

# Reducing Potato Leafhopper (PLH) Impacts on Alfalfa Through PLH-Resistant Cultivars Intercropped with Perennial Forage Grass

J. Hansen<sup>1</sup>, J.K. Waldron<sup>1</sup>, M. Hall<sup>2</sup>, J. Losey<sup>1</sup>, D. Johnson<sup>2</sup>, J. Hanchar<sup>1</sup>, D. Viands<sup>1</sup>  
<sup>1</sup>Cornell University, NY and <sup>2</sup>Pennsylvania State University, PA

## Introduction

Potato leafhopper (PLH) is the most widespread and damaging insect pest of alfalfa in the Northeast, causing risk to new seeding establishment and to established stands during mid-to-late summer. In years of severe PLH infestations, early forage harvest alone will not adequately control insect populations. In addition to early harvest, other non-pesticide PLH management techniques include the use of PLH-resistant alfalfa cultivars and planting perennial grass as a companion crop to the alfalfa.

Potato leafhopper-resistant alfalfa cultivars offer producers a degree of relief from PLH damage. Hansen et al. (2002) have shown that early generation PLH-resistant alfalfa cultivars, while not immune to PLH, had reduced PLH damage symptoms. Other researchers have found that intercropping alfalfa with grasses can reduce PLH populations (Roda et al., 1997a) and that PLH emigration resulted from physical contact with grass rather than from grass volatiles (Roda et al., 1997b).

The following study was designed to conduct a detailed analysis of the effect of PLH-resistant alfalfa intercropped with one of three perennial forage grasses: timothy (*Phleum pratense* L.), orchardgrass (*Dactylis glomerata* L.), or tall fescue (*Festuca arundinacea* Schreb) on PLH populations, crop damage, and yield.

## Materials and Methods

Field trials were planted at two locations in New York (NY) and two locations in Pennsylvania (PA). Trials were designed as randomized complete blocks with five replicates of alfalfa / alfalfa-grass mixtures. The cultivars planted were 'WL 347LH' (PLH-resistant) and 'WL 357HQ' (conventional) alfalfa, 'Summit' timothy, 'Intensiv' orchardgrass, and 'Enhance' tall fescue. The seeding rates were 20 lb/A alfalfa monoculture, 12 lb/A alfalfa in grass mixture, and 6 lb/A, 7 lb/A, and 10 lb/A of timothy, orchardgrass, tall fescue respectively in mixtures with alfalfa. The populations of PLH were low at two of the four locations, so data are presented only for Ithaca, NY and Landisville, PA.

The day before harvests where PLH were present in the plots, each plot was swept with a standard 15 inch diameter sweep net, and the PLH were counted. Samples of each plot were hand-harvested. The alfalfa, grass, and weeds were separated, placed in separate paper bags, and dried at 55 degrees C. These bag weights were used to determine %alfalfa, %grass, and % weeds. The alfalfa portion of the sample was rated for PLH damage on a scale of one to five where one is a sample that has no apparent or minor PLH damage and a five is a sample with severe stunting and yellowing symptoms of PLH damage. The plots were mechanically harvested for yield. Samples for dry matter correction were taken from each plot in two or more replicates at harvest time.

The data were analyzed as a split-plot by SAS Proc Mixed. The resistant alfalfa cultivar was compared to the conventional alfalfa cultivar for the monoculture plots and within each grass species.



## Results and Discussion

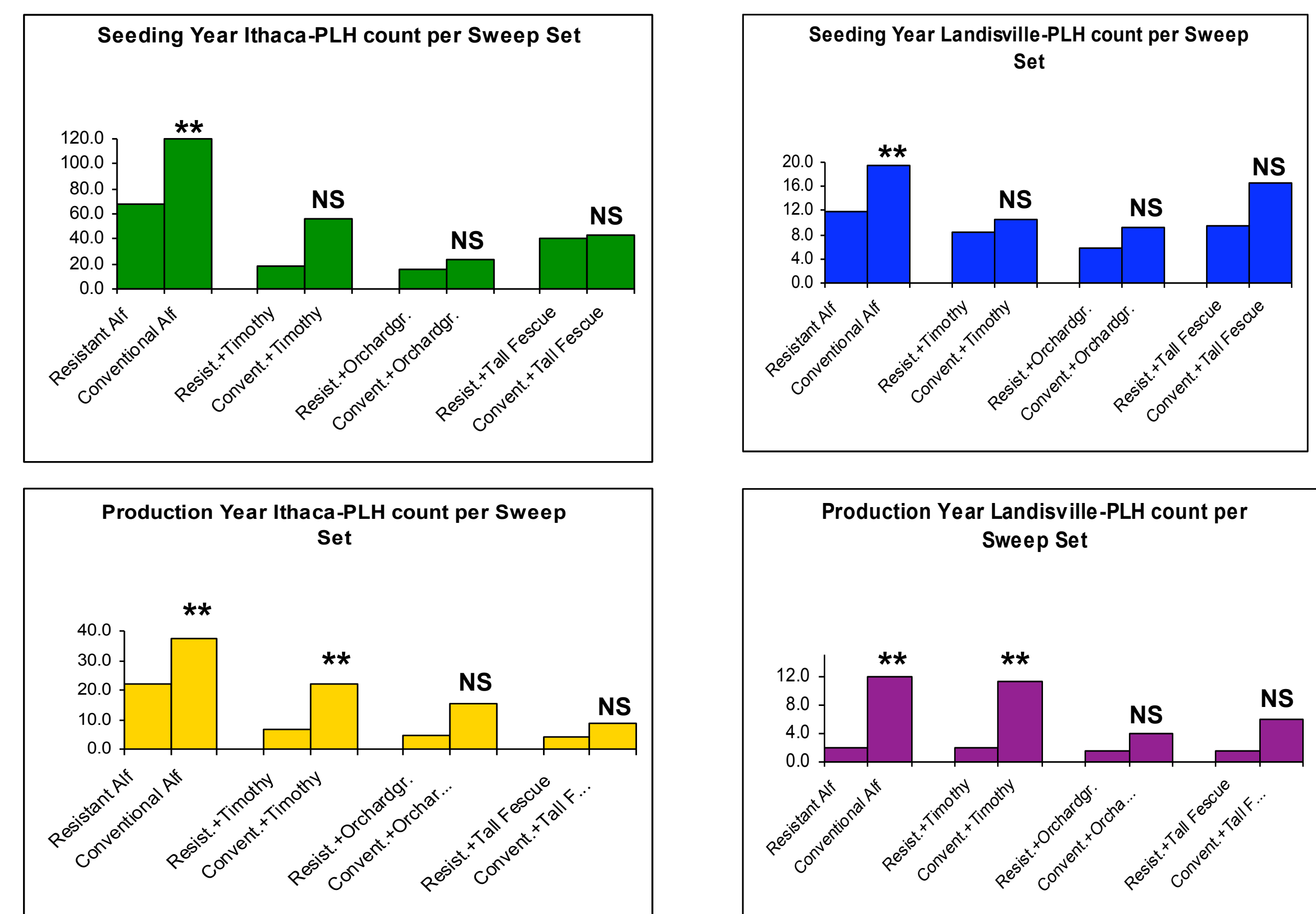
The percent grass in the PLH-resistant alfalfa-mixture plots was not significantly different from the percent grass in the conventional alfalfa-mixture plots (Table 1).

Grass Mixtures	Seeding Year		First Production Year	
	Ithaca	Landisville	Ithaca	Landisville
Resistant Alfalfa + Timothy	47.6	20.6	5.5	8.2
Conventional Alfalfa + Timothy	52.8	34.2	8.6	9.6
difference	-5.2 ns	-13.6 ns	-3.1 ns	-1.4 ns
Resistant Alfalfa + Orchardgrass	38.2	25.6	30.8	22.1
Conventional Alfalfa + Orchardgrass	43.2	35.6	27.7	29.2
difference	-5.0 ns	-10.0 ns	3.1 ns	-7.1 ns
Resistant Alfalfa + Tall Fescue	33.0	11.2	24.0	22.9
Conventional Alfalfa + Tall Fescue	37.8	16.8	27.9	33.2
difference	-4.8 ns	-5.6 ns	-3.9 ns	-10.3 ns

ns = not statistically significant

At first harvest in the seeding year (2006) for both Ithaca and Landisville, the conventional alfalfa monoculture plots had significantly higher PLH counts per sweep set than the PLH-resistant alfalfa monoculture plots (Figure 1). Populations of PLH were high at both sites although at Landisville, a 6 inch rain storm likely reduced the number of PLH on the plots a few days prior to collecting the sweep data. For all three grass species in the alfalfa-grass mixture plots, the conventional alfalfa-grass plots did not have significantly higher number of PLH per sweep set than the PLH-resistant alfalfa-grass plots.

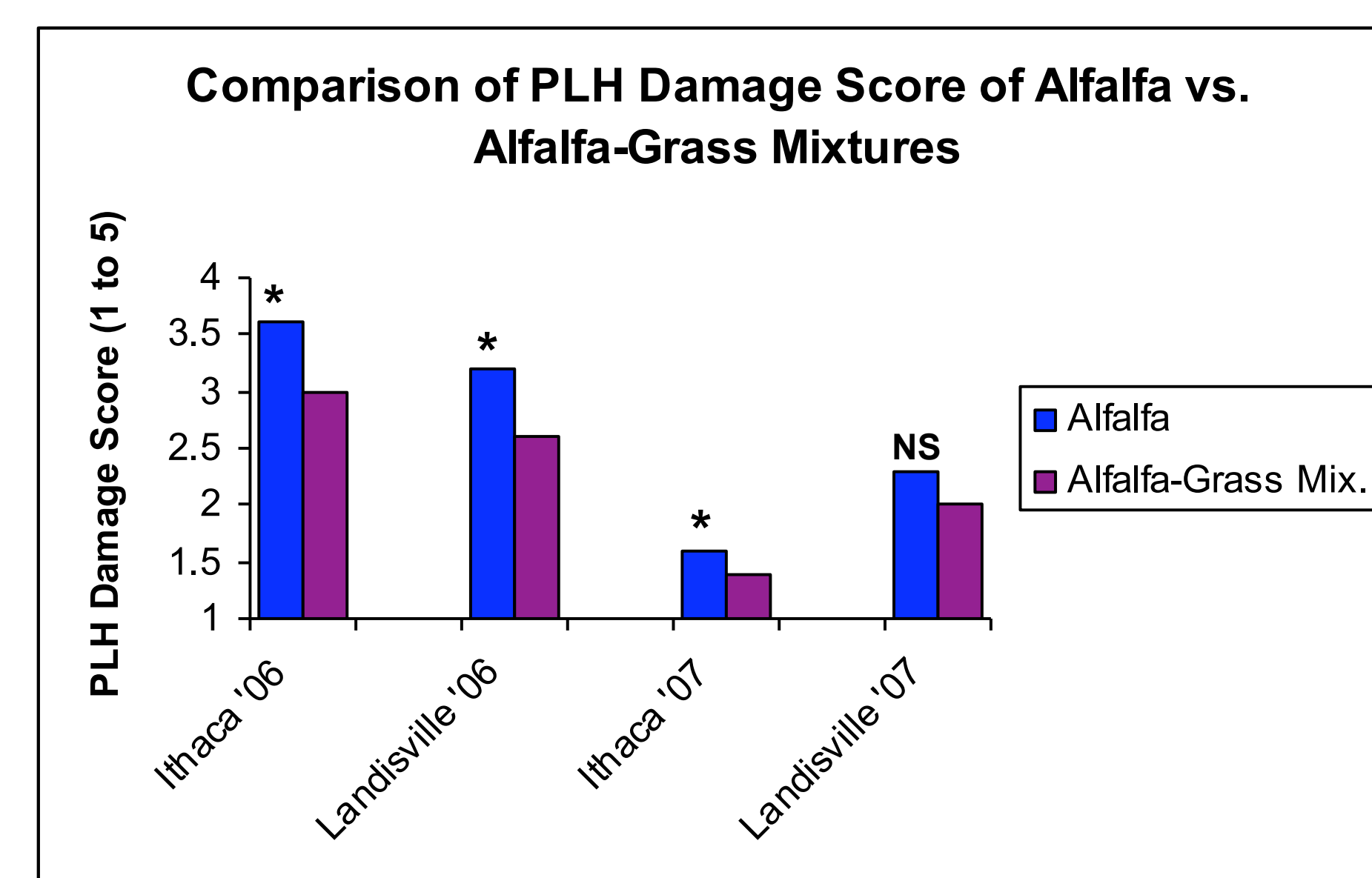
At second harvest in the first production year (2007) at both sites, the conventional alfalfa monoculture plots had significantly higher PLH counts per sweep set than the PLH-resistant alfalfa monoculture plots. Similarly, the conventional alfalfa-timothy plots had significantly higher PLH counts per sweep set than the PLH-resistant alfalfa-timothy plots at both sites. At this harvest, the average percent grass for the alfalfa-timothy mixture plots (8%) was lower than the average percent grass for the alfalfa-orchardgrass (27%) and the alfalfa-tall fescue plots (27%). Differences in PLH counts between the conventional alfalfa-grass plots and PLH-resistant alfalfa-grass plots were not statistically significant for the orchardgrass and tall fescue mixtures.



\*\* = statistically significant at P<0.01, \* = statistically significant at P<0.05, NS = not statistically significant.

Figure 1: PLH count per sweep for seeding year (2006) and first production year (2007) for Ithaca and Landisville. PLH-resistant alfalfa is compared to conventional alfalfa within grass species/monoculture.

The conventional alfalfa monoculture and grass mixture plots had significantly higher PLH damage scores than the PLH-resistant plots for all 16 planned comparisons (data not shown). The alfalfa-grass mixture plots, averaged over the two alfalfa cultivars, had significantly lower PLH damage scores than the average of the alfalfa monoculture plots at three of the four location-year comparisons (Figure 2).



\* = statistically significant at P<0.05, NS = not statistically significant.

Figure 2: Comparison of PLH damage score (1=no apparent damage to 5=severe damage) of alfalfa vs. alfalfa-grass mixtures by year and location.

All three grass species reduced PLH populations on the conventional alfalfa plots compared to the PLH-resistant alfalfa plots in the seeding year. In July of the first production year, the percent timothy in the mixtures was low and did not have reduced PLH populations in the conventional alfalfa plots compared to the PLH-resistant alfalfa plots. For PLH control in alfalfa, both PLH-resistant alfalfa cultivars and alfalfa-grass mixtures had lower PLH populations and PLH damage scores than conventional alfalfa cultivars and alfalfa monocultures, respectively. Planting PLH-resistant alfalfa with a perennial grass species is likely to minimize the chances of significant PLH damage to alfalfa compared to either PLH-resistant alfalfa monocultures or conventional alfalfa planted with a grass species.

## References

- Hansen, J.L., J.E. Miller-Garvin, J.K. Waldron, and D.R. Viands. 2002. Comparison of Potato Leafhopper-Resistant and Susceptible Alfalfa in New York. *Crop Sci.* 42:1155-1163.  
 Roda, A.L., D.A. Landis, and M.L. Coggins. 1997a. Forage Grasses Elicit Emigration of Adult Potato Leafhopper (Homoptera: Cicadellidae) from Alfalfa-Grass Mixtures. *Environmental Entomology* 26:745-753.  
 Roda, A.L., D.A. Landis, and J.R. Miller. 1997b. Contact-Induced Emigration of Potato Leafhopper (Homoptera: Cicadellidae) from Alfalfa-Forage Grass Mixtures. *Environmental Entomology* 26:754-762.