How Information and Messengers Affect Farmers' Cover Crop Adoption: A Field Experiment

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How Information and Messengers Affect Farmers' Cover Crop Adoption: A Field Experiment

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Overview

This study examines the effect of information and messengers on farmers' bids on cover crops. Specifically, an experimental auction was conducted at the 2022 Canada's Outdoor Farm Show to investigate the impact of different types of information emphasizing private or public benefits of cover crops, delivered by different messengers including scientists, non-profit organizations, policymakers, fellow farmers, and private company representatives.

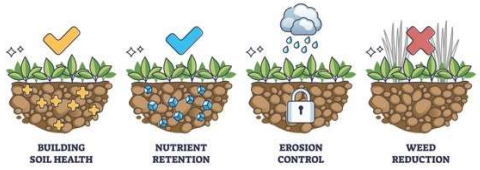

Figure 1: Advantages of cover crop use

Background

- Agricultural activities are a major source of environmental pollution.
  Water: High levels of non-point source pollution and environmental issues of eutrophication.
  Air: High levels of greenhouse gas emission by agricultural activities.
  Soil: High levels of soil erosion in agricultural land.
- One of the proven agricultural best management practices (BMPs) to reduce environmental pollution and soil erosion is cover crops.
- The adoption of agricultural BMPs, including cover crops, is sub-optimal. This sub-optimal adoption can be attributed to farmers' characteristics and behavioral barriers, as well as the non-excludability of BMPs' environmental benefits, which gives rise to free riding when adoption is voluntary.

Objective

This lab-in-the-field experiment examines how information and messengers impact farmers' bids on a variety of cover crops.

Experimental Design

- An incentive-compatible experimental auction was employed to analyze the following treatments that can encourage the adoption of cover crops:
  - ❖ Information highlighting the private or public benefits of cover crops.
  - ❖ Identical information delivered by 5 different messengers.
- This study employed a 2 x 5 between-subjects design and a control group to evaluate farmers' bids for four cover crop seed types through a random *n*-th price Becker-DeGroot-Marschak (BDM) auction.

Model

We use a hurdle model to estimate the impact of information and messenger treatments on farmers' bids for cover crops.

$$Prob[y_{ij}^* > 0] = \Phi(x_{ij}'\gamma)\,,\ z_{ij} = 1 \text{ if } y_{ij}^* > 0 \quad (1)$$

$$Prob[y_{ij}^* \le 0] = 1 - \Phi(x_{ij}'\gamma)\,,\ z_{ij} = 0 \text{ if } y_{ij}^* \le 0 \quad (2)$$

$$E[y_{ij}|z_{ij} = 1] = x_{ij}'\beta + \sigma\lambda_{ij} \quad (3)$$

Where y_{ij} and y_{ij}^* represents the observable bid placed and the farmers' unobservable true valuation, respectively. Variable and z_{ij} represents the decision of the respondents to place a bid ($\boldsymbol{z_{ij}}$=1) or not ($\boldsymbol{z_{ij}}$ =0). x' is a vector of dummy variables for each information and messenger treatment, and γ is a vector of coefficients for these unobservable attributes. σ is the standard normal cumulative density function, and λ_{ij} represents the inverse Mills ratio, which is a weighting method for the error term, $\sigma\lambda_{ij}$. The models are indexed by individual *i* and product *j*. Equations (1) and (2) are binary choice models that estimate the hurdle model's selection portion, which identifies if the farmer decides to bid on cover crops seeds. Equation (3) is the intensity equation and estimates the outcome portion of the hurdle model, which identifies how much farmers bid on cover crops after overcoming the zero-bid hurdle.

Results

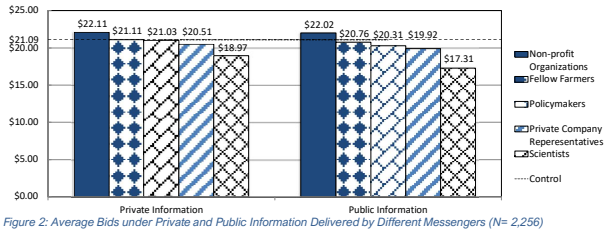

Figure 2: Average Bids under Private and Public Information Delivered by Different Messengers (N= 2,256)

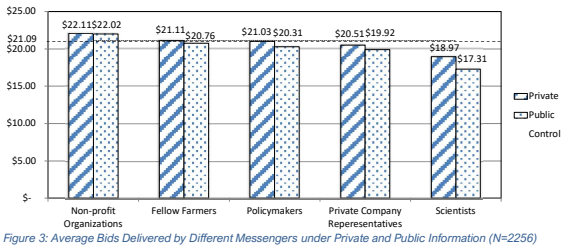

Figure 3: Average Bids Delivered by Different Messengers under Private and Public Information (N=2256)

Variables	Coefficients	Standard Error
Selection Model		
Public Information	0.03	0.09
Private Information	0.10	0.09
Operational Land	-0.00	0.00
Percentage Rented	0.00*	0.00
Organic	0.15	0.12
Farming Experience	-0.01*	0.00
Age	-0.00	0.00
Education	0.01	0.02
Race (Diverse)	-0.08	0.10
Women	0.07	0.08
Historical Cover Crop Use	0.25***	0.07
Liberal	0.37***	0.12
Commercial Farm	0.14**	0.07
Constant	0.70***	0.14
Outcome Model		
Public Information	-1.50	0.92
Private Information	-0.60	0.963
Operational Land	0.00	0.00
Percentage Rented	0.01	0.01
Organic	3.00***	1.16
Farming Experience	0.00	0.03
Age	-0.12***	0.03
Education	-0.22	1.99
Race (Diverse)	-1.47	1.04
Women	1.77**	0.82
Historical Cover Crop Use	1.02	0.73
Liberal	4.28***	1.15
Commercial Farm	0.22	0.70
*** p<0.01, ** p<0.05, * p<0.1		

Table 1: Results from hurdle models (selection and outcome model) examining the effects of information treatments on farmers' bids compared to the no information control group.

Variables	Coefficients	Standard Error
Selection Model		
Scientists	-0.02	0.11
Non-profit Organizations	0.10	0.11
Policymakers	0.20*	0.11
Fellow Farmers	0.06	0.11
Private Company Representatives	0.01	0.11
Operational Land	0.00	0.00
Percentage Rented	0.00*	0.00
Organic	0.14	0.12
Farming Experience	-0.01*	0.00
Age	-0.00	0.00
Education	0.01	0.02
Race (Diverse)	-0.09	0.10
Women	0.07	0.08
Historical Cover Crop Use	0.25***	0.07
Liberal	0.39***	0.13
Commercial Farm	0.14*	0.07
Constant	0.70***	0.14
Outcome Model		
Scientists	-3.38***	1.12
Non-profit Organizations	0.60	1.10
Policymakers	-0.30	1.13
Fellow Farmers	-0.30	1.11
Private Company Representatives	-1.90*	1.13
Operational Land	0.00	0.00
Percentage Rented	0.01	0.01
Organic	2.83**	1.15
Farming Experience	0.00	0.03
Age	-0.12***	0.03
Education	-0.20	0.20
Race (Diverse)	-1.63	1.04
Women	1.86**	0.82
Historical Cover Crop Use	0.98	0.73
Liberal	4.58***	1.16
Commercial Farm	0.16	0.70
*** p<0.01, ** p<0.05, * p<0.1		

Table 2: Results from hurdle models (selection and outcome model) examining the effects of messenger treatments on farmers' bids compared to the control group

Conclusion

- Highlighting private versus public benefits of cover crops did not significantly impact farmers' bidding behavior, but for each messenger the private information performed at least as well as the public information.
- Identical information attributed to non-profit organizations increased farmers' average bid by 4.6% while those attributed to scientists decreased the average bid by 14.2%, both compared to the control group.

Acknowledgment

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