POTATO LEAFHOPPER POPULATIONS IN GLANDULAR HAIRED ALFALFA ESTABLISHED WITH OATS AND THEIR EFFECTS ON YIELD

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Introduction

Several Potato leafhopper (PLH) resistant alfalfa varieties are now commercially available. Resistance in these varieties coincides with glandular-hairs that protrude from the epidermal surface of the alfalfa and secrete a sticky substance. An accustomed methodology among alfalfa growers in Wisconsin is to establish spring seeded alfalfa with oats as a companion crop. The rationale behind this method is that the oats stifle weed growth and hinder soil erosion during alfalfa seedling germination (Stout *et al*, 1992). Unfortunately, as the oats progress in maturity, they compete with the alfalfa for nutrients, sunlight, space, and water. These added pressures increase environmental stress on the alfalfa which may cause decreased yield, and weakening to insect herbivory. Conversely, the presence of oats may act as a deterrent to colonizing adult PLH. Regardless of resistance, varieties may be better protected with oat companion crops. Growers may remove the companion crop with three different methods: using a selective grass herbicide to kill the young oats, harvest the oats with the first cut of alfalfa and use as oatlage, or harvest when the grain has reached maturity. The last would cause greatest stress to the alfalfa seedlings (Flora & Sulc 1996). The purpose of this study was to determine if the oat establishment method had a carry over effect the following growing season in regards to yield and PLH populations in resistant and susceptible varieties of alfalfa.

Materials and Methods

An experiment designed to examine the interaction between establishment method and the effect on PLH populations in different varieties of alfalfa was conducted during the summers of 1998 and 1999 at Arlington research station. Alfalfa and oats were seeded in the spring of 1998 and plots were 18'x 18' with 5' alleys in between. Using a 2x3x4 factorial setup in a split-split plot design with four complete blocks, the experiment utilized four varieties of alfalfa: Vernal, 5454 (both varieties are susceptible to PLH feeding), Arrest and 53V63 (both are glandular haired varieties and show resistance to PLH feeding). The oat companion crop was grown in one of three ways: Poast + (oats sprayed with a grass herbicide when approx. 4 inches tall), Oatlage (oats harvested with the alfalfa stand prior to oat maturity), and Grain (oats harvested when fully matured). To assess feeding damage by PLH, one half of each block was sprayed with Warrior-T, a synthetic pyrethroid, to control PLH in the plots. A 20' buffer area separated the sprayed and unsprayed plots.

During the summer of 1999 (year after establishment) data for the analysis were obtained using several sampling techniques. To gain information about the PLH population a D-vac (five sucks per treatment) was used. The D-Vac samples contained information on the abundance of adult and nymph potato leafhopper in each plot. D-vac samples were held in individually labeled D-vac bags, taken to the laboratory, and placed in a freezer to kill all living insects. The following day the PLH adults and nymphs were counted. Alfalfa heights were estimated by taking the average of five measurements in each

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plot. Hopperburn was estimated by visual assessment of percent (0-100 %) yellowing observed in each plot. All data were collected once every 7-9 days. At the end of the growing season in 1999 the amount of weed growth (grass vs broad leaf) and alfalfa stand counts were measured by randomly counting the vegetation present in 2 square feet of each plot. Yields were taken on May 26, July 8, and August 6, 1999.

Results and Discussion

PLH Populations

From June 22-28 insecticide treated plots had significantly lower populations. In sprayed and unsprayed plots there were no varietal differences in adult numbers. Nymph populations however, were significantly higher in 5454 on June 28. Peak adult and nymph populations occurred on July 6, 1999. On this date, there were no differences between varieties for nymphs and adult males. Females discriminated between variety and oat treatment and showed high affinity for 5454 in Poast+ and Grain establishment methods. When the varieties were grown in Oatlage however, females showed greater affinity for 53V63 than 5454. The field was harvested and for the rest of the summer no varietal differences were observed for adult or nymph populations. With the insecticide treatment however, we saw a significant movement of adult populations into sprayed plots from the unsprayed plots.

Hopperburn

From the beginning of the season until the end of data collection there were always significant varietal differences. In unsprayed plots, 5454 showed significantly higher amounts of hopperburn, and 53V63 showed significantly lower amounts. Insecticide treatment showed significant differences between sprayed and unsprayed plots, except for July 6 (peak PLH infestation) where 53V63 showed no difference in hopperburn between sprayed and unsprayed plots.

Weeds and Stand Count

Grass weed densities revealed that spraying insecticide significantly reduced the amount present in plots. There were also significantly less in Poast+ establishment method which shows a carry-over effect for plots sprayed with herbicide one year earlier. Vernal had significantly more broad leaf weeds than the other varieties. Insecticide use marginally decreased broad leaf weed density. In stand counts, there were significant differences found among variety, spray, and establishment method. 53V63 had thicker stands than vernal or 5454. Oatlage plots had severely low stand counts compared to Oat and Poast+ plots.

Yield

The yield results for the growing season of 1999 can be seen in Tables 1-4. First crop yields are used as a direct comparison of the effect of establishment method from the summer of 1998. Second and third cut yields are better related to PLH feeding damage in the second summer. First cut yields show that whether sprayed or unsprayed, 53V63 yielded higher in the Grain establishment method. In the other two establishment methods, 53V63 again yielded higher out of the four varieties in the unsprayed treatments. The lowest yield was for 5454 grown in the Poast+ plots. Vernal always showed reduced yields in sprayed and unsprayed plots. The second cut yields showed a similar trend with 53V63 yielding higher, especially in the plots that were taken to harvest. Third crop yields for unsprayed plots of 53V63 were higher in Grain and Poast+ than in the Oatlage establishment method.

Table 1
1st Cut yields Ton/A (harvested 5/26/99)

	Poast+		Oatlage		Grain	
Variety	**Spray**	**Control**	**Spray**	**Control**	**Spray**	**Control**
5454	2.45	1.80	2.41	1.96	2.43	2.09
Vernal	2.16	1.92	1.92	1.94	2.05	1.93
53V63	2.37	2.20	2.25	2.21	2.49*	2.47*
Arrest	2.31	2.10	2.24	1.99	2.46	2.31

*Highest yields

Table 2
2nd Cut Yields Ton/A (harvested 7/8/99)

	Poast+		Oatlage		Grain	
Variety	**Spray**	**Control**	**Spray**	**Control**	**Spray**	**Control**
5454	1.89	1.35	1.89	1.62	2.12	1.62
Vernal	1.93	1.57	1.92	1.52	1.95	1.48
53V63	2.23*	1.84	2.01	1.74	2.11	1.99
Arrest	1.97	1.73	2.05	1.62	2.12	1.77

Table 3
3rd Cut Yields Ton/A (harvested 8/6/99)

	Poast+		Oatlage		Grain	
Variety	**Spray**	**Control**	**Spray**	**Control**	**Spray**	**Control**
5454	1.09	0.64	1.29	0.64	1.13	0.58
Vernal	1.02	0.57	1.01	0.67	1.00	0.47
53V63	1.10	0.77	1.03	0.84	1.36*	0.94
Arrest	1.02	0.78	1.11	0.91	1.31	0.67

Table 4
Total yields 1999

	Poast+		Oatlage		Grain	
Variety	**Spray**	**Control**	**Spray**	**Control**	**Spray**	**Control**
5454	5.43	3.78	5.59	4.22	5.68	4.29
Vernal	5.11	4.05	4.84	4.12	4.99	3.88
53V63	5.70	4.81	5.30	4.78	5.96*	5.40
Arrest	5.30	4.60	5.41	4.51	5.88	4.74

References

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