Choice Experiment Survey of N Application Behavior

Jinhua Zhao
Economics; Ag. Food and Resource Economics (AFRE); Environmental Science and Policy Program (ESPP)
Michigan State University
Core survey team

- Adam Reimer
- Qi Tian
- Jinhua Zhao
- Inputs from other team members
- Help from Frank Lupi (esp. on block design)
Purpose of the second phase survey

- **Quantify** the influences of key factors on farmer N application decisions
  - Concerns about yield, profitability, time/labor constraints, etc.
  - In contract, not responsive to fertilizer price (40% not responsive vs 32% responsive in first phase survey)

- **Tradeoffs among**
  - Prohibiting fall N application
  - Requiring sidedress application
  - Requiring winter cover crops
  - Annual subsidy level

- Assuming no yield losses: combinations of the three practices result in varying degrees of N savings, but no yield changes
Methodology: choice experiment survey

- Survey methodology developed in marketing. Now routinely used in social economic research, medical research, etc.
  - Obtain valuation of different “traits” of a product
- Our interest: “costs” of different measures currently available to reduce N application → tradeoffs and policy recommendations
- Effectively: try to measure willingness-to-accept (WTA) for taking certain measures to reduce N, over and above the cost savings.
- Basic approach: propose different combinations of “traits” and ask respondents to rank them.
- Methodology evolved to include sophisticated statistical tools to design the survey and analyze the results
Our survey

- Hypothetical: cheap talk treatment
- Messaging treatment: positive vs negative messaging about the environmental impacts of N application
- Information treatment: opportunity to delay one year so as to learn, and then choose again
- Each farmer faces four choice occasions (scenarios), each with two alternatives plus the status quo (no to any programs)
- Questions about basic socio-economic characteristics
- $5 unconditional payment for each survey to raise response rate
- D-efficient design based on pretest data
- Payment levels (per acre per year): $5, 20, 40, 100, 180
Example of a survey
Increasing Nitrogen Efficiency and Improving Farmer Profitability

Farmers have made significant gains in improving nitrogen (N) efficiency in corn operations, and N efficiency can be further enhanced by emerging technologies and improvements in field-based modeling. Expanding agricultural production to meet growing global demand and making agricultural production more environmental friendly will require farmers to optimize fertilizer use through improved use of new practices and more efficient application. Through greater efficiency in nitrogen use, farmers can not only save money but also protect the environment by decreasing losses of N to water and air. New programs may also be able to help. In the case of N, good stewardship is what is best for your bottom line.
Negative messaging

**Effects of Nitrogen on the Environment**

Nitrogen (N) is a crucial component of crop production. However, N lost from farming operations **contributes to pollution of the environment.** In surface waters, N contributes to algal growth, damaging both **water quality** and natural ecosystems both near farm fields and many miles downstream. Ecosystem eutrophication (over-fertilization) and hypoxia (lack of dissolved oxygen) in coastal areas is a major problem, including in the Gulf of Mexico. Excess soil N can also lead to **air pollution.** N can enter the atmosphere as nitrogen oxides (NOx) that contribute to smog and acid rain. Nitrous oxide (N\textsubscript{2}O) is also a greenhouse gas that contributes to climate change. By weight, N\textsubscript{2}O is 300 times more powerful than CO\textsubscript{2} at warming the atmosphere. According to the US Environmental Protection Agency (EPA), seventy percent of all US emissions of N\textsubscript{2}O are from agriculture.
Scenario Introduction

Suppose hypothetically the US government is starting a 10 year program that encourages farmers to improve N use efficiency on their farmland. Participation in this program is voluntary and farmers could enroll any part of their farm. Farmers who participate will receive a payment in exchange for adopting N efficiency practices.

Below we ask you to make choices about several different scenarios. For each scenario, you are asked to choose between participating and not participating in two different programs. One scenario will be randomly chosen for evaluation. Therefore, **you should not compare the scenarios when making choices.** In each scenario, your task is simply to choose whether to participate or not.

For the randomly chosen scenario, the most-selected program will be implemented immediately if the majority of respondents decide to participate. If no program is implemented, **you will be provided with another chance one year later to decide again in which programs you would like to participate.** Further, we will make **new information** available obtained from ongoing research about best N practices.
Cheap talk

Your input on policy designs is very important. While these program designs are hypothetical, your honest answers will be critical in informing future policies. When answering the following questions, please respond as if this were a real option.
No impact on yield

These programs are NOT intended to impact yield. The goal of these programs is to increase efficiency in N application so that less fertilizer is needed without affecting yield. For these scenarios, please assume that crop and N prices will stay steady at current prices. Your participation in these scenarios does not prohibit your participation in other existing cost share programs.
Definitions

Please keep these definitions in mind when reading through the policy scenarios on the following pages:

**Fall Application Prohibited:** A ban on fall application of synthetic fertilizers, such as anhydrous ammonia, following fall harvest with the purpose of providing N for next year’s crop.

**Side-dress Application Required:** Application of N fertilizer following corn emergence in the spring (typically between 4 and 8 weeks after planting). This program component requires at least one post-emergence application of nitrogen.

**Winter Cover Crops Required:** Crops planted to provide cover following harvest of the primary crop, intended to prevent erosion, improve soil health, and supply nutrients. The specific plant species selected is up to you.

**Expected Nitrogen savings:** Percentage of N application rate (based on agronomic models) you will not need to apply with the given practices, based on an average application rate of 170 lbs N/acre.

**Annual Payment Level:** This payment per acre will be provided annually in a single payment with enrollment in the program. There is no cap, so you can enroll as many acres as you want.
Scenario #1

Note: This program is not expected to reduce corn yield with appropriate application rates. Expected N savings are based on average application rate of 170 lbs/acre with no practice adoption. The program chosen by the majority of respondents will be implemented immediately. If no program is implemented for now, you will be provided with new information about N application and given another chance to decide one year later.

<table>
<thead>
<tr>
<th></th>
<th>Program 1</th>
<th>Program 2</th>
<th>Do not participate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall application prohibited</td>
<td>Yes</td>
<td>No</td>
<td>I would not participate in these programs</td>
</tr>
<tr>
<td>Sidedress application required</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Winter cover crops required</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Expected Nitrogen savings</td>
<td>25%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Annual payment level</td>
<td>$100/acre</td>
<td>$40/acre</td>
<td></td>
</tr>
</tbody>
</table>

I would choose ... (check only one) [ ] [ ] [ ] [ ]

1. How sure are you about your choice?
   - [ ] 5 . . . . Very certain
   - [ ] 4 . . . . Certain
   - [ ] 3 . . . . Somewhat certain
   - [ ] 2 . . . . Slightly certain
   - [ ] 1 . . . . Not at all certain
Scenario #2

Note: This program is not expected to reduce corn yield with appropriate application rates. Expected N savings are based on average application rate of 170 lbs/acre with no practice adoption. The program chosen by the majority of respondents will be implemented immediately. If no program is implemented for now, you will be provided with new information about N application and given another chance to decide one year later.

<table>
<thead>
<tr>
<th></th>
<th>Program 1</th>
<th>Program 2</th>
<th>Do not participate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall application prohibited</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Sidedress application required</td>
<td>No</td>
<td>Yes</td>
<td>I would not participate in these programs</td>
</tr>
<tr>
<td>Winter cover crops required</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Expected Nitrogen savings</td>
<td>10%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Annual payment level</td>
<td>$180/acre</td>
<td>$100/acre</td>
<td></td>
</tr>
</tbody>
</table>

I would choose ...
(check only one)

2. How sure are you about your choice?
- □ 5 . . . . Very certain
- □ 4 . . . . Certain
- □ 3 . . . . Somewhat certain
- □ 2 . . . . Slightly certain
- □ 1 . . . . Not at all certain
**Scenario #3**

Note: This program is not expected to reduce corn yield with appropriate application rates. Expected N savings are based on average application rate of 170 lbs/acre with no practice adoption. The program chosen by the majority of respondents will be implemented immediately. If no program is implemented for now, you will be provided with new information about N application and given another chance to decide one year later.

<table>
<thead>
<tr>
<th></th>
<th>Program 1</th>
<th>Program 2</th>
<th>Do not participate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall application prohibited</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Sidedress application required</td>
<td>No</td>
<td>Yes</td>
<td>I would not participate in these programs</td>
</tr>
<tr>
<td>Winter cover crops required</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Expected Nitrogen savings</td>
<td>10%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Annual payment level</td>
<td>$100/acre</td>
<td>$100/acre</td>
<td></td>
</tr>
<tr>
<td>I would choose ...</td>
<td></td>
<td></td>
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<tr>
<td>(check only one)</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

3. How sure are you about your choice?
   - □ 5 . . . . Very certain
   - □ 4 . . . . Certain
   - □ 3 . . . . Somewhat certain
   - □ 2 . . . . Slightly certain
   - □ 1 . . . . Not at all certain
Note: This program is not expected to reduce corn yield with appropriate application rates. Expected N savings are based on average application rate of 170 lbs/acre with no practice adoption.

The program chosen by the majority of respondents will be implemented immediately. If no program is implemented for now, you will be provided with new information about N application and given another chance to decide one year later.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Program 1</th>
<th>Program 2</th>
<th>Do not participate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall application prohibited</td>
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<td>Yes</td>
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<td>Sidedress application required</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Winter cover crops required</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Expected Nitrogen savings</td>
<td>50%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Annual payment level</td>
<td>$180/acre</td>
<td>$100/acre</td>
<td></td>
</tr>
</tbody>
</table>

I would not participate in these programs

I would choose ... (check only one)

4. How sure are you about your choice?
   - [ ] 5 . . . . Very certain
   - [ ] 4 . . . . Certain
   - [ ] 3 . . . . Somewhat certain
   - [ ] 2 . . . . Slightly certain
   - [ ] 1 . . . . Not at all certain
Other related questions

6. When you were deciding whether to participate in the program, how much influence did each of the characteristics have in your decision? Please indicate below.

<table>
<thead>
<tr>
<th></th>
<th>Not at all important</th>
<th>A little important</th>
<th>Somewhat important</th>
<th>Very important</th>
<th>Extremely important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall application</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side-dress nitrogen application</td>
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</tr>
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<td>Winter cover crops</td>
<td></td>
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<td></td>
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<td>Annual payment level</td>
<td></td>
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</tbody>
</table>
Also questions on

- Farm characteristics: farm size, crops grown, past practices (N application, tillage), participation in conservation programs (CRP, EQIP, CSP, etc.)
- Farmer characteristics: age, education, income, years of farming
- Opinions about a range of farmer practices (fertilizer, pesticides, prices, sustainability)
- Views on relationship between farmers and the environment
- Info sources, and trusts in these sources
- **Purpose**: relate these to estimated values and tradeoffs
Survey implementation

- Focus groups: improving survey instrument
- Pre-test survey: improving survey instrument and preliminary data for bid design
  - $2 incentive, 23% rate of return
- Survey
  - Target: 1500 surveys in three states (Michigan, Indiana, Iowa)
  - Random draw of farmer names from USDA Farm Service Agency (>100 acres)
  - Two rounds: second round targeting nonrespondents
  - 1st round (Feb – March 2016): 4800 surveys
    - Returns: 1054
  - Second round (early April): 3520 surveys
    - Returns so far: 156
Next steps

- Estimation of WTA for
  - Winter cover crops
  - Sidedressing
  - No fall N application

- Estimation of total WTA for different program designs

- How these values depend on messaging about N impacts of farmer practices and information/learning opportunities
Thank you