Cultural Alternatives For Avoidance of Lettuce Infectious Yellows Virus (LIYV)

John McGrady, Vince Rubatzky, Norm Oebker, Tim Hartz, Marvin Butler, Phil Tilt, and Sherry Hagerman

Introduction

The occurrence of sweet potato whitefly vectored LIYV has a substantial economic impact on winter lettuce production in the California and Arizona desert districts. The disease reduces both yield and quality of the winter production. The earliest plantings are impacted ore severely, with damage persisting, although usually at diminishing levels for later harvests.

Observations reported by Toscano (1989) and others indicate that later lettuce planting dates resulted in a reduction of crop losses to LIYV. Mid October planting dates resulted in considerably fewer infected plants and no loss of marketable yield. Additionally, Byrne (1989) reported that lettuce is not a preferred host for whitefly and that older lettuce is even less preferred. The Toscano and Byrne reports suggest that avoidance of whitefly, either by later planting (when whitefly population are lower or absent), or by protection of the young plants, (transplants produced in whitefly free areas or shields from attack with row covers) could greatly reduce both the incidence of infection and disease development. Natwick, et al (1988) reported using row covers to successfully protect against virus vectoring insects, These reports and observations suggest that row covers, transplants and/or later plantings may be viable alternative procedures.

Our objectives were to demonstrate effectiveness and feasibility of non-chemical cultural procedures as alternative control methods to reduce exposure to and infection by sweet potato whitefly. Successful employment may allow normal seasonal plantings. This research project was supported by the California Iceberg Lettuce Research Council.

Materials and Methods

At the Yuma Valley Agricultural Center, three direct-seeded planting dates (PD) were established at two week intervals beginning August 15 (Table 1). Row covers (Kimberly Farms spunbonded polypropylene) were installed prior to furrow irrigation in the first two PDs and immediately after first emergence in PD3. Transplants were raised from the same seed lot as their direct-seeded counterparts in each PD; 'Empire'was used in the first two PDs and 'Merit' in the third. Transplants were one week older than the direct-seeded plants when set in the field to allow time for transplant shock recovery. Row covers were removed at intervals in PD2 and PD3 and final removal coincided with time of field transplant placement. Yellow sticky traps were placed randomly in the fields and captured whiteflies counted weekly; traps under the row covers were checked periodically to ascertain whitefly exclusion. Plant tissue samples were collected from all treatments at the time of transplant field setting and 45 days after transplanting (DAT) for serological assay for LIYV using an ELISA protocol developed by Brown and Poulos (1989). Plants in the field were visually rated for LIYV symptoms 45 DAT and at harvest.

Results

The experimental plots were located at the Yuma Valley Agricultural Center and were adjacent to a cotton field. Whitefly populations were heavy early in the season and decreased dramatically after cotton harvest (Figure 1). There were no significant difference in whitefly numbers between PDs nor between treatments within a PD. There were no whiteflies on sticky traps underneath the row covers. Due to this heavy whitefly pressure row covers were not removed at intervals in PD1. Consequently, heat stress under the row covers reduced early stands. High numbers of early whiteflies resulted in severe LIYV infection and no marketable yield in PD1.

Early (45 DAT) visual ratings of LIYV symptoms (Table 2) indicated reduced severity of expression of the virus in the transplants of the first two PDs and under row covers in PD2 and PD3. No evidence of virus presence by ELISA was found 45 DAT when visual ratings indicated partial expression. The relatively high ratings for transplants can be attributed to stress from poor field placement; this caused poor head development, yellowing and necrosis difficult to discern from LIYV symptoms.

Head weight was low for all transplants in all three plantings (Table 2). There was no marketable product in the first PD but yield data was taken for comparison purposes. As expected, head quality improved with successive planting dates. Percent of heads harvested was based on the number of heads available. Yield improved in the second and third PD and was about the same for direct-seeded and row cover plots.

Low yield from the transplants can be attributed to several factors, primarily the very low elevation of the bed after passage of the transplanter; this did not facilitate adequate irrigation and may have resulted in poor root system development. The light weight of the transplants also resulted in poor placement of the seedlings (at angles or on top of the soil, necessitating hand planting) and variable depth of planting. The problem of heat stress under the row covers and transplant placement difficulties obviate the need for lighter weight row cover material (no heat buildup) and use of a semi-automatic transplanter to assure proper placement of the seedlings in the soil in subsequent experiments. These changes will be incorporated into the fall 1991 project in a Yuma area grower's field.

References

Brown, J.K. and B.T. Poulos. 1989. Detection of lettuce infectious yellows virus (LIYV) in greenhouse and field-inoculated plants using an indirect enzyme-linked immunosorbent assay (ELISA). J. Rio Grande Valley Hort. Soc. 42:13-18.

Toscano, N.C., 1989. Insect Pest Management of Lettuce. [Lettuce Planting Dates - A Way of Reducing the Incidence of Infectious Yellows in Lettuce], pp. 69-72. Research report in California Iceberg Lettuce Research Program Annual Report, April 1, 1988-March 31, 1989.

Byrne, D.N., 1989. The Sweet Potato Whitefly, *Bemisia tabaci*, in Arizona. Handout of oral presentation at First California Arizona Desert Vegetable Workshop, November 18, 1988, Yuma, AZ.

Natwick, E., A. Durazo III, and F. Laemmlen, 1988. Direct Row Covers for Insects and Virus Diseases Protection in Desert Agriculture. Plasticulture 78:35-46.

Table 1. Dates of some 1990 cultural management operations at the Yuma Valley Agricultural Center.

	PLANTING DATE		
OPERATION	1	2	3
Direct Seeded	August 15	August 29	September 11
Transplants set (r.c.* removed)	September 11	September 26	October 10
Harvest	December 4**	December 14	December 19

* row cover
** no marketable heads harvested

FIG 1. NUMBER OF WHITEFLIES/SQ INCH ON YELLOW STICKY TRAPS, YVAC, 1990

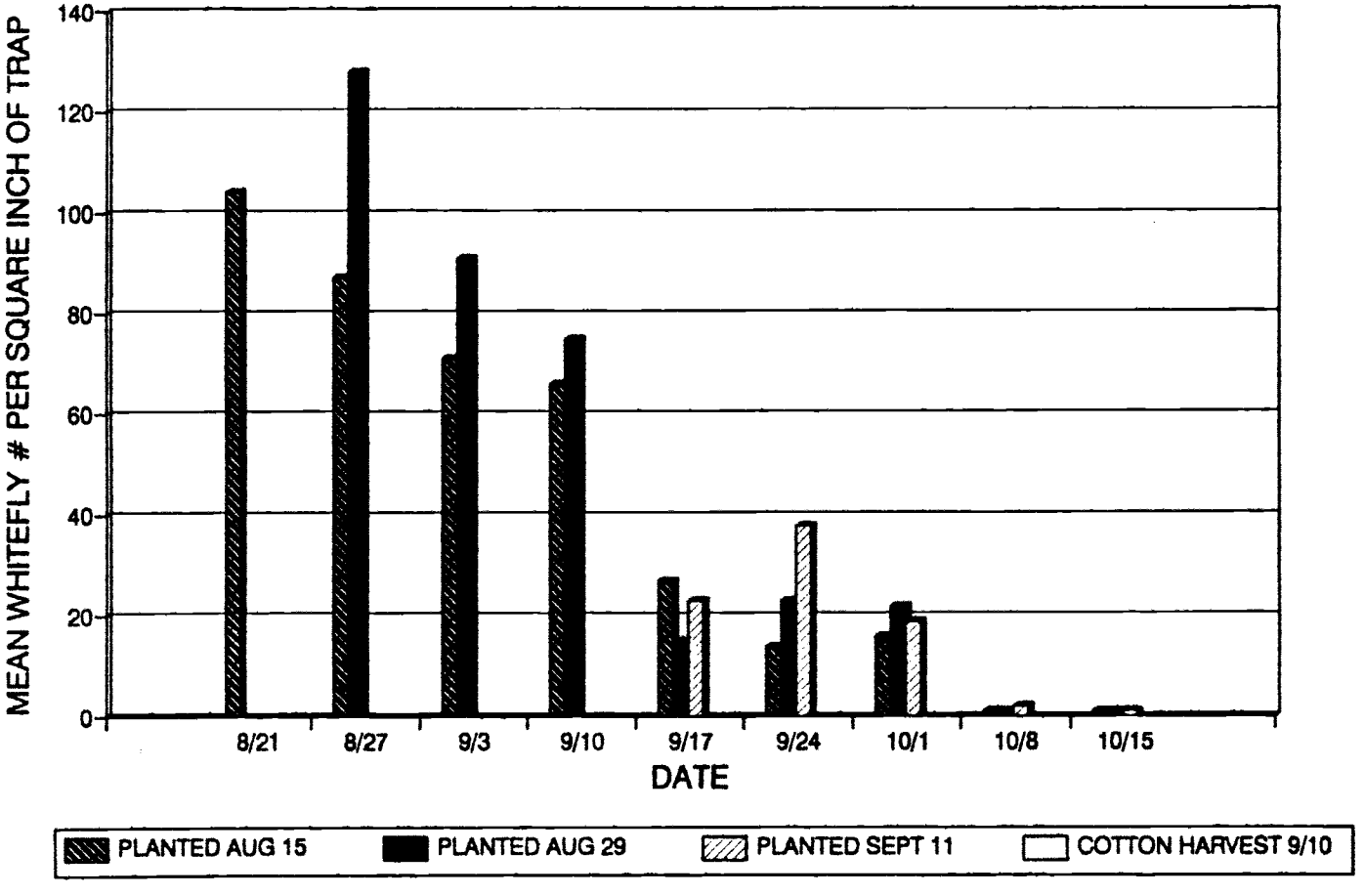

Table 2. Visual rating of LIYV symptoms, ELISA results, mean head weight and percentage heads harvested at the Yuma Valley Agricultural Center (PD_1, PD_2, 'Empire', PD_3, 'Merit').

	Rating*		ELISA**		Head Wt(lb)	Harvested
	45DAT	Harvest	at tp	45DAT		
PD_1 direct seeded	3.0	4.7	-	-	0.7	29
row cover	3.1	4.2	-	-	1.1	17
transplanted	2.8	4.1	±	-	0.7	39
PD_2 direct seeded	3.2	3.0	+	-	1.1	87
row cover	2.3	3.8	-	-	0.9	87
transplanted	2.5	4.3	-	-	0.9	82
PD_3 direct seeded	2.9	2.8	±	-	0.9	91
row cover	2.5	2.5	±	-	0.9	88
transplanted	3.1	2.0	-	-	0.8	80

* Rating 1-9 with 9 as most severe; ratings 45 days after transplanting (DAT) and at harvest.

** ELISA, tp = transplanting, + = virus present, - = virus absent.