Nitrogen Management Behavior & Decision-Making Processes: Results from Surveys

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Survey Research in the Nitrogen Coupled Human & Natural Systems Project

- What do we know?
- What do we need to know?

- Information sources for Nitrogen
- N Fertilizer Application
- Adoption of Practices

- Existing, available survey data is unable to fully answer our questions.
Grower Survey 1

- Fielded in March and April 2014
  - Modified Tailored Design Method (Dillman et al. 2009)
  - 4 waves (survey & cover letter, postcard, 2 follow-up questionnaires)
- 3 states: Indiana, Iowa, and Michigan
- Questionnaire design team: natural & social scientists
- Sample size = 260
- Response rate of 20% is similar to other recent work
  - Nyaupane and Gillespie 2011; Arbuckle et al. 2013; Reimer and Prokopy 2014; Rejesus et al. 2013
Grower Survey 1

Stratified Sample per NASS recommendation by farm size

35 questions covering a range of topics

- farm operation characteristics
- fertilizer management decisions
  - timing, formulation, placement, application rates
- use of application technologies and potential barriers for their adoption;
- information sources;
- environmental concern and attitudes;
- participation in government farm conservation programs;
- general views about farming;
- demographics
Grower Survey 1

Stratified 3 State Sample
Michigan (40%)
Indiana (31%)
Iowa (29%)

oversample of large farms

- Demographic characteristics of our sample
  - 59 years old ............... (range is 32 to 91)
  - 33.6 years in farming ...(range is 6 to 69)
  - 34.3 years farming this farm .... (5 to 90)
- Education...37% college degree
- Male

- Size of Farm Operation
  - 75% of the sample farms less than 500 acres
  - More than half of the farms had market values greater than $1 million USD; and 48% had at least $500,000 or more in total value of farm products sold.
Nitrogen Fertilizer Rates

• How do you base your nitrogen recommendation for a given year?

  • USE this source:
    • Past year.......................59%
    • Yield goals....................55%
    • Recommendation.............54%
    • ...on my own..................45%
    • Price of corn..................44%

  • PRIMARY source?
    • Yield goals....................39%
    • Recommendation.............30%
    • ...on my own..................25%
    • Past year.......................13%
    • Price of corn..................9%

• Some differences by state.
Information Sources Nitrogen Fertilizer

- Do you receive N application rate information from this source?

- 6 Most frequently used sources:
  - Fertilizer consultant........67%
  - Other farmers, friends......40%
  - County extension..............39%
  - Crop consultant..............37%
  - Farm magazines/media........31%
  - Seed supplier...................29%

- Most farmers use more than one information source......
  - Average of 2.45 sources (for the above 6).
  - Average of 3.28 sources (for all 17).

- relatives
- other farmers, friends, neighbors
- landlords
- commodity group
- lender
- county extension/university specialist
- online N calculator (Iowa N rate calculator, MRTN)
- crop consultant
- fertilizer consultant/supplier
- fertilizer contract applicator
- the Farm Service Agency
- the Natural Resources Conservation Service
- the Farm Bureau
- farm cooperative
- seed supplier
- equipment dealers
- farm magazines/media
- other
Information Sources Nitrogen Fertilizer

Do you receive N application rate information from this source? **Note: ranked.**

- fertilizer consultant/supplier
- other farmers, friends, neighbors
- county extension/university specialist
- crop consultant
- farm magazines/media
- seed supplier
- online N calculator (Iowa N rate calculator, MRTN)
- farm cooperative
- relatives
- the Natural Resources Conservation Service
- fertilizer contract applicator

Note: excludes those groups with less than 5% of farmers reporting having used.

Note: 17% in our sample reported having used this source.
Many farmers report having used sources that they both perceived as **influential** and that they **valued**.

- **How likely is this source to influence your decisions about N application rates?**
  - 1=low influence to 5=high influence
- **How much value do you place on their views?**
  - 1=low value to 5=high value
Information Sources

• Fertilizer Consultant

How likely is this source to influence your decisions about N application rates?
1=low influence to 5=high influence

How much value do you place on their views?
1=low value to 5=high value

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Nitrogen Fertilizer Application Practices

- In the survey, we asked about fertilizer management decisions
  - i.e. timing, formulation, placement, application rates.

- anhydrous ammonia
- granular urea
- ammonium sulfate
- UAN
- aqua ammonia
- starter fertilizers

- Some consistent application methods:
  - Most farmers (9:10) injected anhydrous N fertilizer.
  - 9:10 farmers in our sample broadcast urea N fertilizer.

- UAN & starter had more varied methods of application.
Nitrogen Fertilizer Application Practices

- Percentage of applications by type & application rate by fertilizer type

- Application rate by fertilizer type
  - Total 172 lbs N/acre
  - Anhydrous 153 lbs N/acre
  - Urea 114 lbs N/acre
  - UAN 111 lbs N/acre
Nitrogen Fertilizer Application Practices

- In the survey, we asked about fertilizer management decisions
  - i.e. timing, formulation, placement, application rates.
  - UAN & starter had more varied application methods.

![Pie chart showing UAN application methods: injected 41%, sprayed 27%, banded 9%, broadcast 23%]
Nitrogen Fertilizer Application Practices

- In the survey, we asked about fertilizer management decisions
  - i.e. timing, formulation, placement, application rates.
- UAN & starter had more varied application methods.

![Pie chart showing application methods for Starter (Pop-up) Fertilizer]
- 57% banded
- 38% injected
- 4% broadcast
- 1% sprayed
Adopting Nitrogen Use Efficiency Practices

Which of the following farm production practices have you implemented on your farm in 2013?

- On your largest field in 2013
  - Side-dress N app.........................48%
  - Soil/plant nitrate testing.......42%
  - Slow-release fertilizer............42%
  - Variable rate N app...............21%
  - Winter cover crops...............14%
  - Imagery..................................9%

- On your farm operation in 2013
  - Side-dress N app.........................44%
  - Slow-release fertilizer............41%
  - Soil/plant nitrate testing.......38%
  - Variable rate N app...............36%
  - Winter cover crops...............27%
  - Imagery..................................12%
Adopting Nitrogen Use Efficiency Practices

- Which of the following...practices have you implemented on your farm...

![Bar chart showing adoption rates for various nitrogen use efficiency practices](chart.png)
Adopting Nitrogen Use Efficiency Practices

- Which of the following...practices have you implemented on your farm...

![Bar chart showing adoption rates for various nitrogen use efficiency practices.](chart.png)

- Side-dress: 48% (largest field), 44% (on farm), 37% (any time)
- Nitrate test: 42% (largest field), 38% (on farm), 38% (any time)
- Slow-release: 42% (largest field), 41% (on farm), 33% (any time)
- Var rate: 36% (largest field), 21% (on farm), 17% (any time)
- Cover crop: 27% (largest field), 22% (on farm), 14% (any time)
- Imagery: 9% (largest field), 12% (on farm), 9% (any time)
Adopting Nitrogen Use Efficiency Practices

• On a scale of 1 to 10, how likely are you to conduct this practice in the next 3 years on your largest field?
  • mean values (std dev)

  • Side-dress N app.....................7.08 (3.34)
  • Soil/plant nitrate testing.............6.70 (3.19)
  • Slow-release fertilizer.................6.44 (3.12)
  • Variable rate N app..................5.79 (3.23)
  • Winter cover crops...................5.52 (3.32)
  • Imagery..................................4.63 (3.10)
Many factors can prevent farmers from adopting certain practices. In general, how much does each issue limit your ability to change your management practices?

1 = not a barrier to 5 = strong barrier

- Percentage of respondents reporting the factor was a strong barrier to adopting a management practice (combining 2 response categories).
  - Concerns about reduced yields .................. 50%
  - Personal out-of-pocket expenses ........... 46%
  - Uncertainty of benefits .......................... 45%
  - Not being able to see a field demo .......... 17%
  - Lack of information about a practice ...... 16%
  - Lack of confidence in University ext ...... 11%
Summary Slide of Take-Aways

- Information sources for Nitrogen
  - Fertilizer consultants, other farmers, extension, crop consultant, farm magazines/media, seed supplier
- Used sources viewed as influential and valued
- N Fertilizer Application
  - UAN & Starter most frequently applied; avg N application rate of 171 lbs/acre (189 IN; 173 IA; 153 MI)
- Adoption of Practices
  - Side-dress; soil & nitrate testing; slow-release
- Barriers to adoption: yield, $$, uncertainty
- State-by-state differences.
The Road Ahead: What We Need to Know

- How generalizable are these preliminary patterns
  - across space and over time
  - More data points—for states, for years, and for farmers!
- Seasonal variability
  - extreme weather events: heavy rainfall
- Links between
  - social & biophysical data
  - survey results & interviews
- How do we encourage the continued and expanded use of online information sources?
Information Sources Nitrogen Fertilizer

Do you receive N application rate information from this source?

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- farm cooperative
- relatives
- the Natural Resources Conservation Service
- fertilizer contract applicator
- commodity group
- the Farm Bureau
- the Farm Service Agency
- landlords
- lender
- equipment dealers

- 6 Most frequently used sources:
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- Most farmers use more than one information source......
  - Avg 2.45 sources (for the 6).
  - Avg 3.28 sources (for all 17).
Information Sources Nitrogen Fertilizer

- How likely is this source to influence your decisions about N application rates? (strong, combined 4 & 5)
  - fertilizer consultant/supplier........41%
  - crop consultant..........................29%
  - county ext./univ. specialist..........23%
  - seed supplier............................17%
  - online N calculator.....................10%
  - farm magazines/media...............10%
  - farm cooperative......................10%
  - other farmers, friends, neighbors...9%
  - NRCS.........................................6%
  - relatives....................................4%
  - fertilizer contract applicator......4%
  - the Farm Bureau.........................3%
  - the Farm Service Agency............2%
  - Landlords..................................2%
  - commodity group........................1%
  - Lender......................................1%
  - equipment dealers.....................1%

- How much value do you place on their views? (high value, combined 4 & 5)
  - fertilizer consultant/supplier........43%
  - crop consultant..........................26%
  - county ext./univ. specialist..........24%
  - seed supplier............................18%
  - other farmers, friends, neighbors...17%
  - online N calculator.....................13%
  - Lender......................................13%
  - farm magazines/media...............13%
  - farm cooperative...................... 8%
  - relatives....................................7%
  - NRCS.........................................5%
  - fertilizer contract applicator......2%
  - the Farm Bureau.........................2%
  - Landlords..................................2%
  - commodity group........................2%
  - the Farm Service Agency............1%
  - equipment dealers.....................0.5%
Thank you!
Comments and questions?

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