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U.S. DEPARTMENT OF AGRICULTURE

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

PLANT PROTECTION AND QUARANTINE

WHITEVILLE PLANT METHODS CENTER

IMPORTED FIRE ANT STATION

3505 25th Avenue
Gulfport, MS 39501

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Some of the research reports presented herein were conducted "off station" by Whiteville Plant Methods Center personnel. Leader/participants are listed under each project title. Organizational structure for the Whiteville Plant Methods Center (WPMC) is as follows:

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These reports were prepared for the information of the U.S. Department of Agriculture, Animal and Plant Health Inspection Service personnel, and others that are interested in imported fire ant control. Statements and observations may be based on preliminary or uncompleted experiments; therefore, the data are not ready for publication or public distribution.

Results of insecticide trials are reported herein. Mention of trade names or proprietary products does not constitute an endorsement or recommendation for use by the U.S. Department of Agriculture.

Compiled and Edited by:

Homer L. Collins and Anne-Marie Callcott

January 1993

FY 1992 OBJECTIVES

IMPORTED FIRE ANT STATION
GULFPORT, MS

OBJECTIVE #1: Development and refinement of quarantine treatments for certification of regulated articles:

- Emphasis on development of quarantine treatments for containerized nursery stock.
- Evaluate candidate toxicants, formulations, and dose rates for various use patterns.
- Test and evaluate candidate pesticides for use on grass sod and field grown nursery stock.
- Assist in registration of all treatments shown to be effective.

OBJECTIVE #2: Advancement of technology for population suppression and control:

- New product/formulation testing and evaluation.
- Conduct label expansion studies.
- Evaluation of non-chemical biocides including microbial, nematodes, and predaceous arthropods.

OBJECTIVE #3: Preparation/distribution of technical information on control, quarantine procedures, new technology, biological hazards, etc., to state agencies, the media, and the public:

- Provide training to state regulatory agencies and nursery associations.
- Publish and distribute a directory of research, regulatory, and Extension Services involved in IFA activities.

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PROJECT NO: FA02G037

PROJECT TITLE: Evaluation of Candidate Potting Soil Toxicants, 1988.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

An evaluation of a limited number of candidate toxicants for incorporation into nursery potting soil was begun in December 1988, in order to expand the options available to commercial growers of nursery stock.

MATERIALS AND METHODS:

Test procedures used to evaluate all candidate toxicants were as follows: granular formulations of each product tested were blended into nursery potting soil (Strong-Lite®, 382 1bs/cu yd) at an initial rate of 86.3 ppm, except Capture@ 0.3G which was incorporated at 72.6 ppm. A portable cement mixer (2 cu ft capacity) was used to blend the toxicants into the potting media, and was operated for one hour per batch to insure thorough blending. Treated media was then poured into two-quart capacity plastic pots and weathered outdoors at Gulfport, MS under natural conditions for one month prior to the first bioassay. No additional irrigation water was added.

Bioassays (Appendix II) were conducted in the laboratory by confining alate queens to treated soil placed in 2"x2" plastic pots equipped with Labstone® bottoms, which rested on a layer of damp peatmoss. There were four replicates per treatment in each bioassay. Each pot (replicate) contained 50 cc of treated soil and five alate queens. Queen mortality was assessed after seven days of continuous confinement to the treated soil. Treatments which were effective at the first bioassay interval were aged and retested periodically.

RESULTS:

As indicated in Table 1, three candidates (Ammo@, Capture@, and Force@), have

demonstrated excellent residual control of IFA in potting media. Ammo 0.75G was effective for 16 months, while Capture 0.3G and Force 1.5G each maintained excellent control for 41 and 42 months respectively. Subsequent to this trial, Capture 0.3G was registered for this use pattern as Talstar® T&O Granular, and the registration of Force 1.5G is in progress.

Table 1. Evaluation of Candidate Potting Soil Toxicants, 1988.

CANDIDATE	Percent Mortality to Alate IFA Queens at Indicated Months Post-Incorporation*																							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(10)	(12)	(14)	(16)	(18)	(20)	(22)	(24)	//(36)//	(41)	(42)	(43)	(44)	(45)	(46)	(47)
Capture 0.3G	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	50	100	100	70	100	80
Force 1.5G	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	85	100	95	30
Ammo 0.75G	100	100	100	100	100	100	100	100	100	100	100	100	35	50										
Pounce 1.5G	100	100	100	100	95	45	35	0																
Dursban 2.5G	100	100	100	100	45	75	35	0																
Turcam 2.5G	100	100	15	20	0																			
Advantage 5G	45	100	20	40	0																			
Furadan 5G	25	35	0																					
Oftanol 5G	0	25	0																					
Check	5	10	5	5	10	5	5	5	5	5	0	5	0	5	5	5	0	0	0	0	5	10	0	5

* Test initiated December 14, 1988.

PROJECT NO: FA01G161

PROJECT TITLE: Evaluation of Candidate Potting Soil Toxicants, 1991.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally and Homer Collins

INTRODUCTION:

An on-going screening program to evaluate insecticides applied as a pre-plant incorporated treatment for nursery potting soils has been conducted by the IFA Station since 1974. The number of suitable candidate potting soil toxicants was extremely limited, and only one new compound was placed on trial in 1991. However, one product (Force@ 1.56) has shown good potential in previous trials and was retested in this trial. Cypermethrin was previously tested as a 0.756, but the Demon@ 40WP formulation was included in this trial because it had not been tested.

METHODS AND MATERIALS:

Test procedures used to evaluate all candidate toxicants were as follows: granular or dust formulations of each product tested were blended into nursery potting soil (MAFES mix, 900 pounds per cubic yard)[1]. A portable cement mixer (2 cu ft capacity) was used to blend the toxicants into the potting media, and was operated for 15 minutes per batch to insure thorough blending. Treated media was then poured into one-gallon capacity plastic pots and weathered outdoors under simulated nursery conditions for one month prior to the first bioassay. Bioassays were conducted in the laboratory by confining alate queens to treated soil placed in 2" x 2" plastic flower pots equipped with a Labstone® bottom. The labstone absorbs mixture from an underlying bed of damp peat moss. There were four replicates per treatment in each bioassay. Each pot (replicate) contained 50 cc of treated soil and five alate queens.

[1] MAFES Mix is a standard media used by Mississippi Agriculture and Forestry Experiment Station and consists of milled pine bark, sand, and sphagnum peat (3:1:1) + amendments.

Queen mortality was assessed after seven days of continuous confinement to the treated soil. Treatments which were effective at the first bioassay interval were aged and retested periodically.

Treatments tested were as follows:

lambda-cyhalothrin (Commodore® 10WP) at 10, 50 and 100 ppm
cypermethrin (Demon® 50WP) at 10, 50 and 100 ppm
tefluthrin (Force® 1.5G) at 10, 50 and 100 ppm
bifenthrin (Talstar® 10WP) at 50 ppm (standard)

RESULTS:

All treatments provided 100% mortality through 14 months posttreatment except Demon 40WP at the 10 ppm rate. Commodore 10WP also dropped to 85% at 11 months but returned to 100% in all successive months (Table 2).

Table 2. Activity of Candidate Potting Media Insecticides, 1991.[1]

Insecticide	Dose Rate (PPM)	Average % Mortality to Alate IFA Queens at Post-Treatment Interval (Months)													
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Commodore 10WP	10	100	100	100	100	100	100	100	100	100	100	85	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Force 1.5G	10	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Demon 40WP	10	100	100	100	100	100	100	100	100	100	85	45	55	60	85
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar 10WP	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	--	10	10	0	0	5	15	5	0	5	15	5	10	10	0

[1] Trial initiated 10/7/91.

PROJECT NO: FA01G182

PROJECT TITLE: Evaluation of Candidate Potting Soil Toxicants, 1992.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Anne-Marie Callcott

INTRODUCTION:

An on-going screening program to evaluate insecticides applied as pre-plant incorporated treatments for nursery potting soils has been conducted by the IFA Station since 1974. A limited number of candidate potting soil toxicants were evaluated in 1992 in an effort to expand the number of options available to growers who ship containerized plants outside the IFA regulated area. As in previous years, our efforts were impeded by the small number of suitable candidates.

METHODS AND MATERIALS:

Test procedures used to evaluate all candidate toxicants were as follows: granular formulations of each product tested were blended into nursery potting media (MAFES Mix, 900 lbs/cu yd). A portable cement mixer (2 cu ft capacity) was used to blend the toxicants into the potting media, and was operated for 15 minutes per batch to insure thorough blending. Treated media was then placed into 3-qt. plastic nursery pots and weathered outdoors under simulated nursery conditions. At monthly intervals, three pots from each treatment group were composited and subjected to standard alate queen laboratory bioassay (Appendix II).

Test *I:*

Pennington® Gro Tec Inc.® has developed a 0.15 granular fluvalinate under the name of Mavrik®. Mavrik was incorporated into MAFES mix at rates of 12.5, 25, 50 and 100 ppm. Standards included Force® 1.56 and bifenthrin 0.2G incorporated at a rate of 25 ppm.

Test II:

Because of the good dose rate response shown in Test I, Mavrik was incorporated into MAFES mix at higher rates. On 10/29/92, rates of 100, 150, 200 and 300 ppm were incorporated as above and bioassayed monthly.

RESULTS:

Test I:

The 100 ppm rate has consistently provided +85% mortality for 5 months (Table 3). Efficacy at the lower rates is also consistent over time, but decreases as the dose rate decreases.

Test II:

At 1 month posttreatment (PT), rates of 150 ppm and higher were 100% effective.

Table 3. Residual Activity of Granular Mavrik Insecticide Incorporated into Nursery Potting Media at Various Rates.

Insecticide	Rate of Applic. (ppm)	% Mortality to Alate Queens at Indicated Months PT				
		(1)	(2)	(3)	(4)	(5)
Mavrik 0.15G	12.5	0	30	25	30	75
	25.0	45	55	80	80	100
	50.0	80	70	90	95	100
	100.0	90	85	85	100	100
Force 1.5G	25.0	100	100	100	100	100
Talstar 0.2G	25.0	100	100	100	100	100
Untreated Check	--	10	15	5	10	15

PROJECT NO: FA01G100

PROJECT TITLE: Degradation of Candidate Potting Media Toxicants at Various Geographic Locations.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

Granular chlorpyrifos incorporated into potting media has been the mainstay of the IFA quarantine program since 1980. Original research on the efficacy of this product was conducted at Gulfport, MS with Lorsban® 10G. Under the conditions of those tests, a residual activity of up to 39 months was achieved at a dose rate of 11.2 grams AI/cu yd of media (Collins et al. 1980). Registration for chlorpyrifos was granted in 1980 and remained the most commonly employed IFA quarantine treatment until recently. Treatments of media with 1.0 lb of chlorpyrifos (Dursban® 2.5G) per cu yd initially afforded a 24 month certification (PPQ Control Manual M301.81).

In recent years, interceptions of IFA infested nursery stock has increased significantly. Many of these infestations were found to be in certified containers. Complaints of product failure became common and regulatory officials began to question the effectiveness of granular chlorpyrifos treatments. Tests were initiated in November 1989 at three widely separated geographic locations to confirm the phenomena of enhanced degradation. A second trial was initiated in Homestead, FL in Septemer 1991 to determine if (1) candidate toxicants were subject to accelerated degradation and (2) chlorpyrifos activity could be enhanced using a specified media.

MATERIALS AND METHODS:

TRIAL I:

In October 1989, three chlorpyrifos formulations (Dursban 10G, Lorsban 15G and suSCon® Green), Triumph@ 1G and Capture@ 0.2G were all incorporated into a standard potting media (Strong-Lite®). The incorporated media was blended at

a rate of 100 ppm, divided into three equal parts per replicate, bagged and transported to three separate experimental sites in Gulfport, MS; Miami, FL; and Whiteville, NC. The media was aged outdoors in standard trade gallon containers. In addition to natural rainfall, supplementary irrigation was added as was deemed necessary at each site. Samples were collected from each site at monthly intervals by Florida Dept. of Agriculture personnel and shipped to this laboratory for bioassays (Appendix II). This trial was designed to last for 18 months.

TRIAL II:

In September 1991, a trial was undertaken to evaluate bifenthrin (Talstar® 10WP) and tefluthrin (Force® 1.5G) at multiple rates in south Florida. Both pyrethroids were incorporated into the standard Gulfport Labmix (1:1:1; pine bark, sand, peatmoss) on 25 September at rates of 10, 25 and 50 ppm. Dursban was incorporated at the standard rate (1.0 lb/cu yd) on the same date into the same media. All toxicants/rates were bagged and transported to the IFAS Experiment Station at Homestead, FL where they were transferred to standard industry gallon containers and weathered under normal horticultural practices. As in the first trial, Florida Dept. of Agriculture personnel collected samples at monthly intervals and shipped them to this laboratory for bioassays.

RESULTS:

TRIAL I:

All of the organophosphorus compounds (Dursban 10G, Lorsban 15G, suSCon Green and Triumph 1G) degraded more rapidly at the Miami site than at either the MS or NC sites (Table 4). Bifenthrin 0.2G remained 100% active throughout the trial (18 months) at all sites.

TRIAL II:

As shown in Table 5, all treatments were 100% effective at 11 months post-treatment. This test was prematurely terminated in August 1992 due to Hurricane Andrew.

Table 4. Relative Degradation of Selected Insecticides at Different Geographic Locations.

CANDIDATE	SITE	% Mortality of Alate IFA Queens at Indicated Months Post-Treatment								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	///	(18)
Bifenthrin	MS	100	100	100	100	100	100	100		100
	NC	100	100	100	100	100	100	100		100
	FL	100	100	100	100	100	100	100		100
Dursban	MS	100	100	100	10	5	0	0		
	NC	100	100	40	75	15	15	0		
	FL	25	5	0	5	10	40	5		
Lorsban	MS	100	100	100	100	100	25	5		
	NC	100	100	100	55	10	40	0		
	FL	100	100	100	10	5	20	5		
suSCon	MS	100	100	50	10	25	0			
	NC	100	100	100	95	60	5			
	FL	95	25	15	20	65	0			
Triumph	MS	100	100	5	5	10	15			
	NC	100	100	100	30	20	0			
	FL	55	25	20	10	5	0			
Check		0	5	0	0	0	5			

Table 5. Relative Toxicity of Various Toxicants/Rates to IFA Alate Queens.

CANDIDATE	Dose Rate (PPM)	Percent Mortality of Alate IFA Queens at Indicated Months Post-Treatment (1)	(2)////(8)	//	(11)[1]
Talstar 10WP	10	100	100	100	100
	25	100	100	100	100
	50	100	100	100	100
Force 1.5G	10	100	100	100	100
	25	100	100	100	100
	50	100	100	100	100
Dursban	1.0 lb/ cu yd	100	100	100	100
Check		0	0	0	10

[1] Trial terminated due to Hurricane Andrew

PROJECT NO: FA01G110

PROJECT TITLE: Degradation of Candidate Insecticides in a Commercial Nursery Environment.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley, Homer Collins, Lee McAnally, Avel Ladner and Tavo Garza (Texas Dept. of Agric.)

INTRODUCTION:

As part of a continuing program to evaluate candidate toxicants as quarantine treatments for IFA, and as an extension of trials as described elsewhere, various formulations of bifenthrin, chlorpyrifos, and other candidate toxicants were evaluated at a commercial nursery in southeastern Texas. Greenleaf Nursery at El Campo, Texas, is a large and diversified containerized operation that cooperated in the trials described herein.

MATERIALS AND METHODS:

TRIAL I:

Toxicants were blended into a media mixture formulated by Greenleaf Nursery on site (5:2:1 mix of pine bark, sand and rice hulls). Mixing of toxicants into the media mixture was accomplished on 1/23/90, with 3.0 cu ft cement mixers. Dursban® 10G and Lorsban® 15G were mixed at the labelled rate (11.2 g AI/cu yd). suSCon® Green and Talstar® 10WP (bifenthrin) were incorporated at rates of 25, 50 and 100 ppm. Capture@0.26 (bifenthrin) was mixed at rates of 25 and 50 ppm and Triumph@1G was incorporated at a rate of 150 ppm. Plots of each treatment were established on site and were subjected to normal horticultural practices. Samples were collected at monthly intervals by the Texas Dept. of Agriculture personnel, and bioassayed at the Gulfport IFA Lab (Appendix II).

TRIAL II:

On 20 August, 1991, Force@1.56 (tefluthrin) was incorporated at 25 and 50 ppm into the custom media described above and formulated on site at Greenleaf

Nursery. It consisted of a 5:2:1 mixture of pine bark, sand and rice hulls. Dursban 2.5G was incorporated into the standard IFA mix (1:1:1 pine bark, sharp sand and sphagnum peat moss) at a rate of 11.2 g AI/cu yd. A check was established for both media.

RESULTS:

In Trial I, Triumph 1G sustained efficacy for only 1 month (Table 6). Dursban 10G at the standard rate, suSCon Green at 25 and 50 ppm remained active for only 2 months. By month 4, suSCon Green (100 ppm) and Lorsban 15G had begun to deteriorate. Both bifenthrin formulations (Talstar 10WP and Capture 0.2G) continue to show 100% efficacy for 34 months at rates >50 ppm.

In Trial II, all treatments provided excellent control through 16 months (Table 7).

Table 6. Degradation of Candidate Insecticides in a Commercial Nursery Environment, Trial I.

CANDIDATE	RATE [PPM]	Percent Mortality to Alate IFA Queens at Indicated Post-Treatment Intervals (Months) (1)	(2)	(3)	(4)	(5)	(6)	(7)	///	(23)	(25)	(30)	(32)	(33)	(34)
Capture 0.2G	25	100	100	100	100	100	100	100		100	100	100	100	100	45
	50	100	100	100	100	100	100	100		100	100	100	100	100	100
Talstar 10WP	25	100	100	100	100	100	100	100		100	100	100	20	100	75
	50	100	100	100	100	100	100	100		100	100	100	95	100	100
	100	100	100	100	100	100	100	100		100	100	100	100	100	100
suSCon Green	25	100	100	95	85	35	10	5[1]							
	50	100	100	90	60	40	20	5[1]							
	100	100	100	100	35	65	45	20[1]							
Dursban 10G	STD	100	100	95	10	15	5	10[1]							
Lorsban 15G	STD	100	100	100	5	0	0	0[1]							
Triumph 1G	150	100	85	65	10	0	0	10[1]							
Check		5	0	0	0	0	5	0		0	30	10	10	15	0

[1] Dropped due to loss of efficacy

Table 7. Degradation of Candidate Insecticides in a Commercial Nursery Environment, Trial II.

CANDIDATE	MEDIA	RATE (ppm)	% Mortality to Alate IFA Queens at Indicated Months Post-Treatment								
			(1)	(2)	(3)	(4)///(9)		(12)	(14)	(15)	(16)
Force 1.5G	Greenleaf	25	100	100	100	100	100	100	100	100	100
	Greenleaf	50	100	100	100	100	100	100	100	100	100
Check	Greenleaf	--	15	0	0	0	0	10	10	0	5
Dursban 2.5G	IFA mix	per label[1]	100	100	100	100	100	85	100	100	100
Check	IFA mix	--	20	10	5	0	0	5	0	10	0

[1] 1.0 lb. 2.5G per cu yd of media.

PROJECT NO: FA01G022

PROJECT TITLE: Residual Activity of Candidate Potting Media Toxicants Aged Under Actual Nursery Conditions in Georgia, Mississippi, and Louisiana.

TYPE REPORT: Interim

LEADERS/PARTICIPANT(s): Homer Collins, Anne-Marie Callcott, Avel Ladner, Tim Lockley, Lee McAnally and Randy Cuevas

INTRODUCTION:

Each year the IFA laboratory investigates candidate potting media toxicants for use in certification of nursery stock to be shipped outside the IFA quarantine area. Those that show promise in preliminary trials under simulated nursery conditions are targeted for more strenuous testing under actual nursery conditions. In 1992, two insecticides were selected for more testing: tefluthrin, a 1.5G formulation has shown 24 months of residual at 50 ppm and 17 months at 25 ppm (FA01G090); and lambda-cyhalothrin, a 10WP formulation has shown 12+ months of residual at rates of 10, 50 and 100 ppm (FA01G161 - ongoing trial).

METHODS AND MATERIALS:

Three commercial nurseries cooperated in this project. Wight Nursery in Cairo, GA, Windmill Nursery in Franklinton, LA, and Green Forest Nursery in Perkinston, MS provided space, potting media, and labor. The following insecticides were incorporated on site into nursery potting media at rates of 25 and 50 ppm; bifenthrin 0.2G (Talstar®), tefluthrin 1.5G (Force®) and lambda-cyhalothrin 1.5G (Commodore@). Technical chlorpyrifos formulated onto sphagnum peat moss was also incorporated at rates of 50 and 100 ppm. Treated media was placed in standard 6" plastic nursery pots and subjected to the normal agronomic practices of the nursery including irrigation, weed control, etc. Treatment dates were as follows: Feb. 25, 1992 (Green Forest); Mar 11, 1992 (Wight); and Apr. 1, 1992 (Windmill). At one month, three months, and quarterly thereafter, three pots from each treatment group at each nursery were collected, composited and sent to the IFA lab in Gulfport for standard

laboratory bioassay (Appendix II).

Formulation of chlorpyrifos on sphagnum peat:

A number of studies initiated by the IFA laboratory (see 1991 IFA Annual Report, FA01G041, FA01G101) have indicated that the addition of sphagnum peat to nursery potting media may enhance the residual activity of chlorpyrifos. Thus, the idea of using sphagnum peat the carrier for a specialized chlorpyrifos formulation was conceived. Preliminary studies with sphagnum peat carriers have shown some success (FA01G041, FA01G101).

Sphagnum peat moss (Les Tourbes Nirom Peat Moss Inc., Quebec, P.Q., Canada) was sifted through a Hubbard wire screen sieve, standard mesh size 6 (6 squares per linear inch), to remove large particles and to acquire a fairly uniform size. To achieve a 2.5% formulation, 202 g technical chlorpyrifos (99% technical, The Dow Chemical Co., Midland, MI) was mixed in 24,000 ml of analytical grade acetone (the amount of acetone necessary to thoroughly saturate 8,000 g of peat). This solution was added to 8,000 g of the sifted sphagnum peat and mixed in a 2 cu ft cement mixer for 15 minutes. The formulated peat was then spread in a 1-1.5" layer in an open container and allowed to air dry for 48 hours.

Each of these components and component combinations was subjected to gas chromatograph (GC) analysis to insure correct and accurate formulation. GC analysis was performed by the National Monitoring and Residue Analysis Laboratory in Gulfport, MS.

RESULTS:

Preliminary results are shown in Table 8. At one month posttreatment (PT), all chemicals and rates were 100% effective in the nursery media, except the 25 ppm rate of Commodore 1.5G in Windmill (90% effective). By 3 months PT, all chlorpyrifos rates, except Windmill 100 ppm, showed significant reduction in efficacy. All other chemicals show excellent residual through 9 months. (Windmill data for month 9 not yet available)

Table 8. Residual Activity of Various Granular Insecticides Incorporated into Media from Various Commercial Nurseries.

NURSERY	CHEMICAL	RATE (ppm)	% ALATE QUEEN MORTALITY AT INDICATED MONTHS POST TREATMENT				
			(1)	(3)	(6)	(9)	(12)
Green Forest	Bifenthrin 0.2G	25	100	100	100	100	
		50	100	100	100	100	
	Commodore 1.5G	25	100	100	100	100	
		50	100	95	100	100	
	Force 1.5G	25	100	100	100	100	
		50	100	100	100	100	
	Chlorpyrifos 2.5G	50	100	5	5	*	
		100	100	5	5	*	
	Check	-	0	5	15	15	
Wight	Bifenthrin 0.2G	25	100	100	100	100	
		50	100	100	100	100	
	Commodore 1.5G	25	100	95	100	100	
		50	100	100	100	100	
	Force 1.5G	25	100	100	100	100	
		50	100	100	100	100	
	Chlorpyrifos 2.5G	50	100	35	15	50	
		100	100	50	20	55	
	Check	-	5	35	20	5	
Windmill	Bifenthrin 0.2G	25	100	100	100		
		50	100	100	100		
	Commodore 1.5G	25	90	100	100		
		50	100	100	100		
	Force 1.5G	25	100	100	100		
		50	100	100	100		
	Chlorpyrifos 2.5G	50	100	0	0		
		100	100	90	0		
	Check	-	35	10	10		

* Dropped due to decreased efficacy

PROJECT NO: FA01G172

PROJECT TITLE: Evaluation of Potting Media Treatments at Turkey Creek Nursery, Houston, TX.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Homer Collins, Tavo Garza (Texas Dept. of Agric.), Anne-Marie Callcott, Randy Cuevas and Lee McAnally

INTRODUCTION:

Bioactivity and persistence of insecticides are known to be affected by soil type (Whitney 1967, Harris 1973, Getzin 1981 and Miles et al. 1983), and soil moisture (Whitney 1967, Harris 1977 and Miles et al. 1984). To adequately test insecticide efficacy and persistence against IFA, candidate insecticides must be tested using various media types and under various environmental conditions. To test these factors, we incorporate insecticides into nursery potting media supplied by commercial nurseries and age the treated soil at the corresponding nursery. Several of these trials are underway in GA, MS, LA, and TX.

METHODS AND MATERIALS:

Turkey Creek Nursery, Houston, TX, was selected as the site for this study. The nursery purchases media from Louisiana Pacific Co. (New Waverly, TX) premixed with chlorpyrifos. This media is composed of 72% ground pine bark, 8% rancho sand, 8% sphagnum, and amendments, with a bulk density of 521 lb/cu yd (determined by IFA laboratory). Three cubic yards of media with no chlorpyrifos was purchased from Louisiana Pacific and delivered to the nursery for our use. Four insecticides were incorporated into the media on site using two 3-cu ft capacity cement mixers. Each mixer load (2 cu ft media + insecticide) was mixed for 15 min to insure a thorough blend. Insecticides, formulations and dose rates used were as follows:

Trade Name	Common Name	Formulation	Dose Rates (ppm)
Scimitar®	lambda-cyhalothrin	10WP	10, 25 and 50
Force®	tefluthrin	1.5G	10 and 25
suSCon® Green	chlorpyrifos	10CR	400
Talstar®	bifenthrin	0.2G	25
Check	---	---	---

One-hundred 1-gal pots were filled with each treatment, placed in the nursery's can yard, and subjected to normal agronomic practices, including weed control and irrigation. On a monthly basis, three pots from each treatment group was composited, sent to the IFA lab in Gulfport, MS, and subjected to standard laboratory bioassay (Appendix II).

RESULTS:

As indicated in Table 9, all chemicals have provided 3 months of residual activity under actual nursery conditions. The trial will continue until activity of all treatments ceases.

Table 9. Residual Activity of Several Insecticides Incorporated in Louisiana Pacific Media and Aged at Turkey Creek Nursery.

INSECTICIDE	DOSE RATE (ppm)	% ALATE QUEEN MORTALITY AT INDICATED MONTHS POSTTREATMENT			
		(1)	(2)	(3)	(4)
Scimitar 10WP	10	100	100	100	
	25	100	100	100	
	50	100	100	100	
Force 1.5G	10	100	100	100	
	25	100	100	100	
suSCon Green	400	100	100	100	
Talstar 0.2G	25	100	100	100	
Untreated Check	--	0	30	20	

PROJECT NO: FA01G111

PROJECT TITLE: Residual Activity of Drench Treatments, 1991.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally and Homer Collins

INTRODUCTION:

In 1990, a trial was conducted with several candidate compounds to determine their residual activity when used as a drench treatment. These compounds were applied at rates of 100 and 200 ppm. In July 1991, a further trial was initiated utilizing those compounds exhibiting 100% efficacy at 100 ppm for at least 12 months. The objective of this trial was to determine residual activity for those compounds at lower rates.

METHODS AND MATERIALS:

Fifty-four 6"x 6" plastic nursery pots were filled with potting media from Flowerwood Nursery, Mobile, AL. Drench solution was applied at a rate of 400 ml per container. Containers were then placed outdoors to weather naturally. Irrigation water was added as needed to maintain a minimum of 1" water/week. At monthly intervals, 3 pots from each treatment were composited and subjected to alate queen bioassay (Appendix II). Captures 2EC, Tempos 2EC, and Karate® 1EC were applied at 25 and 50 ppm. Talstar® 10WP was applied at 10, 25, and 50 ppm.

RESULTS:

Results are summarized in Table 10. Both bifenthrin compounds (Talstar 10WP, capture 2EC) have maintained 100% mortality through 17 months. Karate 1EC at 25 ppm maintained 100% through 11 months, while the 50 ppm rate maintained 100% mortality through 16 months. Tempo 2EC was extremely variable with neither rate reaching 100% until 4 months posttreatment, nor maintaining it beyond 11 months.

Table 10. Activity of Selected Drench Candidates at 25 and 50 ppm.

Insecticide	Dose Rate (PPM)	Average % Mortality to Alate IFA Queens at Indicated Months Posttreatment																
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Talstar 10WP	10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Capture 2EC	25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Karate 1EC	25	100	100	100	100	100	100	100	100	100	100	100	85	60	80	35	25	95
	50	100	100	100	100	100	100	100	100	100	100	100	100	10	100	100	100	100
Tempo 2EC	25	90	95	95	100	70	100	95	100	100	100	100	75	100	65	40	10	25
	50	100	85	85	100	100	100	100	100	100	100	100	90	100	20	5	5	25
Check		10	10	5	5	0	0	5	5	0	5	15	0	0	0	5	10	0

PROJECT NO: FA01G202

PROJECT TITLE: Residual Activity of Drench Candidates, 1992.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

Over the last several years numerous trials of drench candidates have been conducted. As new compounds are introduced to the market, new trials are initiated. Compounds that have proven effective in previous trials are also included at lower rates to determine the most advantageous rate of application. This is one such test in the ongoing series.

METHODS AND MATERIALS:

Fifty-four 6"x6" nursery containers for each treatment were filled with standard laboratory potting media. Drench solution was applied to each container at a rate of 400 mls drench solution per container. All containers were then placed outdoors to weather under simulated nursery conditions. At monthly intervals, 3 pots from each treatment were composited and an 80-100 cc subsample was subjected to standard laboratory bioassay using field collected alate queens (Appendix II). Treatment rates and theoretical dose rates for each treatment are shown as follows:

Pesticide & Formulation	Rate of Application (g/l H_2O) (ml/l H_2O)	Theoretical Dose Rate (ppm)
Demon® 40WP	.394g/l	50ppm
	.79g/l	100ppm
Commodore® 10WP	1.575g/l	50ppm
	3.15g/l	100ppm
Talstar® 80 g/l F	1.97ml/l	50ppm
	3.94ml/l	100ppm

RESULTS:

Preliminary, uncompleted results are summarized in Table 11. At 4 months posttreatment all treatments are maintaining 100% efficacy with the exception of 2 dips to 95% at 3 and 4 months posttreatment.

Table 11. Effectiveness of Drench Candidates, 1992.

Treatment	Rate (ppm)	Percent Mortality at Indicated Months PT (1)	(2)	(3)	(4)
Demon® 40WP	50 ppm	100	100	100	100
	100 ppm	100	100	100	100
Commodore® 10WP	50 ppm	100	100	100	95
	100 ppm	100	100	100	100
Talstar® 80 g/lF	50 ppm	100	100	95	100
	100 ppm	100	100	100	100
Check		0	10	20	0

PROJECT NO: FA01G131

PROJECT TITLE: Leachability of Dursban® 2.5G in Nursery Potting Media.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Homer Collins and Anne-Marie Callcott

INTRODUCTION:

Distinct differences in the residual activity of granular chlorpyrifos in various types of nursery potting media are well documented (FA01G159, FA01G190, FA01G200, FA01G011, FA01G041, FA01G071, and FA01G101). The original efficacy studies with granular chlorpyrifos for use as a quarantine treatment were done primarily with a peat based media (1:1:1 ratio of Canadian sphagnum peat, sand, and milled pine bark). Original and recent studies indicate 24 months or longer activity in this media. In contrast, activity in Strong-Lite® (a readily available commercial bedding mix) is usually 60 days or less. Both mixes are very similar, since both are high in organic matter. Accelerated or enhanced degradation of chlorpyrifos in Strong-Lite due to microbial activity was ruled out though the use of sterilized and fumigated media (FA01G159 and FA01G011). The literature agrees that microbial activity plays a minor role in the degradation of chlorpyrifos (Hiraskoso 1969, Miles et al. 1979, Getzin 1981 and Chapman 1982). Chlorpyrifos is insoluble in water (MSDS from Dow Chemical USA, Midland, MI), and therefore, would not be expected to leach from treated media. Indeed, other studies have shown that leachability in soils is negligible (Smith 1966, Whitney 1967, Kuhr & Tashiro 1978 and Sharom et al. 1980). The current study compared toxicity of leachate from Strong-Lite to leachate from a peat based mix (1:1:1 sand: peat: pine bark).

METHODS AND MATERIALS:

Dursban 2.5 G was incorporated into Strong-Lite potting media and the IFA lab mix (1:1:1 sand:peat:pine bark) at a rate of 65 ppm (equivalent to labeled rate of Dursban 2.5G in Strong-lite, 1.0 lb/cu yd). Treated media was placed in trade 1-gal plastic nursery pots, and the pots transferred to racks in the

greenhouse.

Immediately following incorporation, two inches of irrigation water were added to each pot, and the leachate from each collected in a pint Mason jar. Untreated checks of each soil type were also watered in the same manner. Thereafter, one inch of irrigation was added per week to each pot to simulate normal nursery irrigation practices. Additionally, immediately prior to media and leachate collection for bioassay, 2 inches of water were added to each pot.

At 24 hours post-treatment (PT) and at monthly intervals thereafter, three pots from each treatment and their respective leachate were bioassayed against alate IFA queens. Soil from each treatment was subjected to standard laboratory bioassay (Appendix II). Leachate was bioassayed by first stirring the leachate using a magnetic stirrer for one minute. A piece of filter paper (Whatman #1) was then dipped in the leachate and placed in a petri dish. Five alate queens were placed on the paper and % mortality determined after 7 days. The filter paper was kept moist by adding 0.5 ml tap water per day.

RESULTS:

Dursban in Strong-Lite began losing efficacy by 2 months PT (Table 12), while the IFA media showed good residual through the 6 month evaluation (end of trial). The leachate from the IFA media was 98% effective at 24 hours PT, indicating some leachability (possibly "fines" that were physically washed through the pot) of chlorpyrifos in that media immediately after incorporation (Table 13). From 1 month PT on, neither leachate was toxic to IFA queens (ca. 30% mortality or less). Therefore, differences in the residual activity of granular chlorpyrifos in Strong-Lite vs. the IFA lab media is not due to removal of chlorpyrifos in the leachate of the Strong-Lite media.

Table 12. Residual Activity of Dursban® 2.5G in Potting Media.

Media	% Mortality of Alate Queens at Indicated Months PT[1] (24 hr)	(1)	(2)	(3)	(4)	(5)	(6)
Strong-Lite	100	100	68.3	100	65	6.7	8.3
Untreated Check	5	15	0	10	0	10	0
IFA Mix	100	100	100	100	100	100	100
Untreated Check	5	5	20	0	5	0	0

[1] Mean based on three replicates

Table 13. Activity of Leachate from Potting Media Treated with Dursban® 2.5G.

Media	% Mortality of Alate Queens at Indicated Months PT[1] (24 hr)	(1)	(2)	(3)	(4)	(5)	(6)
Strong-Lite	3.3	11.7	22.7	26.7	0	5	1.7
Untreated Check	5	5	0	5	0	5	5
IFA Mix	98.3	5	31.7	10	1.7	13.3	10
Untreated Check	5	5	5	20	0	20	0

[1] Mean based on three replicates

PROJECT NO: FA01G200

PROJECT TITLE: Residual Activity of Granular Chlorpyrifos Incorporated into Sand, Pine Bark, and Sphagnum Peat.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

Original efficacy trials with granular incorporated chlorpyrifos conducted in the late 1970's indicated residual activity of at least 24 months (Collins et al. 1980). These original trials utilized a potting media consisting of equal parts sand, sphagnum peat, and milled pine bark. Several trials conducted in 1989 using various commercial potting media showed a great variability to the results of earlier trials. In no case was more than 3-4 months residual activity experienced.

In December 1989, a trial was set up to duplicate the original trials (see FA01G190). Equal parts sand, sphagnum peat, and milled pine bark were blended and Ford's Dursban® 2.56 and Dow's Lorsban® 156 were incorporated into two separate batches at a rate of 11.34 g AI/cu yd. Both treatments were subjected to a fragmented colony bioassay monthly. By 12 months post-treatment both mixes were still providing 100% mortality.

A trial was begun in August, 1990 using each component of the mix separately to determine if one or more of the components contributed to the enhanced residual activity of chlorpyrifos.

METHODS AND MATERIALS:

Four and one-ha1f cu ft each of sand, peat moss, and pine bark were mixed individually with granular chlorpyrifos (Lorsban 15G) at a rate of 11.34 g AI/cu yd. A mixture of equal parts of the above components was also mixed following the same procedure. Each of the four mixtures was mixed in a portable cement mixer for one hour in increments of 1.5 cu ft each. The

mixtures were then placed into 6" plastic nursery pots and placed outdoors to weather naturally. Irrigation was added to maintain an average 1-2 inches of water per week.

At monthly intervals, three pots from each treatment were composited and a 200 cc sub-sample subjected to standard laboratory alate queen bioassay (Appendix II). Remaining composited soil was submitted monthly to USDA, APHIS, NMRAL for residue analysis by gas chromatography (GC).

RESULTS:

Results are summarized in Tables 14 and 15. Table 15 indicates results of GC analysis and Table 14 indicates efficacy results. At 14 months post-treatment (PT), Lorsban 15G in sand was removed from the test due to decreased efficacy. Sand has also shown the lowest amounts of chlorpyrifos present by GC analysis. Sphagnum peat and the 1:1:1 mixture remained at 100% efficacy through 24 months. Pine bark remained at 100% through 22 months. This indicates that sphagnum peat or the combination of sphagnum peat and pine bark may contribute to the enhancement of chlorpyrifos residual.

Table 14. Residual Activity of Lorsban 15G in Various Potting Media Components.

	Percent Mortality at Indicated Months Post-Treatment																							
Component	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Sand	100	100	100	100	100	100	100	30	25	75	75	10	0	0	[1]	--	--	--	--	--	--	--	--	--
Peat Moss	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Pine Bark	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	85	60
Mixture (1:1:1)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

[1] Dropped from trial due to decreased efficacy.

Table 15. Residue of Lorsban 15G Detected in Various Potting Media Components by Gas Chromatography.[1]

Component	Theor. Dose Rate (PPM)	Chlorpyrifos Residue at Indicated Months Post-Treatment (ppm)															
		(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Sand	9.25	12.29	6.04	4.85	5.47	5.22	3.88	4.16	2.85	0.89	0.74	1.21	0.91	0.36	0.22	0.23	[2]
Peat Moss	107.19	201.12	527.88	167.09	785.34	188.92	53.82	529.24	66.92	160.00	22.20	70.06	571.65	111.16	51.44	82.44	24.36
Pine Bark	82.80	120.88	135.41	88.08	78.28	90.30	62.76	119.60	93.50	81.90	57.60	55.4	112.91	71.89	48.83	31.04	38.40
Mixture	22.24	26.41	26.52	36.31	27.84	33.87	25.27	28.03	12.71	19.50	161.40	14.43	26.91	24.64	18.87	10.90	11.80

Table 15. Cont.

Component	Chlorpyrifos Residue at Indicated Months Post-Treatment (ppm)		
	(16)	(17)	(18)[4]
Sand	--	--	--
Peat Moss	[3]	59.88	30.76
Pine Bark	[3]	67.01	16.42
Mixture	[3]	9.50	16.68

[1] GLC analyses performed by USDA, APHIS, NMRAL.
[2] Discontinued due to lack of efficacy.
[3] Samples lost before turn in for analysis
[4] GC discontinued at 18 months due erratic results

PROJECT NO: FA01G011

PROJECT TITLE: Influence of Antibiotics and Fumigation on Residual Activity of Granular Chlorpyrifos in Nursery Potting Media.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Homer Collins and Anne-Marie Callcott

INTRODUCTION:

Trials conducted in the late 1970's indicated that granular chlorpyrifos (Lorsban® 10G) incorporated into a potting media comprised of equal parts volume of sand, milled pine bark, and sphagnum peat provided a minimum of 24 months residual activity (Collins et al. 1980). In 1989, chlorpyrifos degradation in a number of different types of potting mixes was evaluated, and found to average 2-3 months (Lockley and Collins 1990). However, relatively long residual activity of granular chlorpyrifos can occur under certain conditions; 1990 studies with the potting mix used in the original studies (1:1:1: sand, pine bark and sphagnum) again provided at least a 12 month residual (FA01G190). Other studies in 1990 indicated that the component of the potting mix which is apparently responsible for the extended activity is peat (FA01G200). Research focusing on the relationship between peat and residual activity of chlorpyrifos is underway. The present study was initiated in another effort to determine if soil microorganisms are responsible for the rapid degradation of chlorpyrifos in nursery potting media.

If biotic factors are involved in the rapid degradation of chlorpyrifos treated media, the use of potting media rendered sterile by fumigants such as methyl bromide should extend the activity of the chlorpyrifos. Antibiotics such as bacteriacides and fungicides might also slow or prevent the degradation process. Massive doses of Benelate® and Agri-strep®, both alone and in combination with methyl bromide fumigation, were evaluated as prophylatic treatments to extend residual activity of granular chlorpyrifos in Strong-Lite potting media. Rates tested were 500 ppm for both Benelate and

Agri-strep.

Benelate (benomyl as a 50F formulation) is a broad spectrum fungicide with activity against a variety of soil fungi including *Botrytis*, *Fusarium*, *Rhizzoctonia*, *Sclerotina*, *Anthracnose*, *Penicillium*, and others. Agri-strep (Streptomycin sulfate, 21.2%) is an agricultural bacteriacide used for control of certain bacterial plant diseases including fire blight of apples and pears, blue mold of tobacco, and bacterial wilt of chrysanthemums. Rates of 50-200 ppm are commonly employed.

METHODS AND MATERIALS:

Treatments evaluated in the current study included:

1. Methyl bromide fumigated Strong-Lite media treated with 65 ppm granular chlorpyrifos.
2. Methyl bromide fumigated Strong-Lite media + 500 ppm benomyl + 500 ppm streptomycin sulfate treated with 65 ppm granular chlorpyrifos.
3. Non-fumigated Strong-Lite media + 500 ppm benomyl + 500 ppm streptomycin sulfate treated with 65 ppm granular chlorpyrifos.
4. Non-fumigated Strong-Lite media without antibiotics treated with 65 ppm granular chlorpyrifos.
5. Non-fumigated IFA Lab media without antibiotics treated with 65 ppm granular chlorpyrifos.
6. Non-fumigated Strong-Lite media without antibiotics treated with Talstar 10WP at 50 ppm (standard treatment).
7. Untreated check (no fumigation, antibiotics, or insecticides).

Strong-Lite potting and bedding mix is a typical potting media used throughout the industry. It is comprised of a composted blend of pine bark, peat moss, vermiculite, and perlite (Strong-Lite Corp., P.O. Box 8028, Pine Bluff, AR 71611). Dry weight bulk density was 382 lbs per cubic yard. The IFA Lab media is a blend of coarse river sand, milled pine bark (B.W.I. of Jackson, Inc., Jackson, MS 39209), and sphagnum peat (Les Tourbes Nirom Peat Moss, Inc. Quebec, P.Q. Canada). Dry weight of this mix is 1124 lbs per cubic yard.

Ten cu ft of Strong-Lite media was fumigated under 4 ml polyethylene sheeting with 1.0 lb of methyl bromide on March 1, 1991. Temperature was ca. 75°F, and tarping remained in place for 72 hours after the gas was introduced. Granular chlorpyrifos was incorporated into potting media March 4-6, 1991 at the labelled rate of 1.0 lb/cu yd, providing an initial dose rate of 65 ppm. Granular chlorpyrifos was also incorporated into the IFA lab potting mix at 65 ppm based on dry weight bulk density of the media. Thorough incorporation of insecticides and bacteriacide was accomplished by tumbling 1.5 cu ft batches of each respective treatment in a 2.0 cu ft cement mixer for one hour.

Each treatment group was then placed into a total of 54 six-inch plastic nursery pots so that 3 randomly selected pots per month could be destructively sampled for a total of 18 months or until activity ceased. Pots were maintained outdoors on raised benches in a similar nursery environment, receiving a minimum of 1" of water/week either through natural rainfall of additional irrigation water. Standard laboratory bioassays (Appendix II) employing alate IFA queens were conducted on a monthly basis to determine residual activity of each treatment.

RESULTS:

As shown in Table 16, the combination of a fungicide and a bacteriacide, regardless of the quality of the media (fumigated vs. non-fumigated), did not extend the activity of granular chlorpyrifos. We, therefore, conclude that microbial degradation is not a factor in the dissipation of chlorpyrifos from nursery potting media. The two controls (IFA media + Dursban and Strong-Lite media + Talstar) provided 18 months of residual, the scheduled duration of the trial.

Table 16. Residual Activity of Chlorpyrifos Incorporated into Potting Media Treated with Various Combinations of Fungicides and Bacteriacides.

Treatment	% Mortality at Indicated Months Post-Treatment																	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Strong-Lite + methyl bromide + 500 ppm benomyl + 500 ppm streptomycin sulfate + 65 ppm Dursban	100	100	50	10	*													
Strong-Lite + 500 ppm benomyl + 500 ppm streptomycin sulfate + 65 ppm Dursban	100	100	0	20	*													
Strong-Lite + methyl bromide + 65 ppm Dursban	100	100	30	35	*													
Strong-Lite + 65 ppm Dursban	100	100	65	35	*													
IFA Lab media + 65 ppm Dursban	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Strong-Lite + 50 ppm Talstar	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Strong-Lite check	40	10	25	30	5	5	5	5	0	0	5	10	30	5	60	15	35	25

* Dropped from trial due to decreased efficacy

PROJECT NUMBER: FA01G041

PROJECT TITLE: Addition of Peat Moss to Strong-Lite® Potting Media to Enhance Residual Activity of Granular Chlorpyrifos.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott and Homer Collins

INTRODUCTION:

Rapid degradation of granular chlorpyrifos in most nursery potting media has been well documented by this laboratory (see 1989, 1990 Annual Reports). However, the original trials using granular chlorpyrifos incorporated into a laboratory potting mix (1:1:1 sand:peat moss:pine bark) provided over 24 months activity. These results were duplicated in 1990 (see 1990 Annual Report, FA01G190), and 12 months residual activity against both fragmented colonies and alate queens was achieved. In another study reported in the 1990 Annual Report (FA01G069), Lorsban® 156 incorporated into sphagnum peat moss provided over 12 months of activity. The enhanced degradation of chlorpyrifos in most types of media remains unexplained.

This study examines the effects of various amounts of sphagnum peat on the efficacy of Dursban® 2.56 in Strong-Lite potting media.

METHODS AND MATERIALS:

This study was initiated on March 1, 1991. Dursban 2.5G was incorporated into Strong-Lite potting media, sphagnum peat (Les Tourbes Nirom Peat Moss, Inc., Quebec, Canada), and various volume to volume combinations of these two media at a rate of 65 ppm.

Treatment combinations evaluated were as follows:

Media mix	Bulk Density (lb/cu yd)	g of 2.5G/ 1.5 cu ft	initial chlorpyrifos conc. (ppm)
Strong-Lite only	382	25.22	65
1:1 Strong-Lite:peat	314	20.59	65
3:1 Strong-Lite:peat	329	21.58	65
9:1 Strong-Lite:peat	347	22.76	65
peat only	257	16.85	65

Treated media was placed in standard gallon nursery pots and aged outdoors under simulated nursery conditions (irrigation applied to supplement rainfall). At monthly intervals, three pots from each treatment group were composited and standard laboratory bioassays performed.

RESULTS:

Dursban in the Strong-Lite only mix and the 9:1 Strong-Lite peat mix was effective for two months (Table 17), and in the 3:1 media was effective for 4 months. The peat only treatments provided up to 8 months of excellent control, then was somewhat erratic, but generally showed good control through 18 months. The 1:1:media also provided residual activity through 18 months. Based on those results, we concluded that sphagnum peat does enhance the residual activity of chlorpyrifos in potting media.

Table 17. Residual Activity of Dursban 2.5G Incorporated Into Various Volume to Volume Combinations of Strong-Lite Potting Media and Sphagnum Peat.

Media Mix	% Mortality to Alate IFA Queens at Indicated Months Post-Treatment[2]																				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Strong-Lite only	100	100	55	30	5	[3]															
9:1 Strong-Lite:Peat	100	100	35	45	10	[2]															
3:1 Strong-Lite:Peat	100	100	100	100	45	95	45	100	10	80	0	0	80	45	45	15	[2]				
1:1 Strong-Lite:Peat	100	100	100	100	100	100	100	100	100	100	100	100	100	100	85	100	90	100	10	65	30
Peat only	100	100	100	100	100	100	100	100	65	100	20	75	100	100	100	100	100	100	0	70	90
Strong-Lite check	30	10	25	30	5	5	5	5	0	10	0	15	30	5	60	15	35	25	20	5	5

[2] standard laboratory alate queen bioassay procedure

[3] dropped due to decreased efficacy

PROJECT NO: FA01G101

PROJECT TITLE: Influence of Sphagnum Peat on Residual Activity of Chlorpyrifos.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Homer Collins, Anne-Marie Callcott, and Lee McAnally

INTRODUCTION:

Loss of chlordane for use as an IFA quarantine treatment for nursery stock led to the registration of granular chlorpyrifos for this use. Data to support the registration was generated at the APHIS Imported Fire Ant Station by Collins et al. (1980). All trials were conducted on site using a "typical" nursery potting media comprised of a 1:1:1 pine bark: sand: sphagnum peat. When chlorpyrifos was incorporated into this mix at a rate of 11.2 gm. AI insecticide per cubic yard of media, over 24 months residual activity against IFA was obtained. This treatment was used for over a decade as the primary treatment for containerized nursery stock.

Subsequent trials with a variety of potting media at several geographic locations indicated that the residual activity of granular chlorpyrifos in other types of potting media is far less than 24 months (Lockley & Collins 1990).

However, recent studies (McAnally & Collins 1991) confirmed that granular chlorpyrifos does provide good residual activity when used in the original media comprised of sand, pine bark, and sphagnum peat in a 1:1:1 ratio by volume. These results led us to hypothesize that the presence of sphagnum peat in the media was acting as an antibiotic to retard an unknown microorganism that was responsible for breakdown of the chlorpyrifos. Sphagnum peat is known to suppress certain soil microorganisms, especially *Rhizoctonia* (Tahvonen 1982). This hypothesis was subsequently disproven by studies involving sterilization of media and addition of antibiotics (Collins & Callcott 1992). The current study investigates the addition of various quantities of sphagnum peat to commercial nursery media as a means of

enhancement of the residual activity of granular chlorpyrifos.

METHODS AND MATERIALS:

Four types of potting media were used in this study; three were obtained from commercial nurseries and one was the IFA laboratory mix. Dursban® 2.5G was incorporated into each media at a rate of 18.4 ppm using a cement mixer for 1 hour. This rate was chosen for the following reasons:

1. If we had used the labelled rated of Dursban 2.5G (1 lb/cu yd), a variable dose rate would have been administered to each media in the trial due to the variation of bulk density. A single dose rate for all media eliminated this variable.

2. 18.4 ppm was selected as the rate of choice because it represents the rate which was obtained by applying the labelled rate of Dursban 2.5G to the IFA laboratory mix. This rate of application has been shown to provide a minimum of 24 months residual in numerous studies conducted in the late 1970's and in recent trials. Most recent trial results are found in IFA reports FA01G190 and FA01G200.

Talstar® 10WP was also incorporated into each media at a rate of 50 ppm.

Sphagnum peat was added to each of the nursery media at rates of 5:1, 3:1 and 1:1 by volume (media:peat) and blended into the media at the same time the chlorpyrifos was incorporated. Additional peat was not added to the IFA mix.

Media from each treatment was placed in standard plastic nursery pots and weathered under normal environmental conditions. Supplemental irrigation was added when necessary to simulate nursery conditions. At monthly intervals, two pots from each treatment group were composited, and standard laboratory bioassays performed (Appendix II).

Media Components and Properties

Two cubic yards of media were obtained from each of three cooperating nurseries. The cooperating nurseries and the components of their respective media were as follows:

Nursery	Components (per 2 yds media)
Greenleaf El Campo, TX	5:2:1 pine bark:sand:rice hull 7.0 lb 33-0-0 3.0 lb iron sulfate 7.0 lb 0-18-0 20 lb dolomite 14 oz 0-0-60 4 oz frit (micro)
Flowerwood Mobile, AL	19:3 pine bark:sand 1.73 cu yd pine bark 0.27 cu yd sand 18.2 lb premix (13-6-6) 9.1 lb dolomite 6.8 lb oyster shells
Windmill Franklinton, LA	straight pine bark 2 cu yd pine bark 9.6 lb dolomite 10 lb oyster shells (crushed) 3 lb micromax
IFA mix Gulfport, MS	1:1:1 pine bark:sphagnum peat:sand Pine Bark Mulch, Forest Gardens Inc., Society Hill, Opelika, AL Les Tourbes Nirom Peat Moss Inc., Quebec, P.Q., Canada river sand from Biloxi River at Three Rivers Road, Harrison Co., MS

Samples of each media each media/peat combination (minus pesticide) were sent to the Dept. of Agronomy, Mississippi State Univ. (Soil Testing Lab) for analysis of pH and cation exchange capacity. This lab was not able to accurately determine percent organic matter. Therefore, duplicate samples were sent to National Monitoring and Residue Analysis Laboratory (NMRAL), for percent organic matter analysis. Percent total organic carbon was determined by NMRAL using a LECO analyzer.

Samples were submitted to NMRAL for GC analysis for chlorpyrifos prior to

treatment to insure non-contaminated soil. A sample from each treatment was also submitted for analysis for treatment chemical (chlorpyrifos or bifenthrin) immediately after mixing.

Particle Size

Particle size of each of the 5 media types and 9 media/peat combinations was determined by passing a 400 cc sample (based on dry weight) through a set of Hubbard screen sieves; mesh size 5, 10, 20, 40 and 60. After the sample was introduced into the top sieve, the set was placed on an electric shaker (Eberbach Corporation, Ann Arbor MI; 115 volts; 60 cy.) for 10 minutes. Three replicates per sample were shaken. The amount of media remaining in each sieve by weight was determined, and the average percent retained by each sieve (mesh size) was calculated.

RESULTS:

Laboratory Bioassay:

Bioassay results through 17 months posttreatment (PT) are shown in Table 18. Greenleaf media treated with chlorpyrifos lost efficacy by 3 months PT. The Greenleaf media showed good residual activity in all but the Dursban only treatment at 5 months PT and by 6 months PT reduced residual activity was seen in all treatments. The 1:1 treatment regained 100% control at 8 and 9 months PT, before a decline again at 10 months PT.

Flowerwood media alone or combined with sphagnum peat and treated with chlorpyrifos provided good control for 1 month, but all media combinations showed reduced efficacy by 4 months PT. The high mortality in the one and three month Flowerwood checks may be as result of contamination of the media when mixed at the nursery. (Table 19 shows 0.61-1.58 ppm of chlorpyrifos present in the pretreat Flowerwood soil samples).

Chlorpyrifos incorporated into Windmill nursery media or media/peat combinations provided no activity against alate queens. The percent organic

matter of this media was much greater than that of the other media types, excluding sphagnum peat moss (Table 20). However, granular chlorpyrifos incorporated into sphagnum peat moss has provided up to 15 months of residual activity in other trials (McAnally & Collins 1992).

All media treated with Talstar has shown excellent control for 17 months.

Media Properties

Physical characteristics of each media and peat combination are shown in Tables 20, 21, and 22. The enhanced residual activity of granular chlorpyrifos in the IFA lab media (1:1:1 sand, peat, pine bark) cannot be explained solely on the basis of variation in certain physical characteristics (bulk density, pH, % organic matter, cation exchange capacity, etc.). The addition of various ratios of peat to 3 different commercial media did appear to somewhat extend the residual activity of chlorpyrifos in 2 out of 3 media tested. As in numerous other trials, this study confirms that the enhancement of residual activity of chlorpyrifos occurs when used in one specific type of potting media. Thus far, all efforts to explain this phenomenon have not been successful.

Table 18. Residual Activity of Dursban 2.5G Incorporated into Various Nursery Potting Media and Media/Peat Combinations.

Media	Treatment	% Alate Queen Mortality at Indicated Months Post-Treatment																
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Greenleaf	Dursban	100	100	35	35	0	10	30	0	25	*							
5:1	Dursban	100	100	100	100	100	40	100	5	0	*							
3:1	Dursban	100	100	100	100	100	0	25	5	5	*							
1:1	Dursban	100	100	100	100	100	50	50	100	100	40	90	5	25	10	*		
Greenleaf	Talstar	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Greenleaf	Check	10	30	10	15	20	10	0	0	10	5	75	10	5	0	15	30	10
Flowerwood	Dursban	100	100	100	60	0	*											
5:1	Dursban	100	20	10	15	5	*											
3:1	Dursban	100	100	15	20	10	*											
1:1	Dursban	100	100	100	80	85	*											
Flowerwood	Talstar	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Flowerwood	Check	65	35	60	20	15	5	0	15	15	0	15	0	30	20	10	25	15
Windmill	Dursban	70	85	10	30	40	*											
5:1	Dursban	65	50	0	55	30	*											
3:1	Dursban	95	100	20	25	45	*											
1:1	Dursban	60	50	40	20	5	*											
Windmill	Talstar	100	100	100	100	100	100	100	100	95	100	100	100	100	100	100	100	100
Windmill	Check	20	40	10	20	5	0	10	5	5	5	60	15	10	20	25	5	10
IFA mix	Dursban	100	100	100	100	100	100	100	100	100	95	100	100	100	100	100	100	100
IFA mix	Talstar	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IFA mix	Check	20	0	15	10	10	5	0	50	0	5	15	0	5	5	10	10	5
Peat	Check	20	10	20	0	10	5	5	0	10	10	10	0	5	15	0	0	0

* dropped due to decrease efficacy

Table 19. Amounts of Dursban and/or Talstar present in untreated and treated media as determined by GC analysis. All analysis conducted by NMRAL and reported in parts per million (ppm).

	Untreated Media		Treated Media			
			Dursban		Talstar	
Media	theore-tical	GC result	theore-tical	GC result	theore-tical	GC result
Greenleaf	0	bdl[1]	18.4	14.41	50.0	40.46
5:1	0	bdl	18.4	28.53	--	--
3:1	0	0.01	18.4	37.50	--	--
1:1	0	bdl	18.4	37.30	--	--
Flowerwood	0	0.69	18.4	[illegible]42	50.0	64.08
5:1	0	0.61	18.4	[illegible]30	--	--
3:1	0	0.70	18.4	52.22	--	--
1:1	0	1.58	18.4	34.85	--	--
Windmill	0	0.30	18.4	34.55	50.0	19.01
5:1	0	0.22	18.4	138.80	--	--
3:1	0	0.20	18.4	186.67	--	--
1:1	0	0.12	18.4	128.40	--	--
IFA mix	0	0.03	18.4	43.25	50.0	44.75
Peat	0	0.29	--	--	--	--

[1] bdl = below detectable limits (0.01 ppm)

Table 20. Characterization of Various Nursery Media and Peat Mixes.

Media	Percent Organic Matter[2]	Cation Exchange Capacity (milli-equiv./100 g. soil)[3]	pH[2]	Bulk Density (lbs./cu.yd)[4]
Greenleaf	24.1	10.53	5.1	890
5:1	47.8	14.24	4.9	895
3:1	27.4	18.77	5.0	869
1:1	29.8	13.23	5.2	561
Flowerwood	39.9	9.35	5.6	920
5:1	32.6	18.51	4.8	920
3:1	27.2	13.73	5.2	867
1:1	24.4	11.75	5.3	708
Windmill	57.5	13.54	6.7	481
5:1	62.1	15.82	5.4	440
3:1	61.1	15.43	6.2	507
1:1	57.6	11.46	6.6	393
IFA mix	13.6	11.13	5.0	1351
Peat	62.1	21.39	4.7	246

[2] Determination by NMRAL
[3] Determination by Agronomy Dept., Mississippi State Univ.
[4] Determination by IFA Station

Table 21. Bulk Densities of Various Nursery Soils.

Media	Bulk Density (lb/cu yd)[5] (1)	(2)	(3)	Mean	CV[6] (%)
Greenleaf	891.19	884.43	895.14	890.25	1.86
5:1	888.38	881.05	916.54	895.32	4.20
3:1	909.22	842.75	855.14	869.04	5.76
1:1	606.71	566.71	509.25	560.89	8.25
Flowerwood	942.46	919.36	899.08	920.30	4.44
5:1	915.42	789.23	1055.69	920.11	12.71
3:1	976.82	825.85	797.68	866.78	9.84
1:1	784.16	688.39	652.34	708.30	8.64
Windmill	472.64	478.83	492.92	481.46	2.67
5:1	415.74	452.92	451.79	440.15	4.58
3:1	487.85	516.01	516.58	506.81	3.35
1:1	370.11	425.88	382.50	392.83	6.63
IFA Mix[7]	1351.44	--	--	1351.44	3.19
Peat	220.26	262.51	256.32	246.36	8.09

[5] Each trial used a different soil sample; 3 replicates per trial
[6] CV = coefficient of variation; computed using raw data (9 replicates)
[7] Only on trial run since bulk density was within the range of other tests

Table 22. Particle Size of Various Nursery Media and Peat Mixes.

Media	% of Media Retained by Indicated Mesh Size[1] (5)	(10)	(20)	(40)	(60)	(>60)
Greenleaf	9.48	13.97	29.21	24.20	15.04	8.11
5:1	13.97	12.77	27.67	21.26	13.14	11.18
3:1	8.03	13.00	32.16	24.63	15.54	6.63
1:1	13.06	18.31	34.95	21.58	9.11	3.00
Flowerwood	30.46	32.11	18.51	10.71	5.74	2.48
5:1	29.40	27.25	17.05	11.17	8.33	6.79
3:1	28.64	28.33	19.22	10.67	6.80	6.35
1:1	28.94	30.08	17.94	11.03	7.03	4.99
Windmill	40.91	13.06	29.03	11.33	3.59	2.08
5:1	44.35	14.12	21.03	12.12	4.34	4.05
3:1	35.84	17.56	25.59	14.44	4.63	1.93
1:1	37.17	17.19	24.28	15.23	3.90	2.22
Lab mix	3.72	3.53	7.29	16.10	61.04	8.32
Peat	23.22	14.09	24.10	20.75	7.92	9.91

[1] percentage by weight

PROJECT NO: FA01G012

PROJECT TITLE: Residual Activity of Two Formulations of Chlorpyrifos Using Sphagnum Peat as a Carrier.

PROJECT TYPE: Final

LEADERS/PARTICIPANTS: Anne-Marie Callcott and Homer Collins

INTRODUCTION:

A number of studies initiated by the IFA laboratory (see IFA Annual Report, FA01G041 and FA01G101) have indicated that the addition of sphagnum peat moss to nursery potting media may enhance the residual activity of chlorpyrifos. Thus, the idea of using sphagnum peat as the carrier for a specialized chlorpyrifos formulation was conceived. Preliminary studies with sphagnum peat carriers have shown some success (FA01G132), and other studies are underway. This study was initiated to determine the residual activity of two formulations of chlorpyrifos using sphagnum peat as the carrier when incorporated into Strong-Lite® potting media.

METHODS AND MATERIALS:

Strong-Lite Bedding Plant Mix (Strong-Lite Horticultural Products, Pine Bluff, AR) was chosen because numerous studies have demonstrated rapid dissipation of chlorpyrifos in this media. Formulogic (Princeton, N.J.) produced a 5% formulation of chlorpyrifos on sphagnum peat pellets. A 2.5% formulation on sphagnum peat was formulated by the IFA laboratory. These two formulations were incorporated into Strong-Lite potting media at the Ford's Dursban®2.5G labelled rate of 1 1b/cu yd (ca. 65 ppm). Talstar®10WP was incorporated into Strong-Lite at a rate of 25 ppm and used as a control. Treated media was placed in standard 6" plastic nursery pots and subjected to simulated nursery practices. At monthly intervals, three pots from each treatment group were collected, composited and subjected to standard laboratory bioassay (Appendix II).

Formulation of 2.5% chlorpyrifos on sphagnum peat:

Sphagnum peat moss (Les Tourbes Nirom Peat Moss Inc., Quebec, P.Q., Canada) was sifted through a Hubbard wire screen sieve, standard mesh size 6 (6 squares per linear inch) to remove large particles and to acquire a fairly uniform size. To achieve a 2.5% formulation, 202 g technical chlorpyrifos (99% technical, The Dow Chemical Co., Midland, MI) was mixed in 24,000 ml of analytical grade acetone (the amount of acetone necessary to thoroughly saturate 8000 g of peat). This solution was added to 8000 g of the sifted sphagnum peat and mixed in a 2 cu ft cement mixer for 15 minutes. The formulated peat was then spread in a 1-1.5" layer in an open container and allowed to air dry for 48 hours.

Each of these components and component combinations was subjected to gas chromatograph (GC) analysis to insure correct and accurate formulation. GC analysis was performed by the National Monitoring and Residue Analysis Laboratory in Gulfport, MS.

RESULTS:

The Formulogic 5.0% sphagnum peat formulation of chlorpyrifos provided 3 months of residual activity, while the IFA 2.5% formulation provided 4 months of residual activity (Table 23). Therefore, these sphagnum peat carrier formulations did not extend the residual of chlorpyrifos in Strong-Lite potting media.

NMRAL found the Formulogic formulation to be accurate (5% chlorpyrifos) and the IFA formulation is be slightly below expected (1.97% chlorpyrifos).

Table 23. Residual Activity of Chlorpyrifos Formulated on Sphagnum Peat Moss and Incorporated into Strong-Lite Potting Media.

Treatment/Formulator	% Mortality at Indicated Months Post Treatment						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Chlorpyrifos 2.5%/ IFA Station	100	100	100	100	10	0	15
Chlorpyrifos 5.0%/ Formulogics	100	100	100	20	20	20	10
Talstar 10WP/FMC Corp.	100	100	100	100	100	100	100
Untreated Check	0	0	20	10	10	0	5

PROJECT NO: FA01G052

PROJECT TITLE: Effect of Green Pine Bark vs. Composted Pine Bark in Nursery Media on Residual Activity of Chlorpyrifos.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Original efficacy trials with incorporated granular chlorpyrifos conducted in the late 1970's indicated at least 24 months of residual activity (Collins et al. 1980). These original trials utilized a potting media consisting of equal parts sand, sphagnum peat, and milled pine bark. Several trials conducted in 1989 using various other commercial potting media showed a great variability to the results of earlier trials. In no case was more than 3-4 months residual activity achieved.

In December 1989, a trial was set up to duplicate the original trials (see FA01G190). Equal parts sand, sphagnum peat, and milled pine bark were blended and Ford's Dursban® 2.5G and Dow's Lorsban® 15G were incorporated into two separate batches at a rate of 11.34 g AI/cu yd. Both treatments were subjected to a fragmented colony bioassay monthly. By 12 months post-treatment, both mixes were still providing 100% mortality.

An additional trial was begun in August, 1990, using each component of the mix separately to determine if one or more of the components contributed to the enhanced residual activity of chlorpyrifos. Peat moss and pine bark both maintained 100% efficacy through 18 months and are still being monitored. In all of the above trials 'green' or uncomposted pine bark was used.

Another trial (FA01G101) studying the effects of varying amounts of peat moss added to the media, utilized media obtained from Windmill Nursery, Franklinton, LA. This media consisted of composted pine bark plus amendments, and no acceptable activity was evident at any time. Lack of activity in this trial prompted us to speculate that the age of the pine bark component of the

media mix may somehow affect the performance of chlorpyrifos.

METHODS AND MATERIALS:

This trial was initiated on June 9, 1992 to determine whether green (fresh composted) pine bark enhances the residual activity of chlorpyrifos. Four media types were evaluated. Media composition and bulk density are as follows:

Media	Composition	Bulk Density (lb/cu yd)
Green pine bark	100% green pine bark	344
Composted pine bark	100% composted pine bark	535
Green pine bark mix	1:1:1 green pine bark, sphagnum peat, sand	1194
Composted pine bark mix	1:1:1 composted pine bark, sphagnum peat, sand	1290

Each media was treated with granular chlorpyrifos (Lorsban 15G) at a rate of 65 ppm (labelled rate for Dursban 2.5G). A portable cement mixer was used to blend each media type with the appropriate quantity of chlorpyrifos. Each batch (1.5 cu ft media + chemical) was blended for 15 minutes. Treated media were then placed in 6"x6" plastic nursery containers and placed outdoors to weather naturally. Artificial irrigation was added by an overhead sprinkler system at a rate of approximately 1" per week. At monthly intervals, three pots from each treatment were composited and an 80-100 cc sub-sample subjected to standard laboratory alate queen bioassay.

Particle size

Particle size of each of the 3 media types was determined by passing a 400 cc sample (based on dry weight) through a set of Hubbard screen sieves; mesh size 5, 10, 20, 40, and 60. After the sample was introduced into the top sieve, the set was placed on an electric shaker (Eberbach Corporation, Ann Arbor, MI-115 volts; 60 cy) for 10 minutes. Three replicates per sample were shaken. The amount of media remaining in each sieve by weight was determined, and the

average percent retained by each sieve mesh size) was calculated.

RESULTS:

Particle Size

Particle size of the two types of pine bark used in the trial are shown as follows:

Media	% of Media (by weight) Retained by Indicated Mesh Size					
	(5)	(10)	(20)	(40)	(60)	(>60)
Green Pine Bark	36.4	22.8	25.0	10.7	3.5	1.6
Composted Pine Bark	44.7	10.5	13.7	10.8	12.7	7.6

Bioassays

At 3 months post-treatment, the chlorpyrifos incorporated in the composted bark began to decline. All other treatments remain at 100% efficacy through 6 months. Results summarized in Table 24 are a preliminary indication that the aging process may influence the residual properties of chlorpyrifos. These very preliminary results may indicate that the presence of certain compounds (such as terpines) which eventually "weather" out of pine bark may enhance residual activity of chlorpyrifos.

Table 24. Influence of Pine Bark Age on Residual Activity of Granular Chlorpyrifos.

Treatment	% Mortality at Indicated Months Post-Treatment (1)	(2)	(3)	(4)	(5)	(6)
Mix Green Bark	100	100	100	100	100	100
Mix Composted Bark	100	100	100	100	100	100
Green Bark	100	100	100	100	100	100
Composted Bark	100	100	100	35	10	5
Check	5	0	5	10	10	0

PROJECT NO: FA01G122

PROJECT TITLE: Residual Activity of Chlorpyrifos Using Pine Bark as a Primary Carrier.

PROJECT TYPE: Interim

LEADER/PARTICIPANT(s): Tim Lockley, Lee McAnally & Randy Cuevas

INTRODUCTION:

In recent years, the rapid loss of residual activity by chlorpyrifos in potting media has caused significant reduction in the certification period authorized by USDA. In the early 1980's, experiments with chlorpyrifos at the Gulfport Station indicated significant residual activity (+ 2 years) and subsequent periods of certification were based on these data. Experiments conducted in the late 80's and early 90's showed a significant reduction in residual activity in various potting media. When the earlier experiments were repeated using a media prepared on site (1:1:1, sand, peat, pine bark), a significant increase in residual activity was noted. Studies initiated at the IFA lab indicated the possibility of either sphagnum peat moss or pine bark as the enhancing agent. Some success was shown with peat as the carrier and other studies are currently underway. Pine bark is the only other possible enhancing agent. This trial was begun to determine the potential of pine bark as a carrier to enhance residual activity of chlorpyrifos.

MATERIALS AND METHODS:

"New" pine bark was ground and sifted through a Hubbard wire screen sieve (mesh size 6 squares/linear inch) to remove any large particles and to acquire a uniform size. Chlorpyrifos was added by mixing 250 ml of analytical grade acetone and 25.0 g of technical chlorpyrifos (Dow Chemical Co., Midland, MI). This solution was mixed with 1,000 g of pine bark in a 2 cu ft cement mixer for 15 minutes. The formulated pine bark was then spread at a depth of 1 - 1.5 inches in an open container and allowed to air dry for 48 hours.

Each of the components and component combinations was subjected to gas

chromatographic (GC) analysis to insure accurate formulation. GC analysis was performed at the National Monitoring and Residue Analysis Laboratory in Gulfport, MS.

Comparative studies were undertaken with the pine bark formulated material at the IFA lab in Gulfport, MS, Alabama Agricultural Experiment Station at Mobile, and at the IFAS site at Homestead, FL. Grace Sierra Bedding Plant Mix (Grace Sierra Horticultural Products Co., 1001 Yosemite Dr., Milpitas, CA) was chosen because of previous data showing an extremely rapid degradation of chlorpyrifos in this media. The material was incorporated into the media at the rate of 1.0 lb AI/cu yd (83.3 ppm). Pine bark without chlorpyrifos was mixed in an equivalent amount for an untreated check. Chlorpyrifos formulated at 2.5% on peat moss (83.3 ppm) and suSCon Green (400 ppm) were selected for comparison and incorporated into Grace Sierra media. Force® 1.5G and Commodore® 10WP were composited at 25 ppm in media (3:1:1 pinebark; peatmoss; sand) mixed at the Gulfport IFA Station. Media was placed in standard trade gallon pots and subjected to normal horticultural practices. At monthly intervals, two pots were collected from each replicate, composited and subjected to a bioassay (Appendix II). Periodic (quarterly) samples were submitted for GC analysis to more closely compare degradations between sites.

RESULTS:

As replicates at the Homestead, Florida site were destroyed in late August by Hurricane Andrew, only one sample was taken from that site. At 30 days posttreatment, all replicates at all sites caused 100% mortality to alate queens. By month 2, of the chlorpyrifos mixtures, only the Mobile pine bark test retained 100% efficacy. By month 3, no chlorpyrifos treated media maintained sufficient efficacy and after month 4 was discontinued. Both Force and Commodore continue to cause 100% mortality (Table 25).

Table 25. Relative Efficacy of Three Chlorpyrifos and Two Synthetic Pyrethroid Formulations in Selected Media to IFA Alate Queens.

Site	Formulation	% Mortality to Alate IFA Queens at Indicated Months Posttreatment			
		(1)	(2)	(3)	(4)
Gulfport, MS	Force 1.5G	100	100	100	100
	Commodore 10WP	100	100	100	100
	suSCon Green	100	30	35	--
	Peat Moss 2.5G	100	25	45	--
	Pine Bark 2.5G	100	20	20	--
Mobile, AL	Force 1.5G	100	100	100	100
	Commodore 10WP	100	100	100	100
	suSCon Green	100	70	50	--
	Peat Moss 2.5G	100	80	15	--
	Pine Bark 2.5G	100	100	65	--
Homestead, FL	Force 1.5G	100	--		
	Commodore 10WP	100	--		
	suSCon 10CR	100	--		
	Peat Moss 2.5G	100	--		
	Pine Bark 2.5G	100	--		
Check		0	35	20	0

PROJECT NO: FA01G142

PROJECT TITLE: Effects of Solvent-extracted Pine Bark as a Media Component on the Residual Activity of Chlorpyrifos.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Homer Collins and Anne-Marie Callcott

INTRODUCTION:

In our continuing efforts to determine the cause of the enhanced residual of chlorpyrifos in a 1:1:1 mixture of sphagnum peat, pine bark and sand, we have begun to investigate the role of pine bark. Studies using pine bark as a carrier for chlorpyrifos, and "new" (green) vs. "old" pine bark as a media component have been initiated. In this study, we wanted to determine whether solvent extractable compounds from the pine bark could be involved in enhancing chlorpyrifos residual.

METHODS AND MATERIALS:

Green, freshly ground pine bark (*Pinus palustris*), was obtained from Southern Bark Company, Wiggins, MS, on June 11, 1992 and solvent extracted as follows: 1 cu ft of bark was placed in a 12 gallon open container with 6 gallons of isopropyl alcohol and acetone (50:50 by volume), and manually agitated for 30 minutes. The solvent was then decanted, and excess solvent allowed to drain over a sieve for ca. 15 minutes. A second extraction was then performed with fresh solvent solution described above. The bark-solvent mixture was again manually agitated for 30 minutes prior to decanting and allowing to drain overnight. The bark was then spread in a thin layer (ca. 1"), and allowed to air dry for two days prior to use.

Extracted pine bark was mixed with Sphagnum peat and coarse river sand in a 1:1:1 ratio (vol:vol) to prepare a potting media. This media was then treated with Dursban® 2.56 (Ford's Chemical and Specialty Co., Pasadena, TX), at a rate equivalent to 1.0 1b formulated Dursban per yd^3 of potting media by tumbling the media and insecticide in an electric cement mixer. Treated media

was then placed in trade 1-gallon plastic pots and subjected to simulated nursery environmental conditions.

A second batch of media was prepared and treated as above except that plain bark from the same source as the solvent extracted bark was used.

Both groups of treated media were bioassayed at monthly intervals using alate IFA queens in a standard laboratory bioassay procedure (Appendix II).

RESULTS:

At 6 months posttreatment (PT), both media types are providing 100% control of IFA (Table 26).

Table 26. Residual Activity of Chlorpyrifos Incorporated into 1:1:1 IFA Media Using Solvent Extracted Bark or Plain Bark as a Media Component.

Bark Treatment	% Mortality at Indicated Months PT					
	(1)	(2)	(3)	(4)	(5)	(6)
Extracted	100	100	100	100	100	100
Plain	100	100	100	100	100	100
Check	0	15	5	0	20	20

PROJECT NO: FA01G132

PROJECT TITLE: Enhanced Residual Activity of Chlorpyrifos Through Inert Carrier Modification.

TYPE REPORT: Final

LEADER/PARTICIPANT(S): Homer Collins, Avel Ladner and Lee McAnally

INTRODUCTION:

The rapid degradation of granular chlorpyrifos in various types of nursery potting media is well documented in the USDA, APHIS, IFA Station Annual Reports, 1989-1991. However, chlorpyrifos incorporated into a 1:1:1 mixture, by volume, of sphagnum peat moss, pine bark and sand has provided residual activity of 24 months and more. This is the only media in which we have found the extended residual activity. Since many commercial media contain large quantities of pine bark, we first focused our attention on sphagnum peat. Several trials using sphagnum peat to enhance the residual activity of chlorpyrifos have been initiated. In the trials initiated here, the use of sphagnum peat as an inert carrier for chlorpyrifos was studied.

MATERIALS AND METHODS:

Trial I:

Dursban® 4EC was placed in solution with 100 mls of water and used to thoroughly saturate 48.4 g of sphagnum peat moss (ca. 2.5% formulation). The peat was sifted through a No. 6 wire mesh screen prior to mixing to insure a uniform carrier size. This formulation was allowed to air dry and then incorporated into Windmill Nursery potting media at a rate of ca. 100 ppm. Standard laboratory bioassays were performed on a monthly basis (Appendix II).

Trial II:

In this trial, 0.63 g technical chlorpyrifos was mixed in 50 ml of acetone. This was used to saturate 25.2 g of sifted sphagnum peat which produced a 2.5% formulation. The peat was allowed to air dry for 24 hours prior to incorporation into Strong-Lite® potting media at a rate of 62.5 ppm (labelled

rate of Dursban 2.5G in Strong-Lite). Ford's Dursban 2.5G was also incorporated into Strong-Lite media at the labelled rate (62.5 ppm). Standard laboratory bioassays were performed monthly.

RESULTS:

In both trials, the chlorpyrifos formulated onto sphagnum peat did not afford any longer residual than did the standard commercial formulation of chlorpyrifos (Ford's 2.5G). These results appear in Tables 27 and 28.

Table 27. Residual Activity of Chlorpyrifos EC Formulated onto Sphagnum Peat.

Formulation	% Alate Queen Mortality at Indicated Months Posttreatment									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
IFA Peat 2.5%	100	100	100	100	100	100	85	50	40	25
Ford's 2.5G	100	100	100	100	100	100	100	70	35	0
Check	5	25	5	0	15	20	25	0	10	0

Table 28. Residual Activity of Technical Chlorpyrifos Formulated onto Sphagnum Peat.

Formulation	% Alate Queen Mortality at Indicated Months PT						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
IFA Peat 2.5%	100	100	100	100	100	25	5
Ford's 2.5G	100	100	100	100	100	10	15
Check	0	0	0	15	5	10	0

PROJECT NO: FA01G071

PROJECT TITLE: Residual Activity of Polyon® Polymer Coated Urea Granules Containing Dursban.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Homer Collins and Avel Ladner

INTRODUCTION:

In cooperation with Pursell Industries (Sylacauga, AL), a series of controlled released formulations containing Dursban® were evaluated for residual activity in a typical nursery potting media environment. Release rates of the granules are controlled by the thickness of the polymer layer, granule size, etc. It was hypothesized that constant, gradual diffusion of the pesticide through the thin polymer coating by osmosis might offer extended residual activity beyond that of conventional non-protected granular Dursban formulations.

METHODS AND MATERIALS:

TEST I:

Twelve (12) formulations varying in particle size, % active ingredient, thickness of polymer layer, etc. were received on 4/26/91. All formulations plus a standard (Ford's Chemical 2.56 Dursban) were blended into Strong-Lite® media at a theoretical initial concentration of 65 ppm (labelled rate for Dursban 2.56) April 29-30, 1991. A 2.0 cu ft electric cement mixer was loaded with 1.5 cu ft of Strong-Lite and each formulation was mixed for 30 minutes to insure thorough incorporation. Treated media was then used to fill 36 six-inch plastic nursery pots per formulation. Pots were maintained outdoors under simulated nursery conditions and received a minimum of 1" of water per week either through natural rainfall or supplemental irrigation.

Two pots/month were randomly selected and destructively sampled by compositing and removing 4 aliquots of 50 cc of media for standard alate IFA queen bioassay (Appendix II).

TEST II:

All 1991 formulations (those with codes ending in 91) were tested again at higher rates of application. The above procedures were followed, and formulations were incorporated into Strong-Lite potting media at a rate of 400 ppm. There was not enough material available of I-91 and IR1-91 to supply 400 ppm, therefore, these formulations were incorporated at 367 and 295 ppm, respectively.

RESULTS:

TEST I:

Results of the first trial are shown in Table 29, and indicate that this polymer technology did not extend the residual activity of chlorpyrifos when incorporated at 65 ppm.

TEST II:

All formulations provided 100% control for 3 months when applied at rates of 295+ ppm (Table 30). Three formulations provided good control through 9 months (I-91, R1-91 and II R3-91), effectiveness declined thereafter.

While the higher rates of application did provide longer chlorpyrifos residual activity, these controlled released formulations did not extend the residual activity of chlorpyrifos for an acceptable length of time (18-24 months).

Table 29. Evaluation of Polyon Polymer Formulations of Dursban (Test I).

Formulation Code	% Mortality to Alate IFA Queens at[1] Indicated Months Post-Treatment (1)	(2)	(3)
I R10 -90	95	5	15
II R10 -90	45	10	20
II R3 -91	100	10	30
II R1 -91	85	10	15
I - 91	100	40	25
I R1 - 91	100	30	20
I R3 - 91	100	25	25
II - 91	100	25	30
II R6 - 90	15	20	40
II -90	80	10	15
I R6 -90	30	10	40
I -90	40	10	35
2.5G	70	20	20
Check	25	15	20

[1] Mean based on 4 replicates with 5 alate queens/replicate (standard bioassay procedure).

Table 30. Evaluation of Polyon Polymer Formulations of Dursban (Test II).

Formulation Code	% Mortality to Alate Queens at Indicated Months Posttreatment											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
I R1-91	100	100	100	100	100	25	nd	20	70	0	**	
I-91	100	100	100	100	100	100	nd	75	100	10	55	40
I R3-91	100	100	100	70	50	100	nd	100	75	10	5	10
II-91	100	100	100	55	50	75	nd	40	90	35	**	
II R1-91	100	100	100	100	35	100	nd	70	100	35	15	5
II R3-91	100	100	100	100	100	100	nd	100	100	50	80	65
2.5G	100	100	100	100	100	*	nd	--	--	--	--	
Check	10	15	25	5	0	0	nd	5	20	0	5	10

[1] Mean based on 4 replicates with 5 alate queens/replicate (standard bioassay procedure).
* Dursban 2.5G pots accidentally destroyed
** Dropped due to decreased efficacy
nd -no data for month 7

PROJECT NO: FA01G010

PROJECT TITLE: Evaluation of Acrylamide Copolymers for Extended Residual Activity of Pesticides in Nursery Potting Media.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Homer Collins, Avel Ladner and Lee McAnally

INTRODUCTION:

Long residual insecticides blended into nursery potting media prior to planting is a highly favored method of preventing IFA infestation of containerized nursery stock. Chlorinated hydrocarbon insecticides provided up to 3 years activity when mixed into nursery media. However, all uses of these products were canceled by the EPA in the late 1970's. Granular chlorpyrifos has been used since 1980, and early studies indicated that over 24 months residual activity was achieved with this product. However, recent studies have shown that a much shorter residual is provided by chlorpyrifos in all but one specific type of potting media. Several synthetic pyrethroid insecticides including bifenthrin and tefluthrin have shown up to 24 months residual activity in several previously completed trials. An extremely long residual (minimum of 18-24 months) is needed for a successful preplant incorporated treatment for potting media. Talstar® 10WP, a formulation of bifenthrin with EPA registration for use on ornamental plants, has shown excellent potential for use as an IFA quarantine treatment in numerous other trials. A system to extend the normal residual activity of either Talstar or Dursban® might prove to be a very successful treatment.

Several synthetic polymers with a superior hydroscopic properties are used to maximize water retention around plant roots. At the request of Industrial Services International (4301 32nd St W. A-11, Bradenton, FL 34205) three synthetic acrylamide copolymers were evaluated as a method of extending the residual activity of Talstar 10WP and Dursban 2EC.

Terra-sorb copolymers are capable of absorbing 300-400 times their weight in water. The copolymer particles could possibly serve as a reservoir for the

pesticide/water system. Normal degradation processes might or might not be impacted since pesticide molecules could theoretically reside within the copolymer particles during retention periods (i.e., wet phase). As the media dries through evaporation between rainfall or irrigation, the water/pesticide system might be slowly released back into the media from the copolymer particle. The reverse cycle may occur during the wet phase.

METHODS AND MATERIALS:

Talstar insecticide was blended into nursery potting media (Strong-Lite®, Pine Bluff, AR) at a rate of 100 ppm. Each of the following copolymers was added at a rate of 2.0 lb copolymer per cubic yard of media per manufacturer's suggestion:

Copolymer	Mean particle size (mm)
Terra-sorb GB	1.0 to 1.0
Terra-sorb HB	1.0 to 1.5
Terra-sorb AG	1.0 to 3.0

A portable cement mixer was used to blend 1.5 cu ft batches of the media/insecticides/copolymer mixture. Each batch received 1.5 cu ft media, 50.4 grams copolymer, and 9.6 grams Talstar 10WP. Treated media was placed in 6"x6" plastic pots and subjected to simulated nursery conditions, i.e., weather variables and irrigation. A minimum of 2" water/week was applied either through natural rainfall or supplemental irrigation. The following treatments were evaluated:

1. Talstar 10WP insecticide - 100 ppm
2. Talstar 10WP insecticide - 100 ppm + Terra-sorb GB
3. Talstar 10WP insecticide - 100 ppm + Terra-sorb HB
4. Talstar 10WP insecticide - 100 ppm + Terra-sorb AG
5. Dursban 2EC drench - 100 ppm
6. Dursban 2EC - 100 ppm + Terra-Sorb AG
7. Untreated check (no insecticide or copolymer)

Residual activity of each treatment against IFA was determined by collecting samples of treated media at monthly intervals (3 pots/month) and conducting the standard IFA Station IFA alate queen bioassay procedure (Appendix II).

RESULTS:

The test results to date are shown in Table 31. The addition of copolymers did not extend the residual of Dursban 2EC, and all treatments with Talstar 10WP remained effective through the 22 month post-treatment evaluation. The trials will be continued until all activity ceases.

Table 36. Evaluation of Acrylamide Copolymers for Extended Residual Activity of Pesticides in Potting Media.

Formulation	Dose Rate (PPM)	% Mortality of Alate Queens at Indicated Post-Treatment (Months)												
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(10)	(12)	(14)	(16)	(20)	(22)
Talstar 10WP	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar + AG	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar + GB	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar + HB	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Dursban 2EC	100	100	25	10	20	0	5	*						
Dursban 2EC+AG	100	100	100	10	25	10	5	*						
Check	0	10	0	15	15	5	5	5	5	0	5	25	10	15

* Dropped from test

PROJECT NO: FA01G240

PROJECT TITLE: Empire® Drench Study.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Avel Ladner

INTRODUCTION:

Empire®, a control release formulation of chlorpyrifos, produced by DowElanco (Greenfield, IN) is labelled for control of fleas, ants, ticks, and other household pests. Previous trials by this lab have indicated some potential for use as a drench treatment for quarantine certification of containerized plants. A more detailed study involving dose rates ranging from 1.9 mls/gal water to 90 mls/gal water was initiated on 4/12/90.

METHODS AND MATERIALS:

Empire insecticide was applied as a drench to Strong-Lite® potting media in trade gallon nursery pots on 4/4/90. Rates used were 1.90, 3.75, 7.5, 15, 30, 60, and 90 mls insecticide/gal. of water. Each pot of media received 400 mls. of a finished solution. Pots were then aged outdoors under natural conditions of light, temperature, and rainfall. Additional irrigation water was not added.

At monthly intervals, 3 pots from each treatment were composited and standard laboratory bioassays performed using IFA alate queens (Appendix II).

RESULTS:

The highest rate of application (90 mls/gal water) provided excellent control 21 months posttreatment [PT] Table 33) and continued fairly well through 25 months. The 60 mls/gal rate varied somewhat, but fairly good control was evident through 22 months. Rates of 15-30 mls/gal water generally provided good control 8 to 9 months PT. Lower rates were variable.

Table 33. Residual Activity of Empire Applied at Various Rates as a Drench to Simulated Nursery Stock.

Rate of Application (mls./gal. water)	% Mortality at Indicated Months Post-treatment																								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
1.90	100	100	25	0	100	20	30	0	10	75	10	*													
3.75	100	100	25	35	100	5	100	20	10	95	20	*													
7.50	100	100	65	90	100	95	100	45	100	10	25	*													
15	100	100	100	100	100	100	100	100	35	45	15	*													
30	100	100	85	100	100	100	100	100	90	95	40	*													
60	100	100	100	100	100	100	65	100	100	100	100	90	100	100	90	100	100	80	100	100	100	25	25	85	*
90	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	15	75	100	100	20
Check	5	40	0	0	0	10	5	5	10	0	0	20	10	0	25	0	10	5	15	10	5	0	10	10	5

* dropped from trial due to loss of efficacy

PROJECT NO: FA01G151

PROJECT TITLE: Evaluation of Residual Activity of Chlorpyrifos Drenches in Various Types of Potting Media.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

In 1989, several trials were conducted with candidate pesticides to determine their residual activity when applied to nursery media as a drench. During these trials Dursban® 2E was included as a standard, but failed to yield residual activity beyond 30-60 days. Subsequent tests indicated that granular formulations of chlorpyrifos tend to exhibit longer residual activity in media containing high proportions of sphagnum peat moss. This trial was designed to determine variations in residual activity of chlorpyrifos 2E when applied as a drench to different types of potting media.

METHODS AND MATERIALS:

Eight different media were utilized in this study. Each media was placed in 18, 6"x 6" black plastic nursery containers. Each container was then drenched with Dursban 2E at the labelled rate for IFA quarantine treatment. Drench solution was applied to each container at 1/5 volume of that container. Containers were then placed outdoors to weather naturally. Water was added as necessary to maintain a minimum of 1-2" irrigation per week. At monthly intervals 3 pots per treatment were composited and a 200 cc subsample subjected to standard alate queen bioassay (Appendix II). Media used are as follows:

Media	Components
Baccto	Unknown
Dodd's	1:1 Pine Bark, Peat, & 1 cu ft/1 cu yd Aero-lite
Greenleaf	5:2:1 Bark, Sand, Rice Hulls
Windmill	Composted Pine Bark
Strong-Lite	Composted Pine Bark, Peat Moss, Vermiculite
Peat Moss	Canadian Sphagnum
Lab Mix	1:1:1 Pine Bark, Sand, Peat Moss
MAFES Mix	3:1:1 Pine Bark, Sand, Peat Moss

RESULTS:

Results are summarized in Table 34. Although highly effective for at least 3 months in most media, Dursban in Strong-Lite media failed after 1 month and showed a decline in the Greenleaf media at 3 months. At 4 months posttreatment, efficacy dropped in Dodd's and Baccto mixes. At the termination of the test, chlorpyrifos remained 100% efficacious in only the Windmill and MAFES medias. These, and results of numerous other trials, graphically illustrate the influence of the type of potting media on the residual activity of chlorpyrifos.

Table 34. Activity of Dursban Drench (labelled rate of application) in Various Media.

Media	Average % Mortality to Alate IFA Queens at Indicated Months Post-treatment					
	(1)	(2)	(3)	(4)	(5)	(6)
Windmill	100	100	100	100	100	100
Dodd's	100	100	100	60	10	5
Baccto	100	100	100	55	10	10
Peat Moss	100	100	100	100	100	45
MAFES Mix	100	100	100	100	100	100
Lab Mix	100	100	100	100	100	80
Greenleaf	100	100	75	0	10	0
Strong-Lite	100	70	5	0	25	5
Check	0	20	5	0	0	5

PROJECT NO: **FA01G030**

PROJECT TITLE: Evaluation of a Spray-on Procedure for Treatment of Potting Soil.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Homer Collins and Avel Ladner

INTRODUCTION:

Historically, certification of containerized plants has been achieved either through the incorporation of granular or dust formulation of an insecticide into the media or by immersion or drenching plants with an insecticide solution. The most commonly used treatment involves incorporation of **Dursban®** 2.56 into potting media. Nurseries utilize a variety of mixing procedures ranging from very sophisticated to very basic. Since incorporation of granular or dust formulations directly impacts the effectiveness of a treatment, thorough incorporation is imperative. Unequal mixing can result in "hot spots" in the treated media, as well as areas which may be undertreated. A totally different concept for application of a quarantine pesticide to potting media would be the use of a spray in lieu of incorporation, immersion, or drenching. Granular or dust formulations of candidate treatments do not lend themselves to a spray-on applicator. However, certain long-residual liquid treatments would appear to be compatible with a spray-on procedure. **Talstar® 10WP,** a synthetic pyrethroid, already labelled for use on ornamentals by FMC Corp., has provided over 20 months activity when incorporated into potting media at various rates. **Empire®** 20, a micro-encapsulated chlorpyrifos formulation by Dow Chemical, has provided up to 7 months residual following a drench application at 120 ppm in one preliminary study. These two formulations were evaluated for residual activity following a spray-on application to nursery potting media at 100 ppm.

METHODS AND MATERIALS:

Strong-Lite® potting media was used in this trial. One-half of the amount of the media to be treated (i.e., 1.5 cu ft) was spread on an asphalt surface to

a depth of 1.5 inches. Dimensions of the soil pile were 3.5′ x 3.5′ x 0.12′ (i.e., 1.5 cu ft). One-half of the insecticide was sprayed on at a volume of 1 qt finished spray per 3 cu ft media. Finished sprays were applied with a Solo® Model 475 backpack sprayer set to deliver ca. 60 psi through a single Tee-Jet 8002 flat fan spray tip. Rate of delivery for this system was approximately 950 ml/minute.

The second half of the media was then placed over the first half, and the final half of the insecticide solution applied. Final rate of application was 100 ppm for both insecticides. After application, treated media was "turned" 4 times in perpendicular directions. Treatments were applied on June 1, 1990 using Empire 20 (Batch IY890311-F, Nov.'88) and Talstar 10WP (Batch TH8006).

Treated media was then placed in 6" x 6" plastic pots and weathered in a simulated nursery environment. At monthly intervals, 2 pots were randomly selected and destructively sampled by bioassaying with alate queens (Appendix II).

RESULTS:

Results are listed in Table 35, and indicate that Talstar 10WP remained active through 25 months post-treatment (PT), with one drastic decrease in efficacy at 18 months PT. Empire was very erratic and was dropped from the trial after the 10 month bioassay.

Table 35. Effectiveness of Talstar 10WP and Empire ME Applied as a "Spray-On" Treatment for Potting Soil.

Formulation	Dose Rate (PPM)	% Mortality of Alate Queens at Indicated Posttreatment Interval Months																								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
Talstar 10WP	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	5	100	100	100	100	100	100	100
Empire 20%	100	100	10	30	100	85	15	5	5	15	5	*														
Check	--	20	0	5	20	15	5	10	5	30	0	20	10	15	0	5	10	10	0	5	10	5	5	10	5	20

* dropped from trial due to lack of efficacy.

PROJECT NO: FA01G130

PROJECT TITLE: Impact of Bulk Density and Components of Potting Media on Residual Activity of Bifenthrin Applied Topically or Incorporated into the Media.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott

INTRODUCTION:

Talstar® 10WP (bifenthrin) has shown extremely long residual activity in various trials conducted by the IFA Station. Dose rates ranging from 100 ppm to 25 ppm have lasted many months following incorporation of the pesticide into potting media. Most recent trials using topical applications at 100 ppm have provided 9 months residual activity against alate IFA queens. The need for more information on performance of bifenthrin in various types of media and influence of application procedure on efficacy prompted the present study.

METHODS AND MATERIALS:

Four types of nursery potting media were included in this study. Characteristics of each media were as follows:

Media	Bulk Density (lb/cu yd)	Components
Strong-Lite®	400	blend of composted peat moss, pine bark, vermiculite and perlite
Baccto®	601	unknown; highly organic, no vermiculite
Dodds®	332	1:1 pine bark:peat moss 1 cu ft/cu yd airolite 8 lbs lime/cu yd 1.5 lbs micromax/cu yd (micronutrients)
IFA lab mix	1124	1:1:1 sand:pine bark: peat moss

Each type of media was treated by two different procedures; (1) topical and (2) incorporation of pesticide into the media by blending with a cement mixer. Rates of application were 4.54 grams AI/cu yd incorporated (equivalent to 25 ppm in Strong-Lite), and 0.01625 grams AI/pot topical (also equivalent to 25 ppm in Strong-Lite). Due to differences in bulk densities, the theoretical dose rates for each media and application procedure were as follows:

Media	Method of Application	Theoretical Dose Rate (ppm)
Strong-Lite	incorporation	25
	topical	25
Baccto	incorporation	16.6
	topical	14.1
Dodds	incorporation	30.1
	topical	23.2
IFA mix	incorporation	8.9
	topical	9.8

At monthly intervals following application, 3 pots from each treatment were composited and bioassayed with alate queens according to procedures described in Appendix II.

RESULTS:

Results appear in Table 36. Talstar in Strong-Lite potting media, applied by either method gave excellent results for 18 months, at which time the trial was scheduled to terminate. Dodds also gave good control regardless of application method for 18 months. The bulk density of both these media are similar, and thus the initial theoretical dose rates were also similar (23-30 ppm). The IFA lab mix gave the next best control despite having the highest bulk density and therefore the lowest initial dose rates (9-10 ppm). The topical application was very effective for 8 months, and then produced erratic, but fairly good control through 18 months. The incorporated method was effective for 18 months. Talstar in Baccto was the least effective; it's initial dose rates were 14-16 ppm. The topical application was effective for 8 months and then produced very erratic results. The incorporation method was also effective for 8 months before

declining and becoming erratic.

These results again demonstrated the absolute necessity of applying IFA treatments on a weight-to-weight basis rather than weight-to-volume, thereby obtaining a standardized dose rate.

Table 36. Residual Activity of Talstar 10WP Following Topical Application or Incorporation into Various Potting Media.

Potting Media	Method of Application	Initial Theoretical Dose (ppm)	% Mortality at Indicated Months Post-Treatment																	
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Strong-Lite	topical	25	100	100	100	100	100	100	100	100	80	100	100	100	100	100	100	100	100	100
	incorporation	25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	untreated check	0	10	0	15	15	0	5	20	15	20	35	10	25	10	30	5	0	5	10
Baccto	topical	14.1	100	100	100	100	100	100	100	95	40	95	100	35	30	90	80	100	55	75
	incorporation	16.6	100	100	100	100	100	100	100	100	80	80	95	65	60	100	100	100	100	100
	untreated check	0	0	0	0	15	0	10	30	15	5	20	5	30	20	15	5	5	0	5
Dodds	topical	23.2	100	95	100	100	100	100	100	100	80	100	100	100	100	100	100	100	100	100
	incorporation	30.1	100	100	100	100	100	100	100	100	100	100	100	95	100	100	100	100	100	95
	untreated check	0	0	5	5	10	5	5	30	15	10	10	0	5	0	10	0	5	0	0
Lab mix	topical	9.8	100	100	80	100	100	100	100	90	60	100	100	100	60	100	95	100	100	95
	incorporation	8.9	100	100	100	100	100	100	100	100	100	100	95	100	100	100	100	100	100	100
	untreated check	0	10	5	0	5	0	0	20	5	10	5	0	15	10	50	10	0	0	0

PROJECT NO: FA01G150

PROJECT TITLE: Effect of Irrigation on Residual Activity of Talstar® IOWP Incorporated into Potting Media.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott and Homer Collins

INTRODUCTION:

Talstar IOWP (bifenthrin), a pyrethroid insecticide, has shown great promise as an IFA toxicant when applied topically or incorporated into potting media. Talstar IOWP incorporated into potting media and subjected to normal horticultural practices has shown residual activity up to 36 months (FA02G037). More recent trials using topical application at 10-25 ppm have provided 8 months or more of residual activity against IFA alate queens (FA01G130), depending on media type. This study was initiated to determine the effects of varying amounts of irrigation on the residual activity of bifenthrin.

METHODS AND MATERIALS:

Talstar IOWP was incorporated into Strong-Lite® potting media using a 2 cu ft cement mixer at a rate of 50 ppm. Treated soil was placed in trade gallon nursery pots and divided into 3 groups. Each group of treated pots received a different amount of irrigation (in addition to natural rainfall) per week. Irrigation rates are 1 inch, 2 inches, and 4 inches per week.

At monthly intervals following treatment, 3 pots from each irrigation group were composited and bioassayed with alate queens according to procedures described in Appendix II.

RESULTS:

Eighteen months of control was provided by Talstar IOWP while receiving in excess of 339 inches of rainfall and irrigation [ca. 5.3 inches of water per week] (Table 37). Thus, excessive rainfall or irrigation has not affected the efficacy of Talstar IOWP in Strong-Lite potting media.

Table 37. Influence of Irrigation on Residual Activity of Talstar® 10WP Incorporated into Strong-Lite® Potting Media.

Irrigation Schedule (inches/wk)	% Mortality and Amount Water at Indicated Months Posttreatment											
	1 Month		2 Months		3 Months		4 Months		5 Months		6 Months	
	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)
1	100	6.35	100	13.75	100	20.70	100	+39.14	100[2]	+51.49	100	+61.89
2	100	11.35	100	22.75	100	33.70	100	+59.14	100	+74.49	100	+88.89
4	100	21.35	100	40.75	100	59.70	100	+90.14	100	+111.49	100	+133.89
Check[1]	10	6.35	0	10.75	15	14.70	15	+31.14	0	+40.49	5	+47.89

Table 37 (Cont'd)

Irrigation Schedule (inches/wk)	% Mortality and Amount Water at Indicated Months Posttreatment											
	7 Months		8 Months		9 Months		10 Months		11 Months		12 Months	
	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)
1	100	+74.89	100	+88.81	100	+104.16	100	+114.76	100	+120.41	100	+135.46
2	100	+106.89	100	+123.81	100	+143.16	100	+155.76	100	+165.41	100	+185.46
4	100	+161.89	100	+186.81	100	+214.16	100	+249.76[3]	100	+257.41	100	+287.46
Check	20	+57.89	20	+66.81	0	+78.16	0	+83.76	10	+88.41	25	+100.46

Table 37. (Cont.)

Irrigation Schedule (inches/wk)	% Mortality and Amount Water at Indicated Months Posttreatment											
	13 Months		14 Months		15 Months		16 Months		17 Months		18 Months	
	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)
1	100	+140.21	100	+145.73	100	+152.38	100	+162.63	100	+180.63	100	+193.33
2	100	+194.21	100	+204.73	100	+215.38	100	+229.63	100	+252.63	100	+269.33
4	100	+304.21	100	+320.73	100	+339.38	100	+361.63	100	+394.63	100	+418.33
Check	10	+104.21	30	+111.23	5	+118.88	0	+129.13	5	+145.13	10	+156.33

[1] check received approximately 1.5 inches of irrigation per week in addition to minimal rainfall, or only rainfall when totaling 1" or more per week.

[2] rainfall during the week of 1/6/91 was in excess of 11.25 inches (rain gauge overflowed one night, therefore +6.00 inches fell); additional irrigation was not added this week; all totals from this interval will be recorded as "+inches".

[3] irrigation water left on one week-end; estimate of irrigation during that time was added to total (24"); scheduled irrigation was continued later.

PROJECT NO: FA01G260

PROJECT TITLE: Evaluation of Talstar® (bifenthrin) Tablets for IFA Control in Containerized Nursery Stock.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Homer Collins and Lee McAnally

INTRODUCTION:

Several formulations of bifenthrin have shown excellent potential for long term control of IFA in nursery stock. Formulations currently under study include Capture® 0.26 applied as a granular incorporated treatment, Talstar® 2E as a drench or pour-on, Talstar® 10WP as an "over-the-top" or topical treatment, Talstar 10WP as an incorporated treatment and Talstar 10WP as a "spray-on" during potting media preparation.

A novel Talstar formulation was prepared by FMC in an effort to expand the number of treatment options available to the nursery industry. The novel formulation is a tablet measuring ca. 1.5 x 0.5 cm, and weighing approximately 1.2 grams. The potential use pattern would be simply to place a tablet on the surface of a containerized plant, and water in. Concentrations ranging from 0.5% to 5% bifenthrin were prepared by FMC and submitted to us for evaluation. A list of concentrations tested is as follows:

Talstar % Conc.	g. AI/tablet	Theoretical dose ratelcontainer'
0.5	.006	12 ppm
1.0	.012	24 ppm
2.0	.024	48 ppm
5.0	.060	120 ppm

[1] Assuming placement of 1 tablet in a 6"x6" container with 500 g potting media (dry wt. basis).

METHODS AND MATERIALS:

Efficacy of the Talstar tablets was determined by (1) comparing rate of colony mortality artificially infested pots, and (2) comparing residual activity against alate IFA queens.

Test I- Artificially infested pot study:

Plastic nursery pots (6"x6") were filled with potting media and allowed to acclimate under simulated nursery conditions for 5 days prior to onset of the trials. Approximately 0.5" irrigation water was applied daily during the acclimation period. Fragmented IFA colonies (50cc of workers, brood and reproductive forms; queen status unknown) were separated from the nest tumulus by flooding. One fragmented colony was then added to each pot to simulate an actual infestation. Infested pots were placed in "moats" to prevent ants from escaping. Each bifenthrin concentration was tested on 5 different infested pots or replicates. Each treatment was applied by placing 1 tablet in the center of each infested pot and then adding 0.5" irrigation water through an overhead sprinkler irrigation system. Approximately 0.5" of water was added daily for about 1 week or until 100% colony mortality was achieved. Mortality was assessed daily by observation of treated colonies. Colonies were rated as "dead" when 20 or fewer worker ants remained active.

Test II - Residual activity against alate IFA queens:

Plastic pots (6"x6") were filled with 500 grams (dry weight basis) of potting media. Each concentration of Talstar tablet was applied to a total of 72 pots (3 reps/month x 24 months = 72 pots/treatment). Tablets were placed on the center surface of each pot and immediately irrigated with 0.5" of water. At monthly intervals, soil from 3 pots/concentration was collected and bioassayed with alate queens according to standard laboratory protocol described in Appendix II.

RESULTS:

Test I - Artificially Infested Pot Study:

The 0.5% and 1.0% bifenthrin tablets achieved 100% colony mortality in 4 of 5 pots within 7 days of treatment. Although the remaining colony in each treatment had 50-80% population mortality, the survivors remained up to 3 weeks post-treatment (PT). At that time, the test was terminated. The 2.0% tablet achieved 100% mortality in only 1 pot. The other 4 colonies (at ca. 75% population reduction) survived through 3 weeks. The 5.0% tablet achieved 100% colony mortality in 3 of 5 test pots. The other 2 colonies survived at reduced populations for 3 weeks.

Test II - Residual Activity Against Alate IFA Queens:

Results are summarized in Table 38. All treatments were 100% effective through 7 months, and remained at or above 90% through 9 months. Results were beginning to become erratic beyond 10 months; but concentrations of 1.0% and higher generally gave good control throughout the 18 month study.

Table 38. Residual Activity of Bifenthrin Tablets in Potting Media.

Tablet Conc.	Initial Theor. Dose Rate (ppm)	% Mortality to Alate Queens Confined to Treated Media at Months Post-treatment																	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
0.5	12	100	100	100	100	100	100	100	90	100	30	20	100	100	100	95	45	65	100
1.0	24	100	100	100	100	100	100	100	100	100	100	80	100	100	100	100	100	100	100
2.0	48	100	100	100	100	100	100	100	95	100	70	80	100	100	100	100	100	90	100
5.0	120	100	100	100	100	100	100	100	100	100	100	80	100	100	100	100	100	100	100
Check	--	5	15	5	10	0	0	5	0	5	15	10	5	5	0	10	5	15	10

PROJECT NO: FA01G181

PROJECT TITLE: Effects of Selected Plant Cultivars on the Activity of Bifenthrin in Nursery Potting Media.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley and Lee McAnally

INTRODUCTION:

The Imported Fire Ant Station has undertaken extensive trials evaluating the potential phytotoxic effect of candidate insecticides on selected cultivars of woody ornamental and bedding plants. However, to our knowledge, no studies have been undertaken to evaluate the potential effect the plants themselves may have on the efficacy of chemicals amended to potting media for IFA quarantine control either through the uptake of the chemical by the plant, or through the synthesis of antagonistic or synergistic chemical compounds by the plant itself.

MATERIALS AND METHODS:

On May 3, 1919, four selected cultivars (Gardenia 'August Beauty', Holly *Ilex* savannah, Holly *Ilex* 1at*ifol*ia and Azalea 'Formosa') were placed in two-gallon capacity pots containing Dodd® potting media [371 lbs/cu yd] incorporated with Talstar® 10WP at 50 ppm [4.7 g/1.5 cu ft]. Fifty replicates were established for each cultivar. One hundred two-gallon capacity pots were set up containing the same media without plants. Monthly bioassays to determine efficacy were made and GLC analyses of media was collected from each cultivar and the control to determine if any of the test plants had any effect [positive or negative] on the efficacy [residual activity] of bifenthrin.

RESULTS:

Results to date are shown in Tables 39 and 40. Based on these observations, there appears to be no difference in treated media with or without the presence of any of the 4 cultivars evaluated. GC analysis has shown extremely erratic fluctuations in ppm from month to month.

Table 39. Degradation of Bifenthrin as Affected by Actively Growing Nursery Stock.

CULTIVAR	Relative Degradation of Talstar 10WP (ppm) at Indicated Months Posttreatment[1]																
	(0)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Azalea [Formosa]	50.0[2]	79.5	135.4	75.32	55.98	109.11	52.96	62.02	52.69	156.95	142.40	130.10	19.90	28.48	35.45	41.73	14.11
Gardenia [Aug. Beauty]	50.0[2]	72.0	135.8	91.80	36.16	60.85	53.71	41.30	45.19	125.41	55.47	72.61	20.26	16.14	17.11	24.66	9.48
Ilex savannah	50.0[2]	72.6	163.5	52.01	28.24	40.99	38.16	57.39	44.42	97.41	91.60	37.21	11.01	24.22	18.43	18.22	9.49
Ilex latifolia	50.0[2]	46.6	201.8	81.33	55.34	75.09	53.47	66.60	50.44	51.44	51.14	30.37	9.60	30.98	15.03	23.74	16.06
Control (No plants)	50.0[2]	108.7	95.8	52.01	51.55	62.18	48.03	120.38	48.28	61.77	63.38	37.32	13.59	46.03	19.65	9.99	12.33

[1] GLC analyses conducted by USDA, APHIS, NMRAL, Gulfport, MS - no data available for month 1 or 4.
[2] Initial theoretical concentration of bifenthrin based on dose rate administered.

Table 40. Efficacy of Bifenthrin Against IFA Alate Queens as Affected by Selected Cultivars Grown in Treated Potting media.

CULTIVAR	Relative Percent Mortality of IFA Queens at Indicated Months Post-Incorporation								
	(0)	(2)	(3)	(4)	(5)	(6)	(7)	///(18)	(19)
Azalea [Formosa]	100	100	100	100	100	100	100	100	100
Gardenia [Aug. Beauty]	100	100	100	100	100	100	100	100	100
Ilex savnnah	100	100	100	100	100	100	100	100	100
Ilex latifolia	100	100	100	100	100	100	100	100	100
Control(No plants)	100	100	100	100	100	100	100	100	100
Untreated check	0	0	0	0	0	0	0	0	5

PROJECT NO: FA01G051

PROJECT TITLE: Efficacy of Low Rates of Talstar® 10WP Applied as a Drench.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott

INTRODUCTION:

Talstar 10WP and 2EC applied as drenches have shown great promise as possible quarantine treatments for containerized nursery plants. A study reported in 1990 indicated that a 2EC drench, with an initial theoretical dose rate of 230 ppm, was effective against IFA alate queens for more than 6 months (FA01G070). A study initiated in 1990, using both the 2EC and 10WP formulations of Talstar applied at 100 and 200 ppm, showed 100% efficacy up to 17 months (FA01G080). Due to the excellent results of these two trials, a trial was initiated using much lower initial drench rates of Talstar 10WP.

METHODS AND MATERIALS:

Standard 2-liter nursery pots were filled with Strong-Lite® potting media, placed outdoors and subjected to approximately 1" of irrigation. Each pot was then drenched, using 1/5 the volume of the pot of finished drenching solution (400 ml). Initial dose rates were as follows:

Initial Dose Rate (ppm)	g. Talstar 10WP/ gal water
1	0.047
5	0.235
10	0.470
25	1.175

The pots were then aged under simulated nursery conditions, with irrigation added as needed to supplement rainfall. At monthly intervals, three pots from each group were composited and subjected to standard laboratory bioassays (Appendix II).

RESULTS:

As indicated in Table 41, a drench rate of 1 ppm was not effective against IFA alate queens. The 5 and 10 ppm rates showed some inconsistency, but fairly good results through 12 months posttreatment (PT). The 25 ppm rate provided 100% control through the 12 month PT bioassay, at which time the trial was scheduled to terminate.

Table 41. Residual Activity of Low Rates of Talstar® 10WP Applied as a Drench.

Initial Dose Rate (ppm)	% Queen Mortality at Indicated Months Post-Treatment											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	95	60	5	15	*							
5	100	100	100	25	100	100	100	100	100	100	100	100
10	100	100	100	90	100	100	95	100	100	100	100	80
25	100	100	100	100	100	100	100	100	100	100	100	100
Check	20	20	0	0	10	25	10	30	5	0	5	10

* dropped due to decreased efficacy

PROJECT NO: FA01G061

PROJECT TITLE: Further Evaluation of a Spray-on Procedure for Treatment of Potting Soil with Talstar® 10WP.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Homer Collins and Avel Ladner

INTRODUCTION:

Historically, certification of containerized plants has been achieved either through the incorporation of granular or dust formulations of an insecticide into the media, by immersion, or by drenching plants with an insecticide solution. The most commonly used treatment involved incorporation of Dursban® 2.5G into potting media until June 1992 when it was replaced with Talstar® T&O Granular. Nurseries utilize a variety of mixing procedures ranging from very sophisticated to very basic. Since incorporation of granular or dust formulations directly impacts the effectiveness of a treatment, thorough incorporation is imperative. Unequal mixing can result in "hot spots" in the treated media as well as areas which may be undertreated.

A totally different concept for application of a quarantine pesticide to potting media would be the use of a spray-on in lieu of incorporation, immersion, or drenching. Granular or dust formulations of candidate treatments do not lend themselves to a spray-on applicator. However, certain long-residual liquid treatments would appear to be compatible with a spray-on procedure. Talstar 10WP, a synthetic pyrethroid, already labelled for use on ornamentals by FMC Corp., has provided excellent activity when incorporated into potting media at various rates of application. Preliminary results following a spray-on treatment with Talstar 10WP at 100 ppm indicate that residual control for 25 months following treatment was obtained (see Report FA01G030). An additional study using much lower rates of application was initiated on 4/24/91.

METHODS AND MATERIALS:

As in the study cited above, Strong-Lite® potting media was again used in this trial. The dry weight bulk density of Strong-lite is 382 lbs/cu yd. One-half of the amount of the media to be treated at any given dose rate was spread on an asphalt surface to a depth of 1.5 inches. Dimensions of the soil pile were 3.5'x 3.5'x 0.125' (i.e., 1.5 cu ft). Finished sprays were applied with a Solo® Model 475 backpack sprayer set to deliver ca. 60 psi through a single Tee-Jet 8002 flat fan spray tip. Rate of delivery for this system was approximately 700-800 ml/minute. One-half of the insecticide was sprayed on at a volume of 500 ml. finished spray per 1.5 cu ft media.

The second half of the media was then placed over the first half, and the final half of the insecticide solution applied. After application, treated media was "turned" 4 times in perpendicular directions. Four different rates of Talstar ranging from 5 to 50 ppm were tested. All rates were based on the dry weight bulk density of Strong-Lite, and were applied at a volume of 1 liter finished spray per 3.0 cu ft of media. Dursban 4E was applied at a rate of 11.2 g AI/cu yd (64.5 ppm) as a standard. All treatments were applied on 4/24/91. Treated media was then placed in 6"x6" plastic pots and weathered in a simulated nursery environment. Supplemental irrigation was added to natural rainfall to maintain a minimum of 1" water per week. At monthly intervals, 2 pots were randomly selected and destructively sampled by bioassaying with alate queens (Appendix II).

RESULTS:

Results are shown in Table 42 and indicate Talstar 10WP, applied at rates of 10, 25, and 50 ppm, show good residual 19 months after treatment. Evaluations will continue until cessation of activity.

Table 42. Evaluation of a "Spray-on" Procedure for Treatment of Potting Media with Talstar 10WP.

Applic. Rate (PPM)	% Mortality of Alate Queens at Indicated Months PT[1]																		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
5	100	100	60	60	100	90	60	100	100	100	85	55	50	100	35	30	25	35	35
10	100	95	100	100	100	100	100	100	100	100	100	90	80	100	100	100	100	100	95
25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	100
50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Dursban 4E (65 PPM)	25	20	0	10	15	35	5	--	--	30	--	--							
Check	10	20	5	10	0	10	0	5	10	5	0	10	10	10	0	5	0	10	5

[1] Standard bioassay procedure described in Appendix II.

PROJECT NO: FA01G090

PROJECT TITLE: Evaluation of Bifenthrin 0.26 and Tefluthrin 1.5G Incorporated at Varying Rates in a Standard Potting Media.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

Chlordane (5% dust) applied at a rate of 4 oz/cu yd of potting media was used as a quarantine treatment for containerized nursery stock until its cancellation in late 1979. An on-going program of evaluation of insecticides as pre-plant incorporated treatments for nursery potting soil has been conducted since 1974. Until recently, the most effective treatment was chlorpyrifos (Collins et al. 1980). A 0.2G formulation of bifenthrin (Talstar® T&O Granular) was registered in June 1992. Several states have also issued SLN labels for Talstar 10WP.

As part of an attempt to increase the number of options open to commercial nurserymen, new toxicants are constantly being screened for extended residual activity and efficacy against IFA. Among the most promising of these candidates is tefluthrin.

MATERIALS AND METHODS:

On March 7, 1990, granular formulations of bifenthrin (Capture®0.2G) and tefluthrin (Force®1.5G) were mechanically incorporated into a commercial nursery potting media [Strong-Lite®, 382 lbs/cu yd] at rates of 12.5, 25.0, 50.0, 75.0 and 100.0 ppm. A portable cement mixer, used to blend the toxicants into the media, was operated for 1 hour to insure a thorough blending. Treated media was placed into 75 standard one-gallon capacity plastic pots (per treatment) and weathered outdoors under natural conditions. Supplemental irrigation was added as deemed necessary to simulate nursery practices.

Bioassays were conducted in the laboratory by confining alate IFA queens to treated media in 2" x 2" plastic pots equipped with Labstone® bottoms. Labstone absorbed moisture from an underlying bed of damp peatmoss. Four replicates per treatment were bioassayed. Each replicate contained 20 cc treated soil and 5 alate queens. Mortality was assessed after 7 days continuous confinement to the treated media. Treatments were evaluated monthly for efficacy beginning one month post-treatment.

RESULTS:

Bifenthrin at rates > 25 ppm has displayed excellent results through 32 months posttreatment; 12.5 ppm was effective for about 26 months. Tefluthrin at 100 ppm was effective through 32 months, while the 50 and 75 ppm rates were effective for 24-26 months (Table 43). At rates of 12.5 and 25 ppm, tefluthrin remained active for 15-17 months.

Table 43. Evaluation of Bifenthrin 0.2G and Tefluthrin 1.5G Against Alate IFA Queens Incorporated at 5 Rates to a Standard Potting Media.

CANDIDATE	RATE [PPM]	% Mortality to Alate IFA Queens at Indicated Months Post-Incorporation*																	
		(1)\\\(15)	(16)	(17)	(18)	(19)	(20)	(21)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
Bifenthrin	12.5	100	100	100	100	100	80	95	100	90	100	100	100	60	85	100	75	---	---
	25.0	100	100	100	100	100	95	100	100	100	100	100	100	90	100	100	75	100	100
	50.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	75.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	100.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Tefluthrin	12.5	100	100	45	30	---	---	---	---										
	25.0	100	100	100	100	15	20	---	---										
	50.0	100	100	100	100	80	100	100	100	100	100	40	15	---					
	75.0	100	100	100	100	100	100	100	100	100	100	100	25	40	---				
	100.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Check		0	0	0	5	5	0	0	0	0	0	0	0	5	0	0	5	0	10

* Trials initiated 3/7/90.

PROJECT NO: FA01G091

PROJECT TITLE: Effect of Irrigation on Residual Activity of Force@ 1.5G Incorporated into Nursery Potting Media.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Anne-Marie Callcott and Homer Collins

INTRODUCTION:

Force 1.5G® (tefl uthrin), a pyrethroid insecticide, has shown excellent potential as an IFA toxicant when incorporated into potting media. Residual activity is apparently rate dependent. This study was initiated to determine if varying amounts of irrigation effect residual activity of this compound.

METHODS AND MATERIALS:

Force 1.5G was incorporated into the MAFES standard potting media[4] using a 2 cu ft cement mixer at a rate of 50 ppm. Treated media was placed in trade gallon nursery pots and divided into 3 groups. Each group of treated pots received a different amount of irrigation (in addition to natural rainfall). Irrigation rates were 1 inch, 2 inches, and 4 inches per week.

At monthly intervals following pesticide application, 3 pots from each irrigation group were composited and bioassayed with alate queens according to procedures described in Appendix II.

RESULTS:

Results appear in Table 44. At 12 month post-treatment (PT), all irrigation regiments provided 100% efficacy against alate queens while receiving in excess of 279.92 inches of rainfall and irrigation (ca. 5.3 inches of water per week).

[4] MAFES mix is a standard media used by Mississippi Agriculture and Forestry Experiment Station and consists of Milled pine bark, sand, and sphagnum peat (3:1:1) + ammendments.

Table 44. Influence of Irrigation on Residual Activity of Force® 1.5G Incorporated into MAFES Potting Media.

Irrigation Schedule (inches/wk)	Percent Mortality and Amount of Water at Indicated Months Post-Treatment											
	1 Month		2 Months		3 Months		4 Months		5 Months		6 Months	
	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)
1	100	5.55	100	14.00	100	27.10	100	+41.50[3]	100	+55.40	100	+74.70
2	100	9.55	100	23.00	100	40.10	100	+58.50	100	+77.40	100	+88.70
4	100	17.55	100	41.00	100	66.10	100	+92.50	100	+121.40	100	+142.70
Check[1]	0	5.00	20	14.45	70[2]	24.55	10	+38.95	30	+52.85	5	+60.15

Table 44. (cont'd)

Irrigation Schedule (inches/wk)	Percent Mortality and Amount of Water at Indicated Months Post-Treatment											
	7 Months		8 Months		9 Months		10 Months		11 Months		12 Months	
	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)	% Mort	Cumul H_2O (inches)
1	100	+78.40	100	+85.65	100	+92.10	100	+103.27	100	+110.07	100	+120.92
2	100	+100.40	100	+115.65	100	+130.10	100	+147.27	100	+158.07	100	+173.92
4	100	+162.40	100	+185.65	100	+208.10	100	+235.27	100	+254.07	100	+279.92
Check	45	+68.85	5	+81.10	20	+92.55	10	+104.22	5	+110.02	0	+120.87

[1] Check received ca. 1 to 1.5 inches of irrigation per week in addition to minimal rainfall.
[2] unexplained high check mortality
[3] Over 6 inches of rainfall on the week-end of Feb. 15, 1992 (more than gauge was capable of recording).

PROJECT NO: FA01G212

PROJECT TITLE: Relative Phytotoxicity of Tefluthrin [Forces 1.5G] to Selected Foliage and Woody Ornamental Plants.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Tim Lockley, Lee McAnally & Adolph J. Laiche, Jr. [Mississippi Agricultural & Forestry Experiment Station].

INTRODUCTION:

Chlorpyrifos 5% granular [FA-5] was registered in January of 1980 for use as a fire ant quarantine treatment for potting media. The registrant [Dow Chemical Company] elected to withdraw FA-5 from the market in 1981 when several cases of phytotoxicity were alleged (Collins et al. 1981) All of the reported cases were from central Florida and, with one exception [Dwarf Yaupon, *Ilex vomitoria*], involved greenhouse grown foliage plants. Most of the reported injuries were linked to problems other than chlorpyrifos induced phytotoxicity. Because of the alleged potential for phytotoxicity, foliage plants must be currently grown under complete cover to meet certification requirements. This precludes large scale outdoor production of these plants.

MATERIALS & METHODS:

The experiment was carried out in cooperation with the Mississippi Agricultural and Forestry Experiment Station [MAFES], South Mississippi Branch, Poplarville, MS.

Ten varieties of plants [5 foliage & 5 woody ornamental] were selected for evaluation of possible effects of granular tefluthrin on plant growth and phytotoxicity when incorporated into potting media. Plants were selected on the basis of availability, local popularity among commercial growers and/or a previous history of phytotoxic response.

The experimental media consisted of a mixture of pine bark, peat moss and sharp sand [3:1:1] with a dry bulk density of 741 lbs/cu.yd. This media was

mixed at MAFES using components on site. Tefluthrin was incorporated on 23 March 1992 at rates of 1X [50 ppm] and 3X [150 ppm].

On 16 June 1992 [85 days post-incorporation], all plants were sacrificed. Evaluations were made using three criteria; total top biomass in grams, top biomass rating scale and, root rating scale.

Top Rating Scale

1. Plant healthy
2. Slight yellowing, wilting or other mild symptoms such as marginal chlorosis
3. Symptoms more severe, leaf drop, necrosis
4. Severe stunting, abnormal leaf or stem structure
5. Dead

Comparative Root Rating Scale

0. Roots dead
1. Least developed
2. Mean development
3. Best developed

Root ratings were made based upon comparisons of each plot.

RESULTS & DISCUSSION:

As shown in Table 45, some phytotoxic response was indicated among Azalea 'pink ruffle' at the 1X rate in total top biomass. However, root response at the 3X rate showed a positive response to the treatment. *Abelia grandiflora* showed some negative response in top biomass at both the 1X and 3X rates. However, in the root evaluation, results were mixed. Among the remainder of the woody ornamentals, no phytotoxicity was noted. *Ilex compacta* showed enhanced growth at the 1X rate [top biomass] and the 1X and 3X rates in root growth. Azalea 'wakeibisu' displayed no significant differences in top biomass but did show superior root structure at the 1X rate.

Among the foliage plants, significant differences in top biomass was indicated at the 1X treatment among Coleus, Salvia, Pothos, and Portulaca varieties. Only Lisianthus failed to show any response. Similar results were shown in root structure with all five foliage plants displaying positive root structural responses to the 1X rate.

Table 45. Relative Phytotoxic Response of Ten Selected Varieties of Foliage and Woody Ornamental Plants of Media Incorporated Granular Tefluthrin.

	SHOOT FRESH WEIGHT [g][1]			ROOTS		
CULTIVAR	CK	1X	3X	CK	1X	3X
WOODY ORNAMENTALS						
Ilex 'San Jose'	22.3a	21.6a	20.1a	3.0a	3.1a	3.0a
I. compacta	46.3a	58.9b	52.7ab	2.9a	3.6b	4.0b
Azalea 'Pink Ruffle'	82.6a	65.9b	77.6ab	3.1a	2.7a	3.3b
Azalea 'Wakeibisu'	45.9a	46.6a	42.1a	3.0a	3.3b	3.1a
Abelia grandiflora	151.4a	127.7b	131.0b	3.1a	2.7b	3.4a
FOLIAGE PLANTS						
Coleus[2]	185.6a	242.7b	215.3ab			
	388.3a	457.3b	312.4a	2.7a	3.6b	2.9a
Lisianthus	58.1a	59.2a	57.3a	2.3a	3.3b	2.9ab
Salvia	222.4a	284.1b	208.7a	1.9a	4.0b	2.0a
Pothos	290.3a	327.0b	276.6a	3.1a	3.6b	3.6b
Portulaca	523.1a	606.4b	547.9a	2.7a	3.5b	3.0a

[1] Means within cultivars not followed by the same letter are not significantly different at the 5% level using Duncan's multiple range test.

[2] Because of excessive growth, Coleus were pruned on 22 April and top biomass was measured.

PROJECT NO: FA01G112

PROJECT TITLE: Leachability of Force@ 1.56 and Acephate 15G Through a Column of Potting Media.

TYPE REPORT: Final

LEADER/PARTICIPANT(s); Homer Collins, Lee McAnally, Randy Cuevas, and Anne-Marie Callcott

INTRODUCTION:

Tefluthrin is a pyrethroid insecticide which has shown promise as an IFA quarantine insecticide, and is marketed as Force® 1.5G. It has a low solubility rate (0.02 ppm) in water, and thus low leachability. On the other hand, acephate is very soluble in water (700 mg/ml) and is formulated as soluble powder (75 SP). An experimental granular formulation of acephate (15%) has been produced by Valent U.S.A. Corporation. We routinely test leachability of candidate chemicals or chemical formulations in order to determine their potential use as "over-the-top" or topical treatments for containerized nursery stock.

METHODS AND MATERIALS:

Trial I:

A 8" diameter PVC pipe (7.75" ID) was sectioned into 3' lengths. A fiberglass screen bottom was glued in place, and 1" diameter holes were drilled every 6 inches along one side of the column. After closing the holes with duct tape, the soil columns were loosely packed with approximately 1 cubic foot of potting media consisting of 3:1:1 pine bark, sand, and peat moss. Columns were then moistened by the addition of 1 gallon water/column. After 24 hours, the treatments were applied to three different (replicate) columns by evenly sprinkling the material onto the surface of each soil column. Immediately after treatment, 2" of irrigation water was applied to each column.

Tefluthrin:

Force 1.56 was applied to the columns as described above at rates of 10, 25,

and 50 ppm. Columns were maintained in a greenhouse and kept moist by the addition of the equivalent of 2" of irrigation water/week (1545 cc) for six weeks. At that time, the masking tape was removed and cores removed with a 1" soil corer. Cores at 6", 12", 18", 24", and 30" levels were collected from each replicate and then composited prior to subjection to standard bioassay procedures using alate IFA queens (Appendix II).

Acephate:
Acephate 15G was applied to the columns at rates of 1 and 2 g per column. Six columns were treated with each rate and 2 remained as untreated checks. Rates were chosen after trials in FA01G142 and FA01G152 indicated that at least 1 g of insecticide per standard 6" nursery container is required to eliminate an established colony. Columns were maintained in a greenhouse and watered 1" immediately after treatment and at 4 days posttreatment. Core samples from 3 columns (replicates) of each treatment rate and from one check column were collected, composited, and bioassayed at 2 days posttreatment (see above). Core samples were collected from the remaining columns at 5 days posttreatment and bioassayed.

Trial II:
Acephate:
A 6" diameter PVC pipe was sectioned into 2" lengths of which four lengths (sections) would make one column. Metal screening was cut into 8" x 8" squares. One square was glued onto the bottom section of each column. Metal screens were attached to the bottom of the remaining sections by using a layer of weatherstripping rope caulk on either side of the screen. The caulk helped hold the 2" sections together and prevented leaking between sections. Fully saturated MAFES mix was then packed into the bottom section of the column. The next section with its caulk and screen was put on top, more MAFES mix added, and so on, until all four sections were together. The top section was filled with media to within one-half inch of the top.

On September 22, 1992, 2 g of acephate 15G was sprinkled over-the-top of 6 of the columns, 0.4 g of acephate 75SP over another 6 (equivalent to 2 g of 15G), and 2 columns remained as untreated checks. Each column immediately received

1" of water. At 1 day posttreatment, three columns of each acephate treatment were separated and the media from corresponding sections (and formulations) composited and subjected to standard alate queen laboratory bioassay. The media from each section of one of the check columns was also bioassayed. The remaining columns received another 1" of water on day 4, and at 5 days posttreatment, were handled as above and bioassayed.

RESULTS:

Trial I

Tefluthrin:

Soil columns were packed and moistened on 12/5/91. Insecticide was applied on 12/6/91. Results of the bioassay are in Table 46. The 50 ppm rate was 100% effective at 6 inches, but no further, indicating that high rates of Force may be feasible for use an "over-the-top" treatment.

Acephate:

As shown in Table 47, no residual activity was detected at any soil level regardless of treatment rate. This granular formulation may demonstrate only minor leachability and therefore, remained above the 6" level, or it may have leached through the soil entirely and was removed in the leachate. We believed the former to be more probable and thus continued testing the chemical utilizing different procedure (Trial II).

Trial II:

Acephate:

This trial indicated that the 15G formulation did not leach as readily as the 75S formulation as shown by the 100% mortality provided by the 15G in the top 2" of the soil at 1 and 5 days posttreatment (PT). While both formulations provided fairly good activity at 4" and above, neither showed acceptable activity throughout the entire column, which would be necessary for an effective over-the-top quarantine treatment (Table 48).

Table 46. Leachability of Force 1.5G through a Column of Potting Media.

RATE	DEPTH	% MORTALITY*
10 PPM	6	35
	12	0
	18	0
	24	5
	30	0
25 PPM	6	40
	12	10
	18	5
	24	10
	30	5
50 PPM	6	100
	12	20
	18	50
	24	25
	30	0
CHECK	--	10

* 6 Weeks after treatment; 2 inches water/week

Table 47. Activity of Acephate 15G at Various Levels in MAFES Nursery Media.

Treatment (g/column)	Soil Level (inches)	% Mortality to Alate Queens at Indicated Days PT	
		(1)	(5)
1.0	6	10	35
	12	35	15
	18	10	20
	24	25	15
	30	20	25
2.0	6	40	25
	12	45	65
	18	25	65
	24	20	25
	30	10	10
Check	6	5	5
	12	5	15
	18	5	20
	24	5	5
	30	15	25

Table 48. Activity of Two Acephate Formulations at Various Soil Levels.

Formulation	Soil Level (inches)	% Mortality to Alate Queens at Indicated Days PT (1)	(5)
Acephate 15G	2	100	100
	4	70	65
	6	45	75
	8	50	55
Acephate 75S	2	95	90
	4	95	90
	6	70	70
	8	35	65
Check	2	0	0
	4	10	5
	6	5	15
	8	15	0

PROJECT NO: FA01G072

PROJECT TITLE: Evaluation of Granular Acephate For Use as Over-the Top Treatments.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Acephate 75S is registered for consumer usage as an individual mound treatment. A 15% granular formulation was received by the IFA lab for experimental purposes to determine adaptability to nursery usage as a quarantine treatment. One such usage is as an over-the-top treatment prior to shipment. This trial was set up to determine effectiveness as a treatment against infested pots.

METHODS AND MATERIALS:

Twenty 6"x6" plastic nursery containers were filled with standard lab potting media (MAFES mix). Fragmented colonies obtained by flotation method were then added to each pot and allowed to acclimate for 3 days. Granular acephate was then applied to the surface of 15 pots. Rates of 0.5, 0.75, and 1.0 g per pot were used. Each rate was applied to 5 replicate pots, leaving 5 untreated check pots. Water equivalent to 1" irrigation was applied after treatment. Additional water was applied as needed to maintain moisture.

A second iteration of this test was initiated using the same methods described above. The rates of application were changed to 0.25, 0.33 and 0.5 g per pot.

RESULTS:

At four days post-treatment (PT) in the first trial, all replicates for all rates exhibited approximately 50% mortality. At seven days PT all replicates for all rates were at 100% mortality.

In the second trial, all application rates exhibited 100% mortality within 2 days.

PROJECT NO: FA01G092

PROJECT TITLE: Evaluation of Acephate 156 as a Preplant Incorporated Treatment for Nursery Potting Media.

TYPE REPORT: Final

LEADERS/PARTICIPANTS: Anne-Marie Callcott and Randy Cuevas

INTRODUCTION:

Acephate is registered as a soluble powder for use against individual IFA mounds. However, nurserymen certifying containerized stock for shipment outside the IFA quarantine area have no use for individual mound treatments, and powder formulations are not easy to handle nor easy to incorporate into potting media. Valent U.S.A. Corporation has produced an acephate 15% granular formulation for experimental use. We tested the residual activity of this formulation in the current trial.

MATERIALS AND METHODS:

Acephate 156 was incorporated into MAFES mix at rates of 50, 100 and 200 ppm on March 25, 1992. Treated media was placed in gallon nursery pots and placed in our can yard under simulated nursery conditions. Untreated check media was handled in the same manner. At monthly intervals, three pots from each treatment rate were composited and subjected to standard laboratory alate queen bioassay (Appendix II).

RESULTS:

Only the 200 ppm rate showed any efficacy against IFA alate queens, and only at 1 month posttreatment (Table 49). No residual activity was seen with the lower rates, and the trial terminated after 3 months. These results agree with Collins et al. (1980).

Table 49. Residual Activity of Acephate 15G Incorporated into Nursery Media[1].

TREATMENT	RATE OF APPLICATION (ppm)	% ALATE QUEEN MORTALITY AT INDICATED MONTHS POST TREATMENT		
		(1)	(2)	(3)
Acephate 15G	50	40	30	20
	100	20	35	0
	200	90	65	35
Untreated check	-	20	0	10

[1] MAFES mix

PROJECT NO: FA01G152

PROJECT TITLE: Acephate 15G as a Topical Treatment for Certification of Containerized Nursery Stock.

TYPE REPORT: Final

LEADERS/PARTICIPANTS: Anne-Marie Callcott and Lee McAnally

INTRODUCTION:

Acephate is registered as a soluble powder (75S) for use against individual IFA mounds. However, nurserymen certifying containerized stock for shipment outside the IFA quarantine area have no use for individual mound treatments, and powder formulations are not easy to handle nor easy to incorporate into potting media. Valent U.S.A. Corporation has produced an acephate 15% granular formulation for experimental use. A previous trial (FA01G092) determined that this granular formulation had no residual activity when incorporated into standard potting media at rates up to 200 ppm (monthly bioassays). However, topical, or over-the-top, treatments have been successful at rates as low as 0.25 g per pot (ca 30 ppm),at eliminating IFA colonies established in a container using the MAFES media (FA01G072). To certify containerized stock that was to be shipped within a few days or weeks, a topical treatment would need to eliminate any existing colony, and remain active against newly mated queens which might fly in and against colonies which might be relocating. This trial was initiated to determine the immediate effect of acephate 15G when used as a topical treatment against existing colonies in containerized stock.

MATERIALS AND METHODS:

Three potting media types were used: Green Forest Nursery potting media (aged pine bark + amendments), Perkinston, MS; MAFES mix (3:1:1 pine bark, sphagnum peat, sand); and Grace Sierra bedding mix, a commercially available bagged mix (Grace Sierra Horticultural Products Co., Milpitas, CA).

Test I - Potted nursery media:
Elimination of an established colony in a nursery pot was determined by infesting nursery pots with fragmented IFA colonies. Six 3-quart nursery pots were filled with each type of potting media and placed on a brick in a 12"x18"x5" plastic pan. The sides of the pan were talced and ca 1" of water was added to the pan to prevent escape. A hole 1½" from the bottom of the pan allowed excess water to drain. Field collected colonies were separated from their nest tumulus by the floatation method (Banks et al. 1981) and 50 cc of workers and brood added to each pot. The fragmented colonies were allowed to acclimate 2 days in the pots. On June 19, 1992, 0.25 g of acephate 15G was sprinkled on the media surface of 3 pots from each media type; the other 3 pots served as checks. One inch of irrigation was immediately added, and subsequently added twice a week. Pots were inspected daily for mortality and were considered dead when less than 20 workers were present.

A second trial was initiated July 13, 1992 because of the low mortality achieved by the 0.25 g rate in the Grace Sierra and Green Forest media. The above procedures were employed except that 0.5 g of acephate 15G was applied topically. On Aug. 7, 1992, three replicates of the Green Forest media were treated topically with 1.0 g or 1.5 g of acephate 15G.

Test II - Containerized nursery stock:
Although treating nursery pots filled with media gives an indication of the proper dose rate needed for elimination of established IFA colonies, the addition of plants to the pots may impact the dose rate. Although it is not feasible economically to utilize containerized nursery stock in all trials, it is necessary to establish a more realistic dose rate. Using plants in trials also reveals any phytotoxicity problems. Possible effects of nursery stock on topical insecticide applications primarily involve the root system. As plants age in a particular size pot they tend to become root-bound before they are sold or "potted up" to a larger pot. Granular insecticides may tend to run off the edges of root-bound plants when watered in instead of penetrating the entire media and root structure within the pot, thus requiring a larger dose rate to insure adequate insecticide penetration. Also associated with root-bound plants and the problem of inadequate chemical penetration, is the

possibility that ants may congregate in the center of the root ball and thus avoid contact with the insecticide.

A trial was initiated on July 27, 1992 to determine an effective dose rate of acephate 15G when topically applied to containerized nursery stock. Azaleas (*Rhododendron sp.*) were acquired from the Alabama Agric. Experiment Station, Mobile, AL. The plants had been grown in 3-quart pots in a media of 3:1 pine bark and peat moss. Five plants per rate plus 5 untreated checks were used. The plants were artificially infested in the same manner as listed above. Granular acephate was applied topically at rates of 0.25, 0.5 and 1.0 g per container and immediately watered in with 250 cc of water. Plants received 250 cc of water daily for the remainder of the test. The plants were examined daily for 7 days and rated with an approximate percent mortality.

Since these rates were not consistent, another trial was initiated Aug. 10, 1992, using rates of 1.5 and 2.0 g per plant. Plants used were the same type, size and media composition as above, and were subjected to the same regimen. Three plants per rate were used as well as 3 checks.

RESULTS:

Test I - Potted nursery media:
The 0.25 g rate was effective at eliminating colonies from the MAFES mix in 5 days or less, and the 0.5 g rate was effective in both the MAFES media (ca 50 ppm) and the Grace-Sierra media (ca. 148 ppm) within 2 days. Rates of at least 1.0 g per pot were necessary to consistently eliminate colonies from the Green Forest media (ca 177 ppm). The higher quantity of insecticide needed in this media was probably due to physical aspect of the media. Green Forest media consist of varying size pieces of pine bark, some up to 2"x4" in dimension. These large pieces allow more air space in the media and thus more chance for insecticide runoff.

Test II - Containerized nursery stock:
None of the rates used in the first trial were consistently effective (Table

50). In the second trial, both rates produced a minimum of 95% mortality within 24 hours and 100% mortality within 48 hours (Table 51).

Table 50. Colony Mortality Produced by Acephate 15G Applied Topically to IFA Infested Containerized Nursery Stock - Trial I.

TREATMENT	REP.	PERCENT MORTALITY AT INDICATED DAYS PT						
		1	2	3	4	5	6	7
0.25 g/pot	1	0	20	50	50	-	-	90
	2	0	20	20	20	-	-	90
	3	0	20	20	20	-	-	50
	4	0	20	20	90	-	-	90
	5	0	20	50	75	-	-	100
0.50 g/pot	1	0	20	50	90	-	-	90
	2	0	50	90	90	-	-	90
	3	50	50	100	--	-	-	--
	4	0	0	0	20	-	-	20
	5	100	100	--	--	-	-	--
1.0 g/pot	1	0	0	0	0	-	-	25
	2	100	--	--	--	-	-	--
	3	50	75	75	90	-	-	90
	4	100	--	--	--	-	-	--
	5	100	--	--	--	-	-	--
Check	1	0	0	0	0	-	-	0
	2	0	0	0	0	-	-	0
	3	0	0	0	0	-	-	0
	4	0	0	0	0	-	-	0
	5	0	0	0	0	-	-	0

Table 51. Colony Mortality Produced by Acephate 15G Applied Topically to IFA Infested Containerized Nursery Stock - Trial II.

TREATMENT	REP.	PERCENT MORTALITY AT INDICATED DAYS PT		
		1	2	3
1.5 g/pot	1	100	--	-
	2	95	100	-
	3	95	100	-
2.0 g/pot	1	100	--	-
	2	100	--	-
	3	100	--	-
Check	1	0	0	-
	2	0	0	-
	3	5	5	-

PROJECT NO: FA01G250

PROJECT TITLE: Dose Rate Trials with Triumph@ 1G in Nursery Potting Media, 1990.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Avel Ladner

INTRODUCTION:

A long term dose rate study with Triumph 1G was initiated in January 1986 (FA02G036, 1989 Report). Dose rates of 5.6, 11.2, 22.4, and 44.8 g AI/cu yd. were incorporated into Baccto® potting media (Michigan Peat Co., Houston, TX). Residual activity was congruent with increasing dose rates. The 44.8 g AI/cu yd media rate was effective through 48 months. More recent studies using other commercial potting media have shown decreased efficacy of Triumph 1G. A repeat of the original trial was initiated in 1990 in an attempt to reproduce that data.

METHODS AND MATERIALS:

Triumph 1G was incorporated into Baccto potting media using a portable cement mixer. Each batch of soil was blended for minimum of 1 hour. Dose rates used were 11.2, 22.4, and 44.8 g AI/cu yd potting media. Treated media was placed in trade gallon nursery pots and placed outdoors to weather naturally. Additional irrigation was not added.

At monthly intervals, 3 pots from each treatment group were composited and standard laboratory bioassays performed using IFA alate queens (Appendix II).

RESULTS:

The lowest rate, 11.2 g AI/cu yd was very effective for 20 months, the 22.4 rate for 23 months and the highest rate, 44.8 g AI/cu yd, for 25 months (Table 52). These and other data confirm the deleterious effects of irrigation on residual activity of Triumph in potting media.

Table 52. Residual Activity of Triumph 1G Incorporated into Baccto Potting Media at Various Rates.

Rate of Application (g AI/cu yd media	% Mortality of Alate Queens at Indicated Months Post-Treatment																									
	(1)	(2)	(4)	(6)	(8)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)
11.2	100	100	100	100	100	100	100	100	100	100	100	100	100	85	100	100	90	75	50	45	50	75	45	40	15	0	5
22.4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	85	85	100	100	100	85	70	70	100	100	80	85	35
44.8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	90	35	60	65	55
Check	0	0	0	20	5	0	0	5	20	10	15	0	10	10	0	0	5	10	5	10	5	25	5	0	10	0	0

PROJECT NO: FA01G082

PROJECT TITLE: Evaluation of Insecticide Treated Plastic Nursery Pots for Certification of Containerized Nursery Stock.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Avel Ladner and Homer Collins

INTRODUCTION:

Certification of containerized nursery stock in compliance with the Federal quarantine usually involves insecticidal treatment of the growing medium. A novel approach which might be more environmentally acceptable and also less expensive would be to either surface treat the container or impregnate the insecticide into the plastic from which nursery containers are formed. A preliminary trial to evaluate surface treatment of plastic trade 1-gallon containers was conducted in 1992.

METHODS AND MATERIALS:

Clean new trade 1-gal pots were dipped into insecticide solutions, air dried, filled with nursery media (MAFES mix), then placed outdoors under simulated nursery conditions. At various intervals following treatment, pots were bioassayed with live IFA colonies in the laboratory. Insecticides evaluated were: Capture@ 2EC, Tempo@ 2EC, and Dursban® 2EC. Each product was tested at 3 rates of application: 0.5 oz/gal water, 1.0 oz/gal water, and 2.0 oz/gal water. Thirty pots were dipped into each solution for 10-15 seconds so that it was totally submerged and saturated. Bioassays were conducted by placing two pots from each treatment into a 2'x8' test arena containing a freshly collected field colony. Sides of the test arena were talced to prevent ants from escaping. Two-hundred watt light bulbs placed over the test arena rapidly desiccated the soil and nest tumulus which stimulated the colony to seek refuge in the more moist container of potting media. Bioassays were conducted at the following intervals:

1. 24 hrs after insecticidal treatment
2. 1 week after insecticidal treatment
3. 1 month after insecticidal treatment
4. Monthly thereafter until activity ceased

Colonies were allowed 48 hrs to complete the move from the desiccated nest tumulus into the pots. Afterwards, each pot was removed from the test arena and the potting media closely searched for the presence of live ants. Total number of ants present were then estimated.

Treatments which allowed more than 10 workers to become established in one or more pots were considered ineffective.

RESULTS:

Preliminary uncompleted results are shown in Table 53. Tempo 2EC coated pots successfully prevented colony establishment for 1 week after application when pots were immersed in solutions containing either 1.0 or 2.0 oz 2E/gal water. After weathering for 1 month, treated pots had little or no effect on invading colonies.

Pots treated with Capture 2EC at 2 oz/gal water successfully prevented colony establishment for 3 months. This trial is still underway, and Dursban 2EC has not been tested.

These results are considered to be extremely encouraging because this procedure represents a totally new concept for certification of containerized pots. Observations indicate that foraging workers (scouts) encounter the toxicant around the drain holes and sides of the pots. Due to the extremely rapid knockdown of pyrethroids, these ants die before a pheromone trail to the rest of the colony can be established. It seems doubtful that sufficient long residual activity can ever be achieved through surface applications of EC or other formulations. However, the use of insecticide impregnated pots (or water permeable pot inserts) may offer a more economical and environmentally acceptable treatment than the presently used drenches or incorporation of

pesticides into the potting media. This area of investigation will be continued in 1993.

Table 53. Effectiveness of Insecticide Coated Plastic Nursery Pots in Preventing IFA Colony Establishment.

TREATMENT		Number of IFA Workers Successfully Invading Pots at Indicated Post-treatment Intervals[1]					
Insecticide	Rate (oz/gal H_2O)	(24 Hrs)	(1 Wk)	(1 Mo)	(2 Mo)	(3 Mo)	(5 Mo)
TEMPO 2EC	0.5	175	500	>300	>500	[2]	
	1.0	0	0	>150	>200	[2]	
	2.0	0	0	>200	>200	[2]	
CAPTURE 2EC	0.5	>1,000	4	10	6	0	>100
	1.0	>1,000	0	30	100	250	>500
	2.0	7	0	0	5	0	>500
DURSBAN 2EC	0.5	[3]					
	1.0	[3]					
	2.0	[3]					
Untreated Cks (pooled results)		>500	>500	>500	>500	>500	>500

[1] Mean number of IFA workers invading 2 pots/treatment
[2] Trial discontinued due to loss of effectiveness
[3] Incomplete results

PROJECT NO: FA01G062

PROJECT TITLE: Evaluation of Insecticide Impregnated Burlap Liners for Certification of Balled and Burlapped Nursery Stock.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, David F. Williams (USDA, ARS, MAVERL, Gainesville, FL), Avel Ladner, and Randy Cuevas

INTRODUCTION:

The Federal Imported Fire Ant Quarantine (7 CFR 301.81) prohibits movement of nursery stock, grass sod, and other regulated articles outside the quarantine area unless they have been approved or certified free of infestation. Certification of balled and burlapped nursery stock (B&B) for movement outside the imported fire ant (IFA) quarantine area poses a difficult problem. Historically, this type of nursery stock was certified IFA free by broadcast in-field applications of chlorinated hydrocarbon insecticides such as heptachlor, aldrin, dieldrin, or chlordane. Initially, dieldrin and heptachlor at 3 lb [AI]/acre were used to certify movement of nursery stock. However, the use of heptachlor and dieldrin was discontinued February 13, 1970. In preference for chlordane, which was applied at the rate of 10 lb [AI] per acre for grass sod and field-grown ornamental. In October 1976, this treatment regimen was revised, and 5 lb [AI] chlordane was specified for use. This treatment remained in effect until March 6, 1978, at which time EPA cancelled the registration of chlordane for use on turf. Registration of chlordane for treatment of nursery potting soil in which potted plants are grown, and on field grown ornamental plants was continued until December 31, 1979 at which time the final EPA cancellation order concerning use of chlorinated hydrocarbon insecticides for all quarantine treatments became effective.

Data generated by this laboratory in 1979 led to registration of Dursban® 4E and 2E for use as a root dip (immersion) treatment for B&B stock. The immersion treatment, along with a twice daily for three consecutive days

"watering" procedure is approved for use in USDA, APHIS Treatment Manual M301.81 (Rev. Jan. 1985). A February 1988 addendum to that manual also recognizes an in-field treatment prior to harvest that employs applications of baits (either Amdro® or Award™) in combination with granular Dursban (2.5G, Ford's Chemical and Specialty Co., Pasadena, TX). The baits are applied at labelled rates (1.0 to 1.5 lbs bait/acre), followed in 3-5 days with a broadcast application of granular chlorpyrifos at 6.0 lb [AI]/acre. This procedure provides a 12 wk certification period following a 30-day exposure period.

None of these three options are acceptable to the nursery industry for the following reasons:

1. Immersion treatments are labor intensive, totally disruptive to the root ball, and result in an unsalable product. Disposal of the treating solution and worker exposure are also very large problems. Therefore, associated cost, logistics, and environmental concerns preclude use except for very small nurseries.

2. The twice per day watering procedure requires a special holding or catchment facility and disrupts the normal harvest and shipping cycle.

3. The in-field treatment would be more acceptable if plants were harvested en masse (block harvested). However, not all plants in any given growing block are simultaneously harvested. Instead, individual plants are selected and harvested over a period of many months, perhaps years, in order to fill specific purchase orders. To maintain continuous or long term certification would be cost-prohibitive and require usage of large quantities of pesticide.

A simple, inexpensive, and environmentally sound procedure is needed for treatment of B&B nursery stock. B&B stock, by definition, is encased in a burlap liner following digging or harvest. This liner maintains integrity of the root ball and remains in place when plants are replanted following purchase. These liners then deteriorate in the soil and the new roots grow

through the burlap.

Insecticide or repellent impregnated fabric is commonly used by the U.S. Military as a deterrent to ticks, mosquitoes, and chiggers (Schreck et al. 1977, Schreck et al. 1978, Evans et al. 1990.). We hypothesized that insecticide impregnated burlap liners might be effective for control of imported fire ants infesting B&B nursery stock and investigated this procedure in the current study.

METHODS AND MATERIALS:

Treatment Procedure

Standard burlap used to prepare B&B nursery stock was obtained from Hummert Nursery Supply Co., St. Louis, MO. The burlap was sectioned into 36" x 36" (8631.3 cm^2) panels prior to insecticide impregnation using the procedure described by Schreck et al. 1978, 1980. Three insecticides (cylfuthrin, Miles, Inc., Kansas City, MO; bifenthrin, FMC Corp., Philadelphia, PA; and chlorpyrifos, DowElanco, Greenfield, IN) were evaluated. During initial testing, burlap liners were treated at 4 rates of application (25, 50, 100, and 300 mg AI/1000 cm^2 of fabric). Insecticides were impregnated into the burlap fabric by first preparing stock solutions of technical material (AI) in acetone. Final or treating solutions were diluted to a total volume of 220 ml. Each 36" x 36" section of burlap was placed in a 1000cc beaker and allowed to absorb the insecticide solution for 1 hour. The burlap pieces were then removed and allowed to thoroughly air dry (about 4 h). Treated burlap was then be enclosed in disposable plastic bags and stored at room temperature for 2 to 4 wk prior to use. Theoretically, this procedure achieved fabric concentrations of 25, 50, 100, and 300 mg/1000 cm^2.

Each rate of application was evaluated on 5 separate colonies (replicates). Five control colonies were also established, but the burlap liner for the control colonies was treated with acetone only.

Calculations

Application Rate (mg/1000cm^2)	mg AI per 36" x 36" burlap
25	209.0
50	418.0
100	836.0
300	2508.0

Testing Procedure

Test I — Active field colonies of IFA (nest index of 20 on the Lofgren and Williams (1982) population index scale) were collected by shoveling the entire nest and associated tumulus directly onto the treated burlap sections. Ends of the burlap were then folded together and secured with twine to simulate the root ball of a B&B plant. Each simulated root ball (IFA colony) was individually contained in plastic trays (15" x 20" x 3"), the inner sides of which were coated with talc to prevent the ants from escaping. Colonies were then transported to the lab and maintained under ambient conditions for 6 days. Approximately 400 ml water was applied to the surface of each "ball" on the second day. After the 6 day exposure period, all liners were removed, the nest disassembled, closely searched for the presence of live IFA, and activity of each colony noted. Colonies were considered dead if < 10 live ants (any caste) were detected. Live colonies were rated on the nest index scale given by Lofgren and Williams (1982).

Test II - Procedures described above were used to evaluate the effects of both cyfluthrin emulsifiable concentrate (Tempo® 2EC), in lieu of technical insecticide. Treated colonies were held outdoors in a simulated nursery can yard, and exposed to approximately 0.4" of irrigation water applied daily through an overhead pulsating sprinkler system. Rate of application of the Tempo was 100 mg AI/1000 cm burlap. Exposure interval was 4 days.

Data Analysis

Data on colony mortality afforded by each treatment were analyzed by ANOVA, and statistical differences at the $P = 0.05$ level determined by Tukey's studentized range (HSD) test (SAS Institute 1988).

RESULTS:

All treatments killed large numbers of workers, and weakened the colonies. However, a "colony nucleus" comprised of workers and brood remained sequestered in the center of each simulated root ball. Given enough time, we feel that the insecticide impregnated burlap liners would eventually result in colony mortality. However, this would require weeks or perhaps months of exposure, and trade practices of the nursery industry preclude long exposure periods after plants are harvested for sale. Economics might also preclude acceptance and use of this procedure even if effective. Preliminary cost analyses indicated that use of bifenthrin at a rate of 100 mg AI/1000 cm^2 of burlap would cost approximately \$1.10 per yd^2. Results are summarized in Table 54.

Table 54. IFA Control in Simulated B&B Nursery Stock with Insecticide Impregnated Burlap.

INSECTICIDE	RATE OF APPLICATION (mg AI/1000 cm^2 Burlap)	MEAN % CHANGE IN PRETREATMENT NEST INDEX[1]
Check	---	-5a
Cyfluthrin (Technical)	25	-13.2a
	50	-15.4a
	100	-19.8a
	300	-17.6a
Chlorpyrifos (Technical)	25	-8.8a
	50	-6.6a
	100	-13.2a
	300	-15.4a
Bifenthrin (Technical)	25	-11.0a
	50	-13.2a
	100	-22.0a
	300	-48.8b
Cyfluthrin 2EC[2]	100	-15.4a
Cyfluthrin (Technical)[2]	100	-8.8a

[1] Mean based on 5 replicates/treatment. Means followed by the same letter are not significantly different at $P<0.05$ according to Tukey's studentized range (HSD) test.

[2] Test II.

PROJECT NO: FA01G081

PROJECT TITLE: Residual Activity of Bifenthrin and Chlorpyrifos for Red Imported Fire Ant Control in Commercial Sod.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Homer Collins, Mark Trostle [Texas Department of Agriculture, (TDA) Austin, TX], Andy Feild (TDA), Tavo Garza (TDA), Avel Ladner, and Lee McAnally

INTRODUCTION:

Grass sod is currently certified for movement outside the IFA regulated area by use of granular chlorpyrifos at either 4.0 or 6.0 lbs AI/acre (PPQ Treatment Manual M301.81). A 10G chlorpyrifos formulation is registered for this use (Ford's Chemical and Specialty Co., Pasadena, TX) and is used throughout the IFA regulated area. Biology of the ant, management practices, and the uncertainty of markets require the use of residual contact pesticides for certification of sod. Baits alone are not acceptable for certification of sod because newly mated queens, which do not forage for food, could be transported on or slightly below the sod surface. Conventional short term pesticides do not provide the residual activity needed to kill ant colonies; hence, the only approved treatment procedure involves high rates of chlorpyrifos.

A controlled release formulation of chlorpyrifos produced in Australia by Incitec International (Brisbane), has shown good potential for residual control of IFA in previous small plot trials. The Incitec formulation (suSCon® Green) contains 10% chlorpyrifos in a plastic matrix and is sized as a 1.0 mm particle. Efficacy of bifenthrin as a 10WP formulation, suSCon Green, and Dursban® 10G were compared in the present study.

METHODS AND MATERIALS:

Test plots were located in a non-production field of common St. Augustine grass (*Stenotaphrum* secumdatum) near Wadsworth, TX. Plots were 210' x 210' (1 acre), with 6 replicates per treatment arranged in a completely random design.

RIFA populations were assessed prior to and 4, 8, 12, and 20 weeks following application according to the procedure described by Lofgren and Williams (1982). Both population indices and colony mortality were computed for each rating interval. The RIFA population prior to treatment averaged 94 nests per acre. Analysis of variance and Tukey's studentized range (HSD) test (SAS Institute 1988) were used to determine statistical differences in treatment means at the $P<0.05$ level for each posttreatment rating interval.

Treatments were applied May 21-23, 1991. Granular formulations were applied with a Herd GT-77™ (Herd Seeder Co., Logansport, IN) mounted on a John Deere, AMT 600 all-terrain vehicle. A swath width of 25′ was assigned and the vehicle was operated at ca. 6.5 mph. Rate of application averaged 5.3 and 5.9 lb AI/acre for Dursban 10G and suSCon Green respectively. Talstar® 10WP was applied as a water based spray at a rate of 0.25 lb AI/acre in 12.2 gal of water. A roller pump boom sprayer comprised of five KSS-3 tips spaced 36" apart provided an overall swath of 16′. The system was pressurized to 14-18 PSI and towed behind a Honda 300 ATV which was operated at approximately 4.6 mph.

RESULTS:

Pretreatment population indices were drastically reduced (92 to 98%) by all treatments 4 weeks after application (Table 55). By 20 weeks after application, decreased efficacy was noted in both the Dursban 10G and Talstar 10WP plots. However, suSCon Green remained highly effective at 20 wks (99.6% reduction in pretreatment population indices), but reinfestation had occurred by 36 wks posttreatment.

Table 55. RIFA Population Suppression in Commercial Grass Sod with Residual Insecticides.

Treatment	Pretreat Population[1]		Mean % Change in Pretreat Population Index ± SEM at Indicated Post-treatment Intervals (Weeks)[1]				
	Mean cols./ subplot	Mean pop. index	(4)	(8)	(12)	(20)	(36)
suSCon Green (5.9 lb AI/A)	24	402	-97.8 ± 0.5a	-93.2 ± 1.9a	-99.2 ± 0.6a	-99.6 ± 0.4a	-85.0 ± 4.0a
Dursban 10G (5.3 lb AI/A)	31	537	-96.5 ± 2.2a	-87.5 ± 5.9a	-92.3 ± 3.8a	-77.2 ± 9.1b	-57.7 ± 12.1a
Talstar 10WP (0.25 lb AI/A)	21	367	-92.0 ± 1.6a	-95.2 ± 2.3a	-87.2 ± 2.9a	-82.8 ± 4.3a	-61.7 ± 8.1a
Untreated Ck.	20	356	-27.5 ± 7.5b	-26.5 ± 16.1b	-45.5 ± 11.9b	-56.3 ± 8.0b	+2.5 ± 11.2b

[1] Means based on 6 replicates/treatment except suSCon (5 replicates). Means within a column followed by the same letter are not significantly different according to Tukey's Studentized Range (HSD) Test (SAS Institute 1988).

PROJECT NO: FA01G162

PROJECT TITLE: Evaluation of Pageant™ DF for Fire Ant Control in Commercial Turf Grass.

TYPE REPORT: Final

LEADER/PARTICIPANT(S): Homer Collins, Tavo Garza [Texas Department of Agriculture], Avel Ladner, Anne-Marie Callcott, and Randy Cuevas

INTRODUCTION:

Pageant™ DF, a chlorpyrifos formulation produced by DowElanco, Greenfield, IN is registered for control of fire ants in commercial sod at a rate of 16 lbs formulated material per acre (8.0 lbs AI/acre). Trials were initiated in July 1992 to compare levels of control at labelled and lower rates of application.

METHODS AND MATERIALS:

Test plots were located in a closely mowed fallow field comprised predominantly of Johnson grass (Sorghum halepense) and sensitive weed (Schrankia *microphylla*) at Milberger Turf Farms, Bay City, TX. Plots were 210' x 210' (1 acre), with 3 replicates per treatment arranged in a completely random design. RIFA populations were assessed in each plot prior to and at 6, 12, and 18 weeks following application according to the population index procedure described by Harlan et al. (1981) and modified by Lofgren and Williams (1982). Both population indices and colony mortality were computed for each rating interval. The RIFA population prior to treatment averaged 275 (± 54) nests per acre, and all colonies examined appeared to be polygynous. Analysis of variance and Tukey's standardized range (HSD) test (SAS Institute 1988) were used to determine statistical differences in treatment means at the $P<0.05$ level for each post-treatment (PT) rating interval.

Treatments evaluated included Pageant DF at 8, 4, and 2 lbs AI/acre and an untreated check. Approximately 30 gallons of finished solution was applied per acre. All treatments were applied July 22, 1992, using a roller pump boom sprayer comprised of five TKSS-10 spray tips spaced 36" apart. The system was

pressurized to 50 running PSI, and towed behind a Honda 300 ATV which was operated at approximately 4.0 mph. A swath width of 25 feet was obtained with this system. Soil conditions were very moist. Plots were not irrigated following application.

RESULTS:

At 6 wks PT, all treatments were significantly different from the check (Table 56); however, the check had a 71% decrease in population index. This may have been due to extreme heat and little or no rain during the 6 wk period. The checks recovered somewhat at 12 weeks PT while the two lowest Pageant rates showed a decrease in efficacy. By 18 wks PT, no treatment was significantly different from the check, even though the 8 lb AI/acre rate still showed an 87% decrease in population. Due to the high mortality in the check plots, these results are somewhat questionable. However, they do indicate that lower rates of Pageant may be effective on grass sod for a limited time (6 wks). Further trials are necessary to verify these results; these trials are planned for 1993.

Table 56. Efficacy of Pageant DF Applied at Various Rates to Simulated Commercial Sod Plots.

Treatment	% Change in Population Index at Indicated Weeks PT[1]		
	(6)	(12)	(18)
2 lb AI/acre	-95.0a	-62.4ab	-47.9a
4 lb AI/acre	-92.4a	-68.8ab	-51.5a
8 lb AI/acre	-97.3a	-92.3~~b~~a	-87.7a
Check	-71.5b	-32.7b	-38.9a

[1] Means followed by the same letter are not significantly different according to Tukey's standardized range (HSD) test (SAS Institute 1988).

PROJECT NO: FA01G102

PROJECT TITLE: Evaluation of suSCon® Green for IFA Control in Commercial Turf Grass, 1992.

TYPE REPORT: Interim

PROJECT PARTICIPANT(S): Homer Collins, Tim Lockley, Avel Ladner, Lee McAnally, Anne-Marie Callcott, and Randy Cuevas

INTRODUCTION:

Dursban® 50WP and Pageant™ DF (DowElanco, Greenfield, IN) are the only products currently registered and available for certification of grass sod in compliance with the Federal Imported Fire Ant Quarantine. Labelled rate of application for both formulations is 16 1b formulated material (8.0 1b AI) per acre. Sod farmers are encouraged, but not required, to apply biannual applications of any registered bait material (either Amdro® or Award™) in addition to the specific quarantine treatment. Biology of the ant, management practices, and the uncertainty of markets require the use of residual contact pesticides for certification of sod. Baits alone are not acceptable for certification of sod because newly-mated queens, which do not forage for food, could be transported on or slightly below the sod surface. Conventional short term pesticides do not provide the residual activity needed to kill ant colonies; hence, the only approved treatment procedure involves application of high rates of chlorpyrifos.

A controlled release formulation of chlorpyrifos produced in Australia by Incitec International (Brisbane), has shown good potential for residual control of IFA in previous small plot trials. The Incitec formulation (suSCon® Green) contains 10% chlorpyrifos in a plastic matrix and is sized as a 1.0 mm particle. suSCon Green at three rates of application (nominally 5.0, 3.0, and 1.0 lb AI per acre) was evaluated for control of IFA in turf grass.

METHODS AND MATERIALS:

Test plots were located at the Pearl River Sod Farm near Wiggins, MS in a "ribbon" field of common St. Augustine grass (*Stenotaphrum* secumdatum). Sod

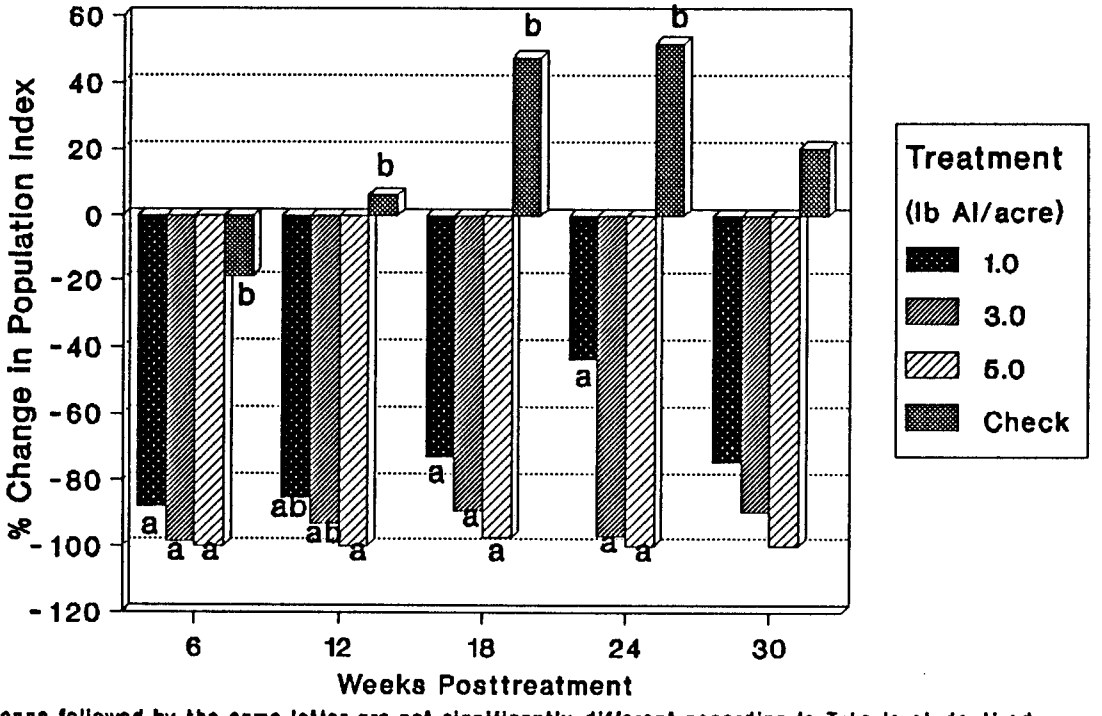
strips ca 12" in width had been harvested from this field earlier in the spring, and "ribbons" of grass ca 6" in width were left to rejuvenate the field. Therefore, some areas of bare ground were present at the time of treatment. Plots were 210′ x 210′ (1 acre), with 3 replicates per treatment arranged in a completely random design. RIFA populations were assessed in each plot prior to and 6, 12, 18, and 24 weeks following application according to the procedure described by Lofgren and Williams (1982). All treatments were applied on May 15, 1992 with a Herd GT-77™ (Herd Seeder Co., Logansport, IN) mounted on a farm tractor. A swath width of 21′ was assigned and the vehicle was operated at ca 4.0 mph. Soil was extremely dry at the time of application, and rainfall did not occur within 24 hrs of treatment.

Analysis of variance and Tukey's studentized range (HSD) test (SAS Institute 1988) were used to determine statistical differences in treatment means at the $P < 0.05$ level for each post-treatment rating interval.

RESULTS:

As show in Fig. 1, rates of 3 and 5 lbs AI/acre provided excellent control up to 24 weeks posttreatment. One-hundred percent control was achieved at the 5 lb rate, while a 51.5% increase in the untreated check plots was recorded at 24 weeks. Prior to the 30 weeks count, the nurseryman harvested a portion of the test site. This included 1 plot (replicate) each from the check, and the 1.0 and 5.0 lb AI/acre treatments. The loss of these plots resulted in insufficient replicates for statistical analyses to be performed. Evaluations will continue until reinfestation is noted.

Figure 1. Efficacy of Various Rates of SuSCon®Green Applied to Commercial Grass Sod.



Means followed by the same letter are not significantly different according to Tukey's studentized studentized range (HSD) test (SAS Institute).

PROJECT NO: FA02G032

PROJECT TITLE: Fenoxycarb Formulation Trials, 1992.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Homer Collins, Anne-Marie Callcott, Avel Ladner, Tim Lockley, Lee McAnally, and Randy Cuevas

INTRODUCTION:

Fenoxycarb exhibits classical IGR activity against a variety of insects including cockroaches, fleas, mosquitoes, etc. In preliminary studies with red imported fire ants (RIFA), Banks et al. (1983) found that it caused dramatic alterations in egg-laying and brood development and eventual death of most treated colonies. Other trials (Banks 1986, Banks et al. 1988) confirmed efficacy, and this product was registered for use on turf, non-agricultural land, nurseries, sod farms, and non-bearing citrus as Logic® in October 1985. The Award" brand of Logic was introduced in 1991 for use on turf, nurseries, non-agricultural areas, etc. Commercial formulations of both Award and Logic contain 1%AI in a soybean oil/defatted corn bait. At the request of the registrant (Ciba-Geigy Chemical Co.), several experimental formulations of fenoxycarb were evaluated in two separate trials in 1992.

METHODS AND MATERIALS:

Test I - 6/4/92:

Test plots were located in non-grazed permanent pasture in Harrison County, MS. A totally monogynous RIFA population averaging 74 colonies per acre infested the property. Treatments evaluated included a 1%AI formulation, a 0.5% formulation, and a standard commercial formulation of Amdro®. All treatments were made with a shop-built granular applicator mounted on a farm tractor (Collins 1987). The equipment was operated at 4 mph on a 10' swath. Rate of application was 1.25 lbs bait per acre for all formulations. Treatments were applied on June 4, 1992. Soil was very moist, and the soil temperature (1" depth) was 68°F. Air temperature was 78°F under partly cloudy skies. Plots were one-acre in size and arranged in a completely randomized

block design with 4 replicates per treatment. The population index method (Harlan et al. 1981) as modified by Lofgren and Williams (1982), as well as colony mortality was used to rate all plots at 6, 12, 18, and 24 weeks after treatment. Analysis of variance and Tukey's studentized range (HSD) test (SAS Institute 1988) were used to determine statistical differences in treatment means at the $P < 0.05$ level for each posttreatment rating (PT) interval.

Test II:

Test II was similar to Test I since the test plots were located in an adjacent field and the same application equipment and rating system was employed. However, plots were treated on August 5, 1992. Treatments evaluated included formulation codes FL-921424, FL-921425, and FL-921414. All contained 0.5% fenoxycarb.

RESULTS:

Test I:

Light rain (estimated at <0.1") occurred during application of the 1.0% formulation. All treatments provided excellent reduction in population indices through 12 weeks (Table 57). Reinfestation was apparent in all plots at the 18 week count and the trial was terminated.

Test II:

Preliminary results show no difference in efficacy of the various formulations used through 18 weeks (Table 58). Only the 921424 formulation has achieved greater than 90% control, but acceptable control was achieved with all treatments.

Table 57. Efficacy of Various Award Formulations, 1992. Test I.

Treatment	% Change in Population Index at Indicated Weeks PT[1]		
	(6)	(12)	(18)
Award 1.0%	-94.9a	-91.9ab	-61.8a
Award 0.5%	-91.1a	-99.2a	+51.7a
Amdro	-96.3a	-95.8ab	-56.1a
Check	-38.2b	-1.3b	+45.7a

[1] Means followed by the same letter are not significantly different according to Tukey's studentized range (HSD) test (SAS Institute 1988).

Table 58. Efficacy of Various Award Formulations, 1992. Test II.

Treatment	% Change in Population Index at Indicated Weeks PT		
	(6)	(12)	(18)
921414 (0.5%)	-86.1a	-86.1a	-83.2a
921424 (0.5%)	-89.2a	-88.9a	-93.2a
921425 (0.5%)	-81.6a	-81.0a	-80.3a
Check	+0.6a	+44.9b	+7.6b

[1] Means followed by the same letter are not significantly different according to Tukey's studentized range (HSD) test (SAS Institute 1988).

PROJECT NO: FA02G012

PROJECT TITLE: Influence of Dew on Efficacy of Award™ Fire Ant Bait.

TYPE REPORT: Interim

LEADER/PARTICIPANT(S): Homer Collins, Avel Ladner, Anne-Marie Callcott, Lee McAnally, and Randy Cuevas

INTRODUCTION:

Effectiveness of all fire ant baits is known or thought to be influenced by a number of variables including soil temperature, soil moisture, rain, and dew (Lofgren et al. 1964, Porter & Tschinkel 1987). Amdro® (American Cyanamid Co., Princeton, NJ) must be harvested and ingested by foraging IFA workers soon after application in order to prevent photolysis of the active ingredient (Vander Meer et al. 1982). Pesticide labels for most fire ant baits caution users not to apply the product to grass or vegetation that is wet from dew or rainfall, and control programs are often delayed to allow dew to dry before treatment begins. These delays are costly, inefficient, and may be unnecessary because hard data on the effect of dew on efficacy of baits is not available. The current study investigates the influence of dew on efficacy of Award (Ciba-Geigy Corporation, Greensboro, NC). Since all baits employ soybean oil as a feeding attractant and pregelled defatted corn as an inert carrier (Illinois Cereals, Paris, IL), the results of this trial should be representative of other baits.

METHODS AND MATERIALS:

Treatment Procedure

One acre test plots (210' x 210') were established in a non-grazed permanent pasture in Harrison County, MS. Four plots (replicates) were treated with labelled rates of Award (1.0 lb/acre) under "heavy" dew conditions in early morning (before dew begins to dry — about 6:30 AM). Treatment of four adjacent plots was delayed until dew has dried and conditions are similar to morning application — about 6:30 PM of the same day. The amount of dew present on vegetation was measured by weighing the amount of dew formed on 36"

x 36" (8361.273 cm^2) panels of flannel cloth (n=4), placed directly in contact with the soil/vegetation surface and pinned in place with No. 6 nails. The cloth panels were placed directly in the test plots late in the afternoon on the day immediately preceding treatment. The amount of dew present at the time of treatment was determined by re-weighing each panel and expressing the amount of dew as g/1000 cm^2. Soil temperature at the 1" depth was recorded immediately prior to both applications. Bait was applied with a shop-built granular applicator mounted on a farm tractor.

Data Analysis

Treatment effects were determined by the population index method (Harlan et al. 1981) as modified by Lofgren & Williams (1982). RIFA population counts were made prior to treatment and at 6, 12, and 18 weeks after application. Data on treatment effects was analyzed by ANOVA, and statistical differences at the $P < 0.05$ level determined by Tukey's standardized range (HSD) test (SAS Institute 1988).

RESULTS:

All treatments were applied on July 8, 1992 to a pasture comprised of approximately 75% Bahia grass (*Paspalum notatum*), mean height 17.53 ± 1.45 cm and 25% dog fennel (*Eupatorium capillifolium*), mean height 70.10 ± 2.97 cm Sunrise was 6:00 AM and sunset 8:01 PM on the day of treatment. The treatment applied under dew conditions occurred between 6:55 AM and 7:40 AM, with air temperature of 78°F and soil temperature at 68°F. An average of 24.23 g/1000 cm^2 of dew was present on the cloth panels in the four replicates. The "dry" treatment was applied between 6:40 PM and 7:25 PM with air temperature at 88°F and soil temperature at 80°F. An average of 0.92 g/1000 cm^2 of moisture was present, probably due to high summer humidity.

Results indicate that the presence of dew during application does not negatively affect the efficacy of Award bait (Table 59).

Table 59. Effect of Dew on Efficacy of Award Fire Ant Bait.

Treatment	% Change in Population Index at Indicated Weeks PT[1]			
	(6)	(12)	(18)	(24)
Dew	-88.6a	-91.9a	-89.6a	-92.2a
No Dew	-86.4a	-84.9a	-75.5a	-91.3a
Check	+5.6b	+31.5b	+21.6b	+24.2b

[1] Means followed by the same letter are not significantly different according to Tukey's studentized range (HSD) test (SAS Institute 1988).

PROJECT NO: FA02G022

PROJECT TITLE: RIFA Control with Award™ Blended into a Controlled Release Fertilizer Formulation.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Homer Collins, Avel Ladner, Randy Cuevas, Anne-Marie Callcott, Tim Lockley and Lee McAnally

INTRODUCTION:

Due to the low rate of application (1.0 to 1.5 lbs/acre), all fire ant baits are difficult to apply with most commonly used granular applicators. Most agricultural products such as seeds, fertilizers, etc. are dispersed at much higher rates of application. Therefore, dispersal equipment is designed for these higher rates of application and cannot be calibrated to deliver labelled rates of fire ant baits. One method of eliminating these problems would be to blend fire ant baits into fertilizer or grass seeds which would then be applied as a "tank mix" of the two products. Past attempts to control fire ants with a blend of fire ant baits and conventional fertilizers were not successful (1984 IFA Station Annual Report). Although accurate calibrations and delivery are possible with these mixes, efficacy is greatly decreased. It is hypothesized that the loss in efficacy is due to the dust granules from the fertilizer which adhere to the bait particles rendering then unpalatable to the ants. In addition to solving some calibration problems, the use of a fertilizer/bait blend offers an economic incentive as well, because an area to be treated for ants and also fertilized would require only a single application.

Polyon® polymer coated urea granules (Pursell Industries, Sylacauga, AL) containing 42% nitrogen (42-O-O), like other controlled release fertilizer formulations, are essentially non-dusty, and appeared to be compatible with fire ant baits. At the request of Pursell Industries, a small test to evaluate IFA control with Award™ (Ciba-Geigy Corp., Greensboro, NC) blended into Polyon urea granules was conducted.

METHODS AND MATERIALS:

Trial I:

Award was blended into the urea granules at a rate of 1.5 lb bait per 100 lbs fertilizer on June 3, 1992. An electric cement mixer (2.0 cu ft capacity) was operated for approximately 5 minutes per batch. This mixture was applied approximately 24 hours later at a rate of 101.5 lbs/acre with a Herd GT-77® Granular Applicator (Herd Seeder Co., Logansport, IN), which was mounted on a farm tractor. This equipment was operated on a 32′ swath at 4 mph. Control plots were treated with Award only at a rate of 1.5 lbs bait/acre using a shop built granular applicator mounted on a farm tractor (Collins 1988). Due to the sticky, unflowable nature of the pure Award, it was necessary to operate the equipment on a 10′ swath at 4 mph. Untreated check plots were also established. All test plots were 1 acre (210′ x 210′), with a circular subplot located in the center in which population counts were conducted. All treatments were applied on June 4, 1992 and replicated 3 times. IFA population counts were made in all test plots prior to application, and at 6, 12, and 18 weeks after application. The population index system described by Harlan et al. (1981), and modified by Lofgren and Williams (1982) was used to determine treatment effects for each rating interval. Analysis of variance and Tukey's studentized range (HSD) test (SAS Institute 1988) were used to determine statistical differences in treatment means at the $P < 0.05$ level for each post-treatment (PT) rating interval.

Trial II- Shelf life study:

On 7/27/92, Award was blended into polyon granules at a rate of 1.5 lbs Award (Batch #RA11019) to 100 lbs fertilizer using an electric cement mixer. The mixed materials were resealed into original fertilizer bags and stored at ambient temperature and humidity. This material will be applied to 4 one-acre plots at a rate of 50 lb/acre in the spring of 1993.

RESULTS:

Trial I:

Weather conditions during treatment were as follows: Skies clear to partly cloudy; air temperature was 80°F, and soil temperature (indirect sun, 1" depth) was 68°F. A light rain shower (estimated at < 0.1") occurred within 1

hour of application.

As shown in Table 60, there was no significant difference in population index reduction at 6 and 12 weeks PT for either treatment. Thus, fertilizer does not appear to enhance or degrade the efficacy of Award. This trial was terminated after the 18 week count because reinfestation had occurred.

Table 60. Effect of Fertilizer on Efficacy of Award™ Fire Ant Bait.

Treatment	% Change in Population Index at Indicated Weeks PT[1]		
	(6)	(12)	(18)
Fert. + Award	-92.4a	-95.8a	-67.8a
Award only	-83.8a	-98.6a	-31.2a
Check	-26.0b	+29.5b	+52.4a

[1] Means followed by the same letter are not significantly different according to Tukey's studentized range (HSD) test (SAS Institute, 1988).

PROJECT NO: FA05G021

PROJECT TITLE: Texas Wildlife Study: Sampling of Non-target Invertebrates.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

As part of a larger study addressing the potential impact of the red imported fire ant (RIFA) on wildlife production in Texas rangelands, five 500-acre plots were treated with Amdro® in the southeastern part of the state on 4/15/91 with a subsequent application made 6 months later on 10/15/91. A third application was made in March 1992. This study is being conducted under the auspices of Texas Tech University (TTU) [lead agency]. TTU is tasked with quantifying the effect of RIFA on annual production of selected vertebrate game, non-game and endangered species. The Texas Department of Agriculture is conducting population sampling of RIFA.

MATERIALS AND METHODS:

The USDA-APHIS-PPQ-Aircraft Operations supplied an airplane for aerial application of Amdro. American Cyanamid Chemical Company supplied the material for application. The first Amdro application was made April 15-19, 1991.

In order to determine if treatment with Amdro has any effect (positive or negative) on non-target invertebrates, collections of various arthropods were made within the treated areas. Comparative collections in untreated plots were also carried out in conjunction with those taken in the replicated treatment plots.

Sampling was comprised of two methods; sweep netting and UV light traps. Sweep net samples were taken from dominant plant communities (in bloom, if available) to collect herb strata, diel-active arthropods. Because of the difficulty involved, no arboreal samples were taken. UV light traps

(portable) were employed to collect nocturnally active insects. Sweep net samples were made using heavy, muslin bags (beating nets). Samples were taken by net immediately after collecting the UV samples (within 30 minutes to 1 hour after true light). One hundred sweeps per plant community were made. UV light traps were placed within 100 m of the area(s) collected by sweep net. The traps were set up and collected during the 30 minutes prior to true dark and 30 minutes prior to true light respectively. Collections were made beginning 3-2 days pretreatment.

Subsequent samples were taken at 24 and 72 hours posttreatment. Further samples were taken in June, July, and October 1991 following the first Amdro application. Subsequent samples were collected in March 1992, 5 months following the second application of Amdro (October 1991) and again in May, June, July, and October 1992 following the 3rd bait application (March 1992). Three paired sites (Bill Welder Ranch, Pat Welder Ranch and McFaddin Ranch) were sampled. Three major groups were selected as non-target species groups or complexes. The carabidae were selected because they are surface dwelling predators and as such are in direct competition with RIFA. The scarabaeidae were selected because they represent a food source for RIFA. The acrididae and tettigoniidae represent a group that could be affected by the treatment regimen.

Collected samples, from both treated and untreated areas, were labelled and transported frozen to the IFA Station in Gulfport, MS where they were separated and identified under magnification. Ant species collected were determined by TTU personnel. Voucher specimens are maintained at the IFA Station. Identified selected arthropod species or species complexes were numerically quantified and analysis of changes in community structure was made.

RESULTS:

No significant difference in mean biomass of arthropods collected pretreatment by UV light trap was observed (Fig. 2). However, by 6 weeks posttreatment (June 1991), the treated mean biomass had increased ca. 2.5 fold over the

untreated mean. The July 1991 mean sample of the treated plots (12 weeks posttreatment), while still indicating significant differences in biomass, had dropped to a level ca. 50% greater than the untreated mean. Although an increase to greater than 100%, was shown at 24 weeks posttreatment, numbers of arthropods collected were insufficient to validate the difference in biomass. Following the second treatment in October 1991, samples were collected in March 1992. Although biomass was still greater in the treated plots, there was insufficient biomass to quantify. Following a third bait application (March 1992), biomass increased rapidly. In the May 1992 collection, the samples from the treated sites showed a level ca. 30% greater than the untreated sites. By June 1992, the difference was >100%. This trend continued through July 1992, but dropped to ca. 60% by October 1992. Overall mean biomass collected tended to follow the population index of RIFA (Fig. 3).

Throughout all samples collected after the initial bait treatment, biomass remained significantly greater ($P=0.01$) in the treated sites when compared with the untreated sites.

Among the 3 groups selected, there was no significant differences between either the carabidae or the orthopterans when compared with treated vs. untreated plots (Table 61). However, carabids and orthopterans were found to be somewhat more numerous in the untreated vs. the treated sites. Conversely, the scarabs showed both a significantly larger number of genera and species (Table 62) and a significantly greater population density in the treated plots when compared to the untreated sites.

The last treatment date was March 1992. Further research is to be conducted throughout 1993 to look at the effects of RIFA reinfestation on invertebrate populations.

Figure 2. Comparative population fluctuations of arthropods captured by UV traps in untreated sites and sites treated with Amdro.

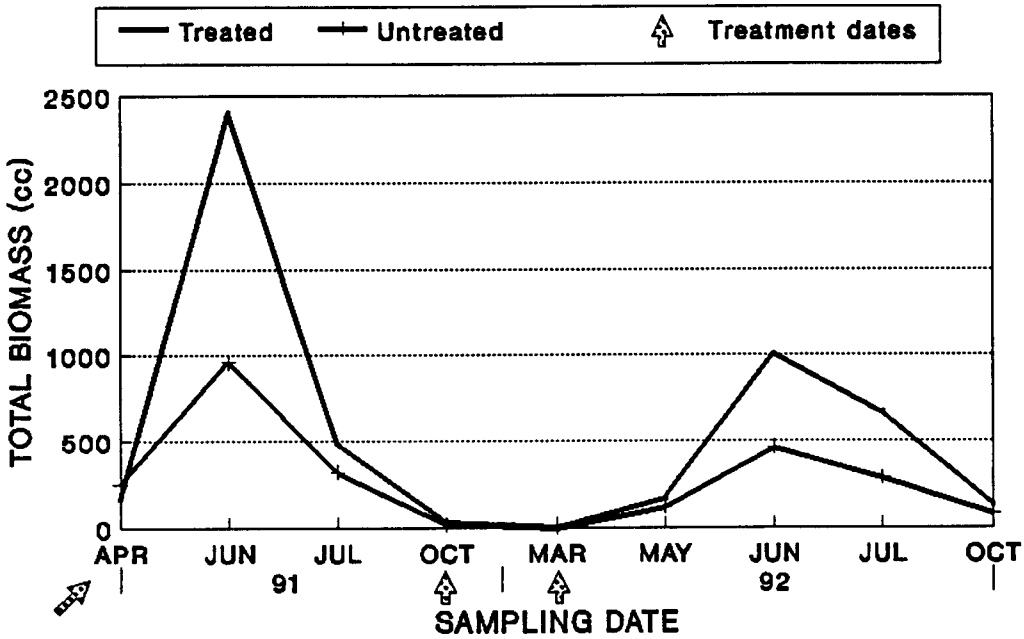


Figure 3. Comparative population fluctuations of red imported fire ants (RIFA) in untreated sites and sites treated with Amdro.

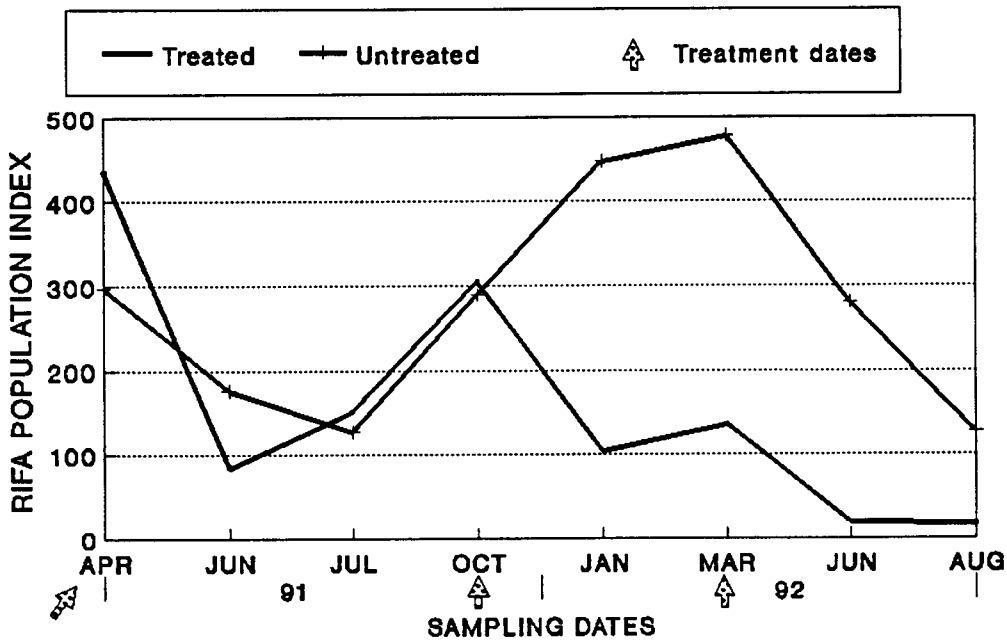


Table 61. Relative Species Diversity of Three Arthropod Groups in Plots Treated and Untreated with Amdro.

Group	Treatment	Number Collected[1] Genera	Species
Sscarabaeidae	treated	15a	30a
	untreated	9b	19b
Ccarabidae	treated	25a	39a
	untreated	25a	42a
Orthoptera	treated	19a	23a
	untreated	17a	19a

[1] Means followed by the same letter are not significantly different (Duncan's Multiple Range Test)

Table 62. Relative Numbers of Arthropods from Three Selected Groups Collected from Sites Treated and Untreated with Amdro.

Group	Number Collected[1] Treated	Untreated
Scarabaeidae	742a	427b
Carabidae	939a	1127a
Orthoptera	1357a	1616a

[1] Means followed by the same letter are not significantly different according to Duncan's Multiple Range Test.

PROJECT NO: FA01G141

PROJECT TITLE: Evaluation of Residual Sprays for Control of Extraneous Foraging RIFA Workers in Tractor-trailers.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

IFA are aggressive foragers and often enter tractor-trailers on cargo or, in some cases, when trucks are parked near active nests. Although workers are sterile, non-reproductive forms, and are incapable of causing an infestation, numerous detections on trucks outside the regulated area have caused concern by various regulatory agencies. A possible mitigative measure to prevent transport of extraneous workers would be the use of residual sprays on floors and walls of tractor trucks. A trial was initiated to compare the residual activity of several common insecticides against IFA workers.

METHODS AND MATERIALS:

Test boards of 3/8" unpainted, exterior plywood were sectioned into 1' x 1' pieces and treated with each candidate insecticide. A total of 5 candidate insecticides were tested, and all are labelled for "ant" control. Candidate insecticides were as follows:

Insecticide	Formulation or % AI	Manufacturer	Labelled Rate of Application
Ficam® W	76WP	Nor-am Chem. Co. 3509 Silverside Rd. Wilmington, DE 19803	0.4 oz/gal H_2O
diazinon	25% AI	Chevron Chemical Co. Ortho Consumer Products P.O. Box 5047 San Ramon, CA 94583	8 oz/3 gal H_2O
Dursban®	4E	Dow Chemical Co. Midland, MI 48674	.5% spray 1 1/3 oz/gal H_2O

Insecticide	Formulation or % AI	Manufacturer	Labelled Rate of Application
malathion	50% AI	Rigo Co. Buckner, KY 40010	3% spray 7.5 oz/gal H_2O
Tempo®	20 WP	Mobay Corp. Agric. Chemicals Div. Specialty Products Group Box 4913 Kansas City, MO 64120	0.65g/qt H_2O

All products were applied at the labelled rate for "ant" control to the point of runoff. Sprays were applied using 1 quart, hand pump mister bottles adjusted to give a coarse spray pattern. Three boards (replicates) per candidate were treated. The boards were aged outdoors under a pick-up camper shell to simulate the interior of a tractor-trailer. Bioassays were conducted 24 hours, 7 days, 1 month, and monthly thereafter until activity ceased.

Bioassays were conducted by confining 20 IFA workers under an inverted, 6" diameter plastic petri dish to each replicate. Mortality counts were made at hourly intervals after exposure to the treated surface.

RESULTS:

Results are summarized in Table 63. Ficam provided the best residual activity, achieving 100% mortality within 2 hrs of exposure 3 months after application. At three months post-treatment (PT) all sprays provided 100% mortality within 5 hours exposure. At 4 months PT, all treatments showed a marked increase in the time required to give complete kill. At 5 months (PT), all treatments required greater than 8 hours exposure to provide 100% mortality. Ficam appeared to provide slightly better results than other treatments, but any of the insecticides tested should provide good control of extraneous foraging RIFA workers in trucks for up to 4 months application at labelled rates.

Table 63. Activity of Selected Insecticides Applied as a Spray-on Surface Treatment for Control of Foraging RIFA Workers in Trucks.

Insecticide	Replicate	Time Required to Produce 100% Mortality at Indicated Post-treatment Intervals (24hrs)	(7da)	(1mo)	(2mo)	(3mo)	(4mo)	(5mo)
Ficam	1	1	1	1	1	2	4	+8
	2	1	1	1	1	2	4	+8
	3	1	1	1	2	2	3	+8
diazinon	1	1	1	2	3	5	8	+8
	2	2	2	2	4	5	6	+8
	3	2	2	2	3	5	7	+8
Dursban	1	2	2	1	2	4	6	+8
	2	2	2	1	2	3	6	+8
	3	1	1	1	2	4	7	+8
malathion	1	1	1	1	2	2	5	+8
	2	2	2	1	4	4	6	+8
	3	2	1	1	2	3	7	+8
Tempo	1	1	3	2	4	5	8	+8
	2	2	3	2	4	4	8	+8
	3	1	2	2	4	4	6	+8
Check	1	0	0	0	5	0	5	0
(% mortality at	2	5	5	*	0	10	0	5
longest exposure)	3	5	0	0	0	0	5	5

* Ants escaped from test chamber

PROJECT NO: FA01G042

PROJECT TITLE: RIFA Infestation of Simulated Telephone Pedestals.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Fire ants are attracted to both AC and DC electrical current and often invade outdoor electrical equipment such as junction boxes, signal equipment and telephone pedestals (McKay & Vinson 1989). In order to compare the effectiveness of insecticidal treatments to prevent fire ant invasion and nest building in such equipment a quick, simple, and inexpensive bioassay procedure was needed. This study reports the results of efforts to artificially infest simulated telephone pedestals.

METHODS AND MATERIALS:

Simulated telephone pedestals were fabricated from 4" diameter PVC pipe which was sectioned into 36" lengths and painted black. To further simulate the environmental conditions within a telephone pedestal, each pipe segment contained a 6" layer of gravel (0.5 to 1.0" diameter) in the bottom of each pipe. Holes (1/8" diameter) drilled along the length of the pipe at the top and bottom served as entrance holes for the ants and to simulate airflow/exchange of the actual pedestals. The pipes were capped with 4" PVC end caps and treated in different fashions to encourage IFA invasion and nest building.

Treatments evaluated (3 replicates per treatment) were as follows:

1. Pipes were established by first excavating a 6-8" hole, the pipe then placed in the hole and the hole backfilled. A fire ant colony was then introduced into the top of the pipe following colony separation by the flotation technique (Banks et al. 1981). Minimal distance to nearest natural IFA colony was 12' (Replicates 1, 2, & 3)

2. Pipes were established as above, then a large IFA colony was excavated and placed into a 3 gallon pail. The colony was then transported to a pipe and the nest tumulus and associated ants were evenly stacked around the base of the pipes. Minimal distance to nearest natural IFA colony was 12′. (Replicates 4, 5, & 6)

3. Pipes were established as described above, but immediately adjacent (touching) to a naturally occurring nest. (Replicates 7, 8, & 9)

4. Pipes were established a minimal distance of 12‹ from the nearest active IFA nest and no artificial infestation attempts were made. (Replicates 10 & 11)

All pipes were established in a roadside right-of-way in rural Harrison County, Mississippi, in March 1992. Observations were made at weekly intervals for the first 4 weeks, then at monthly intervals there after to compare success rates of each treatment.

RESULTS:

None of the treatments described above were successful. In the two treatments (replicates 1-3 and 4-6) in which ants were introduced, the ants either moved out and established a nest nearby, or they simply disappeared altogether. In the treatment where the pipes were introduced into the mounds, after one week replicate 7 moved about three feet away and remained for the duration of the test. After three weeks, replicate 8 also moved about three feet away and remained throughout the test. After three weeks replicate 9 contained very few ants and by week four was abandoned with no other mounds within twenty feet. Replicates 10 and 11 (no artificial infestation) showed no activity whatsoever around the pipe.

These results indicate that simple & inexpensive simulations may not be possible. Presence of AC or DC current will probably be necessary in order to induce movement of a colony into simulated pedestals.

REP#	TREATMENT	RESULTS
1	Floated out colony placed in pipe	1 wk small mound w/in 2 ft. 3 wks small mound gone, nearest mound 9 ft.
2	" "	1 wk no ants in pipe, nearest mound 15 ft., no change remainder of test.
3	" "	1 wk no ants in pipe, nearest mound 6 ft., no change remainder of test.
4	Excavated colony placed against pipe	1 wk no ants, nearest mound 10 ft. no change remainder of test.
5	" "	1 wk no ants, nearest mound 8 ft. no change remainder of test.
6	" "	1 wk no ants, nearest mound 10 ft. no change remainder of test.
7	Pipes placed next to active nests	1 wk adjacent mound moved 3 ft away, no change remainder of test.
8	" "	3 wk adjacent mound moved 3 ft away, no change remainder of test.
9	" "	3 wk few ants left in adjacent mound, 4 wks mound abandoned, no mound w/in 20 ft.
10	Pipes placed w/in 12 ft of existing mound	no activity around pipe throughout test, nearest mound 5 ft.
11	" "	no activity around pipe throughout test, nearest mound 8 ft.

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APPENDIX I

A. PUBLICATIONS:

Allen, C.R., T.C. Lockley & R.S. Lutz. 1993. (IN REVIEW). Response of native arthropods to population reductions of the red imported fire ant in Southeast Texas. Ecology.

Callcott, A.M. & H.L. Collins. 1992. Temporal changes in a red imported fire ant (Hymenoptera: Formicidae) colony classification system following an insecticidal treatment. J. Entomol. Sci. 27: 345-353.

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Lockley, T.C. 1993. (IN REVIEW). A three year systematic survey of the three coastal counties of Mississippi for incidences of polygynous colonies of the red imported fire ant, Solenopsis invicta. Florida Entomol.

Smith, B.J. & T.C. Lockley. 1993. (IN PRESS). Control of red imported fire Solenopsis invicta Buren, in blueberries with fenoxycarb. J. Entomol. Sci.

B. PRESENTATIONS:

Callcott, A.M. 2/92. "Update on Efforts to Determine Factors Influencing Residual Activity of Chlorpyrifos in Potting Media". Imported Fire Ant Technical Work Group Meeting. Gainesville, FL.

Callcott, A.M. 4/92. "Efforts to Determine Factors Influencing Residual Activity of Chlorpyrifos in Potting Media". Imported Fire Ant Research Conference. San Juan, PR.

Callcott, A.M. 10/92. "Review of APHIS Imported Fire Ant Methods Development Activities". Imported Fire Ant Technical Work Group Meeting. Monticello, AR.

Callcott, A.M. 11/92. "Current Research on Control of the Imported Fire Ant". 39th Annual Mississippi Insect Control Conference. Mississippi State University, MS.

Collins, H.L. 4/92. "Management of Imported fire Ant Populations in Commercial Grass Sod". Imported Fire Ant Research Conference. San Juan, PR.

Collins, H.L. 4/92. "Update on Imported Fire Ant Quarantine Treatments". Southern Plant Board Meeting. Jackson, MS.

Collins, H.L. 8/92. "State of the Art Fire Ant Control Technology". Testimony before the Joint Interim Committee on Agriculture and Economic Development of the Arkansas General Assembly. Little Rock, AR.

Collins, H.L. 9/92. "Current Methods Development Activities". National Plant Board Council Meeting. Atlanta, GA .

Collins, H.L. 11/92. "History and Biology of Imported Fire Ants." 39th Annual Mississippi Insect Control Conference. Mississippi State University, MS.

Lockley, T.C. 2/92. "Effect of Red Imported Fire Ant Predation on Population of the Least Tern in Mississippi". Annual Meeting of Mississippi Academy of Science. Biloxi, MS.

Lockley, T.C. & A. Laiche. 7/92. "Phytotoxicity of Talstar 10WP Surface Applied and Preplant Incorporated Cultivars to Selected Cultivars of Succulent and Woody Ornamental Plants". IN: Proceeding of Southern Nurserymen's Association. Atlanta, GA.

Lockley, T.C. 10/92. "Phytotoxicity Potential of Growth Medium Incorporation of Force® Insecticide for Fire Ant Control". 21st Annual Ornamental Horticultural Field Day. Mississippi Agricultural and Forestry Experiment Station. Poplarville, MS.

Lockley, T.C. 11/92. "The Ant that Ate the South". Field Servicing Office Presentation. Minneapolis, MN.

Lockley, T.C., C.R. Allen, S.A. Phillips, S. Demarais & S. Lutz. 12/92. "Effects of Reduction of Red Imported Fire Ant Populations on arthropod Diversity in Southeast Texas". Entomological Society of America National Conference. Baltimore, MD.

Tim Lockley presents Imported Fire Ant informative presentations to various organizations and schools as requested.

APPENDIX II - LABORATORY BIOASSAY PROCEDURE

PROTOCOL FOR BIOASSAY OF INSECTICIDE TREATED POTTING MEDIA WITH ALATE IFA QUEENS

Introduction: The development of quarantine treatments to prevent artificial spread of imported fire ants (IFA) in nursery stock requires the evaluation of candidate pesticides, dose rates, formulations, etc. The use of a laboratory bioassay procedure for these evaluations provides a rapid and inexpensive means of evaluating the numerous candidates tested each year. Various bioassay procedures have been devised over the years, but the procedure currently used by the USDA, APHIS Imported Fire Ant Laboratory in Gulfport, Mississippi, is described herein. This procedure is a slight modification of the test described by Banks et al., 1964 (Jour. Econ. Ent. 57: 298-299).

Collection of test insects: Field collected alate imported fire queens are used as the test insect. IFA colonies are opened with a spade and given a cursory examination for the presence of this life stage. Alate queens are seldom, if ever, present in all IFA colonies in a given area. Some colonies will contain only males, others may have few or no reproductive forms present, others may contain both males and queens, while some will contain only alate queens. Seasonal differences in the abundance of queens is quite evident; in the warmer months of the year 50% or more of the colonies in a given area may contain queens. However, in the cooler months, it is not uncommon to find that less that 10% of the colonies checked will contain an abundance of alate queens. Therefore, it is necessary to examine numerous colonies, selecting only those which contain large numbers of alate queens for collection. During winter, ants will often cluster near the surface of the mound facing the sun. Collection during midday on bright, sunny days is highly recommended for winter; whereas the cooler time of day is recommended for hot, dry days of summer. Once a colony (or colonies) has been selected for collection, the entire nest tumulus is shovelled into a 3-5 gallon pail. Pails should be given a liberal dusting with talcum powder on the interior sides to prevent

the ants from climbing up the sides of the pail and escaping. Approximately 3-6" head room should be left to prevent escape. An effort should be made to collect as many ants as possible while minimizing the collection of adjacent soil which will contain few ants. Collected colonies are then transported to the laboratory for a 3-5 day acclimation period. The addition of food or water during this short acclimation period is not necessary. Alate queens are collected with forceps after placing a 1-2 liter aliquot of the nest tumulus in a shallow laboratory pan. Again, the use of talc on the sides of containers prevents escape while talced rubber gloves minimizes the number of stings experienced by the collector. The forceps should be used to grasp the queens by the wings in order to prevent mechanical injury. An experienced collector can collect 2-300 queens per hour. It is generally advisable to place collected queens in a 500 cc beaker or other suitable vessel containing moist paper towels prior to being introduced into the test chamber.

Test chambers: Test chambers are 2.5" x 2.5" plastic flower pots which have been equipped with a labstone bottom. Labstone is generally available through dental supply firms such as Patterson Dental Co., 2323 Edenborn Ave., Metairie, Louisiana. The labstone bottom prevents the queens from escaping through the drain holes in the bottom of the pot and also serves as a wick to absorb moisture from an underlying bed of wet peat moss (see Figure 1). Ants are susceptible to desiccation so humidity/moisture levels must be optimized. Pots should be soaked in water to moisten the labstone prior to placing potting media in the pots. Plastic petri dishes are inverted over the tops of the pots to prevent escape from the top of the test chambers. Prior to placing queens in the test chamber, 50 cc of treated potting media is placed in the bottom of each pot. Due to possible pesticide contamination, test chambers are discarded after use.

Replicates: Each treatment to be evaluated is subdivided into 4 replicates; with one test chamber per replicate. Five alate queens are then introduced into each replicate.

Test interval: All evaluations are based on a 7 day continuous exposure period. i.e., introduced queens remain in the test chambers for 7 days. At this time the contents of each chamber are expelled into a shallow laboratory pan and closely searched for the presence of live IFA alate queens.

Recording of data: Results of each bioassay are entered on the attached data form. Conclusions regarding efficacy and residual activity of the candidate treatments are drawn from this raw data.

Time estimates: The time required to conduct a bioassay will vary greatly, dependent upon a number of factors:

1) Availability of queens; supply is primarily influenced by season. More time will be spent collecting queens in winter or during extreme droughts.
2) Number of treatments to be evaluated; e.g., if only a single treatment and an untreated check are to be evaluated only 40 queens/month are needed. Conversely, a test involving 4 insecticides at 3 rates of application (12 treatments + untreated check) will require 260 queens monthly for the duration of the test.

Duration of the trial: A successful preplant incorporated treatment for nursery potting soil must provide a minimum of 12-18 months residual activity in order to conform with normal agronomic practices of the nursery industry. Since some plants may be held for longer periods of time prior to sale, a 24-36 month certification period (residual activity) would be ideal. Therefore, most initial or preliminary trials with a given candidate treatment are scheduled for 18 months.