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CAST Commentary QTA 2020-2
May 2020
Material excerpted from original CAST document

Stewardship Challenges for New Pest Management Technologies in Agriculture

The ability to feed and clothe a growing human population has relied upon agricultural innovation for centuries, and will continue to do so.

- Several studies have shown that the widespread adoption of Bt crops can reduce population sizes of target pests and associated damage across large areas, with pest suppression benefits extended to growers not planting Bt crops.
- GM crops introduced in 1996 that were resistant to the broad spectrum herbicide, glyphosate, have benefitted producers by providing flexibility of application and increased profits while managing difficult weed problems.
- By 2015, GM crops were providing more than $15 billion in annual economic benefits, with cumulative global economic benefits valued at $167 billion since their initial introduction.

However, a number of potential risks come with these technological developments as well. They include resistance development, off-target movement of pesticides, worker safety, risks to beneficial insects, gene flow, threats to water quality, and risks to pollinators.

The dependency on technology is quite understandable given the size of modern farming operations, as well as the complexity of management issues that farmers face. Farmers must simultaneously manage for weeds, pests, soil fertility, erosion, and other problems while responding to constantly changing weather conditions, public policies, and recommendations from experts. In other words, integrated stewardship is high complex, time consuming and often costly, and thus, anything that can help farmers simplify their management approach is helpful and desirable in their eyes. Unfortunately, and as the evolution of weed resistance has demonstrated, nature is characterized by heterogeneity and complexity, and integrated stewardship must necessarily recognize the complexity of agricultural production systems.

There are two excellent examples of growers working together cooperatively to address pest management problems. The codling moth control program used natural enemies, knowledge of the mating habits, pheromones, and targeted insecticide applications over a wide area. By the end of this project, codling moth trap captures fell by more than 90%, and a single pesticide application was sufficient to reduce damage to less than 0.2%. Similarly, area-wide pink bollworm control strategies focused on Bt cotton utilization, targeted pesticide applications, mating disruption, cultural practices crop residue management, planting date restrictions, and sterile moth release. Factors related to their success included:

- The pests were controlled using a diverse array of chemical and non-chemical tactics.
- While chemical-based strategies implemented at the farm level proved ineffective, diverse tactics were employed in a collective fashion relying on multiple decision-making bodies, operating across vertical and horizontal networks.
- Both programs relied on incrementalism. Programs expanded in terms of geography and complexity, but built on more modest localized successes.
- Finally, successful completion required long time frames and continued long-term commitment by retailers, grower-leaders, State Departments of Agriculture, Cooperative Extension, Independent consultants and USDA professionals.

The authors recommend five actions to improve the stewardship of pest management technologies in agriculture.

- Engage inclusive stakeholder groups to inform the stewardship program
- Develop improved research capacity that identifies the incentives, risks and constraints that influence effective stewardship of pest management technologies
- Build human management skills associated with pest technology stewardship
- Promote voluntary community-based stewardship for pest management technologies
- Reform public and private policies that work against effective stewardship

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