RIPM - Final Report

A. Grant Data

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Category: Northeast Regional IPM Competitive Grants Program (RIPM)

Title: Reducing Potato Leafhopper (PLH) Impacts on Alfalfa through PLH-resistant Cultivars intercropped with Perennial Forage Grass

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B. Nontechnical Summary

Potato leafhopper (PLH) is the most damaging alfalfa insect pest in the Northeast (NE). Some recent alfalfa cultivars have glandular hairs and PLH-resistance, yet are not immune to damage from PLH. Potato leafhopper-resistant alfalfa cultivars intercropped with perennial forage grass were shown be an IPM strategy that would have environmental and agronomic benefits to forage producers. The objectives were to compare PLH populations and densities, and forage yield and quality of a conventional alfalfa cultivar and a PLH-resistant cultivar both in monoculture and intercropped with grass and to conduct an economic analysis. Trials were established in Pennsylvania (PA) and New York (NY). The trial main plots were insecticide-treated and no-insecticide, and the sub-plots were a PLH-resistant alfalfa cultivar and a conventional alfalfa cultivar each clear-seeded, or seeded with a cultivar of timothy, orchardgrass, or tall fescue. Intercropping PLH-resistant alfalfa cultivars with grass minimized the risk of PLH damage. The PLH-resistant alfalfa cultivar had total season yields that were greater than or equal to the conventional cultivar in NY, but tended to have lower yield that the conventional cultivar in PA. The profitability of alfalfa-grass mixtures was more than the alfalfa monoculture in the seeding year, but less in the first production year. All producers of alfalfa would benefit from this research and results have direct application for producers of alfalfa-grass mixtures. Results of this research have great potential for direct and immediate adoption by conventional and organic producers of alfalfa and alfalfa-grass mixtures in the NE and other regions.

C. Introduction

Forages are one of NY and PA most important crop production assets. In addition to 1.15 million acres of alfalfa in NY and PA; 2.35 million acres of “other hay” crops including alfalfa-grass mixtures, contribute to the region’s agricultural economy (2003 NASS). It is estimated that at least two-thirds of the alfalfa seedings in NY and one-third in PA include a perennial forage

grass, most often timothy or orchardgrass. Perennial forages provide high-quality feedstuffs to livestock, as well as providing environmental and agronomic benefits such as crop rotation, reduced soil erosion, and improved soil structure and fertility (Barnes et al., 1995). Potato leafhopper is the most damaging insect pest of alfalfa in the NE, causing risk to new seeding establishment and survival, and to established stands during mid-to-late summer. When high populations of PLH are not controlled during the establishment year, large reductions in alfalfa yield and quality occur. If PLH are controlled with pesticides, the risks associated with pesticide application include potential accidental exposure to pesticide, potential reduction in beneficial insect populations, off site drift, unnecessary expenditures and reduced profit. Potato leafhopper (PLH)-resistant alfalfa is a new technology available to minimize PLH impacts. Impacts of PLH-resistant alfalfa have not been adequately studied in conjunction in alfalfa-grass mixtures.

D. Objectives

1. Compare PLH populations, and forage yield and quality in the establishment year and first production year of a conventional, PLH-susceptible alfalfa cultivar and a PLH-resistant alfalfa cultivar, each alone and intercropped with perennial forage grass species timothy, orchardgrass, and tall fescue. All research data were collected, analyzed, and summarized. Additional comparisons of interest will be done this fall for more in depth analyses of the results.
2. Complete partial budget economic analysis of forage production using PLH-resistant alfalfa in alfalfa-grass mixtures. Partial budgets for the main comparisons of interest (insecticide treated vs. not treated; PLH-resistant alfalfa vs. conventional alfalfa cultivars; alfalfa monoculture vs. alfalfa-grass mixtures) have been completed. Additional partial budgets will be developed this fall for other comparisons of interest.
3. Share results of this study in extension outreach opportunities throughout NY, PA, and the NE region. At Landisville PA, research plots were viewed and discussed at the Agronomy-Industry field day on June 30, 2006. Agronomic results were presented at Cornell Cooperative Extension In-Service training in November 2007, Steuben County Cooperative Extension Winter meeting in February 2008, and Schoharie County Cooperative Extension Field meeting in June 2008. Information comparing PLH-resistant and conventional alfalfa from the research trials was relayed to producers through an article in New York State Integrated Pest Management Weekly Field Crop Pest Report. Information comparing alfalfa and alfalfa-grass mixtures for PLH damage was reported in Field Crop News from Penn State. Agronomic results were presented at Cornell Seed Growers Field Day at Ithaca NY and at Cornell Musgrave Farm Field Day at Aurora NY in July 2008. An abstract and poster was presented at the North American Alfalfa Improvement Conference in June 2008.

E. Approach

We tested the potential for PLH-resistant alfalfa cultivars to be planted with forage grass as an IPM tactic to eliminate, not just reduce, PLH damage on alfalfa in the Northeast (NE) without the use of insecticides. The approach used was to plant research trials at four locations from the northern most location of Geneva NY to the southern most location of Landisville PA. For each trial the main plots were an insecticide treatment compared to no insecticide treatment, and the sub-plots were a PLH-resistant alfalfa cultivar and a conventional alfalfa cultivar each clear-seeded or monoculture, and each seeded with a cultivar of timothy, orchardgrass, or tall fescue. At each trial we monitored

insect populations, measured alfalfa height and grass height, visually scored PLH damage to the alfalfa, took samples for determining percent grass and for forage quality analyses, and harvested the plots for yield. From this data set, partial budget analysis was used to value the various management options, mainly insecticide treatment vs. no insecticide, a PLH-resistant alfalfa cultivar vs. a conventional alfalfa cultivar and planting monoculture alfalfa vs. planting with a grass companion crop.

F. Progress

In the last year, the forage quality analyses were completed and data from the four locations was analyzed and summarized. Partial budget analyses were completed for three comparisons over two years and four locations.

G. Results

Forage yields were higher in PA than in NY in part due to fewer harvests per year in NY and dry soil conditions in the production year in NY. In PA, the PLH-resistant alfalfa cultivar averaged statistically significant lower total season yield than the conventional cultivar. Since only one PLH-resistant cultivar was used in this study, other cultivars need to be tested before general conclusions concerning yielding ability of PLH-resistant alfalfa can be made. However, this research indicates PLH control for alfalfa in PA to mitigate yield losses may be accomplished mainly through timely insecticide application or early harvest. In NY differences were not detected in yielding ability between the PLH-resistant and conventional alfalfa. Furthermore, monoculture PLH-resistant alfalfa in NY yielded significantly more than monoculture conventional alfalfa when PLH populations were at damaging levels. Similarly PLH-resistant alfalfa in mixtures with timothy, a grass with low mid-summer growth, yielded more than conventional alfalfa –timothy mixtures. When grass with aggressive mid-summer growth such as tall fescue and orchardgrass was planted with alfalfa, the alfalfa had less visible PLH damage, but damage was not eliminated. Thus for NY producers to control PLH insects, PLH-resistant alfalfa cultivars are likely most appropriate for monoculture alfalfa fields and alfalfa-timothy mixtures. Either conventional alfalfa or PLH-resistant cultivars planted in mixtures with grasses with aggressive mid-summer growth could have comparable yields unless PLH populations exceeded threshold guidelines. In both NY and PA, when PLH were at damaging levels, the PLH-resistant alfalfa averaged significantly higher percent crude protein or forage quality than the PLH-conventional alfalfa.

Expected changes in profit associated with insecticide treated versus no insecticide comparisons were mostly negative for three locations, and positive for Landisville PA. For Landisville PA, conditions resulted in the added benefits of spraying exceeding the added costs. For the other locations, conditions resulted in the added cost of spraying exceeding the added benefits. Results suggest that IPM strategies such as scouting would yield decisions to not spray when added benefits were not expected to exceed the added costs of spraying. Expected changes in profit associated with PLH-resistant versus conventional alfalfa cultivar comparisons varied from negative 79 dollars per acre (Rock Springs PA) to 41 dollars per acre over the four locations and the two years. For other than Rocksprings PA, results suggest no change in profit between PLH-resistant and conventional alfalfa cultivars over the conditions experienced, especially in the first production year. Expected changes in profit associated with the alfalfa-grass mixtures versus alfalfa monoculture comparisons varied from 6 to 89 dollars per acre in the seeding year, and

from negative 224 to negative 47 in the first production year. Results suggest that although grass mixtures might be more profitable in the seeding year for the conditions experienced, the change in profit for the first production year was negative. Results were extremely sensitive to the prices placed on forage as determined by quality factors, and percent alfalfa in the stand.

H. Impacts

Project results provide NY and PA alfalfa producers with additional data to encourage use of PLH-resistant alfalfa cultivars in monoculture and in alfalfa-grass mixtures. Approximately 1.15 million acres of alfalfa in NY and PA; 2.35 million acres of "other hay" crops including alfalfa-grass mixtures, contribute to the region's agricultural economy (2003 NASS). An estimated two-thirds of NY and one-third of PA alfalfa is grown with a forage grass. Use of PLH-resistant alfalfa cultivars affords growers an effective IPM option to help minimize insecticide use to control this serious insect pest. While PLH-resistant alfalfa is not immune to PLH it can provide protection for two to three times the population as would cause economic damage to a conventional alfalfa cultivar. Early season protection to new alfalfa stands and in areas where PLH populations reach particularly damaging levels may require an insecticide if economic thresholds are exceeded. Avoiding insecticide applications minimizes risk of pesticide exposure, eliminates this input expense, and protects beneficial insects.

As shown in this project, PLH induced losses affect yield and quality of alfalfa forage. Seed cost of PLH-resistant alfalfa seed is $0-50 per fifty pound bag (or at a seeding rate of 15 lbs/acre $0-15 per acre) additional compared to a conventional alfalfa cultivar. Insecticide treatments for PLH control currently cost about $12-15 per acre. Insecticide to control PLH may be applied several times during the life of an alfalfa stand. In addition to enhancing profitability of alfalfa production for producers, information from this study provides data to enhance educational materials for extension personnel and ag consultants. Information would be helpful for seed salespersons to encourage use of PLH-resistant alfalfa. As alfalfa breeders continue to improve PLH-resistant alfalfa cultivars, there is opportunity for more producer satisfaction and adoption of this type of alfalfa.

The use of PLH-resistant alfalfa cultivars in monoculture and in alfalfa-grass mixtures was validated through this project. To date, seven presentations were given to producers, cooperative extension educators, and seedsmen, two articles were written for Field Crop News on-line publications and one poster and an abstract were presented at the National Alfalfa Improvement Conference in June 2008. It is estimated that approximately 300 people were at the various field days and meetings where presentations about this project were given. It is not known how many people have chosen to plant PLH-resistant alfalfa with or without a grass species, however, use of PLH-resistant alfalfa cultivars is currently being recommended to producers in NY and some producers in PA. The highest yields were attained with insecticide applications, however, when insecticides were not applied, profit was increased in three of the four locations. The project results continue to provide opportunities to enhance educational efforts regarding PLH management. It also affords opportunities to continue exploration and development of IPM options and optimize their impacts on the economical production of animal forage.

References

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