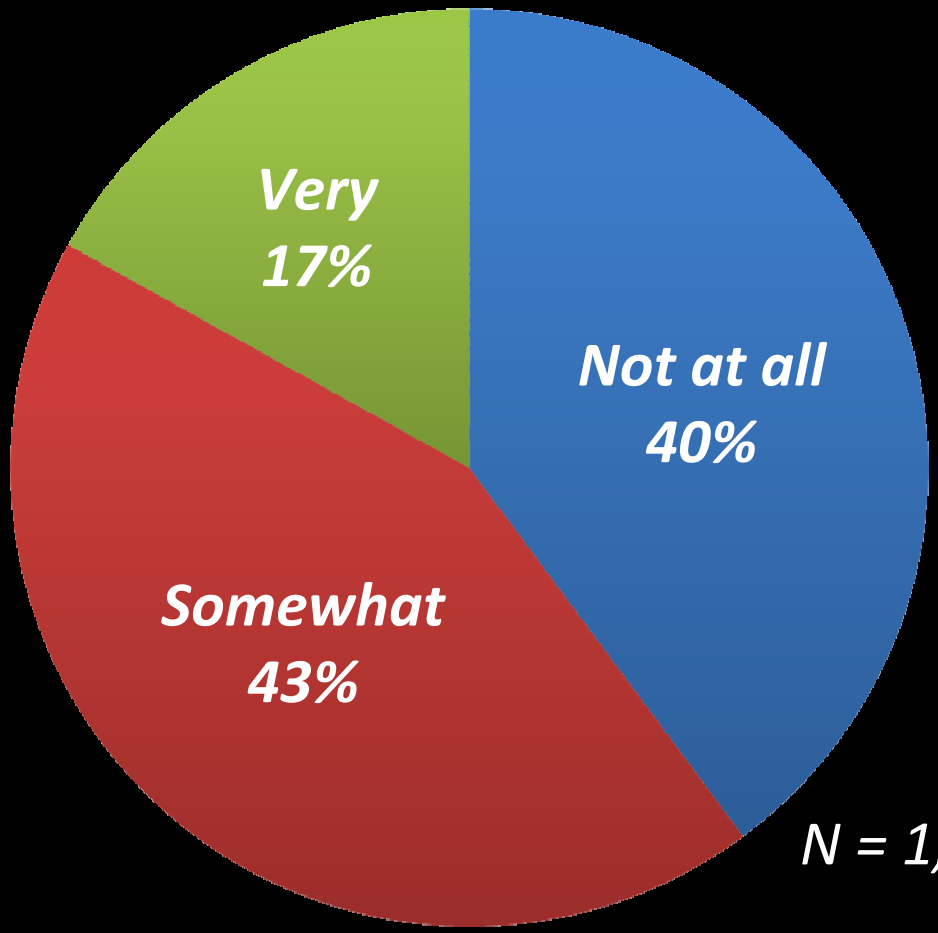
Unfamiliarity with Crop

- Suitability of physical capital
  - Land
    - Yields?
  - Equipment
    - New or different? Modification? Wear and tear?
- Necessary investment in human capital
  - Balanced with lower labor requirements over the long run?

Unfamiliarity with Crop

- Some lessons learned
  - Effective (and ineffective) production practices and cost of growing switchgrass in Tennessee
  - West TN project proved to be valuable as a demonstration for producers interested in participating in East TN project
  - “While switchgrass can be grown on marginal lands it cannot always be commercially harvested from marginal lands.”
  - “Harvest costs can be quite sensitive to field configuration and size, along with availability of adequate space for loading.”

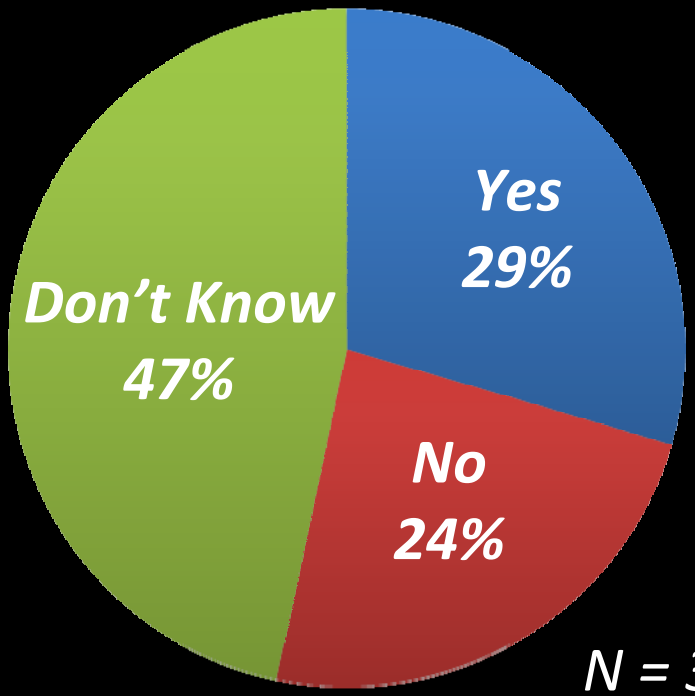
Interested in growing switchgrass as a crop for energy production?



N = 1,252

Source: 2009 Survey of Southern Producers

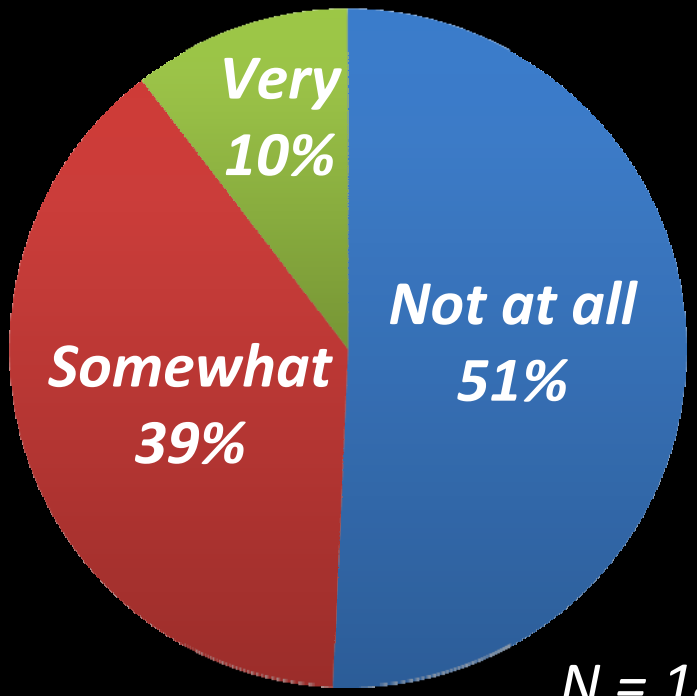
If profitable, would you be interested in growing switchgrass?



N = 3,244

Source: 2005 Survey of Tennessee Producers

How interested are you in growing switchgrass as a crop to be used for energy production?

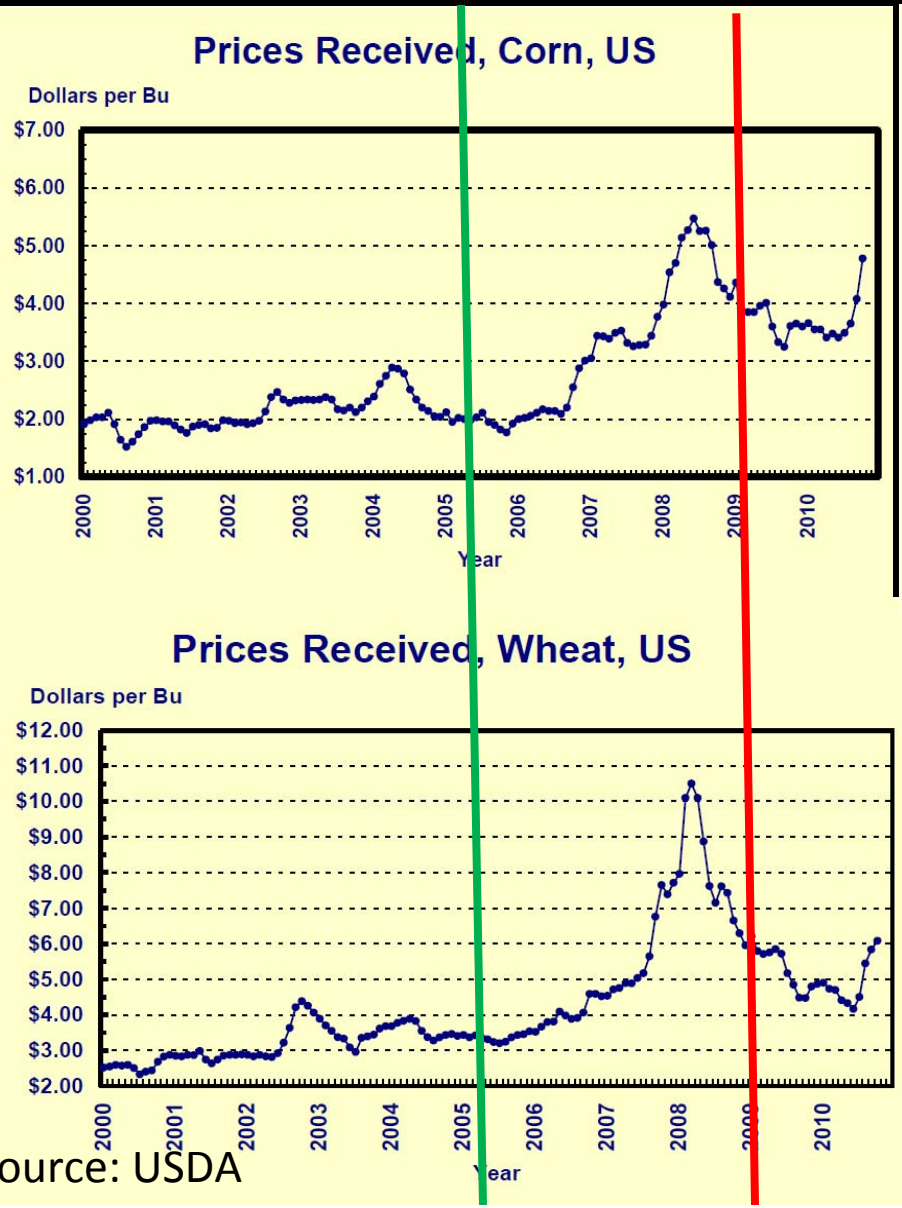


N = 144

Source: 2009 Survey of Southern Producers (TN only)

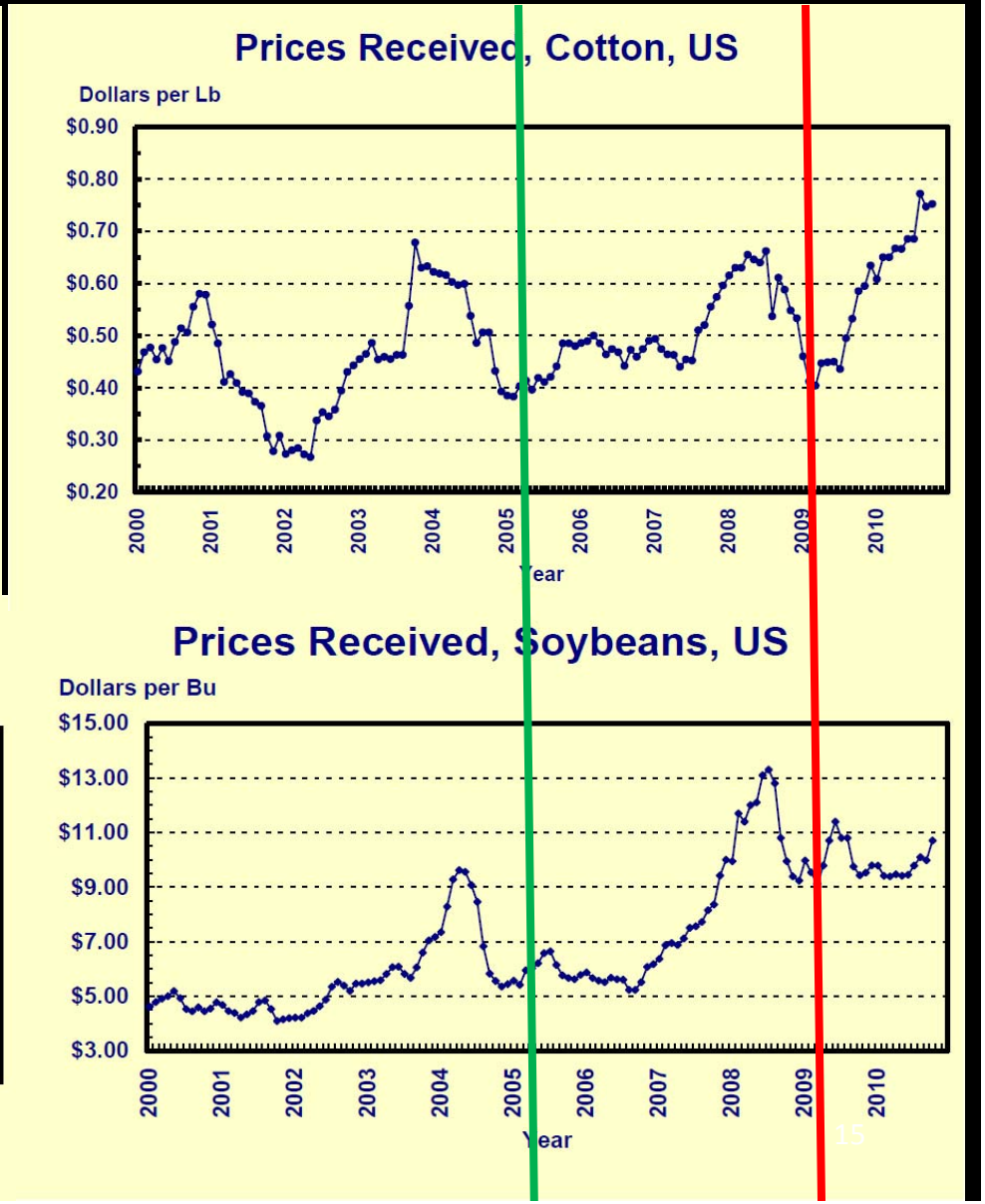
First Survey

Second Survey

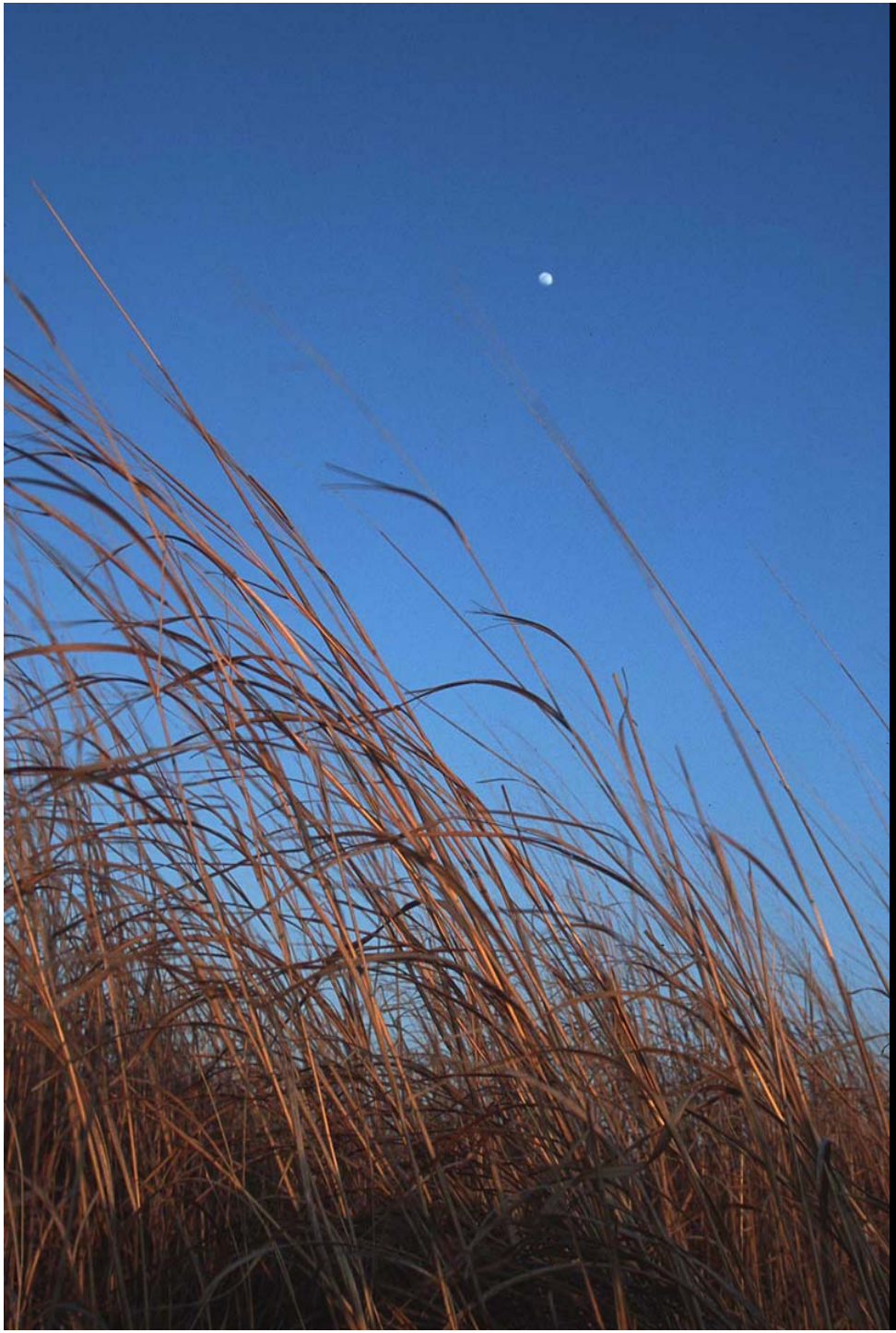


First Survey

Second Survey



Source: USDA



Opportunity Costs

- Perennial nature of switchgrass means that producer's key resource (land) will be tied up for an extended period of time
- Limits ability of producers to respond to or take advantage of price changes

UT Biofuels Initiative

Contract Starting Date	Number of Producers	Acres	Fields	Payment Terms
2008	16	723	49	$450/acre
2009	24 new 11 repeat 35 total	1890	150	$450/acre
2010	21 new 18 repeat 39 total	2487	199	Yr 1: $450/acre + $0/ton Yr 2: $250/acre + $40/ton Yr 3: $150/acre + $50/ton
Totals	61	5100	320	

Comparison

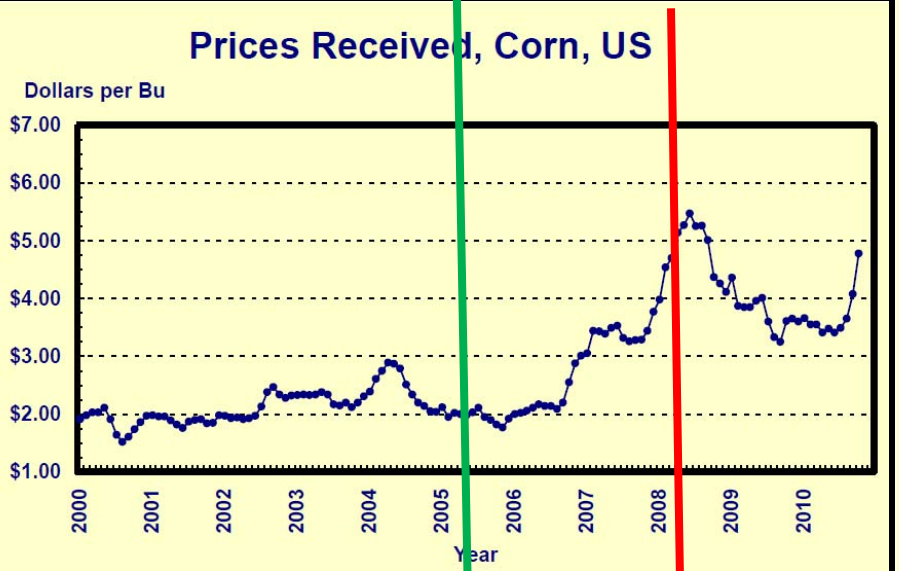
Project	Year	Per Acre Payment	Per Ton Payment	Price per Ton*
West Tennessee	2005	$230.72**	$21.74**	$71.09**
East Tennessee	2008, 2009	$450	$0	$115.38
	2010	YR1: $450 YR2: $250 YR3: $150	$0 $40 $50	$112.31

* Yield is assumed to be 1.6, 4.1, 6.0 and 7.0 tons per acre for years 1 – 4. These numbers are high because establishment costs are only being prorated over 3 or 4 years.
** Weighted average of accepted bids.

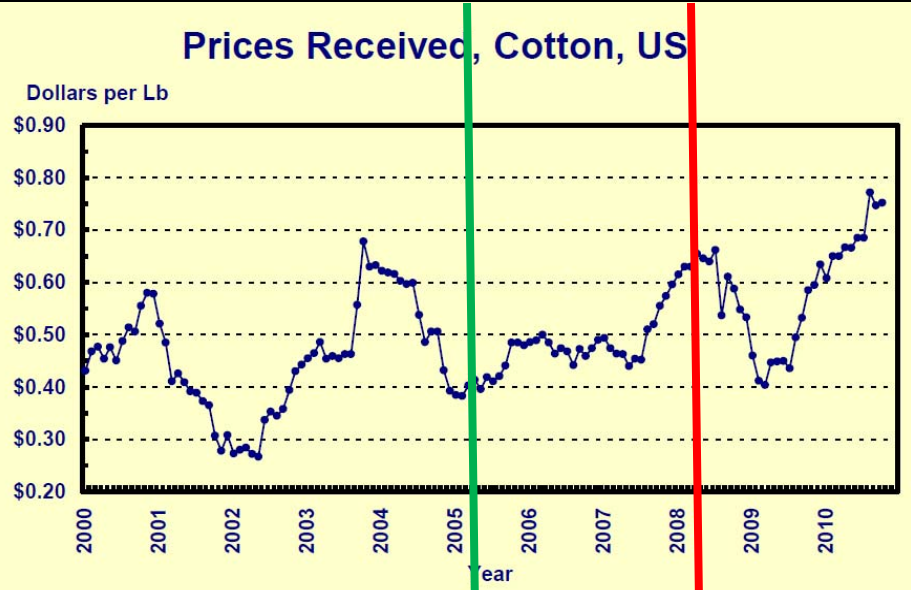
Some possible explanations for the differences in prices. . .

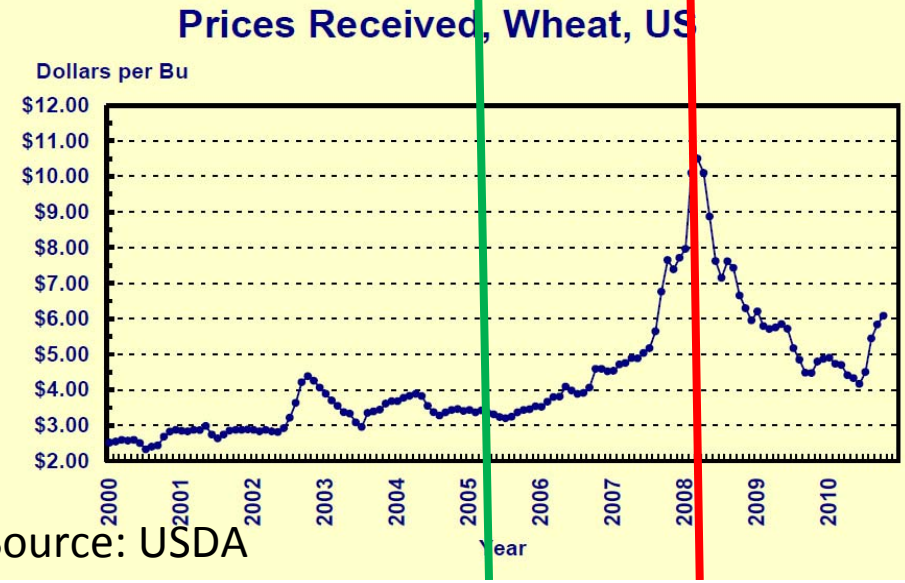
- Procurement: Bidding vs. single price
- Payment: per acre & per ton vs. per acre only
- Contract length: 3 vs. 4 years
- Acreage limitations in West Tennessee
- Knowledge and experience gained over time
- Opportunity costs (i.e., change in crop prices)

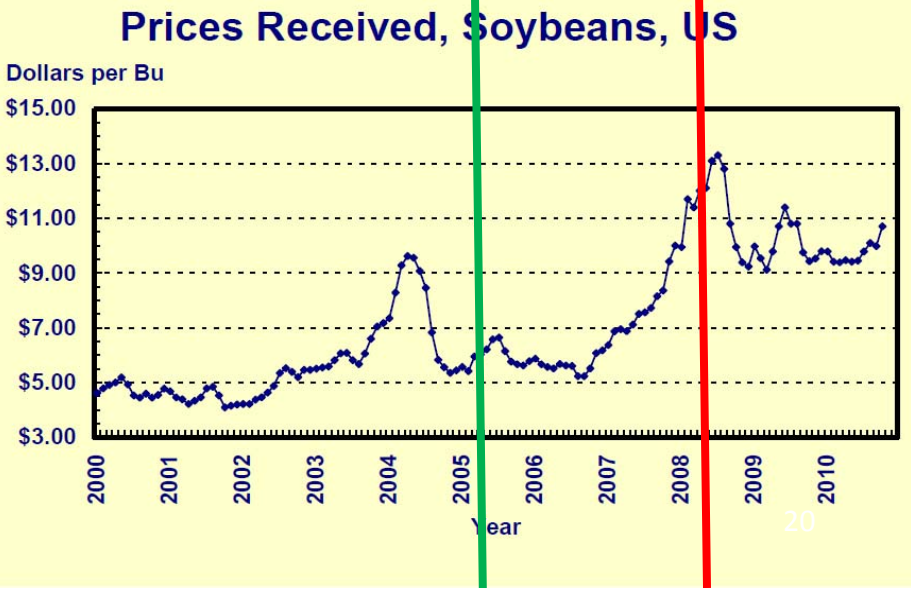
West TN East TN



West TN East TN

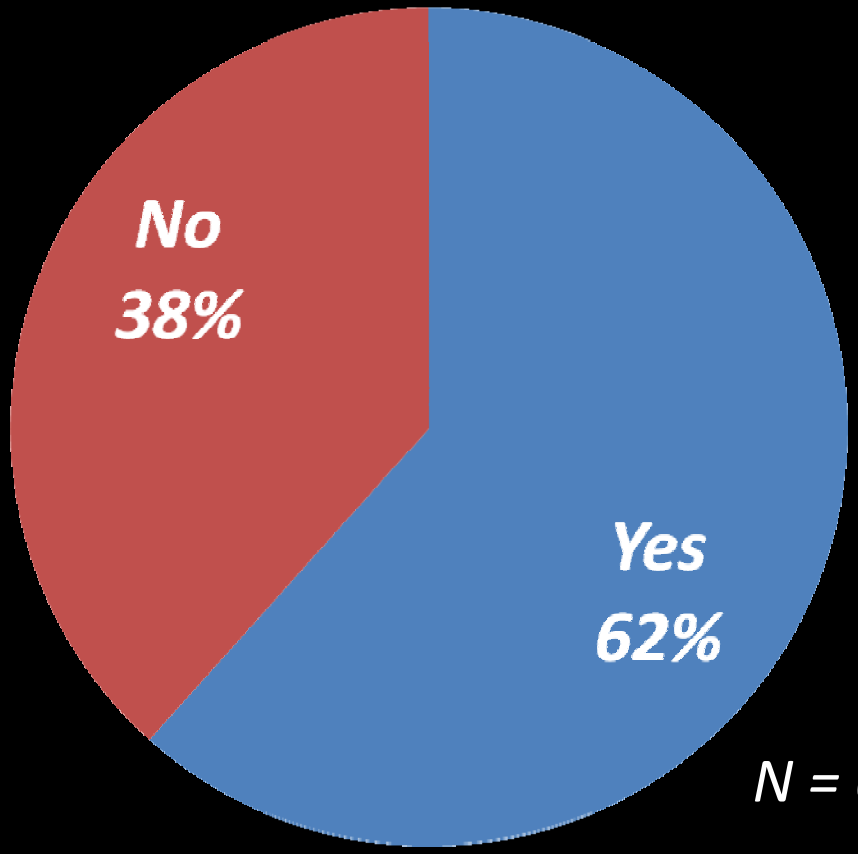






Source: USDA

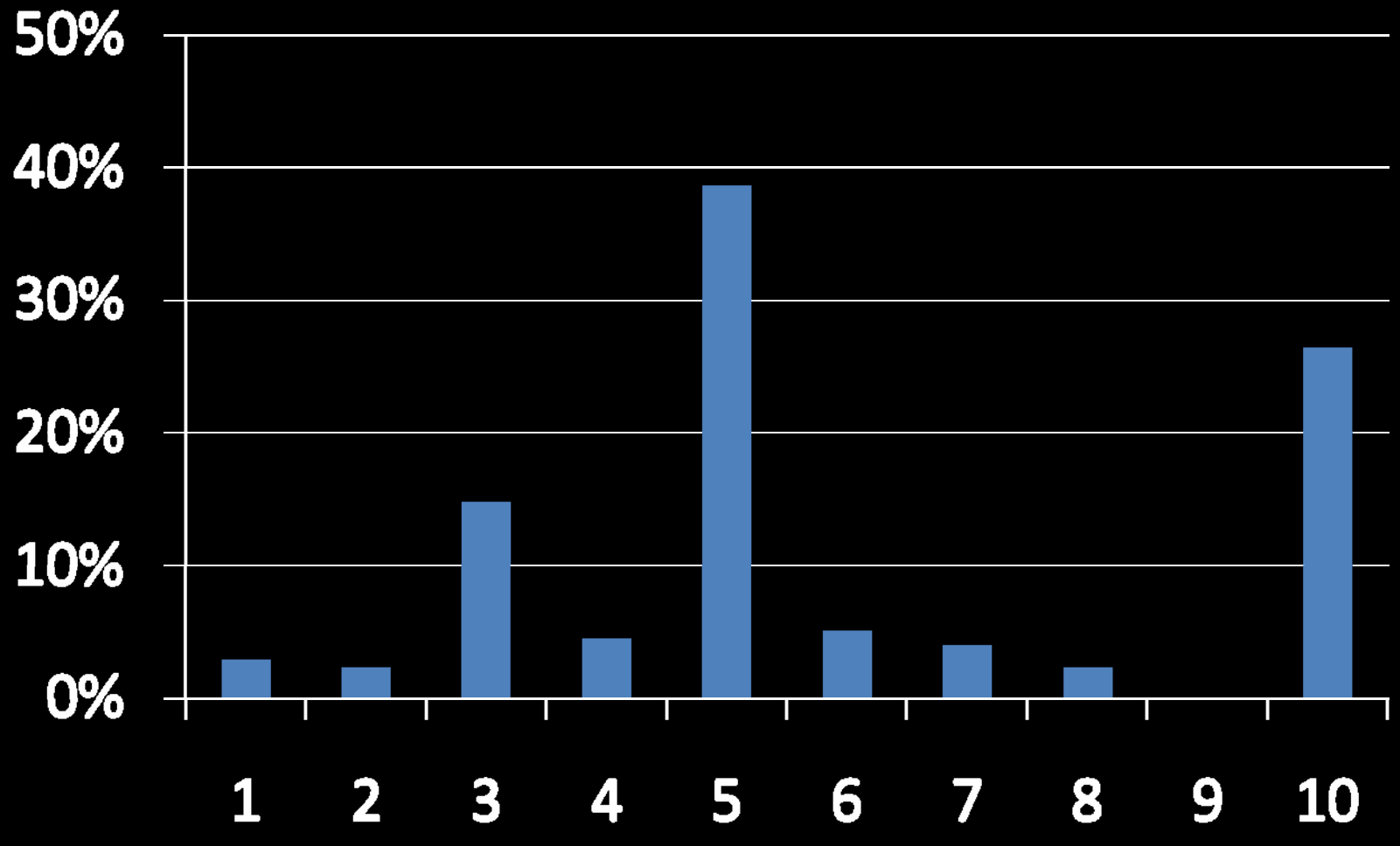
Would you prefer to grow switchgrass under a contract?



N = 680

Source: 2009 Survey of Southern Producers

And the contract length would need to be ____ years



Source: 2009 Survey of Southern Producers

Undeveloped Market

- Uncertain demand for cellulosic ethanol
  - Volatility of energy markets
  - Dependent on governmental policies

Undeveloped Market

- Uncertain demand for crop
  - Which feedstocks?
  - Which varieties?
  - Effects of rapid technological progress in conversion technology and/or varietal improvement

Undeveloped Market

- Infrastructural inadequacies
  - "The infrastructure for production, harvest, storage, transportation and price risk management of corn grain is well-developed; for switchgrass it is virtually nonexistent." (Epplin et al., 2007)

Undeveloped Market

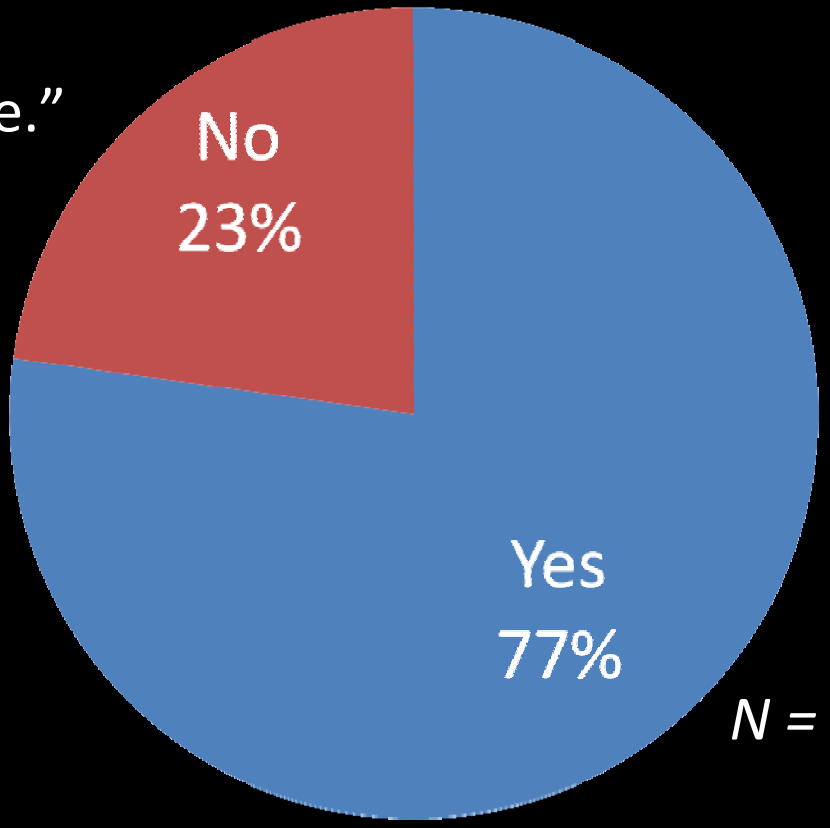
- Uncertain market structure
  - Contract? Spot market? Leased lands? Owned lands?
  - "Switchgrass may be too easy to grow."
    - Returns may not adequately reward producers with high levels of managerial ability
    - Land rich, but limited resource (e.g., part time or retiring farmers) may have comparative advantage

Undeveloped Market – lessons learned

- Producer enrollment
  - Importance of building trust
- Transportation
  - “Farmers and truckers rarely arrive at the same place at the same time. And when they do, an argument often ensues.”
- Cooperatives
  - “Some producers view the invitation to invest in a switchgrass cooperative like an invitation to invest in a chicken house.”

Would you be interested in participating in a cooperative that harvests, transports, stores, and markets switchgrass?

"I don't like people."



N = 693

Source: 2009 Survey of Southern Producers

Establishment Period

- Length between planting and mature yields
  - Financial concern that can be addressed with contract?
- Risk of failure
  - Difficulty controlling weeds

Importance to decision to grow switchgrass (1 = not at all … 5 = extremely)

On-Farm Factors	Mean	N
Profitability compared to alternatives	3.53	1,133
Market not developed enough yet	3.49	1,135
Lower fertilizer and herbicide applications	3.48	1,125
Ability to use as feed for livestock	3.34	1,131
Lengthy establishment period	3.33	1,130
Necessary financial and equipment resources	3.27	1,130
Provide habitat for native wildlife	3.00	1,131
Diversify farming operation	2.93	1,125
Knowledge about growing switchgrass	2.92	1,134
Reduce erosion on farm	2.72	1,132
Whether qualify for CRP payments	2.66	1,132
Possibility that will retire in a few years	2.46	1,146
Planting/harvesting conflicts with other crops	2.43	1,122
Growing perennial on leased land	2.13	1,114

Source: 2009 Survey of Southern Producers

Concerns with Yield Measurements

- Problems associated with different weighing and transportation schedules
  - In-field weighing and measuring for moisture content

Discussion

- Short run or transitional vs. long run or enduring concern
  - What we know
  - From a policy perspective, which is more important in a “start-up” industry?
- “Switchgrass is not grown in a laboratory and it won’t be harvested, transported or pre-processed in one either.”

Additional Information

- Clark, C.D., B. English, and C. Garland, 2007. "Competitive Bidding as a Means of Extracting Farmer Willingness-to-Grow an Alternative Crop," *Journal of Extension* 45(2) (6 pages).
- Epplin, F.M., C.D. Clark, R.K. Roberts, and S. Hwang, 2007. "Challenges to the Development of a Dedicated Energy Crop," *American Journal of Agricultural Economics* 89(5): 1296-1302.
- Jensen, K.L., and C.D. Clark, *in press*. "Drilling, Growing or Conserving Our Way to Greater Energy Independence: An Analysis of the Factors that Motivate Support for Different Fuel Options," Advances in Energy Research. Volume 7. Nova Science Publishers.
- Jensen, K., C.D. Clark, P. Ellis, B. English, J. Menard, M. Walsh, and D. de la Torre Ugarte, 2007. "Farmer Willingness to Grow Switchgrass for Energy Production," *Biomass and Bioenergy* 31(11-12): 773-781.
- Jensen, K.L., C.D. Clark, B.C. English, R.J. Menard, D.K. Skahan, and A. Marra, 2010. "Willingness to Pay for E85 from Corn, Switchgrass, and Wood Residues," *Energy Economics* 32: 1253-1262.
- Marra, A., K.L. Jensen, C.D. Clark, and B.C. English, *in review*. "Willingness to Pay for Reductions in Greenhouse Gas Emissions Through Purchases of E85."


Thank You!

Probit Analysis of Interest in Growing Switchgrass

- Suggested that producers were more likely to be interested in growing switchgrass if they:
  - Owned hay equipment
  - Used custom hay services
  - Used no-till
  - Had horses
  - Had produced under contract
  - Had off-farm income
  - Resided in Alabama, Georgia, Kentucky, or Virginia (Texas was base)

Probit Analysis of Interest in Growing Switchgrass

- Suggested that producers were less likely to be interested in growing switchgrass if they:
  - Had beef cattle
  - Were older