Farmer Preferences for Attributes of Conservation Agriculture in Eastern Uganda

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Abstract

Conservation agriculture has many potential benefits for small farmers. This study seeks to estimate the value that farmers in eastern Uganda place on some these benefits. Data from a choice experiment study are analyzed with a mixed logit model to determine farmers' willingness to pay for increases in maize yield, reductions in erosion, and reductions in land preparation labor requirements. It finds that farmers have a statistically significant willingness to pay for increases in yield and reductions in erosion, but not for reductions in land preparation labor.

Motivation

Conservation agriculture is a farming management system that includes reduced tillage, maintained soil cover, and modified crop rotations. These practices serve to protect the soil from erosion and loss of fertility [1]. There is not yet consensus on the magnitude of the effects of CA, but part of the overall effect will depend on adoption rates of the practices. Adoption will depend in part on how farmers value the benefits of the practices. Because many of the benefits are non-market goods and services, this valuation needs to be estimated in some way. This study uses a choice experiment to do so. Knowledge of this valuation is crucial to policy makers who wish to promote conservation agriculture.

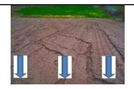
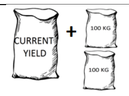
Objectives

This study has two main objectives:

1. To estimate willingness to pay for increased yield, a 50% and "near total" reduction in erosion, and reductions in land preparation labor.
2. To determine if preferences for these attributes vary by district, gender, past farming practices, education, or age.

Data and Methods

This study uses choice experiment data collected in June and July of 2013 in Tororo and Kapchorwa districts in Uganda. Two hundred farmers in each district were surveyed. The survey included questions regarding demographics and farming practices, followed by the choice experiment. An example question from the survey is shown below.

	EXAMPLE QUESTION			
	YIELD	EROSION	LAND PREPARATION LABOR	INPUT COSTS
OPTION A				CURRENT COSTS
OPTION B				CURRENT COSTS + 30,000 30,000
OPTION C				CURRENT COSTS

Choice experiments are a type of discrete choice model in which respondents are asked to choose between different alternatives that contain varying levels of different attributes. By asking a series of such questions, it is possible to determine how each individual attribute impacts the likelihood that the respondent will make a particular choice.

Data were analyzed using a mixed logit model. The mixed logit model has a more flexible functional form than other types of logit models, relaxing the Independence of Irrelevant Alternatives (IIA) assumption and allowing for random preference heterogeneity[2]. Interaction terms between demographic and farming practice variables with attribute variables were also included in the model to determine if farmers with different traits had different preferences.

Results

Variable definitions are given in table 1 and mixed logit results are given in table 2. All attribute coefficients are significant at a 5% level except for *labordecrease*. The variables *ASC*, *additionalyield*, and *total* exhibit random preference heterogeneity.

Table 1: Variable Names	
Variable Name	Definition/concept
ASC (Alternative Specific Constant)	Constant term estimated as a part of conditional and mixed logit models.
additionalyield	Additional 100KG bags of maize.
currenterosion	Current level of soil erosion
half	A decrease in soil erosion by 50%
total	An almost total decrease in soil erosion
labordecrease	Decrease inland preparation labor requirements
price	An increase in input prices. Can take on values of 0; 30,000; 60,000; or 90,000

Willingness to pay results were statistically significant at 5% for *additionalyield*, *half*, and *total*. Results in Ugandan shillings and US dollars are given in Table 3. The lower level and upper level correspond to a 95% confidence interval. Several demographic and farming characteristic variables were interacted with attribute variables to determine if preferences varied by these traits.

The only significant interactions were *district*additionalyield* and *district*total*. These results indicate that farmers in Kapchorwa place more value on erosion control and less value on yield increases than do farmers in Tororo. This is expected, as Kapchorwa is a more mountainous district and has much higher average maize yields than Tororo.

Table 2: Mixed Logit Results				
Log Likelihood	-465.51693			
Prob> chi2	0.000			
Pseudo R2	.07984086			
Choice	Coef.	Std. Err.	z	P > |z|
Mean				
ASC	2.984479	1.236767	2.41	0.016
additionalyield	.8242864	.1517334	5.43	0.000
half	.3797642	.11032	3.44	0.001
total	2.066139	.2219086	9.31	0.000
labordecrease	.1203984	.0717164	1.68	0.093
price	-.0000148	4.69e-06	-3.16	0.002
Standard Dev.				
ASC	2.364859	.8540019	2.77	0.006
additionalyield	.7921258	.2114278	3.75	0.000
half	-.005345	.1956255	-0.03	0.978
total	1.382825	.2213965	6.25	0.000
labordecrease	.0265177	.1527894	0.17	0.862

Table 3: Willingness to Pay Estimates from Mixed Logit Model (in Ugandan Shillings)				
	additionalyield	half	total	labordecrease
WTP	55,583 ($22.23)	25,608 ($10.24)	139,325 ($55.73)	8,118 ($3.24)
Lower Level (95% CI)	25,895	9,109	83,075	-1,012
Upper Level (95% CI)	165,045	77,535	349,039	37,333

Conclusions

Results indicate that farmers are willing to pay a premium for some of the potential benefits of conservation agriculture. This is encouraging for policy makers and extension workers who wish to promote the practices. In addition, the specific outcomes of conservation agriculture in the region may make it better suited to one district over another. If erosion control is a major benefit, farmers in Kapchorwa may be more likely to adopt. If yields increase, farmers in Tororo may be more likely to adopt.

References

1. Food and Agricultural Association. "Conservation Agriculture." www.fao.org/ag/ca. Updated 2014.
2. Hensher, D.A., and Greene, W.H. "The Mixed Logit Model: The State of Practice." Transportation 30: 133-176, 2003.