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Evaluation of BAS 300 11I (Pyridaben) for Mite Control on Texas Citrus

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ABSTRACT

The experimental miticide, BAS 300 11I® 75WP (pyridaben) has been tested in orchard spray trials for efficacy against phytophagous mite species on Texas citrus since 1991. In preliminary trials on replicated single-tree plots of 'Ruby Red' grapefruit, BAS 300 11I at treatment rates of 0.05 to 0.12 lb a.i.-100 gal^{-1} applied as dilute sprays by handgun gave rapid knockdown and residual control of citrus rust mite (CRM), *Phyllocoptruta oleivora* (Ashmead), through 9 weeks postspray, comparable to Vendex 4L® standard miticide. Tank mixing BAS 300 11I at 0.08 lb a.i.-100 gal^{-1} with either 0.5% or 1.0% NR 435 petroleum oil shortened residual CRM control to 7 weeks postspray. In subsequent trials, treatment rates of 0.10 to 0.20 lb a.i.-100 gal^{-1} of BAS 300 11I applied as dilute sprays on mature 'Rio Red' grapefruit trees controlled citrus red mite, *Panonychus citri* (McG), and Texas citrus mite, *Eutetranychus banksi* (McG), for 6 and 8 weeks, respectively. In replicated large plot multi-tree spray trials on 'Ruby Red' grapefruit applied by commercial air blast sprayer, BAS 300 11I at 0.5 lb a.i.-acre^{-1} tank mixed with either 0.0125% Bond® latex spreader-sticker, or 0.4% Champ® copper fungicide and Bond® spreader-sticker provided ≥ 7 weeks CRM control, comparable to that by Vendex 50 WP® and 0.0125% Bond® spreader-sticker. The same treatment rate of BAS 300 11I tank mixed with 1.0% NR 435 oil began to lose residual control at 6 weeks postspray. The latter treatment also had a higher percentage of 'russeted fruit' (damage due to CRM feeding) at harvest, 6.1% verses ≤ 3.8% for the other BAS 300 11I tank mix treatments. In a second commercial spray trial, BAS 300 11I at 0.3 and 0.5 lb a.i.-acre^{-1} provided knockdown and residual CRM control through 9 weeks postspray, while the same treatment rates of BAS 300 11I tank mixed with NR 435 oil (0.4 and 2.0%) and the NR 435 oil treatments alone began to lose efficacy at 7 weeks postspray.

RESUMEN

La eficacia de la aspersión del acaricida experimental BAS 300 11I® 75WP (pyridaben) en contra de especies de ácaros fitófagos en cítricos ha sido evaluada mediante experimentos consistentes en la aspersión en huertas en Texas desde 1991. Durante los experimentos preliminares en toronjo 'Ruby Red' usando repeticiones de parcelas de un solo árbol, BAS 300 11I a una dosis de tratamiento de 0.05 a 0.12 lb i.a.-100 gal^{-1} aplicados como aspersiones diluidas con pistola proporcionaron un abatimiento rápido y un control residual de la población del arador de la naranja, *Phyllocoptruta oleivora* (Ashmead), a lo largo de 9 semanas después de la aspersión, comparable al acaricida estandard Vendex 4L®. El mezclado en tanque de 0.08 lb i.a.-100 gal^{-1} de BAS300 11I con aceite de petroleo NR 435 a 0.5% o 1% acortó el control residual del arador de la naranja a 7 semanas después de la aspersión. En ensayos subsecuentes, las dosis de tratamiento de 0.10 a 0.20 lb i.a.-100 gal^{-1} de BAS 300 11I aplicadas como aspersiones diluidas sobre árboles maduros de toronjo 'Rio Red' controlaron a la arañuela roja de los cítricos, *Panonychus citri* (McG), y a la arañuela de los cítricos de Texas, *Eutetranychus banksi* (McG), por 6 y 9 semanas, respectivamente. En ensayos con árboles de toronjo 'Ruby Red' donde se evaluó la aspersión mediante el asperjador comercial de chorro de aire de varias repeticiones de parcelas grandes compuestas de varios árboles, el uso de la mezcla en tanque de BAS 300 11I a una dosis de 0.5 lb i.a.-acre^{-1} con adherente de latex Bond® al 0.0125% o con el fungicide de cobre Champ® al 0.4% y el adherente de latex Bond® proporcionaron ≥ siete semanas de control del arador de la naranja, comparable con el proporcionado por Vendex 50 WP® y el adherente Bond al 0.0125 %. La misma dosis de tratamiento de BAS 300 11I mezclada en tanque con aceite NR 435 al 1% empezó a perder control residual a las 6 semanas después de la aspersión. El último tratamiento también tuvo un porcentaje alto de 'fruta enmohecida' (daño causado por la alimentación del arador de la naranja de los cítricos) al tiempo de la cosecha que fue de un 6.1% en contraste con ≤ 3.8% observado en los otros tratamientos de mezclas en tanque de BAS 300 11I. En un segundo ensayo de aspersión comercial con BAS 300 11I en dosis de 0.3 y 0.5 lb-acre^{-1} brindó un abatimiento y un control residual del arador de la naranja por 9 semanas después de la aspersión, mientras que la mezcla en tanque de BAS 300 11I en las mismas dosis con aceite NR (0.4 y 2.0%) o el tratamiento solo con aceite NR435 empezaron a perder eficacia a las 7 semanas después de la aspersión.

Any new experimental pesticide must undergo an arduous testing program before its successful registration and inclusion in the Integrated Pest Management (IPM) program for Texas citrus. Several years of tests are generally required including not only efficacy trials with the new chemical against target insect and mite species, but also screening for phytotoxicity to citrus cultivars, tank mix compatibility with other chemical sprays and identification of any toxic effects on natural enemies (beneficials). Since 1991, a promising new experimental miticide/insecticide, BAS 300 11I (pyridaben) has been included in the Citrus Center's chemical testing program and is nearing registration for use on Texas citrus. A product of BASF Corporation, pyridaben will be marketed for citrus under the trade name Nexter®.

This paper reports results of orchard trials conducted with pyridaben for control of the phytophagous mite complex on Texas citrus. Test data from other pyridaben trials have been published elsewhere (French & Hernandez, 1994 a&b; French & Rakha, 1994 a&b; French & Villarreal, 1995). The pest mite species targeted in these efficacy trials include: citrus rust mite, *Phyllocoptruta oleivora* (Ashmead), (the most serious economic pest of Texas citrus); Texas citrus mite, *Eutetranychus banksi* (McG.); and citrus red mite, *Panonychus citri* (McG.). In preliminary trials, varying pyridaben treatment rates were compared to standard labelled miticides and applied as high volume dilute sprays by handgun sprayer on replicated single-tree plots. Later in the evaluation program, pyridaben was tested alone and combined in tank mixes with petroleum oil, spreaders-stickers, and copper fungicides. These trials were generally on replicated multi-tree plots with treatments applied by commercial air blast sprayer. Test data from latter trials are given added emphasis, since the spray mix combinations, application methods and pyridaben rates approximate those that will be used in commercial citrus orchards.

MATERIALS AND METHODS

Two different experimental wettable powder formulations of pyridaben, BAS 300 00I® 20% WP and BAS 300 11I 75% WP were tested in 1991 and 1992; the latter was selected as the preferred formulation and used in all trials thereafter.

Chemical formulations and rates.

The miticides tested include: experimental BAS 300 00I 20WP and BAS 300 11I 75 WP, pyridaben, 2-tert-butyl-5-(4-tert-butylbenzyl-thio)-4-chloropyridazin-3(2H)-one (IUPAC), at test rates of 0.05 to 0.20 lb a.i.•100 gal^{-1} (0.2 to 0.5 lb a.i.•$Acre^{-1}$), (BASF Corp. Research Triangle Park, NC); dicofol (Kelthane® MF), 1,1-Bis (chlorophenyl)-2,2,2-trichloroethanol, at a test rate of 0.5 lb a.i.•100 gal (1.25 lb a.i.•$Acre^{-1}$), (Rohm and Haas Co. Philadelphia, PA); fenbutatin- oxide (Vendex® 4L and 50WP) at test rates of 0.125 to 0.25 lb (0.4 to 1.0 lb a.i.•$Acre^{-1}$), (E.I. DuPont Co., Wilmington, DE).

Additives tested in tank mixes with BAS 300 11I 75 WP included: Narrow range (NR) petroleum oils with NR435 oil (the most commonly used on Texas citrus) having the following specifications: with emulsifier and unsulfonated residue rating of 92% minimum; A.P.I. gravity at 15.5°C (60 °F) of 34,8 minimum; 50% distillation point at 10 mm Hg reduced pressure 227°C (435 °F) and 10-90% range of 27°C (80 °F) maximum, tested at rates of 0.4 to 2.0% volume/volume, (Sun Oil Co., Philadelphia, PA); Bond® Spreader-Sticker containing synthetic latex (45%), primary aliphatic oxyalkylated alcohol (10%), and inert ingredients (45%), standard test rate of 0.0125% volume/volume (Loveland Industries Inc., Greeley, CO); and Champ® flowable copper fungicide containing cupric hydroxide (23%), and inert ingredients (77%), standard test rate of 0.4% volume/volume (Agtrol Chemical Products, Houston,TX).

Preliminary high volume orchard spray trials with pyridaben.

Two separate orchard trials with pyridaben were conducted in 1992. The first was initiated in June on mature 'Ruby Red' grapefruit trees to compare varying rates of BAS 300 11I 75WP, alone and tank mixed with petroleum oil, against BAS 300 00I 20 WP and Vendex L (standard labelled miticide) for efficacy against citrus rust mite (CRM). The second trial was initiated in October on 'Rio Red' grapefruit trees to compare different rates of BAS 300 11I 75WP and the standard miticides, Vendex L and Kelthane MF for efficacy against citrus red mite (RdM). In July 1993, a third trial was conducted on 'Rio Red' grapefruit to compare different rates of BAS 300 11I 75 WP and Vendex L for efficacy against Texas citrus mite (TCM).

Experimental design and spray application. Treatments in each trial were completely randomized and replicated on 4 single tree plots. Sprayed trees were bounded on all sides by unsprayed buffer trees to reduce the risk of drift contamination. Spray treatments were applied to foliar runoff, ca. 3.0 gal/tree, by a portable Hypro 5200 (HyPro Sprayer Co. Saint Paul, MN) high pressure handgun sprayer operating at 250 psi.

Mite counts were made in the following manner.

Citrus Rust Mite (CRM) — At each pre- and post-treatment count date, 14 fruit per tree (replicate) were randomly selected and examined for CRM in situ with a 10X handlens. All live CRM were counted in two, 1-cm lens fields on the shaded side of each fruit. The two counts per fruit were averaged and recorded as one observation. Post treatment counts were made at intervals of 1 to 2 weeks.

Citrus red mite (RdM) and Texas citrus mite (TCM) — At each count date, 24 leaves per replicate were randomly collected and processed through a mite brushing machine (Leedom Engineering, Twain Harte, CA) in the laboratory. RdM and TCM were collected and counted on detergent-coated glass disks under a binocular microscope at 15X. Post-treatment counts were made at 1 to 2 week intervals.

Commercial spray trials with pyridaben.

Pyridaben was evaluated in two large plot multi-tree commercial spray trials conducted in 1995 and 1996. In 1995, BAS 300 11I 75 WP tank mixed with Bond spreader-sticker, NR 435 spray oil, or Bond spreader-sticker and Champ copper fungicide, were compared to Vendex L + Bond spreader-

Table 1. Counts of citrus rust mite (CRM) in sprayed and unsprayed 30-yr-old `Ruby Red' grapefruit trees, Citrus Center, Weslaco, TX 1992.

			Mean no. CRM·cm^{-2} of fruit surface [Z]					
			Weeks postspray:					
Treatment[Y]	lb a.i.·100 gal^{-1}	Pre- spray	+1	+3	+5	+7	+9	Post- spray mean
BAS 300 11I 75 WP	0.05	1.0b [X]	0.1b	0.6b	0.3b	0.9b	0.1c	0.4c
BAS 300 11I 75 WP	0.08	0.8b	0.1b	0.8b	0.2b	2.1b	0.4c	0.7c
BAS 300 11I 75 WP	0.12	9.8a	0.0b	4.3b	0.1b	0.3b	3.8bc	1.7bc
BAS 300 11I 75 WP + 0.5% NR 415 Oil	0.08	1.1b	0.0b	1.2b	0.1b	2.5b	5.9b	1.9bc
BAS 300 11I 75 WP + 1.0% NR 415 Oil	0.08	2.5b	0.0b	0.2b	2.8b	8.8a	4.6bc	3.3b
BAS 300 00I 20 WP	0.08	2.1b	0.1b	0.0b	0.1b	1.6b	2.8bc	0.9c
BAS 300 00I 20 WP	0.12	2.1b	0.0b	0.0b	0.1b	0.4b	2.0bc	0.5c
Vendex 4L	0.125	1.4b	0.1b	0.0b	0.2b	0.4b	2.6bc	0.7c
Control	—	2.1b	1.8a	10.1a	12.4a	8.8a	11.4a	8.9a

[Z]Values are means of citrus rust mite counts for 4 single-tree replicates per treatment and 14 fruit examined per tree.
[Y]Spray treatments were applied June 4, 1992.
[X]Treatment means not showing a common letter are significantly different as separated by Duncan's Multiple Range Test (P=0.05).

sticker for efficacy against CRM. In 1996, commercial rates of BAS 300 11I 75 WP alone and tank-mixed with different rates of NR 435 spray oil were compared to NR 435 spray oil for efficacy against CRM.

Experimental design and spray application. Treatments in each spray trial were randomized and replicated 3 to 4 times on plots of 6 trees each in a 10-yr-old 'Ruby Red' grapefruit orchard on 15 X 28 ft spacing. Treatment sprays were applied by a commercial single volute 1229 air-blast sprayer (FMC Corporation, Agriculture Machinery Division, Jonesboro, AR) with nozzling, pressure and speed calibrated to deliver 250 gallons per acre.

Citrus rust mite counts and fruit damage evaluation. At each count date, 25 fruit were randomly selected from the center 3 trees in each test plot and examined for CRM in situ with a 10X handlens. All live CRM (except eggs) were counted in two, 1-cm lens fields on the shaded sides of each fruit. The two counts per fruit were averaged and recorded as one observation. Upon culmination of each trial, test plots were oversprayed with a labelled miticide. At harvest in 1995, 12 randomly sampled fruit from each test plot tree (72 per treatment replicate) were evaluated for CRM feeding damage. If one third or more of the fruit surface area was damaged it was downgraded to process or juice fruit. The percent of downgraded fruit for each treatment was determined and expressed as percent russet.

Statistical Analysis. All count data were subjected to analysis of variance and means were separated by either Duncan's Multiple Range Test or by Waller/Duncan K-ratio Test.

RESULTS

Pyridaben High Volume Spray Trials.

Citrus rust mite (CRM) were at incipient population levels on fruit in test plot trees just prior to application of spray treatments on June 4,1992. All BAS 300 11I and BAS 300 00I treatments gave good initial knockdown and effective residual CRM control comparable to Vendex L (Table 1). There was little or no difference between BAS 300 formulations or rates in efficacy against CRM. Moreover, tank mixing BAS 300 11I

Table 2. Counts of citrus red mite (RdM) in sprayed and unsprayed of 6-yr-old `Rio Red' grapefruit trees, Citrus Center, Weslaco, TX 1992.

			Mean no. RdM·leaf^{-1} [Z]					
			Weeks postspray:					
Treatment[Y]	lb a.i.·100 gal^{-1}	Pre- spray	+1	+2	+3	+4	+6	Post- spray mean
BAS 300 11I 75 WP	0.10	3.3d [X]	0.0b	0.1b	0.1c	0.0c	0.0c	0.1c
BAS 300 11I 75WP	0.15	23.0a	0.0b	0.1b	0.2c	0.0c	0.0c	0.1c
BAS 300 11I 75WP	0.20	5.0d	0.0b	0.0b	0.1c	0.0c	0.0c	0.1c
Kelthane MF	0.50	17.3b	0.8b	0.6b	1.8b	3.7a	2.8a	1.9b
Vendex L	0.25	13.0c	0.0b	0.0b	0.0c	0.0c	0.1c	0.1c
Control	—	26.3a	16.7a	19.0a	6.2a	1.8b	0.7b	8.9a

[Z]Values are means of citrus red mite counts for 4 single-tree replicates per treatment and 24 leaves sampled per tree.
[Y]Spray treatments were applied October 12, 1992.
[X]Treatment means not showing a common letter are significantly different as separated by Duncan's Multiple Range Test (P=0.05).

Table 3. Counts of citrus mite (TCM) in sprayed and unsprayed of 7-yr-old `Rio Red' grapefruit trees, Citrus Center West Research Farm, Mission, TX 1993.

		Mean no. TCM-leaf^{-1} [Z]							
			Weeks postspray:						Post-spray mean
Treatment[Y]	lb a.i.-100 gal^{-1}	Pre- spray	+1	+2	+3	+4	+6	+8	
BAS 300 11I 75 WP	0.10	18.7a	0.2b[X]	0.0b	0.0b	0.1b	0.1b	0.1c	0.1b
BAS 300 11I 75 WP	0.15	10.8c	0.4b	0.0b	0.1b	0.0b	0.1b	0.2bc	0.1b
BAS 300 11I 75 WP	0.20	15.0b	0.7b	0.1b	0.2b	0.0b	0.3b	0.7b	0.3b
Vendex L	0.125	10.6c	0.4b	0.4b	0.1b	0.0b	0.6b	0.2bc	0.3b
Control	—	8.3c	5.3a	21.0a	3.5a	7.5a	8.7a	2.8a	8.1a

[Z]Values are means of Texas citrus mite counts for 4 single-tree replicates per treatment and 24 leaves sampled per tree.

[Y]Spray treatments were applied on July 27,1993.

[X]Treatment means not showing a common letter are significantly different as separated by Waller/Duncan K-ratio Test (P=0.01).

with NR 415 oil didn't improve the efficacy; in fact, the BAS 300 11I (0.08 lb a.i./100 gal) treatment with 1.0% NR 415 oil gave the shortest residual CRM control (ca., 7 weeks verses 9 weeks for all other BAS 300 treatments). No phytotoxicity was observed on fruit or foliage following any of the spray treatments.

In the orchard trials with BAS 300 11I conducted against citrus red mite (RdM) in 1992, and against Texas citrus mite (TCM) in July 1993, the treatment sprays were initiated when test plot trees supported well established foliar populations of spider mites. In 1992, all BAS 300 11I treatment rates (0.10 to 2.0 lb a.i./100 gal) gave excellent knockdown of RdM and residual control equal to Vendex L, and superior to Kelthane MF standard miticide (Table 2). Heavy rainfall (ca., 4 inches), occured in mid-trial and caused rapid RdM population decline as evidenced in control treatment trees. In 1993, similar treatment rates of BAS 300 11I provided TCM knockdown and long term control (≥ 8 weeks) comparable to Vendex L (Table 3). no phytotoxicity was observed after spray treatments in any of the trials.

Commercial Spray Trials.

In both the 1995 and 1996 trials, application of spray treatments was timed to coincide with increasing CRM populations on fruit in test plot trees.

1995 Trial. All spray treatments provided good initial CRM control, but the BAS 300 11I + 1% NR 435 oil tank mix treatment began to lose efficacy at 6 weeks postspray (Table 4). The two BAS 300 11I treatments (tank mixed with Bond spreader-sticker and Champ copper fungicide) provided long term residual CRM comtrol ≥ 7 weeks postspray. The longer CRM control by these treatments was also reflected in a lower percentage of 'russeted fruit' (damage due to CRM feeding) at harvest, versus the BAS 300 11I + 1% NR 435 oil and untreated control treatments (Table 4). Greater than 60% of the fruit in untreated control trees was downgraded (russeted) due to heavy CRM populations throughout the duration of trial.

On trees sprayed with the BAS 11I + 1% NR 435 oil tank mix, fruit exhibited numerous dark green spots (1/2 to 1 cm diam) referred to as 'oil shadowing,' but the spots gradually faded and the fruit assumed normal color by harvest.

Table 4. Counts of citrus rust mite (CRM) in sprayed and unsprayed plots of 10-yr-old 'Ruby Red' grapefruit trees, Citrus Center, Weslaco, TX 1995.

		Mean no. CRM-cm^{-2} of fruit surface[Z]									
			Weeks postspray:							Post-spray mean	% Russet[X]
Treatment[Y]	Rate lb a.i.-Acre^{-1}	Pre- spray	+1	+2	+3	+4	+5	+6	+7		
BAS 300 11I 75 WP + .0125% Bond Sticker	0.5	3.78a[W]	0.00b	0.00b	0.09b	0.01b	0.01b	0.09b	0.12c	0.05b	1.1b
BAS 300 11I 75 WP + 1.0% NR 435 Oil	0.5	3.84a	0.00b	0.04b	0.00b	1.49b	1.75b	4.97b	9.15b	2.49b	6.1b
BAS 300 11I 75 WP + 0.0125% Bond Sticker + 0.4% Champ Copper	0.5	4.04a	0.41b	0.00b	0.00b	0.00b	0.21b	0.15b	0.29c	0.15b	2.2b
Vendex 50 WP + 0.0125% Bond Sticker	1.0	6.33a	0.05b	0.33b	0.03b	0.09b	0.11b	0.25b	0.11c	0.14b	3.8b
Control	—	6.86a	14.21a	23.15a	53.47a	61.65a	73.07a	40.71a	43.48a	44.25a	64.0a

[Z] Values are means of citrus rust mite counts on 3 replicated plots (6 trees each)/treatment and 25 fruit examined per plot.

[Y] Spray treatments applied by commercial air blast sprayer on April 28, 1995.

[X] Percentage of harvested fruit downgraded due to feeding damage by CRM.

[W]Treatment means within columns not showing a common letter are significantly different as separated by Waller-Duncan K-Ratio Test (P=0.01).

Table 5. Counts of citrus rust mite (CRM) in sprayed and unsprayed plots of 10-yr-old 'Webb Redblush' grapefruit trees, Citrus Center, Weslaco, TX 1996.

		Mean no. CRM·cm⁻² of fruit surface[Z]									
			Weeks postspray:								Post-spray mean
Treatment[Y]	Rate lb a.i.·Acre⁻¹	Pre- spray	+1	+3	+4	+5	+6	+7	+8	+9	
BAS 300 11I 75 WP	0.30	1.90a	0.03b[X]	0.03b	0.00b	0.07b	0.12b	0.20c	0.58b	1.32c	0.29c
BAS 300 11I 75 WP	0.50	1.98a	0.02b	0.00b	0.03b	0.08b	0.00b	0.02c	0.62b	1.06c	0.24c
BAS 300 11I 75 WP + 0.4% NR 435 Oil	0.30	1.98a	0.00b	0.03b	0.13b	0.00b	0.35b	1.90bc	0.83b	0.53c	0.47c
BAS 300 11I 75 WP + 2.0% NR 435 Oil	0.30	3.31a	0.00b	0.01b	0.03b	0.27b	0.64b	1.55bc	1.82b	1.69c	0.75c
BAS 300 11I 75 WP + 2.0% NR 435 Oil	0.50	2.02a	0.00b	0.00b	0.00b	0.01b	0.03b	0.63c	2.19b	2.76c	0.70c
NR 435 Spray Oil	(0.4%)	1.94a	0.05b	1.00b	0.08b	0.21b	0.99b	0.66c	1.61b	4.24bc	1.18c
NR 435 Spray Oil	(2.0%)	2.02a	0.01b	0.00b	0.42b	0.75b	1.52b	3.64b	3.19b	7.69b	2.15b
Control	—	2.96a	11.90a	12.84a	25.29a	20.13a	25.07a	23.08a	31.40a	24.05a	21.72a

[Z]Values are means of citrus rust mite counts on 4 replicated plots (6 trees each)/treatment and 25 fruit examined per plot.
[Y]Spray treatments applied by commercial air blast sprayer on June 3, 1996.
[X]Treatment means within columns not showing a common letter are significantly different as separated by Waller-Duncan K-Ratio Test (P= 0.01).

1996 Trial. All BAS 300 11I spray treatments (0.30 and 0.50 lb a.i.·Acre⁻¹) provided good knockdown and long term control of CRM, but the tank mix treatments of BAS 300 11I + NR 435 oil (0.4% and 2.0%) and the NR 435 oil treatments alone were slightly less effective with CRM populations rebuilding in sprayed trees after 7 weeks (Table 5). Trees in test plots sprayed with any of the treatments containing 2.0 % NR 435 oil exhibited light to moderate yellowing (chlorosis) on new flush foliage; however, no defoliation was noted.

DISCUSSION AND SUMMARY

Pyridaben has been shown to be a powerful inhibitor of mitochondrial respiration in both mammalian and insect/mite systems (acting at Complex I of the mitochondrial electron transport chain) and is similar to the botanical pesticide, Rotenone, in its biological activity (Hollingworth, et. al., 1994 & Hollingworth, & Ahammadsahib, 1995). Pyridaben and other lipophilic analogues are drawing increased attention because resistance in mites and insects through changed sensitivity to Complex I inhibitors at the target site has not been described. Thus, labelling of pyridaben (Nexter®) would not only provide Texas citrus growers with a new alternative miticide but could also be extremely important in management of mite resistance to frequently used miticides.

Control of phytophagous mites, especially citrus rust mite, is paramount in the production of large, high quality fruit for the fresh market. Most Texas citrus orchards receive 3 miticide treatments each season — generally, at post bloom (March - April), early summer (June - July) and late summer-fall (Aug. - Oct.). Because the miticide is frequently applied in spray tank mixes, compatibility with a wide range of insecticides, copper fungicides, petroleum oil and surfactant--sticking agents is important. Results of orchard spray trials reported herein, not only demonstrated pyridaben's effectiveness in controlling citrus rust mite, Texas citrus mite and citrus red mite, but also its compatibility with commonly used Champ® copper fungicide and Bond® latex spreader-sticker. Pyridaben's compatibility in tank mixes with insecticides viz., (Lorsban® and Supracide®), was shown in data reported from earlier spray trials (French & Hernandez, 1994 a). However, pyridaben tank mixed with NR 415 or NR 435 petroleum oil (0.4 to 2.0% v/v) lost residual control of citrus rust mite 1-2 weeks earlier than when the same rate of pyridaben was applied alone. Until further testing is conducted to resolve this apparent incompatibiliy problem, pyridaben would be best incorporated into the spray program at a time in the season when oil is not generally used. Thus, pyridaben would fit well into either the postbloom or late summer-fall cleanup mite spray, since oil is often applied in the early summer spray for control of armored scale insects.

Laboratory bioassays have been conducted to determine pyridaben's toxicity to beneficial insects. Advantage was taken of both insectary-reared and field collected insect predators and parasites for bioassays. For example, field collected adult ladybeetles, *Chilocorus cacti* (Say), showed no mortality when caged for 6 hours on citrus leaves freshly sprayed with pyridaben at the 0.20 lb a.i./100 gal rate (J.V. French & J.C. Legaspi, unpublished data). Similar results were obtained when high numbers of insectary-reared adult boll weevil parasites, *Catolaccus grandis* (Burk) (Hymenoptera: Pteromalidae) were exposed to leaves sprayed with the aforementioned rate of pyridaben (J.V. French, J.C. Legaspi and K. R. Summy, unpublished data). These data indicated that pyridaben is probably easy on beneficials and should fit well into the overall Integrated Pest Management program for Texas citrus.

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