Title of the Presentation

Agent-based Model of Bt corn Adoption and Insect Resistance Management

Author, Author Affiliation, and Author email

Yuji Saikai, Agricultural and Applied Economics, University of Wisconsin, Madison, WI, saikai@wisc.edu

Paul Mitchell, Agricultural and Applied Economics, University of Wisconsin, Madison, WI

Selected Paper prepared for presentation at the 2017 Agricultural & Applied Economics Association Annual Meeting, Chicago, Illinois, July 30-August 1

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Yuji Saikai & Paul D. Mitchell

Department of Agricultural and Applied Economics, University of Wisconsin - Madison

Agricultural and Applied Economics
UNIVERSITY OF WISCONSIN-MADISON

Rural AgriBusiness Institute
University of Wisconsin-Madison

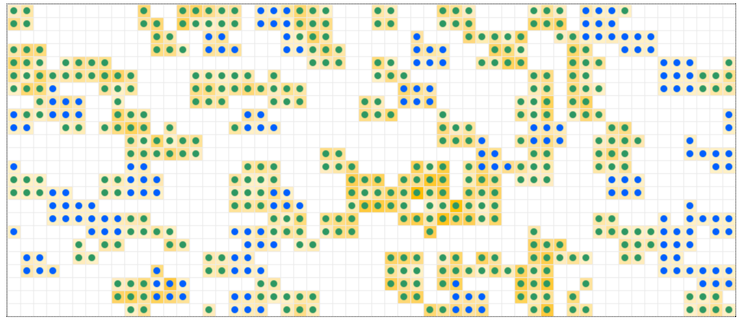
Social Factors

- Most studies focus on biological factors of resistance development. They are important, but not in themselves; rather, dependent on other factors, especially social factors.
- For example, survival rate of each genotype against Bt toxin is crucial, but quite distinct rates can lead to similar resistance evolution once we take into account social components.
- Pests respond to how farmers manage them: what types of management, how much, how often, and how concentrated in a given landscape. These human activities also respond to neighbors' and their own practices in the past. Not to mention regulations and input & output prices.

Complex Systems

- Recognizing the intricate interdependency among farmers, insects, and policy makers, we model insect resistance management as a complex system.
- Complex phenomena, however, need not consist of complex components. They can and do often emerge from simple processes, which interact with each other over time.
- Key components:
  - Explicit physical space
  - Insect reproduction & dispersal
  - Three genotypes with respect to inherent resistance
  - Peer effects on initial adoption of Bt corn
  - Probabilistic profit maximization
  - Heterogeneity in farm size
- To put the pieces together, we use computer simulation — agent-based modeling.

Agent-based Modeling



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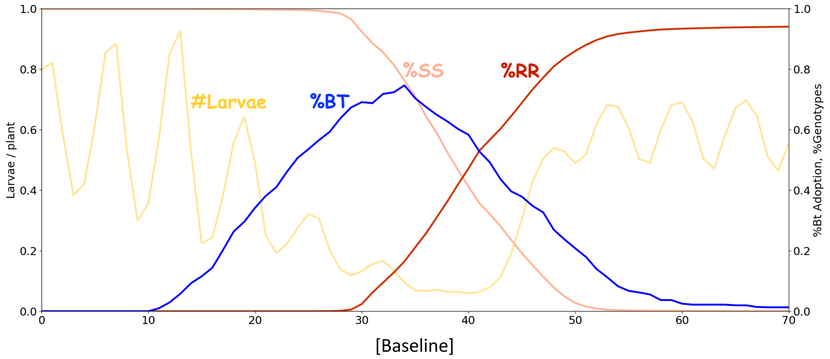
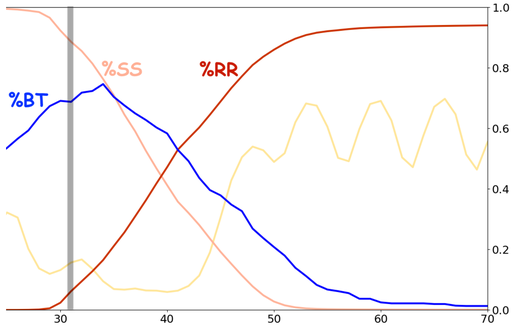
Adoption status of farmers (• adopt, • non-adopt) and insect population (■ the darker, the greater) evolve over time.



[Baseline]

A particular realization of the landscape average, generated by calibrating the model against the actual adoption data in Wisconsin during 1996-2016 (period 11-31). From period 32 onward is the model prediction. The development of resistance to Bt toxin is captured by the fall of the susceptible genotype (SS) and the rise of the resistant genotype (RR).

Policy Analysis



[Baseline]

(intervened at period 32)

[50% tax & 30% refuge requirement]

Over the next 20 years, the total surplus of farmers and seed company essentially remains the same (<2% down). If accounting for other indirect benefits, e.g. environmental protection and postponed R&D expenditure, the social surplus would likely be positive.

(This work funded in part by Monsanto's Corn Rootworm Knowledge Grant program)