

# Determinants of Scab Management Technique Adoption

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# Motivation

- Common scab management practices
  - planting scab resistant varieties
  - cultural practices
    - crop rotations within the same crop field
    - planting varieties with a range of flowering dates;
  - Chemical application
    - Fungicides
- Behavioral factors
  - sources of information
  - costs
  - wealth

# Research Question

- What determines how many scab management techniques adopted
  - Number of techniques
  - Determinants change with number of techniques?
    - More not necessarily better than less

# Conceptual Model

- Assumptions
  - Decision maker aware of potential for infection
    - Do not assume decision maker believes treatment threshold will be achieved
  - Decision makers aware of options for scab management
  - No best technique implied
  - Decision maker consistently uses (adopted) only one set of techniques
    - “Consistently” left to interpretation of respondent

- Number of techniques a function of
  - Economies of scale in scab management
  - Ownership structure
    - Ownership vs. rental of **any** land
    - Cultivated **wheat** land **owned** by respondent
    - **Fraction** of **any** land planted as wheat
  - Availability of information
    - Familiarity (frequency of use; ease of use)
    - Professional and/or Cooperative Extension

- Farm workforce size
- Education
- Experience
- Expected economic benefits of management
- Geographic variation

# Hypotheses

- Farmers with larger operations, in terms of acreage, will attempt to reduce long-run average costs
- Farmers who own greater fractions of the land they cultivate wheat may have different scab management preferences from those who cultivate wheat on rented land

- Significant effect from trusted or familiar sources of information
- Greater experience significant predictor of number of techniques used
- Workforce size significant predictor of number of techniques
- Significant effect from number of benefits
  - Economic size of benefits not measured
- Geography a significant factor for number of techniques chosen



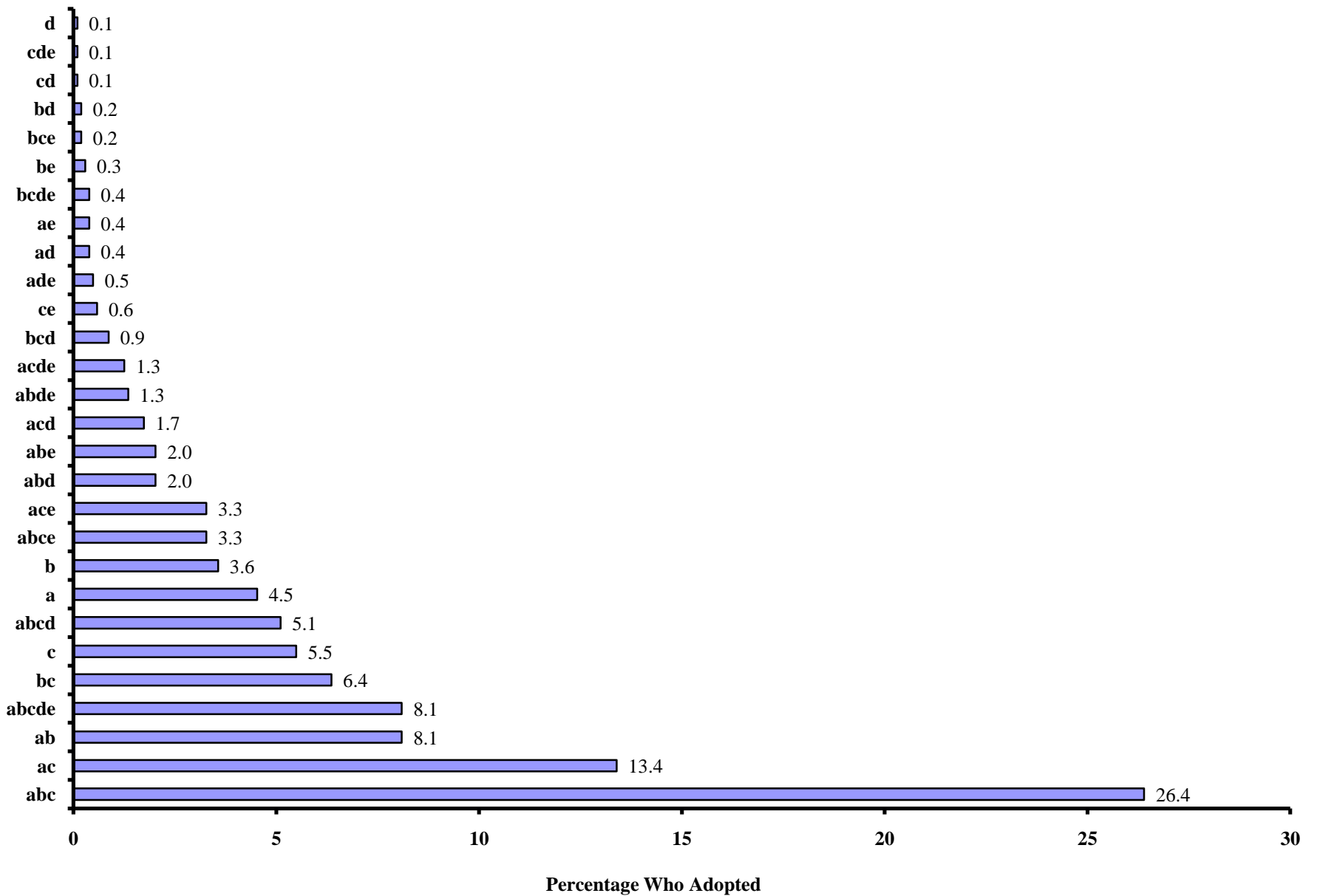
# Method

- Mail survey
  - MN and ND wheat growers with at least 100 ac.  
Wheat in 2010
  - 5150 producers
  - NASS
- 1038 usable responses (20%)
- Logit regression
  - Number of techniques

# General Statistics - Modes

- Acres farmed: 1000-2000 ac
- Percent cultivated land owned: 25%-50%
- Average annual wheat acreage (5 yrs): < 500 ac
- Fraction of farmed land as wheat: 25%-50%
- Average annual wheat yield (5 yrs): 50 bu/ac
- FHB problem: once in 5 yrs

- Management methods:
  - Resistant varieties: 81%
  - Recommended fungicide at heading: 68%
    - Source of recommendation unknown
  - Rotate crops: 76%
  - Varieties with different flowering dates: 22%
  - Stagger planting dates: 22%



- Expected benefits
  - Increased yield: 91%
  - Increased profitability: 87%
  - Fewer DON discounts: 74%
  - Prevent spread of scab: 22%
  - Benefit doesn't justify cost: 11%
  - Unaware of control practices: 2.1%

- How many times in the past five years (2005-2009) have you sprayed fungicide on at least some of your wheat fields for scab control?
  - Every year
- Hire custom applicator: always
- Do policies affect management choices: no

- Attended field days: yes (56%)
- Extension service meetings: hardly ever (36%)
- Most important source of information
  1. Crop consultants (36%)
  2. Field days (15.3%)
  3. Publications prepared by extension (16.6%)
  4. Extension meetings (10.1%)

- What technologies used
  - Blogs: 24.2%
  - Facebook: 5.1%
  - Listserv: 24.4%
  - Twitter: 1.9%
  - Youtube: 4.4%
  - None: 54.4%
- Internet connection speed: high speed
- Internet used to
  - E-mail: 76.3%
  - Extension: 34.7%
  - Company sites: 30.6%
  - Search (farm practices): 52.8%
  - Extension bulletins: 24.1%
  - Scab prediction: 18.4%



- Highest education: two-year degree
- Degree related to ag? 50% no
- Age: 51-60
- Years farming: 31-40

# Multivariate Logit Regression

- Model: Number of techniques =
  - Land
  - Owned wheat
  - Extension
  - Benefits

	One technique	Two techniques	Three techniques	Four techniques	five techniques
<b>Intercept</b>	0.4921	2.5000**	3.3531**	2.5203**	0.8191*
	1.3727	0.4020	0.3736	0.3621	0.4245
<b>Land</b>	-0.1577	-0.1895**	-0.2379**	-0.1555**	-0.045
	0.3883	0.0759	0.0690	0.0626	0.0717
<b>Owned wheat</b>	0.0157	0.0499**	0.0437**	0.0396**	0.0143
	0.1398	0.0267	0.0246	0.0227	0.0262
<b>Extension</b>	-0.4266	-0.4116**	-0.3519**	-0.1779**	-0.1128
	0.3845	0.0856	0.0768	0.0735	0.0866
<b>Benefits</b>	-1.8179*	-0.1299**	-0.1165**	-0.0203	-0.0131
	1.038	0.0571	0.0493	0.0447	0.0531

\*\* indicates statistical significance with 95% confidence  
\* indicates statistical significance with 90% confidence  
Numbers in small type are standard errors

# Discussion

- Intercept, *land*, *owned wheat*, *extension*, and *benefits* are significant predictors of the number of scab management techniques used.
  - *Land*: variable increases when
    - Percentage of cultivated land owned
    - Average annual wheat acreage in last five years
  - *Owned wheat*: variable increases when
    - Total acres farmed
    - Fraction of farmed acreage planted as wheat
    - Percentage of cultivated land owned

- *Extension*: variable increases when attendance at Cooperative Extension events increases
- *Benefits*: variable increases when number of expected benefits increases
- variables are primarily significant when two, three, or four techniques are selected
  - additional information has no value when one technique is being used or all techniques are being used
  - effect of land ownership and use practices of decreasing importance as more techniques are used

- land ownership, extension information, and increasing number of expected benefits dissipates likelihood of any additional techniques being used
  - producer prefer to concentrate their benefits into a smaller number of techniques, allowing them to take maximum advantage of the benefits from any one technique
  - producers to select a narrow set of techniques

- Additional techniques may be a source of loss prevention in assets for which they bear the risk of that loss
  - Opposite when loss shared through a rental contract?
- Farm workforce size, producer education and experience, and regional differences in production were not statistically significant in this model.

# Conclusions

- Farmers with larger operations, in terms of acreage, will attempt to reduce long-run average costs
- Producers owning greater fractions cultivated land wheat may have different scab management preferences from those who cultivate wheat on rented land



- Significant effect from trusted or familiar sources of information: cooperative extension
- Greater experience not a significant predictor of number of techniques used
- Workforce size not a significant predictor of number of techniques
- Significant effect from number of benefits
  - Economic size of benefits not measured
- Geography not a significant factor for number of techniques chosen