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# Transferring biological control technology to Iowa strawberry growers

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# Transferring biological control technology to Iowa strawberry growers

## **Abstract**

Growers receive nearly \$3.5 million gross income from strawberry production in Iowa. Substitution of environmentally friendly, natural products and biological controls for the current chemical-intensive growing approaches will be critical to the expansion of strawberry production in Iowa.

## **Keywords**

Entomology, Plant Pathology and Microbiology, Horticulture, Biocontrol and Integrated Pest Management, Fruit and vegetables, Market research and feasibility studies

## **Disciplines**

Agricultural Science | Agriculture | Entomology | Fruit Science | Horticulture | Plant Pathology



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## Transferring biological control technology to Iowa strawberry growers

**Abstract:** *Growers receive nearly \$3.5 million gross income from strawberry production in Iowa. Substitution of environmentally friendly, natural products and biological controls for the current chemical-intensive growing approaches will be critical to the expansion of strawberry production in Iowa.*

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**Budget:**  
\$15,000 for year one  
\$15,000 for year two  
\$15,000 for year three

### Background

The approximately 130 commercial strawberry growers in Iowa are encountering pressure from several sources to change their pest management practices. Consumer interest in the use of pesticides, particularly on food crops, is high. At the same time, there has been a reduction in the number of registered pesticides allowed for use on crops such as strawberries.

While profit potential from strawberries can exceed \$10,000/acre, damage from disease, insect pests, and weeds can cause serious loss and decreases in profit. Fruit rot diseases can destroy over 75 percent of a crop and the tarnished plant bug can render more than 30 percent of the fruit unmarketable. Currently, strawberry growers in Iowa may apply synthetic chemicals up to 37 times per season to protect their crops. (The average number of applications per season is 7.7 on bearing strawberries.)

The chemical-intensive approach to pest control in strawberry production is costly, and presents potential risks to the applicator, the environment, and the consumers, who may be concerned about pesticide residues, but continue to demand blemish-free fruit. Strawberries come into direct contact with the soil, and often are consumed by humans without processing. This is one of the few crops where the

popular “pick-your-own” operations bring the general public into fields where pesticides have been applied.

### Approach and methods

Field research plots of “Honeoye,” “Jewel,” and “Eariglow” June-bearing and “Tristar” day-neutral strawberries were established at the Iowa State University horticultural research farm near Gilbert. Demonstration plots were established in commercial growers’ fields. Plots of both day-neutral and June-bearing strawberries were set up.

*Tarnished plant bug control* Annual plantings of “Tristar” day-neutral strawberries were established in May 1997 and 1998 at the ISU Horticulture Farm. Experimental design treatments were 1) Mycotrol—*Beauveria bassiana* (a fungus shown to suppress insects when spores are applied as a spray), 2) Danitol insecticide, 3) no insecticide, plastic fences around each subplot, and 4) no insecticides or fences. Counting of tarnished plant bugs on 10 fruit trusses began July 3. Fruit were harvested and evaluated for evidence of tarnished plant bug injury (apical seediness).

*Gray mold control* A five-year plot of matted-row, “Honeoye” June-bearing strawberries was used for this study. Nonpathogenic fungi have been shown to be effective biological control

agents for the gray mold pathogen. The fungi are introduced on to the strawberry plants either as a suspension in a water-based spray or by honeybees that transport the biological control on their bodies as they visit the strawberry flowers. Ten experimental design treatments were used, varying times of application.

*Weed control* Corn gluten meal (CGM) and corn gluten hydrolysate (CGH) from different sources were applied at varying rates to determine their efficacy to control weeds as a preemergence herbicide and to act as a source of nitrogen in strawberry production. (CGH is a highly concentrated, water-soluble form of CGM that can be applied as a liquid spray.) Field plots were planted with 'Jewel' June-bearing strawberries. On-farm demonstration trials were conducted at two sites in central Iowa. Fruit harvest data were collected and included total weight, berry number, and average berry weight. The numbers of broadleaf and grass weeds were counted and visual estimates of weed cover were obtained in three random sections per plot.

## Results and discussion

*Tarnished plant bug control* In 1997 numbers of tarnished plant bugs (TBP) were low until September, when they increased rapidly. Use of Danitol resulted in significantly better control of TBP than any of the other treatments, although a trend toward reduction, narrowly missing the .05 level of significance was associated with Mycotrol. Plastic fencing reduced TBP injury significantly compared to the untreated control but also significantly reduced yield and berry number. The Danitol treatment showed considerably higher yield and berry number than any other treatment.

For 1998 incidence of TPB injury to fruit was lower than in 1997. Only Danitol provided significantly better control of TBP than the untreated control although total yield and berry number did not differ among the treatments.

However, marketable yield was significantly greater for the Danitol treatment than for the other three options.

Numbers of TPB nymphs captured were significantly lower in the Danitol treatment than in the others. Incidence of *B. bassiana* on captured TPB nymphs was significantly higher in the Mycotrol treatment than in the untreated control during two periods in which TPB populations peaked.

*Gray mold control* None of the biological control treatments reduced gray mold incidence significantly compared to the unsprayed control. All of the biological control treatments had considerably lower yields than either the standard fungicide control treatment or the unsprayed control.

*Weed control* CGM and CGH do not affect strawberry plants or yield. They do, however, offer weed suppression alternatives for strawberry producers, though efficacy will likely need to be increased to improve acceptability as a commercial product. CGH controlled weed populations with varying success over the course of the study. Efficacy of weed suppression by CGH may be related to rate of application and environmental factors such as timing, rain, and microbial breakdown.

## Conclusions

*Tarnished plant bug* Application of *B. bassiana* (Mycotrol) appeared to successfully infect tarnished plant bugs, but this was not reflected in a reduced incidence of buttoned fruit. It may be that adult TPBs were not infected to the same extent as nymphs and the adults are responsible for much of the plant injury. Also, it may be that additional moisture (via irrigation) could increase the impact of *B. bassiana* on TPB activity and mortality.

*Gray mold* None of the treatments significantly reduced gray mold incidence compared to the unsprayed control. All of the biological-control treatments had significantly lower yields than either the standard fungicide treatment or the unsprayed control. The outlook for these biological controls for gray mold is not encouraging, though further research with delivery systems and techniques is possible.

*Weeds* Results indicate that corn gluten hydrolysate has potential as a preemergence weed control product for use in matted-row strawberries. However, the degree of weed control would likely need to be increased to improve its acceptability as a commercial product. Natural weed control products may not duplicate the efficacy shown by synthetic herbicides, but might still reduce weed populations to densities below economic thresholds.

TPB has yielded inconsistent results. Until efficiency levels improve, these methods are not likely to be adopted by growers.

Corn gluten meal and hydrolysate may be an effective tool for growers in agroecosystems who do not rely on synthetically produced herbicides. However, the degree of dicot and monocot weed control would need to improve before these were acceptable commercial products.

### **Education and outreach**

Twelve scholarly papers reported on results from this project. Presentations that included information about the findings from this project were made at 12 workshops, conferences, and growers' meetings. Persons attending tours at the ISU Horticulture Farm received information about the project. Stories about the research appeared in the quarterly "Strawberry IPM Update" newsletter received by 650 Iowa Fruit and Vegetable Grower Association members.

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### **Impact of results**

Research into the use of biological controls (parasites, entomopathogenic fungi) against