The Value of Public Information
A Case Study of the Soybean Rust
Coordinated Framework

Michael Roberts, David Schimmelpfennig,
Elizabeth Ashley, Michael Livingston,
Mark Ash and Utpal Vasavada
Motivation

• Government is a key source of information
  – Weather forecasts
  – Crop & price forecasts
  – Dietary guidelines
  – Extension services

• Regulations require disclosure or provision of information
  – Food labels
  – Accounting guidelines for public firms

What is the value of information provided?

Where does the value come from?
The SBR Coordinated Framework

- **Crop Consultants**
- **Producers**
- **Others**

**Outreach**

**PPQ Deputy Administrator & PDMP**

**Data Interpretation**

**SBR Database**

- **Confirmed**
- **Identification**

**Sample**
- Sentinel Plots
- Mobile Teams
- Industry
- Others

**Initial Screening**

- **NPDN**
- **State Laboratory**
- **Others**

- **Negative**
- **Positive**

- **Previous Find**
- **First Find (State)**

**APHIS NIS/NPGBL**
Key Questions

• What is the appropriate role of government in providing information?
• How does information create value?
• How do we quantify the value?
• What are the key factors that determine value?
• How valuable is information provided by SBRUSA?
Why Government Provision?

- Information is a nonrival good.
  - Cost of providing information to an additional person is negligible.

- A private firm providing information would charge a price sufficient to cover its costs.
  - Any farmer (or other individual) who values SBR information less than the price will forego visiting the website.
  - Since some individuals (including those who place a value on information that is greater than zero but less than the private firm’s price) do not obtain information, society as a whole does not achieve the maximum value for the SBR framework.

- Thus the efficient price for information is $0. No private firm could profitably provide information at this price.
The Value of Information

The value of information =

Profits with information − Profits without information
Information creates value by facilitating improved decisions.

**No Information**

- **PREVENT DECISION**
  - Spray
  - Don’t Spray

- **SBR**
  - Infect
    - Good decision
    - Bad decision
  - No infect
    - Bad decision
    - Good decision

**Perfect Forecast**

- **SBR**
  - Infect
    - Good decision
  - No infect
    - Good decision

**Without information, farmers will sometimes spray when unnecessary, or not spray when needed.**

**With perfect information, farmers will always make the right decisions.**
A Simple Example

Yield of 40 bushels/acre (no rust)  A 50% chance of infection
Yield of 40 bushels/acre (rust, apply)  Soybean price is $5/ bushel
Yield of 30 bushels/acre (rust, no apply)  Application costs $25/acre

No Information

Apply:  
40 x $5 – $25  = $175 / acre

No apply:  
½ (40 x $5) + ½ (30 x $5)  
= $175/acre

Either decision gives $175/acre

Value of information = $187.5 – $175 = $12.50/acre

Perfect Information

Apply if rust:  
40 x $5 – $25  = $175 / acre

No apply if no rust:  
40 x $5  = $200/acre

Expected value = $187.5/acre
Reality is more complicated…

• Need to enumerate:
  – All possible decisions
  – Under all possible circumstances
    (The incidence and susceptibility to SBR)
  – The costs and benefits of each possible outcome
  – The chances of all uncertain outcomes

• Need to evaluate:
  – How much uncertainty is reconciled by information
  – Optimal decisions in each circumstance
Partial Information

INFO

‘High Risk’ signal

PREVENT DECISION

SBR

No

Monitor

No Apply

Payoff (5.)

Infest (prob=β)

Apply

Payoff (1.)

Payoff (6.)

No Infest

SBR

Infest (prob=β)

No Infest

Payoff (2.)

Payoff (1.)

Prevent

Apply

Payoff (6.)

Payoff (5.)

No Infest

SBR

No Infest

Payoff (2.)

Payoff (1.)

Payoff (6.)

No Infest

SBR

Infest (prob=γ)

No Infest

Payoff (2.)

Payoff (1.)

Cure

Apply

Payoff (6.)

Payoff (5.)

No Infest

SBR

Infest (prob=γ)

No Infest

Payoff (2.)

Payoff (1.)

Cure

Apply

Payoff (6.)

Payoff (5.)

No Infest

SBR

Infest (prob=γ)

No Infest

Payoff (2.)

Payoff (1.)

Cure

Apply

Payoff (6.)

Payoff (5.)

No Infest

INF"
## Possible Outcomes

<table>
<thead>
<tr>
<th>Decision</th>
<th>SBR Event</th>
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<tbody>
<tr>
<td></td>
<td>Infection</td>
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<tr>
<td>Apply Preventative Treatment</td>
<td>(1.) 1% Yield Loss</td>
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<tr>
<td></td>
<td>Cost of $25.63/Acre</td>
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<tr>
<td>Monitor Fields and Apply Curative Treatment if SBR</td>
<td>(3.) 7% Yield Loss</td>
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<tr>
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<td>Cost of $20.52/Acre</td>
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<tr>
<td>No SBR Management</td>
<td>(5.) 25% Yield Loss</td>
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Corn Belt Information Values

- Do nothing
- Monitor-curative
- Preventative

Value of Information Per Acre ($)

Prior belief of SBR Infection
National Results

Value of soybean rust forecasts with different accuracies and scenarios

<table>
<thead>
<tr>
<th>Forecast accuracy</th>
<th>Poor</th>
<th>Medium</th>
<th>Good</th>
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<tbody>
<tr>
<td>Base case</td>
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<tr>
<td>Risk aversion</td>
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<td>Price feedback</td>
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<td>Heterogeneous beliefs</td>
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Estimated value of information ($ million)

Summary of Findings

• Aggregate information values
  – Depending on scenario
    • Low accuracy (20%): $11-29 million
    • Medium accuracy (50%): $81-124 million
    • High accuracy (80%): $210-299 million

• Value depends most strongly on:
  – Forecast accuracy
  – Farmers’ prior beliefs of infection
Conclusions & Limitations

• It seems likely that the value of the Framework is greater than the $2.5-$5 million cost
  – Our estimates range from about $11 to $300 million

• Quantifying information accuracy and prior beliefs is difficult
  – Experience & survey data may help (ARMS 2006)
Determining Farmer Beliefs and Actions

New questions in ARMS survey:

• At the beginning of the growing season, what did you think was the likelihood of your farm experiencing a soybean rust infestation?

• Did you experience an outbreak of Asian soybean rust on this field in 2006?

• Did you visit the USDA public soybean rust website?

• Did information found on this website cause you to change your management of fungicide use?
  – Increase/decrease/not change your fungicide rate?
  – Increase/decrease/not change your number of fungicide applications?
Further Research

• Cooperative agreement with North Carolina Agricultural Research Service (NCSU and NCA&TU).

• Objective: use data already compiled to predict SBR’s future paths in space and time.
  – NC team has created similar models for citrus canker.

• Application: designing SBR indemnification programs.
  – What is the actuarially fair premium for a given farm?
The Report

http://www.ers.usda.gov/publications/err18