DETERMINANTS OF IRRIGATION TECHNOLOGY ADOPTION IN SOYBEAN PRODUCTION

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INTRODUCTION:

The irrigation scenario in Louisiana is different from the U.S. western states mainly because water availability has not been a major concern in Louisiana until recently. Groundwater is the major source of irrigation in the state. Some aquifers in the state are showing signs of stress due to over exploitation as evidenced by the presence of cone of depression (Sparta aquifer) and saltwater intrusion (Mississippi River Valley Alluvial Aquifer). Water resource can be conserved by using an efficient Irrigation technology. Louisiana farmers use mainly three technologies to irrigate soybeans: furrow, center pivot, and flood irrigation. This study identifies factors affecting irrigation technology adoption among soybean producers in Louisiana. We conducted survey to collect information regarding irrigation practices and concerns, then estimate and analyze the impact of different factors on irrigation technology adoption. The findings would be beneficial to farmers to identify an efficient irrigation technology that gives them the highest profit while conserving groundwater resources.

OBJECTIVES:

- To estimate the major determinants of irrigation technology adoption in LA,

SURVEY :

- We designed survey questionnaire that consists of four sections: section A asks about the crop production information, section B asks about general irrigation system information and cost, section C asks about general irrigation questions and section D consists of sociodemographic information of farmers,
- We Conducted mail survey in December,2015 following Dillman procedure to collect information regarding irrigation concern of farmers in LA,
- Out of 2700 sent out survey, we received only 160 response back

DESCRIPTIVE STATISTICS

VARIABLE DESCRIPTION	VARIABLE	OBS	MEAN	STD. DEV.	MIN	MAX
Irrigation tech.(1=furrow, 0= other tech)	IRR_TECH	49	0.71	0.46	0	1
Well depth in feet	WELL_DEPTH	38	122.16	63.83	40	350
Experience of farmers in crop production	EXPR	103	29.36	14.97	0	57
Maintenance cost of irrigation system	MAIN_COST	40	3775.00	6508.72	0	35000
Gross farm revenue in 2015	REVENUE	121	2.63	1.82	1	7
Drilling cost of well	DRIL_COST	33	16011.36	15003.19	900	65000
Highest education attained by farmers	EDUC	121	3.10	1.12	1	5
Total land under operation	LAND	159	1158.27	2747.32	0	30916
Water source(1 = ground water, 0= other)	WTRS	59	0.69	0.46	0	1

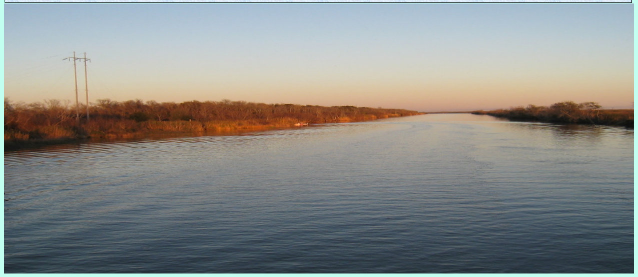
- Out of 49 observations, 71% of farmers use furrow irrigation technology,
- Around 69%(out of 59) of farmers use ground water source for crop irrigation,
- Average well depth is 122 feet, average age of well is 17 years, average electricity and diesel costs are $5000 and $ 1000 respectively,
- In average, farmers spend $ 3775 for maintenance of irrigation system.

METHOD:

Irrigation technology (TA) adoption is defined by the functional form: TA=f(**L, C, S, D**)
Here, L= vector representing well depth, soil type, future concern, C= vector of maintenance cost, energy cost, S=vector of water source ,and D= vector of sociodemographic information of farmers.
Logit model is based on random utility model. The utility of the alternative j for farmer can be expressed as: $U_{ij} = V_{ij} + \varepsilon_{ij} = X'_{ij}\beta + \varepsilon_{ij}$

Farmer chooses the alternative which gives the greatest utility. Then the probability of choice of alternative j over j' is: $\Pi_{ij} = P(V_{ij} + \varepsilon_{ij} > V_{ij} + \varepsilon_{ij'}) = P(\varepsilon_{ij'} - \varepsilon_{ij} < V_{ij} - V_{ij'})$
Here, X= explanatory variables representing functional form in 1 above ,
β= parameters associated to X and
ε_{ij} = random variables distributed logistically

Then we estimate the model with logit framework in which irrigation technology is the dependent Variable.



EMPIRICAL RESULTS:

Estimated parameters using logit model and associated marginal effects are presented in the following table:

VARIABLES	Logit coeff	Marginal effects
WEL_DEPTH	0.142**	0.0293**
	(0.0567)	(0.0119)
EXPR	-0.141*	-0.0292*
	(0.0841)	(0.0166)
MAIN_COST	-7.71e-05	-1.59e-05
	(0.0002)	(4.24e-05)
REVENUE	-7.877***	-1.628**
	(3.010)	(0.798)
DRIL_COST	-0.00095***	-0.000197*
	(0.00035)	(0.00010)
EDUC	-1.006	-0.208
	(0.830)	(0.184)
LAND	0.0245***	0.00507*
	(0.0094)	(0.00267)
CONSTANT	18.06**	
	(7.784)	
OBSERVATIONS	33	33

- Well depth and land holding size have positive effect on furrow irrigation technology adoption,
- Experience of farming, farm revenue, well drilling cost, education, and maintenance costs have negative effect on choosing furrow irrigation technology.

RESULTS CONT'D:

- one feet increase in well depth causes 2.9% increase in predicted probability for adopting the furrow irrigation technology implies more likely to adopt furrow irrigation as depth of drilling increases,
- One year increase in experience causes 2.9% decrease in predicted probability for adopting furrow irrigation, drilling cost reduces the adoption by 0.019% and predicted probability is 20% for farmer with college education than farmers with higher education.
- Per acre increase in land holding increases the predicted probability by 0.5% for adopting furrow irrigation.
- More experienced farmers may switch to more water conserving technology and farmer with higher education are more likely to adopt efficient and water conserving irrigation technology. In our estimation, soil type, energy cost and water source are insignificant, so we have not displayed them.

CONCLUSION

We designed and conducted survey to collect information from Louisiana farmers to understand their concern related to irrigation water quality and availability of sufficient water for crop irrigation. We estimated the impact of various factors on irrigation technology adoption using logit model. We found that experience, revenue, drilling cost and education have negative effect on adopting furrow irrigation technology where as well depth and land holding size have positive effect. This study is based on limited observation and needs to extended with more observation. Additionally, we plan to extend this work by estimating water application rate for different crops in future.