Alfalfa Irrigation Practices And Cultivar Selection For Sweetpotato Whitefly Management In Southern California

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INTRODUCTION

The sweetpotato whitefly strain B destroyed the fall melon crop in the low desert agricultural valleys of southern California, Arizona, and Baja California Norte, Mexico during 1991 and 1992. Many other fall crops including cole crops and lettuce, were also damaged. Cotton and alfalfa have also been severely damaged from the current whitefly infestation.

Insecticides may be a useful tool for whitefly control in the future, but currently are not adequate for crop protection in light of the extremely high population pressure. In order to reduce the whitefly populations to levels where biological control agents or insecticides will be effective, growers will need to adopt new cropping practices. One practice alfalfa growers can easily adopt is summer dormancy, via irrigation termination. This may not be feasible for all alfalfa stands. The duration and time of irrigation termination needed to maximize the impact on sweetpotato whitefly strain B without hurting the stand needs further investigation.

MATERIALS AND METHODS

Dr. Frank Robinson, is currently conducting alfalfa irrigation studies. Several varieties of alfalfa are grouped in four irrigation schemes of optimum (normal irrigations), minimal (one less irrigation per cutting in July-September) short stress (no water August and September) and long stress (no water July-September). Each treatment is replicated three times in a randomized complete block design. The cultivars include CUF101, Cibola, Moapa 69, UC-150, Mesilla, Wilson, and Dofari. The irrigation schedule for each treatment is included in Table 1. On September 20, 1991, ten stems of CUF101 were randomly sampled from each treatment and replicate. Sweetpotato whitefly nymphs were counted on the third trioliate main stem leaf from the base of each stem. Nymphal samples included: Nymphs (crawlers through early 4th instar), redeyed nymphs (4th instars showing red eye spots of the developing adult), parasitized nymphs (empty nymphal cases with a round exit hole of an adult wasp) and empty nymphal cases (y-shaped exit hole of an adult whitefly).

Seven alfalfa cultivars in the optimum irrigation treatment were evaluated for their relative susceptibility to colonization by the sweetpotato whitefly (SPWF) strain B on October 23, 1991. The alfalfa cultivars included: Cibola, CUF101, Dofari, Mesilla, Moapa 69, UC150 and Wilson.

Alfalfa plots of each cultivar were replicated nine times in a ramdomized block design. Five alfalfa stems were extracted at random from each plot. The sample unit for SPWF life stages was the seventh main stem node leaf from the base of the extracted stems. The center leaflets from the trifoliate leaves were examined using binocular microscopes to count eggs, crawlers (first instar nymphs), nymphs (second through early fourth instar nymphs), redeye nymphs (late fourth instar nymphs) and empty nymphal cases (nymphal exudate remaining after adult emergence). The SPWF sample stages, mentioned above, were totaled for each five leaflet samples in each plot and data sets were analyzed using two-way analysis of variance.

RESULTS

In each data set, the whitefly means for optimum and minimal treatments were the largest and were not significantly different from each other, but were significantly different from the long and short treatment whitefly means, $p \leq 0.05$ (Table 2). The long and short stress treatments had whitefly means which were the smallest and were not significantly different from each other. Therefore, irrigation management in alfalfa for a short or long stress (dormancy) period during the summer could greatly reduce whitefly populations. The stress period from irrigation termination may need to be shortened to a one month duration in lighter soils to minimize stand loss.

For cultivar resistance the means from data analysis are reported in Table 4 and 5. When all the means for the samples of eggs, crawlers, nymphs, totatl nymphs, redeye nymphs and empty nymphal cases were compared, the cultivars Mesilla and Wilson may be ranked the least susceptible to sweetpotato whitefly and CUF 101 is the most susceptible to sweetpotato whitefly colonization. Dofari and UC150 are also susceptible to heavy colonization by sweetpotato whitefly, while Cibola and Moapa 69 are intermediate in their susceptibility to SPWF among cultivars compared in this research.

Discussion

To further benefit alfalfa growers economically a short or long water stress in alfalfa would save costs of irrigation, herbicide, insecticide and harvesting costs. The above mentioned cost savings are included in Table 3. Herbicide treatments for summer annual grasses are applied as Treflan TR10 granules at 20 lb/acre at a cost of $22.86 in February or as Poast at 1 pt/acre at a cost of $27.15 in June. An insecticide treatment for leafhoppers, alfalfa caterpillars or beet armyworm will usually be

applied to at least one of three alfalfa hay crops from July-September. Insecticide costs with application costs for beet armyworm would most likely include Lorsban 4E at 1 pt/acre at a cost of $9.79 or Lannate L at 1 pt/acre at a cost of $8.89. With the short and long stress treatments the above pest control treatments would not be needed.

With a per acre foot water cost of $11.50 and labor cost of $5.75/hr the short and long stress treatments would provide a cost savings of $36.38 and $64.41 respectively over the optimum. Harvest cost savings for the short and long stress treatments would be $23.00 and $34.50 respectively, over the optimum and minimal stress treatments. Drying of alfalfa fields during summer months for two years or more could reduce stand, if additional winter irrigations are not applied to replenish the deep soil moisture lost during the summer.

The cost savings outlined above along with the whitefly population suppression deserve serious consideration by growers and managers of alfalfa hay production operations. The cost saving benefits of irrigation termination during summer months are especially important during less than favorable market conditions which have occurred during the summer of 1991 and 1992. Some possible adverse conditions which may occur due to periods of irrigation termination are reduction of beneficial insect populations and stand thinning. These adverse conditions deserve attention and are being looked into be researchers involved in this project.

Table 1. Alfalfa Summer Water Stress In the Imperial Valley Irrigation Treatment Schedules, 1991

Irrigation Treatment	Number of Irrigations			
	July	August	September	October
Optimum Check	3	2	2	2
Minimal stress	3	1	1	2
Short stress	3	0	0	2
Long stress	0	0	0	2

Table 2. Effect of Irrigation Scheduling on Population levels of the Poinsettia Biotype of Sweetpotato Whitefly in Alfalfa in Imperial County, 1991

Irrigation Treatment	Nymphs	Redeyed Nymphs	Parasitized Nymphs	Empty Nymphal Cases	Percent Parasitism
Optimum (Checks)	16.60A	2.23A	1.73A	5.70A	30
Minimal Stress	8.20A	1.70A	1.13A	3.80A	30
Short Stress	1.03 B	0.03 B	0.10 B	0.27 B	17
Long Stress	0.03 B	0.03 B	0.00 B	0.10 B	0

Means followed by the same letter are not significantly different at p=0.05, ANOVA and SNKT.

Table 3. Per Acre Costs for Established Alfalfa Under Various Irrigation Schemes from July - September In the Imperial Valley of California

	Irrigation Costs $11.50/acre foot & Labor	Herbicide Cost & Application Cost	Insecticide Cost & Application Cost	Harvest Cost
Optimum (Checks)	64.41	$22.88 - 27.15	$8.89 - 9.79	$46.00
Minimal stress	46.72	22.85 - 27.15	8.89 - 9.79	46.00
Short stress	28.03	- - -	- - -	23.00
Long stress	- -	- - -	- - -	11.50

Table 4. Means [1] of Sweetpotato Whitefly Strain B Eggs, Crawlers and Nymphs Per Alfalfa Leaflet For Seven Cultivars, University of California Desert Research and Extension Center, 1991.

Cultivar	x Eggs/Leaflet (±SE)	x Crawlers/leaflet (± SE)	x Nymphs/leaflet(±SE
Mesilla	19.3 ± 5.4	8.4 ± 1.1	19.1 ± 2.4
Wilson	26.4 ± 6.1	12.2 ± 2.6	15.0 ± 3.3
Cibola	23.0 ± 5.6	11.2 ± 2.1	20.1 ± 4.4
Moapa 69	26.0 ± 5.7	13.1 ± 3.5	27.2 ± 6.0
Dofari	27.5 ± 8.9	14.1 ± 3.4	23.8 ± 4.6
UC 150	30.8 ± 10.0	17.0 ± 6.4	24.8 ± 5.1
CUF 101	37.9 ± 11.4	16.4 ± 2.9	31.1 ± 5.1
	NS [2]	NS	NS

[1] Means of 45 leaflets from 5 leaf samples/plot with 9 replications
[2] NS = no significant differences among means (p≥0.05)
SE = standard error. Sampled October 23, 1991.

Table 5. Means [1] of Sweetpotato Whitefly Strain B Redeye Nymphs, Empty Nymphal Cases and Total Nymphs Per Leaflet for Seven Alfalfa Cultivars, University of California Desert Research and Extension Center, 1991.

Cultivar	x Redeye Nymphs/Leaflet	x Empty Nymphal Cases/Leaflet	x Total Nymphs Leaflet
Mesilla	1. bc	0.5 bc	29.1 b
Wilson	2.4 bc	0.8 bc	29.6 b
Cibola	3.2 abc	0.6 bc	34.4 b
Moapa 69	3.5 abc	0.3 c	43.9 ab
Dofari	6.0 ab	1.6 ab	43.8 ab
UC 150	5.4 abc	1.3 abc	47.2 ab
CUF 101	7.1 a	2.0 a	54.7 a

[1] Means followed by the same letter are not significantly different (p≥ 0.05) by ANOVA and DMRT. Sampled October 23, 1991.