

## EVALUATION OF SILWET L-77 FOR POSTHARVEST DISINFESTATION OF THRIP IN ASPARAGUS

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### SUMMARY

Silwet L-77 at concentrations of 100 - 1500 ppm and dipping times of 1-20 min. was evaluated for postharvest disinfestation of thrip on asparagus. Addition of 40% ethanol to Silwet L-77 was also evaluated for its efficacy and phytotoxicity. Significant thrip control was achieved with Silwet L-77 concentrations of 250 ppm (or greater) with dipping times of 15 min or longer. Lower concentrations of Silwet L-77 and longer dipping times were less toxic to the spears than high concentrations used with short dipping times. No Silwet L-77 treatments significantly affected asparagus spear quality. Forty percent ethanol treatment was unsuitable.

**Keywords:** asparagus, thrips, postharvest, disinfestation, Silwet L-77

### INTRODUCTION

Asparagus is affected by a complex of invertebrate pests (Watson and Townsend 1981). Passenger insects on harvested asparagus, especially species of thrips, have been a major threat to export (Townsend and Watson 1984; Lill and van der Mespel 1986). Methyl bromide fumigation as a disinfestation method lowers spear quality and reduces shelf life (Beever *et al* 1985). Controlled atmospheric treatment needed to achieve total thrip control takes too long and also affects spear quality (Lill and van der Mespel 1986). Concentrations of dichlorvos needed for total thrip control produce unacceptable residues in asparagus (Carpenter 1987).

Although insecticidal soaps have been shown to cause high thrip mortality in asparagus (Waller 1990) total disinfestation of asparagus still remains a problem. Surfactants are known to cause mortality of insects (Saidy *et al* 1986). The non-ionic organosilicone surfactants have shown superior spreading properties at very low concentrations (Zabkiewicz *et al* 1988), and a compound of this, class Silwet L-77, is approved by the Environmental Protection Agency in the USA for use as a postharvest treatment. Phytotoxicity problems with surfactants have been reported (Parr 1982). Silwet L-77 is less phytotoxic than several other agricultural surfactants (Coupland *et al* 1989).

In this study the efficacy of Silwet L-77 and 40% ethanol for disinfestation of asparagus and their associated phytotoxicity were evaluated.

### METHODS

Two different assessments were carried out. First the phytotoxicity of selected treatments on asparagus spears was assessed and then the effect of the promising treatments on thrip control, was tested.

#### Phytotoxicity

Asparagus for this study was obtained from MAF Research Area, Rukuhia. They were treated within 12 hours of being harvested. The treatments consisted of 100 ppm to 1500 ppm of Silwet L-77 (v/v in water) and 40% ethanol with and without Silwet L-77 over a range of dip times (Table 1). Five single spear replicates were used per treatment. Control treatments were untreated or dipped in water only. After treatment the spears were washed in water for 1 min, drained and stored horizontally in trays at 5°C for 2 weeks before assessment. Head quality (colour of head, appearance)

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and firmness of the asparagus spears after storage were each assessed on a scale of 1-3 (1 = perfect, 2 = acceptable and 3 = unacceptable). Each spear was assessed by two independent observers. The mean score of the assessments was square root transformed prior to analysis of variance and regression analysis.

#### **Thrip control**

Twenty seven of the 29 treatments (Table 1) were evaluated for thrip control. Asparagus (ex. Mr J.R. Harvey's farm, River Road, Hamilton) was treated within 12 hours of being harvested. Three replicates, each of 12 randomly selected spears, were dipped in the test solutions, washed in water (1 min) and drained (2 min), packed in pottles (1.2 litres), covered with polythene film and stored at 5°C for 24 hours before assessment. Mortality of thrip left on the spears was assessed by recovering the thrips, after removing each bract on the spears under a stereo microscope. If necessary, thrips were prodded with a soft brush on the posterior end to ascertain whether they were live. Assessment was completed within 48 hours after removal from cool storage. The proportional mortality of the thrips was compared by logit analysis.

## **RESULTS**

### **Phytotoxicity**

Mean phytotoxicity scores are given in Table 1. Regression analysis showed that time of dipping ( $P < 0.05$ ) and concentration ( $P < 0.001$ ) had a significant influence on asparagus head quality but not on firmness. Spear head quality was significantly different from water only dip in 15 and 20 min dips of 250 ppm Silwet L-77, and in 5 and 10 min dips of 1000 ppm Silwet L-77 treatments. Spear head quality in ethanol only treatment (15 min dip) was different from water only treatment.

All treatments with ethanol and Silwet L-77 treatments were significantly different from the water only dip.

In general spear firmness was affected to a lesser degree by the treatments compared to the spear head quality. Spear firmness in ethanol (5 min) and ethanol plus Silwet L-77 (10 and 15 min) dips were significantly different from the water only dip. Compared with untreated spears however, Silwet L-77 treatments had no adverse effects on asparagus quality whereas ethanol with or without Silwet L-77 at 15 min duration significantly affected spear quality.

### **Thrip control**

The observed number of thrips on spears ranged from 10 to 82 per treatment (Total = 916) with the untreated spears having 54 thrips. A highly significant trend ( $P < 0.001$ ) for increased thrip mortality with increasing Silwet L-77 concentrations between 100 and 500 ppm was observed. Silwet L-77 concentration and dipping time interaction was not significant. Increased dip time had a significant influence ( $P < 0.05$ ) on the thrip mortality.

Compared with the untreated spears all treatments showed significant thrip mortality (Table 1). There were no differences in proportional thrip mortality between 15 min and 20 min water treatments but both gave significantly greater mortality than the untreated. Silwet L-77 at 250 ppm for 15 and 20 min and Silwet L-77 at 500 ppm for 5 to 15 min, gave highly significant thrip control. Forty percent ethanol alone gave over 94% thrip control with a 10 min dip. The ethanol and Silwet L-77 (500 ppm) treatment was significantly better than the lowest rate of Silwet L-77 (100 ppm) but not significantly different from the other rates of Silwet L-77. The 100% mortality of thrips observed with 250 ppm Silwet L-77 (25 min dip), and ethanol and Silwet L-77 (10 min dip) was not statistically different from the 95% mortality due to the low numbers of thrips in the samples.

The mortality caused by relatively low concentrations of Silwet L-77 is seen as a major advantage. The effect on thrips is possibly due to a reduction in surface tension (Murphy *et al* 1991), and other physical properties of Silwet L-77 which cause rapid wetting, thus causing 'flooding' of insects' hiding places and perhaps also of the tracheal system. Further studies with higher thrip numbers are needed to evaluate the reliability of the promising treatments. The mode of action of Silwet L-77 in inducing thrip mortality also warrants further studies.

**TABLE 1: Mean phytotoxicity scores and percentage thrip mortality observed after treating asparagus spears with various concentrations of Silwet L-77 and 40% ethanol.**

Treatment	Silwet L-77 concentration (ppm)	Dipping time (min)	Mean head quality score <sup>1</sup>	Mean firmness score <sup>1</sup>	% Thrip mortality Mean	mortality <sup>2</sup> S.E.	
Untreated			1.17	1.17	4.4	3.56	
Water only	0	15	1.04	1.08	38.0	7.55	
Silwet L-77	100	10	1.17	1.00	30.0	9.89	
		15	1.08	1.12	48.1	14.42	
Silwet L-77	250	20	1.17	1.17	42.4	13.41	
		5	1.08	1.00	68.5	14.89	
		10	1.08	1.08	50.4	22.91	
	500	15	1.35	1.04	92.4	5.97	
		20	1.38	1.17	100.0		
		2	1.12	1.08	77.7	11.15	
Silwet L-77	1000	5	1.20	1.12	93.9	5.91	
		10	1.12	1.17	91.7	7.84	
		15	1.17	1.12	90.7	8.79	
	1500	1	1.08	1.08	80.4	10.91	
		2	1.12	1.00	95.1	6.68	
		5	1.34	1.08	84.2	10.19	
40% Ethanol	0	10	1.35	1.20	85.0	9.67	
		1	1.12	1.17	85.0	8.67	
		2	1.36	1.21	94.5	7.61	
	40% Ethanol + Silwet L-77	500	5	1.25	1.08	83.0	9.72
			2	1.20	1.00	67.2	13.18
			5	1.28	1.24	75.3	11.29
40% Ethanol + Silwet L-77	500	10	1.19	1.08	94.0	4.76	
		15	1.35	1.21			
		2	1.31	1.20	54.8	15.07	
		5	1.30	1.12	72.1	10.41	
LSD (P = 0.05)			0.22	0.17			
			0.29	0.22			

<sup>1</sup> square root transformed data<sup>2</sup> Results from logit analysis

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