COMMODITY TREATMENT

Field Sprays and Insecticidal Dips After Harvest for Pest Management of *Frankliniella occidentalis* and *Thrips palmi* (Thysanoptera: Thripidae) on Orchids

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ABSTRACT Insecticidal double dips applied after harvest reduced >95% of a mixed infestation of *Frankliniella occidentalis* (Pergande) (90%) and *Thrips palmi* Karny (10%) infesting *Dendrobium* 'Uniwai Princess' blossoms compared with untreated controls. Double dipping consisted of immersing an inflorescence for 3 min in insecticide with agitation followed by a 2-h waiting period and a second 3-min immersion in insecticide. Single insecticidal dips were not as effective as double insecticidal dips. In addition, double insecticidal dips were more effective against nymphs emerging from eggs laid before treatment than single insecticidal dips. Four weekly field applications of abamectin 0.15EC reduced the number of thrips per blossom ≤90.8%. There were no significant differences in the number of thrips per blossom between inflorescences that received four weekly field applications of abamectin 0.15EC and inflorescences that received no field treatment and only a single dip in chlorpyrifos 4EC. Phytotoxic response to the insecticide double dips was a loss of vase life ranging from 1.2 to 3.6 d. Response varied among cultivars.

KEY WORDS *Frankliniella occidentalis, Thrips palmi*, orchids

SURVEYS by the University of Hawaii and Hawaii Department of Agriculture have identified a complex of thrips species infesting *Dendrobium* hybrid orchid blossoms in Hawaii, the most prevalent being western flower thrips, *Frankliniella occidentalis* (Pergande), and *Thrips palmi* Karny. Mixed infestations of *F. occidentalis* and *T. palmi* were also reported infesting cucumbers in Hawaii (Rosenheim et al. 1990). *F. occidentalis* occurs worldwide and is considered a major pest of ornamentals in greenhouses (Nasruddin & Smitley 1991, Immaraju et al. 1992).

T. palmi is a federal quarantine action pest with a zero tolerance level (Hata et al. 1991). Orchid flowers shipped from Hawaii to the continental United States and other uninfested areas of the world are rejected by quarantine officials as a result of both *T. palmi* and *F. occidentalis* infestations (Nakahara 1985, Gardner 1991) because distinguishing between immature life stages of those species is difficult and time-consuming. On *Dendrobium*, field control with contact insecticides is difficult because both *T. palmi* and *F. occidentalis* occur deep in the blossoms and petal folds (Hata et al. 1991).

Treatments applied after harvest that are 100% effective against thrips often result in injury to blossoms. Piriyathamrong et al. (1985) demonstrated that cobalt 60 irradiation at 150 krad kills *T. palmi* inside *Dendrobium* orchid blossoms; however, significant effects on orchid vase life occur at 50–100 krad (E. Mersino & J. Moy, University of Hawaii at Manoa, personal communication). Hansen et al. (1992) also found that orchids were sensitive to vapor-heat treatment. Other treatments applied after harvest that have been tested against thrips on orchids include insecticidal soap dips, hot water sonic baths, nitrogen or carbon dioxide atmospheres, and chlorpyrifos-impregnated packing material; none of these treatments provided satisfactory control and acceptable vase life (T.Y.H. & A.H.H., unpublished data).

The objective of our study was to assess the efficacy of field-applied insecticides and the efficacy and phytotoxicity of single and double insecticidal dips applied after harvest against thrips on *Dendrobium* orchids.

Materials and Methods

Study 1. Field Insecticide Application. Experimental plots were established at a commercial *Dendrobium* farm in Kailua-Kona, HI, on 22

April 1992. *Dendrobium* plants were well established, growing in 1.3–cm crushed basaltic rock under 30% polypropylene net shade. Treatment plots (1.2 by 6.1 m) were arranged in a completely randomized experimental design with four replicates. Each replicate contained 120 plants of *Dendrobium* 'Uniwai Princess' separated by a 1.0-m walkway. A 2.1-m buffer zone was established between the experimental plots and the grower's planting. Selection of insecticides applied before and after harvest was based on previous efficacy studies against *T. palmi* and *F. occidentalis* (Hamasaki 1987; Hata & Hara 1989; Oi & Mau 1989; Nasruddin & Smitley 1991; T.Y.H. & A.H.H., unpublished data).

Treatment Before Harvest. Field spraying was discontinued 2 mo before testing. Insecticides were applied to runoff with a compressed-air sprayer equipped with a 8004 Teejet nozzle (Spraying Systems, Wheaton, IL) at 276 kPa. Insecticides were applied at ≈1,375 liters/ha to the entire plant, especially the blossoms. Selected insecticides were applied at the following rates: abamectin 0.15 EC (Avid; MSD Ag Vet., Rahway, NJ) at 0.01 g (AI)/liter, chlorpyrifos 50 DF (Pageant; DowElanco, Indianapolis, IN) at 0.6 g (AI)/liter, and insecticidal soap (potassium salts of fatty acids) (M-Pede insecticide; Mycogen, San Diego, CA) at 4.9 ml (AI)/liter by volume combined with paraffinic oil (Sunspray Ultra-Fine Spray Oil; Mycogen) at 9.9 ml (AI)/liter by volume. A spreader–sticker (Ad-here; Occidental Chemical, Lathrop, CA) was added to abamectin, chlorpyrifos, and the control at a rate of 0.39 ml/liter solution. The control was sprayed with water. Insecticides were applied on 28 April 1992 and continued at weekly intervals until 19 May for a total of four applications. Thrips counts were taken on 1 and 28 April 1992 (before plots were sprayed), 5, 12, and 19 May (during the test period before weekly insecticide application), and 26 May, 1 and 8 June (after spray applications were discontinued).

Ten inflorescences from each plot were randomly harvested before insecticide application and divided into two groups for subsequent treatment. Each group contained four replicates (five inflorescences per replicate) from each field treatment. Inflorescences were immediately placed in plastic bags in a cooler (≈15°C) for transport to the Waiakea Experiment Station, University of Hawaii at Manoa, in Hilo, HI. Blossoms from the first group (treatment before harvest only) were removed from the inflorescences, counted, and immediately placed in Berlese funnels for extraction of thrips (Hata et al. 1991). Preliminary tests showed no significant difference between Berlese funnel extraction (0.90 thrips per blossom) and microscopic inspection of dissected blossoms (0.94 thrips per blossom) (t = 0.0086, df = 6.0, P = 0.9323) (T.Y.H., unpublished data). Berlese funnels were heated by a 60-watt incandescent light bulb, and thrips were collected in a 8:2:1:1 solution of ethanol, distilled water, glycerin, and acetic acid. Thrips recovered were counted under a dissecting microscope and identified to species by mounting specimens in Hoyer's solution and studying species-specific characters (Palmer et al. 1989) under a compound microscope.

Insecticides Before Harvest and Insecticidal Dip After Harvest. The second group of inflorescences was treated with chlorpyrifos 4EC (Dursban; DowElanco) at 0.6 g (AI)/liter. Inflorescences were submerged for 3 min (floral end first) in 19-liter buckets containing 15 liters of insecticide solution and gently agitated 10 times at immersion, at 1.5 min immersion, and again before removal, for a total of 30 times. After dipping, inflorescences were held in water, then allowed to air dry. Thrips were extracted 24 h after treatment.

Study 2. Single Insecticidal Dip. Infested *Dendrobium* inflorescences of 'Uniwai Princess' were randomly harvested from a 2.8-ha, thrips-infested commercial *Dendrobium* farm in Kailua-Kona, HI. Field spraying was discontinued 2 mo before infested inflorescences were harvested. Treatments consisted of three replicates with four inflorescences per replicate. The selected insecticides included fluvalinate (2.0 F) (Mavrik Aquaflow; Sandoz Crop Protection, Des Plaines, IL) at 0.1 g (AI)/liter, abamectin 0.15EC; at 0.01 g (AI)/liter, chlorpyrifos 50DF and 4EC; at 0.6 g (AI)/liter, fluvalinate (2.0 F; at 0.1 g (AI)/liter tank-mixed with piperonyl butoxide (Incite; Loveland Industries, Greeley, CO) at 0.7 g (AI)/liter, and water. Water was used as a control to evaluate the effect of dipping. The entire experiment was repeated three times on 31 March, 20 April, and 15 June. Dipping procedures and evaluation of efficacy were conducted using the same criteria as described for Study 1.

Study 3. Single Versus Double Insecticidal Dip. Single versus double-dip tests were evaluated together to eliminate the problem of fluctuation in thrips populations. Thrips-infested inflorescences were selected using the same criteria as described in Study 2.

Treatments consisted of four replicates with four inflorescences per replicate. Inflorescences were submerged in insecticidal solution for 3 min and gently agitated 30 times using the same procedure as described above. Inflorescences were then divided into two groups and allowed to air dry. Two h later, one group of inflorescences, selected at random, was submerged in a second insecticidal solution following the same procedure. Single dips (SD) and double dips (DD) evaluated at the same rates as in Study 2 included fluvalinate (SD), fluvalinate followed by fluvalinate tank-mixed with piperonyl butoxide (DD), abamectin (SD), abamectin followed by chlorpyrifos 4EC (DD), cyfluthrin 2EC

Table 1. Mean ± SEM thrips per blossom after four weekly insecticide applications with and without a chlorpyrifos 4EC dip after harvest

Treatment[a]	26 May	1 June	8 June	Pooled[b]
		Without dip after harvest		
Abamectin 0.15EC	0.119 ± 0.030b**	0.277 ± 0.092b**	0.653 ± 0.193b***	0.478b ± 0.099
Chlorpyrifos 50DF	1.410 ± 0.141a	1.222 ± 0.208a	0.693 ± 0.169b	1.180a ± 0.185
Oil–soap[c]	1.251 ± 0.034a	1.476 ± 0.121a	1.766 ± 0.138a	1.477a ± 0.112
Control	1.294 ± 0.248a	1.581 ± 0.136a	0.672 ± 0.149b	1.420a ± 0.129
		With dip after harvest		
Abamectin 0.15EC	0.005 ± 0.005	0.015 ± 0.009	0.047 ± 0.021	0.035 ± 0.012
Chlorpyrifos 50DF	0.010 ± 0.006	0.067 ± 0.024	0.025 ± 0.012	0.045 ± 0.009
Oil–soap[c]	0.050 ± 0.012	0.062 ± 0.017	0.052 ± 0.017	0.070 ± 0.016
Control	0.032 ± 0.015	0.057 ± 0.024	0.037 ± 0.018	0.067 ± 0.017

Data transformed to $\log_{10}$ (X + 1) and subjected to ANOVA (**, *** $P < 0.01$, 001, respectively). Means separation by Scheffe multiple-comparison procedure if ANOVA significant, alpha = 0.05 (SAS Institute 1987).

[a] The spreader-sticker Ad-here was added to all treatments except the paraffinic oil–insecticidal soap combination. Field treatments were applied at weekly intervals during the period 28 April to 19 May 1992.

[b] Data pooled from 5 May to 8 June (six weekly surveys).

[c] Tank-mixed paraffinic oil and insecticidal soap.

(Tempo; Mobay, Kansas City, MO) at 0.04 g (AI)/liter (SD), cyfluthrin followed by chlorpyrifos 4EC (DD), fluvalinate (SD), fluvalinate followed by abamectin (DD), water control (SD), water followed by water (DD) (water control for double dip), and an untreated control. The entire experiment was repeated five times on 28 May and 3, 10, 18, and 29 June. Thrips were extracted 24 h after treatment.

To determine efficacy against eggs, the entire experiment was repeated three more times on 1, 8, and 15 July, and thrips were extracted 5 d rather than 1 d after dipping. Five d allowed ample time for egg hatch, which is ≈3 d for *F. occidentalis* at 27°C (Teulon 1992) and 4.8 d for *T. palmi* at 30°C on 'Asomidori' cucumber (Nonaka et al. 1982).

Study 4. Phytotoxicity of Insecticidal Dips. Phytotoxic injury and loss of vase life were evaluated for the double insecticidal dips evaluated in study 3. Treated orchid inflorescences were visually rated on a scale of 0 (no injury) through 9 (complete necrosis) (Hansen et al. 1991). An injury rating of 4 (10–20% discoloration) was considered to be the limit of vase life. Treatments consisted of five inflorescences of *Dendrobium* 'Uniwai Supreme', 'Uniwai Pearl', and 'Uniwai Princess', which were held in 18.9-liter plastic buckets containing water. Phytotoxicity was evaluated until the controls reached a mean rating score of 4. Inflorescences were held in a room where the average daily maximum and minimum temperatures were 23.9 ± 1.4 and 16.5 ± 0.6°C, respectively; the average daily maximum and minimum humidities were 88.8 ± 7.1 and 50.3 ± 1.0%, respectively. Inflorescences were provided with a combination of sunlight (10–12 h) plus fluorescent lights (minimum, 45.3 lux; maximum, 78.0 lux) (Li-188B Integrating Quantum–Radiometer–Photometer; Li-Cor, Lincoln, NE).

Data Analysis. Because the number of blossoms per inflorescence varied, counts were adjusted to the number of thrips per blossom by dividing the total number of thrips recovered by the total number of blossoms. Data were transferred to $\log_{10}$ (X + 1) and subjected to analysis of variance (ANOVA). Means were separated by Scheffe's multiple-comparison procedure. In study 3, data were pooled over five dates and single insecticidal dips, double insecticidal dips, water dips, and no-dip treatments were subjected to single df analysis. Phytotoxicity was evaluated before treatment and 3, 5, 7, 10, 14, and 17 d after treatment and was analyzed by linear regression. All analyses were done with software for personal computers (SAS Institute 1987).

Results and Discussion

Thrips identified in studies 1, 2, and 3 were at a 9:1 ratio of *F. occidentalis*/*T. palmi*. The sex

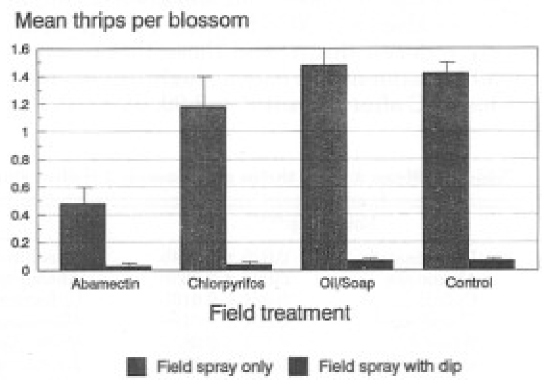

Fig. 1. Mean ± SEM thrips per blossom after four weekly before-harvest applications of abamectin 0.15EC, chlorpyrifos 50DF, and paraffinic oil–insecticidal soap with and without a chlorpyrifos 4EC dip after harvest.

Table 2. Mean ± SEM thrips per blossom 1 d after a single insecticidal dip after harvest

	Mean no. thrips
Fluvalinate 2.0F	0.234 ± 0.025b**
Abamectin 0.15EC	0.097 ± 0.029b
Fluvalinate 2.0F + piperonyl butoxide	0.095 ± 0.026b
Chlorpyrifos DF	0.113 ± 0.017b
Chlorpyrifos 4E	0.054 ± 0.006b
Water dip (control)	1.059 ± 0.225a

Data transformed to $\log_{10}$ (X + 1) and subjected to ANOVA (**, $P < 0.01$). Means followed by the same letter in a column are not significantly different by Scheffe's multiple-comparison procedure, alpha = 0.05 (SAS Institute 1987).

ratio of *F. occidentalis* was 1.5:1 (male/female). Only female *T. palmi* were present in samples.

Study 1. Treatment Before Harvest. The number of thrips per blossom before insecticide application did not vary significantly among treatments on 1 and 28 April. Abamectin 0.15EC significantly (F = 9.03; df = 3, 9; P = 0.0045) reduced the number of thrips per blossom after four weekly insecticide applications on 26 May (Table 1). Significant reduction in the number of thrips per blossom compared with the control persisted for only 2 wk after the last application on 19 May. The number of thrips per blossom significantly increased (F = 21.33; df = 3, 9; P = 0.0002) in paraffinic oil–insecticidal soap plots on 8 June, 2 wk after the last insecticide application. Although no quantitative measurements were made, phytotoxicity occurred after the third application in plots treated with paraffinic oil–insecticidal soap and was characterized by necrotic blossom edges and tissue clearing.

Insecticides Before Harvest and Insecticidal Dips After Harvest. As a dip, chlorpyrifos 4EC alone significantly reduced (t = 6.63, df = 3.2, P = 0.006) the number of thrips per blossom compared with the untreated (field) control (Fig. 1). The data showed no significant differences in the number of thrips per blossom between inflorescences that received four weekly field applications of abamectin 0.15EC only (which significantly reduced thrips) and those that received no field treatment and only a single dip in chlorpyrifos 4EC after harvest (t = 2.09, df = 6.0, P = 0.082) (Fig. 1). There were no significant differences in the number of thrips per blossom among the field treatments (abamectin, chlorpyrifos, paraffinic oil mixed with insecticidal soap) and the control after a single dip in chlorpyrifos 4EC following harvest (Table 1).

Study 2. Single Insecticidal Dip. All treatments significantly (F = 9.69; df = 5, 10; P = 0.0014) reduced the number of thrips per blossom compared with the control, with no significant differences among treatments (Table 2). Phytotoxic injury or significant loss of vase life was not observed; however, chlorpyrifos 4EC-treated blossoms had a detectable odor after treatment.

Study 3. Single Versus Double Insecticidal Dips. *Single Insecticidal Dip.* All insecticidal treatments significantly (F = 32.52; df = 5, 15; P = 0.0001) reduced the number of thrips per blossom compared with both the water dip and the untreated control (Table 3). There were no significant differences among insecticidal dips.

Double Insecticidal Dip. All treatments, including a double dip in water, significantly (F = 78; df = 5, 15; P = 0.0001) reduced the number of thrips per blossom compared with the untreated control (Table 3).

Single degree of freedom comparison of single and double insecticidal dips 5 d after treatment showed that double dips were more effective (F = 5.18, df = 1, P = 0.0245). All thrips extracted were first and second instars. All single insecticidal dips, including the water dip, significantly (F = 17.15; df = 5, 15; P = 0.0001) reduced the number of thrips per blossom compared with the untreated control (Table 4). All double-dip treatments significantly (F = 24.77; df = 5, 15; P = 0.0001) reduced the number of thrips per blossom compared with the control, with no significant differences among treatments (Table 4).

Single degree of freedom comparisons showed that the effect of dipping alone (no dip versus water dip) significantly reduced the number of thrips per blossom. Efficacy was significantly increased with the use of an insecticide dip and was further increased with a double insecticidal dip (no dip < H_2O dip < double H_2O dip <

Table 3. Mean ± SEM thrips per blossom 1 d after single and double insecticidal dips after harvest

Single dip***		Double dip***	
Fluvalinate[a]	0.086 ± 0.024b	Fluvalinate/fluvalinate–piperonyl butoxide	0.007 ± 0.002c
Abamectin	0.048 ± 0.005b	Abamectin/chlorpyrifos	0.006 ± 0.001c
Cyfluthrin	0.041 ± 0.010b	Cyfluthrin/chlorpyrifos	0.002 ± 0.001c
Fluvalinate[b]	0.081 ± 0.016b	Fluvalinate/abamectin	0.015 ± 0.003c
Water dip	0.651 ± 0.087a	Water dip/water dip	0.274 ± 0.050b
Untreated	0.642 ± 0.034a	Untreated	0.642 ± 0.034a

Data transformed to $\log_{10}$ (X + 1) and subjected to ANOVA (***, $P < 0.0001$). Means followed by the same letter in a column are not significantly different by Scheffe's multiple comparison procedure, alpha = 0.05 (SAS Institute 1987).

[a] Fluvalinate single dip for fluvalinate/fluvalinate–piperonyl butoxide double dip.

[b] Fluvalinate single dip for fluvalinate/abamectin double dip.

Table 4. Mean ± SEM thrips per blossom 5 d after single and double insecticidal dips after harvest

Single dip***		Double dip***	
Fluvalinate[a]	0.145 ± 0.009b	Fluvalinate/fluvalinate–piperonyl butoxide	0.001 ± 0.001b
Abamectin	0.022 ± 0.008b	Abamectin/chlorpyrifos	0.001 ± 0.001b
Cyfluthrin	0.006 ± 0.004b	Cyfluthrin/chlorpyrifos	0.001 ± 0.001b
Fluvalinate[b]	0.061 ± 0.017b	Fluvalinate/abamectin	0.000 ± 0.000b
Water dip	0.126 ± 0.041b	Water dip/water dip	0.145 ± 0.030b
Untreated	0.417 ± 0.064a	Untreated	0.417 ± 0.064a

Data transformed to $\log_{10}(X + 1)$ and subjected to ANOVA (***, $P < 0.0001$). Means followed by the same letter in a column are not significantly different by Scheffe's multiple-comparison procedure, alpha = 0.05 (SAS Institute 1987).

[a] Fluvalinate single dip for fluvalinate/fluvalinate–piperonyl butoxide double dip.

[b] Fluvalinate single dip for fluvalinate/abamectin double dip.

single insecticidal dip < double insecticidal dip) (Table 5).

Study 4. Phytotoxicity of Double Dips. Phytotoxic response to the insecticide double dips varied among cultivars. Abamectin followed by chlorpyrifos 4EC or fluvalinate followed by abamectin were the least phytotoxic, reducing vase life compared with the control by 1.5–2.2 d on 'Uniwai Supreme', 'Uniwai Pearl', and 'Uniwai Princess'. Cyfluthrin followed by chlorpyrifos 4EC was most phytotoxic and reduced vase life on 'Uniwai Supreme', 'Uniwai Pearl', and 'Uniwai Princess', 1.2, 2.8, and 3.6 d, respectively. Fluvalinate followed by fluvalinate plus piperonyl butoxide reduced vase life on 'Uniwai Pearl', 'Uniwai Supreme', and 'Uniwai Princess' 2.2, 2.5, and 3.2 d, respectively (Table 6). In general, effects of double-dip insecticides on *Dendrobium* vase life was minimal compared with other postharvest treatments on *Dendrobium* such as irradiation, vapor heat, insecticidal soap dips, and hot water sonic baths (Mersino & Moy, personal communication; Hansen et al. 1992; T.Y.H., unpublished data).

Double insecticidal dips applied after harvest were most effective in reducing thrips in *Dendrobium* blossoms at infestation levels encountered during the test period. Previous tests have shown that a waiting period between dips is essential; inflorescences dipped consecutively without a waiting period resulted in higher thrips survival (T.Y.H., unpublished data). A waiting period of 2 h was needed between dips possibly for the first insecticide dip to cause nerve poisoning symptoms of excitability or restlessness that withdrew insects from cracks and crevices, exposing thrips to the second insecticide dip for final kill. Another possible explanation for the waiting period may be the time necessary for the repelling or killing effect of the first insecticide, which decreased the load or number of thrips per blossom for the second dip. For example, Hata et al. (1992) showed that an insecticidal dip of fluvalinate and insecticidal soap applied after harvest was 100% effective against various pests of red ginger as long as field populations were reduced with insecticide applications before harvest.

Table 5. Comparison of single and double insecticidal dips

Parameter	F	$P > F$
No dip vs. water dip and double water dip	66.32	0.0001
Single water dip vs. double water dip	184.61	0.0001
No dip vs. water dip	340.81	0.0001
Insecticidal single vs. double dip	119.64	0.0001

Single degree of freedom comparison and the corresponding probability of significance. Data pooled from study 3 (counts taken 1 d after harvest).

In the field, abamectin 0.15EC significantly reduced the number of thrips per blossom by 90.8% after four applications. However, there was no significant difference between flowers that received abamectin before harvest and a chlorpyrifos dip after harvest and flowers that received a chlorpyrifos dip after harvest with no before-harvest treatment. Based on this finding, we suggest managing thrips populations only below threshold levels of blossom injury. We have not yet specifically established blossom injury thresholds; however, in our studies, we found no injury when thrips populations averaged ≤1.8 thrips per blossom.

Another benefit of using single or double insecticidal dips applied after harvest is reduced pesticide use in the field, which may prevent the development of insecticide resistance. Tolerance and resurgence of *T. palmi* after insecticide application have been demonstrated (Suzuki et al. 1982, Nafus et al. 1986, Hamasaki 1987). Resistance of *F. occidentalis* to chemical insecticides has been reported (Immaraju et al. 1992). Therefore, insecticides used as insecticidal dips after harvest should be different from those used in the field, and the dipping procedure should be conducted in the packing house away from the field. These safeguards are necessary so that survivors of the dip treatment will be minimal and the probability of these resistant individuals returning to the field population will be low, thus avoiding development of resistance.

In conclusion, our study provides three essential components needed for management of thrips: (1) application of pesticide in the field to prevent thrips blossom injury (eradication of

Table 6. Regression equations and R^2 describing vase life reduction for double insecticidal dips

Treatment	Cultivar	R^2	$P > F$	Model	Vase life, d[a]
Fluvalinate/fluvalinate–piperonyl butoxide	Uniwai Princess	0.93	0.0083	$Y = -0.49 + 0.37X$	12.1
	Uniwai Pearl	0.88	0.0188	$Y = -0.23 + 0.32X$	13.2
	Uniwai Supreme	0.87	0.0207	$Y = -0.67 + 0.37X$	12.6
Abamectin/chlorpyrifos	Uniwai Princess	0.89	0.0152	$Y = -0.57 + 0.34X$	13.4
	Uniwai Pearl	0.88	0.0181	$Y = 0.17 + 0.29X$	13.2
	Uniwai Supreme	0.95	0.0054	$Y = -0.58 + 0.35X$	13.1
Cyfluthrin/chlorpyrifos	Uniwai Princess	0.96	0.0035	$Y = -0.44 + 0.38X$	11.7
	Uniwai Pearl	0.90	0.0146	$Y = 0.10 + 0.31X$	12.6
	Uniwai Supreme	0.93	0.0079	$Y = -0.59 + 0.33X$	13.9
Fluvalinate/abamectin	Uniwai Princess	0.93	0.0088	$Y = -0.54 + 0.33X$	13.8
	Uniwai Pearl	0.91	0.0115	$Y = 0.25 + 0.28X$	13.4
	Uniwai Supreme	0.93	0.0074	$Y = -0.41 + 0.34X$	13.0
Water/water	Uniwai Princess	0.91	0.0119	$Y = -0.58 + 0.30X$	15.3
	Uniwai Pearl	0.93	0.0073	$Y = -0.46 + 0.29X$	15.4
	Uniwai Supreme	0.94	0.0071	$Y = -0.39 + 0.29X$	15.1

[a] Phytotoxicity score, 4 (end of vase life).

thrips in the field is not necessary), (2) double insecticidal dips after harvest, and (3) confirmation of the efficacy of the treatment by Berlese funnel extraction.

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