Use of Stylet Oil to Slow the Spread of Lettuce Infectious Yellows Virus

Merritt R. Nelson, Joseph C. Matejka, and Judith K. Brown.

ABSTRACT

The use of stylet oil to slow the spread of the whitefly-transmitted virus, lettuce infectious yellows, shows sufficient promise to plan for expanded research efforts. The main positive results were a slower buildup of virus infection and a larger number of marketable heads in the block of lettuce sprayed with oil.

Weight (in grams) of individual heads could be correlated with time of infection in that the lowest weights and marketability ratings occurred in plants infected earliest in the season. Whether they were from treated or untreated plots, marketable heads weighed an average of 780 grams; unmarketable heads weighed 491 grams. The key difference is that, on the average, five marketable heads of lettuce were in the oil-treated plots for every three in the untreated plots.

A follow-up experiment will be conducted in 1989 to determine if these preliminary positive results indicate that stylet oil treatment may be a practical control method for slowing the spread of LIYV.

INTRODUCTION

Lettuce infectious yellows virus (LIYV) has been recognized as a major problem in lettuce production in Arizona since 1981 (1). The disease is common in both lettuce and cucurbits in Arizona, California and Mexico. Infections of young plants as they emerge in late-summer and early-fall result in small, light, loose heads. High populations of the whitefly vector originating from summer cotton, plus alternate hosts of the virus in both weeds and crop plants have caused serious disease epidemics in most recent years. Efforts to find a means of reducing losses due to the disease have failed thus far. One option not yet fully tested, however, is the use of stylet oil (3).

A specially formulated mineral oil, designated as stylet oil, has successfully slowed the spread of aphid-transmitted viruses of peppers and cucurbits (3, 5). Theoretically, the oil on the surface of the leaves interferes with the transmission process (5). There are no substantiated reports of success where whitefly-transmitted viruses are involved, although there is one report of an attempt (4).

The transmission mechanisms between aphids and whiteflies are similar, but different. Many aphid-transmitted viruses are limited to the mouth parts or stylets. In this type of transmission process, aphids acquire the virus during short feeding periods and then transmit it shortly after acquisition, as the insect probes and moves from plant to plant. In these cases, the virus is restricted to the mouth parts and, is referred to as "stylet-borne." The processes and mechanisms involved in the transmission of whitefly-transmitted viruses differ; acquisition-access feedings and inoculation-access feedings are much longer. In addition, latent periods are usually required, but once acquired by the whitefly, the virus is transmissible for a much longer time than most aphid-transmitted viruses. Nevertheless, the stylet mouth parts and the means of feeding on plant sap are similar for both insects;

thus, a field test using "stylet oil" for controlling the spread of lettuce infectious yellows virus was undertaken. The investigation of this method was rationalized on the basis that:

1. The early season infections incited by LIYV are responsible for poor quality lettuce.

2. Plants in the seedling stage are the most vulnerable to the effects of the yellows disease; at the same time, due to their small surface area, they are easily covered by a spray application.

3. If treatments are successful, it is estimated that protection for eight weeks would be adequate to significantly improve the quality of the crop, even in the event of virus infection later in the season.

MATERIALS AND METHODS

The product, JMS stylet oil, was obtained from JMS flower farms of Vero Beach, Florida. Recommended application is with a ground sprayer with specially spaced TX stainless steel nozzles using TX-4 orifice for smooth leaf plants. The application should be made at 400 psi, with a tractor speed of no more than 6 kph (3.6 mph). The key is to get good coverage of appropriately sized droplets. An acceptable alternative for experimental use (and smaller areas) is a gasoline-powered backpack sprayer such as an ECHO SHR-200E. With this sprayer and a custom boom with proper nozzles, a pressure of 200 psi is adequate. Good coverage and proper gallonage is achieved by an operator walking at 3.3 kph (2 mph).

In this experiment, the ECHO sprayer was used and mounted on a tractor with the nozzles at appropriate heights above the young lettuce seedlings. The oil was applied with a tractor speed of 3.3 kph (2 mph).

The original intention had been to spray the young plants as soon as they emerged, and again at 3-5 day intervals thereafter. However, unanticipated problems with irrigation schedules made that schedule impossible to follow. The first spray did occur shortly after emergence and then at intervals as possible on the following dates: October 3, 1988; October 13, 1988; October 19, 1988; and November 16, 1988.

To properly test the stylet oil, it was recommended that large blocks be treated rather than small plots. Therefore, a three-acre block of lettuce was planted at the Yuma Valley experiment station; half was sprayed with JMS stylet oil and half was not. Four double-row 50-foot plots were selected and spaced uniformly in each of the two blocks of lettuce. Data taken included: 1. Virus infection, 2. Head weights, and 3. Marketable vs non-marketable heads.

Virus infection was recorded in the field on dates indicated by visual observation of symptoms. Selected samples were tested using the ELISA serological system to confirm accuracy of visual symptom readings (2).

RESULTS AND DISCUSSION

Virus readings were made on November 8, 14, 22, and December 8 (Table 1). On December 8, the field was approximately 100 percent infected. None of the lettuce from the plants that were infected on November 8, 14, or 22 were marketable, and individual heads were correspondingly lighter (judged by appearance and head density), than marketable heads (Tables 3).

Despite the lack of optimum timing for oil applications, two promising observations suggested that further tests should be conducted. First, virus infection in the sprayed plots was delayed somewhat in comparison to unsprayed plots. Second, there were more marketable heads in the sprayed vs unsprayed plots (Table 3).

During the fall of 1989, timing of applications, equipment, and procedures will be optimized further to determine if implementing a rigorous spray program (involving the use of stylet oil to delay and reduce virus infection) will reduce yield losses in early-fall planted lettuce.

Table 1. Number of lettuce plants exhibiting symptoms of lettuce infectious yellows in 90 plants per plot, on dates indicated.

Unsprayed

	11/18	11/14	11/22	12/8
I	4	14	28	-
II	5	15	33	-
III	4	14	22	-
IV	1	8	25	-
AVE	4 (4%)	10.25 (12%)	27 (30%)	100%

Sprayed

I	2	7	22	-
II	2	6	17	-
III	0	6	17	-
IV	4	7	16	-
AVE	2 (2%)	6.5 (7%)	18 (20%)	100%

Table 2. Average weight (grams) of heads from plants in different categories.

		Early Infection	Late Infection	Marketable	Soft Unmarketable	Small Unmarketable	Average Total Hds
Sprayed							
I	NW	431	568	616	436	277	520
	NE	526	628	685	446	310	590
II	NW	466	702	791	569	409	561
	NE	442	712	806	566	469	655
III	NW	544	657	758	498	514	622
	NE	461	702	811	491	493	545
IV	NW	559	731	818	529	515	686
	NE	658	789	848	574	552	752
AVE		510	686	767	514	442	616
Unsprayed							
I	NW	486	559	710	478	431	526
	NE	543	643	773	516	502	593
II	NW	413	684	840	440	365	560
	NE	607	679	809	683	538	662
III	NW	602	760	841	652	392	663
	NE	492	673	757	560	474	585
IV	NW	463	783	856	575	393	616
	NE	546	773	794	700	443	657
AVE		519	694	798	576	442	608

Table 3. Summary of marketable heads in sprayed and unsprayed plots.

Sprayed

		Mkt	Soft Unmkt	Small Unmkt	Total Unmkt	Total Evaluated
I	NW	29	13	7	20	49
	NE	32	4	8	12	44
II	NW	25	7	16	23	48
	NE	22	6	15	21	43
III	NW	18	8	17	25	43
	NE	24	13	12	25	49
IV	NW	24	6	13	19	43
	NE	29	2	12	14	43
AVE		25	7	13	20	45

Unsprayed

I	NE	13	10	21	31	44
	NW	13	8	17	25	48
II	NE	19	12	20	32	51
	NW	21	5	19	24	45
III	NE	19	10	11	21	40
	NW	12	11	16	27	39
IV	NE	13	4	12	16	29
	NW	16	8	8	16	32
AVE		16	9	16	25	41

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