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# Use of intra-field alfalfa trap cropping for management of the potato leafhopper

**Abstract:** *Potato leafhopper, a serious alfalfa pest, may be controlled by early harvest or by application of insecticide. Using natural enemies to battle the leafhopper is another option. Selective cutting in alfalfa fields may help curb leafhopper infestations by confining the pests in one strip, which also may harbor a fungus that helps to control the leafhopper.*

**Principal Investigator:**
John J. Obrycki

**Co-investigator:**
Laura Anne Weiser
Entomology
Iowa State University

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## Background

The potato leafhopper, one of the most virulent insect pests of alfalfa in the Midwest, injects toxins into alfalfa plants, stunting their growth. While the leafhopper travels from the southern United States to Iowa in April, the pest rarely causes economic damage to alfalfa until the summer's second harvest. Early harvest or application of insecticides, while helpful in controlling the pest, also kill beneficial insect species and disrupt food webs within alfalfa fields.

An earlier biocontrol project suggested the use of an intra-field trap crop for the leafhopper. An uncut strip of alfalfa was left to grow between the first and second harvests, providing the appropriate microenvironment for the enhancement of a fungus that spread to alfalfa weevil larvae on adjacent regrowth. During the study, researchers noted that leafhopper numbers in the uncut strip areas were extremely high until second harvest, but virtually nonexistent in the adjacent regrowth until populations (in the strip) had developed to adults and moved to the cut areas. These observations suggested that an alfalfa strip, left to grow between the two harvests, could be used as a trap crop for potato leafhoppers and a staging area for a buildup of fungal pathogens.

The objective of this study was to quantify the biotic mortality factors of the potato leafhopper and evaluate the use of alfalfa strip harvesting to manage leafhopper populations in the Iowa alfalfa fields.

## Approach and methods

*Effects of alfalfa strip-cutting on the distribution of potato leafhoppers:* Alfalfa fields in different sections of Iowa were chosen as study sites:

- Iowa State University research farm, Chariton;
- Mark and Julie Roose farm, Pella;
- Iowa State University research farms, Ames;
- New Mellary Abbey, Dubuque; and
- Jeff Klinge and Deb Tidwell farm, Farmersburg.

At the first harvest, a narrow strip of alfalfa was left uncut. A series of yellow sticky traps was set up at three locations in each field to monitor the movement of the leafhoppers back into the alfalfa regrowth. Sticky traps were replaced each week until the second harvest, and the number of leafhopper and natural enemies present were recorded for each trap. Six 20-sweep insect samples were taken at each field.

*Source of leafhopper populations infesting second alfalfa growth:* In 1998 and 1999, the areas surrounding three alfalfa fields located in Ames were surveyed for native host plants of the leafhopper. Yellow sticky traps in the area were changed weekly and the number of leafhoppers recorded. To monitor the movement of leafhopper from alternate host areas into alfalfa, yellow sticky traps were placed both within and on the edges of each alfalfa field, and changed and checked weekly.

*Insect predator feeding trials:* A greenhouse experiment was conducted to determine the predation rates of three insects on leafhoppers. Predators were allowed to feed on leafhopper nymphs and adults, and results were recorded after 24 hours.

## Results and discussion

*Effects of alfalfa strip-cutting on the distribution of potato leafhoppers* The 1998 results showed that for at least one to three weeks after harvest, the number of potato leafhoppers in the uncut strip was significantly higher than in the regrowth By the third and fourth weeks, similar numbers of the hoppers were observed in the alfalfa strip and regrowth. The uncut strips showed greater hopperburn damage throughout the study.

In addition to the uncut strip serving as a trap crop for leafhoppers, it also could serve as a refuge for natural enemies. Several different insect predators were identified on the yellow sticky traps. There was no difference in the numbers of these predators in the uncut strip and the regrowth area. The uncut strip also may provide a suitable microhabitat for a fungus known to affect the potato leafhopper, although no evidence of this fungus (*Z. radicans*) was found in the fields.

*Source of leafhopper populations infesting second alfalfa growth* The second week of May proved to be the peak arrival time for leafhoppers in Iowa alfalfa fields. The highest numbers of potato leafhoppers were found on five common tree species. Different distributions of leafhoppers were found in each of the alfalfa fields sampled. This may have been due to the extent of the surrounding leafhopper alternate hosts. (One alfalfa field was bordered on three sides by alternate hosts, while another field had alternate hosts on only one border.)

*Insect predator feeding trials* The ladybeetle consumed significantly more nymphal leafhoppers than adults within 24 hours, which was different than some earlier results. The other two predators split, one preferring nymphs, the other adults. But it was clear that all three predators can feed on leafhopper individuals. Other common alfalfa predators need to be evaluated as potential natural enemies, with particular attention paid to what stages of leafhopper growth are preferred for eating.

## Conclusions

These studies show that by utilizing a narrow uncut strip at harvest, the recolonization of alfalfa regrowth by potato leafhoppers can be delayed from seven to 21 days. (The life cycle of the leafhopper is approximately three weeks from egg to adult, and alfalfa is harvested in Iowa at four-week intervals.) Therefore, the delay in colonization by the adult leafhoppers in the regrowth can potentially reduce damage by leaving a lower number of progeny to do harm for a shorter time.

When an alfalfa field is harvested, not only do the leafhoppers die, but their natural enemies disperse because the supply of prey is diminished. Natural enemies do not usually return to a field until their prey does, creating a potential delay in biological control. Conservation biological control focuses on retaining natural enemies in a particular area. These uncut strips can not only act as a trap crop for the leafhopper, but also for several natural enemies (insect and fungus) present in the strips.

## Impact of results

Strip harvesting is not a novel management technique and has been little utilized in recent years. This project revisited the potential for strip harvesting to serve as both a cultural and biological control technique for alfalfa growers. It showed that leaving uncut strips of alfalfa in the field at harvest will concentrate leafhopper populations (cultural control) and retain natural enemies in the alfalfa field (conservation biological control). This research also can be extended to look at the effects of strip harvesting on other alfalfa pest insects.

The strip harvesting management strategy offers growers alternative techniques for managing potato leafhopper outbreaks. If the numbers of leafhoppers in the uncut strips reach economically damaging thresholds, the grower can harvest the strip early, thereby killing the leafhopper eggs and nymphs present in the strip. However, the grower still has the option of selectively spraying only the uncut strip to curb the leafhoppers. Selectively spraying a small area of the field is preferable to treating the entire field chemically. Some growers indicated that they will continue to use trap cropping.

## Education and outreach

Articles on this work have appeared in several newspaper and magazines, as well as in publications of the Entomological Society of America. Professional presentations were made at local and national meetings of the Entomological Society of America and at the Midwest Biological Control Workshop in Michigan. Six field days showcasing this project and attended by nearly 500 individuals were held at the various research sites between 1997 and 1999.

*For more information contact John Obrycki, Entomology, Iowa State University, Ames, Iowa 50011; (515) 294-4431, e-mail jobrycki@iastate.edu*