1994
ANNUAL REPORT

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:

Anne-Marie Callcott and Homer L. Collins

January 1995

FY 1994 OBJECTIVES

IMPORTED FIRE ANT STATION
GULFPORT, MS

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

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

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

- o New product/formulation testing and evaluation.
- o Conduct label expansion studies.
- o 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:

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

CONTENTS

SECTION I

DEVELOPMENT OF QUARANTINE TREATMENTS FOR CONTAINERIZED AND BALLED & BURLAPPED NURSERY STOCK

SECTION II

DEVELOPMENT OF QUARANTINE TREATMENTS FOR GRASS SOD

SECTION III

POPULATION SUPPRESSION TRIALS

SECTION IV

MISCELLANEOUS PROJECTS

PROJECT NO: FA01G161

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

TYPE REPORT: Final

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® 1.5G) has shown good potential in previous trials and was retested in this trial. Cypermethrin was previously tested as a 0.75G, but the Demon® 40WP formulation was included in this trial because it had not been tested.

MATERIALS AND METHODS:

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. A pulsating overhead irrigation system supplied ca. 1-1½" water per week. 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. Queen

[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.

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 monthly.

Treatments tested were as follows:

- lambda-cyhalothrin (Commodore® 10WP) at 10, 50 and 100 ppm
- cypermethrin (Demon® 40WP) at 10, 50 and 100 ppm
- tefluthrin (Force® 1.5G) at 10, 50 and 100 ppm
- bifenthrin (Talstar® 10WP) at 50 ppm (standard)

RESULTS:

Through 31 months posttreatment all Force and Talstar treatments maintained 100% mortality as did Commodore at the 50 and 100 ppm rate (Table 1). At the 10 ppm rate, Commodore maintained good control (>85%) through 30 months. Demon at 100 ppm also maintained good control (>85%) through 31 months. Demon at 50 ppm was effective for 17 mths, while the 10 ppm rate dropped below 100% after 9 months.

Table 1. Activity of Candidate Potting Media Insecticides, 1991.

Insecticide	Dose Rate (PPM)	% Mortality to Alate Queens at Indicated Post-Treatment Interval (Months) (1)	(2)	(4)	(6)	(8)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
Commodore 10WP	10	100	100	100	100	100	100	85	100	100	100	100	100	100	85	100	100	100	100	100	90	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	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	100	100	100	100	100	95	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	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Demon 40WP	10	100	100	100	100	100	85	45	55	60	85	70	35	100	15	25	0	5	55	30	35	25
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	85	90	100	100	100	85	40	50
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	100	100	100	85	100
Talstar 10WP	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	--	10	10	0	15	0	15	5	10	10	0	5	5	0	5	5	15	10	10	10	15	0

Insecticide	Dose Rate (PPM)	% Mortality to Alate Queens at Indicated Post-Treatment Interval (Months) (26)	(27)	(28)	(29)	(30)	(31)
Commodore 10WP	10	100	95	100	100	85	40
	50	100	100	100	100	100	100
	100	100	100	100	100	100	100
Force 1.5G	10	100	100	100	100	100	100
	50	100	100	100	100	100	100
	100	100	100	100	100	100	100
Demon 40WP	10	40	15	30	20	45	20
	50	45	60	55	70	15	40
	100	100	90	100	100	100	95
Talstar 10WP	50	100	100	100	100	100	100
Check	--	5	0	10	0	0	10

PROJECT NO: **FA01G123**

PROJECT TITLE: Evaluation of Candidate Potting Media Toxicants, 1993.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally and Randy Cuevas

INTRODUCTION:

An on-going screening program to evaluate insecticides applied as pre-plant incorporated treatments for nursery potting media has been conducted by the IFA Station since 1974. In 1993, only one new insecticide was tested, but new formulations of several insecticides were tested.

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 media (MAFES Mix, 750 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. A pulsating overhead irrigation system supplied ca 1-1½ water per week. At monthly intervals, three pots from each treatment group were composited and subjected to standard alate queen laboratory bioassay (Appendix II).

Fipronil (pyrazole insecticide) is a new product from Rhone Poulenc which has shown promise when used as a soil termiticide. This chemical is formulated as a 1.5% granular material and was incorporated at rates of 5, 10, 25, 100 and 300 ppm. New formulations of Talstar T&O Granular® (bifenthrin) and Commodore® (lambda-cyhalothrin) were also tested. Previous formulations of Talstar were comprised of a sand carrier, and Commodore was previously formulated on gypsum. On August 10, 1993, bifenthrin 0.2G on a peanut hull carrier and Commodore 1GR on a sand carrier were incorporated at rates of 10, 15, and 25 ppm. Force 1.5G was incorporated at rates of 5, 10, and 25 ppm.

RESULTS:

Bifenthrin and Force at all rates have been effective for 16 mths (Table 2). Fipronil at 5 ppm was effective for 8 mths, and at 10 ppm for 13 mths. All other rates (25 - 300 ppm) have been effective for 16 mths. Commodore at 10 and 15 ppm showed erratic results. However, the 25 ppm rate of Commodore has been effective for 16 mths. Bioassays will continue until activity of all treatments ceases.

Table 2. Evaluation of Candidate Potting Media Toxicants, 1993.

Chemical	Dose Rate (ppm)	% Mortality to Alate Females at Indicated Months Posttreatment															
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Bifenthrin 0.2G on peanut hulls	10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	15	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
Commodore 1G on sand	10	55	90	90	100	90	100	100	75	70	90	100	90	80	60	85	70
	15	95	55	95	100	95	100	100	80	75	100	100	100	85	100	100	100
	25	100	90	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Force 1.5G	5	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	10	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
Fipronil 1.5G	5	100	100	100	95	100	100	100	100	30	80	60	95	70	0	10	0
	10	100	100	100	100	100	100	100	100	100	90	100	100	100	55	65	40
	25	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	100	100	100	100
	300	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	-	15	10	15	5	10	10	0	10	15	5	0	5	10	0	5	0

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, Randy Cuevas and nursery cooperators

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 additional 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 29, 31 and 31 months of residual at rates of 10, 50 and 100 ppm, respectively (FA01G161).

MATERIALS AND METHODS:

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@, currently marketed as Fireban®) 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 April 1, 1992 (Windmill). At one month after treatment, three months and quarterly thereafter, three pots from each treatment group at each nursery were collected, composited and sent to the IFA Station for standard laboratory bioassay (Appendix II).

Formulation of chlorpyrifos on sphagnum peat:

A number of studies initiated by the IFA Station (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 as the carrier for a specialized chlorpyrifos formulation was conceived, and 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:

Results are shown in Table 3. 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 showed excellent residual through 15 months. The pots at Green Forest Nursery were accidently destroyed by workers at the nursery before the 18 month test. Commodore at 25 ppm in Wight media showed reduced efficacy at 24 mths PT, while the 50 ppm rate has shown good results through 33 mths. On the other hand, Commodore in Windmill media, at both rates, has shown reduced and erratic results since the 12 mths PT evaluation. Force, at 25 ppm in Wight media, showed reduced efficacy at 18 mths, and erratic efficacy since that time. The 50 ppm rate has been very effective for 30 mths. In Windmill media, Force at 25 ppm was effective through 15 mths, and the 50 ppm rate has also shown good efficacy through 27 mths. Bifenthrin, in Wight and Windmill media at both rates, has been effective for 33 and 27 mths, respectively. These results indicate that media type does not appear to significantly affect the efficacy of bifenthrin or tefluthrin. However, the efficacy of Commodore may be affected by media type.

Table 3. Residual Activity of Various Granular Insecticides Incorporated into Media from Various Commercial Nurseries.

NURSERY	CHEMICAL	RATE (ppm)	% ALATE QUEEN MORTALITY AT INDICATED MONTHS PT								
			(1)	(3)	(6)	(9)	(12)	(15)	(18)	(21)	(24)
Green Forest	Bifenthrin 0.2G	25	100	100	100	100	100	100	†		
		50	100	100	100	100	100	100	†		
	Commodore 1.5G	25	100	100	100	100	100	100	†		
		50	100	95	100	100	100	100	†		
	Force 1.5G	25	100	100	100	100	100	100	†		
		50	100	100	100	100	100	100	†		
	Chlorpyrifos 2.5G	50	100	5	5	*					
		100	100	5	5	*					
	Check	-	0	5	15	15	5	30	†		
Wight	Bifenthrin 0.2G	25	100	100	100	100	100	100	100	100	100
		50	100	100	100	100	100	100	100	100	100
	Commodore 1.5G	25	100	95	100	100	100	95	100	100	75
		50	100	100	100	100	100	100	100	100	100
	Force 1.5G	25	100	100	100	100	100	100	65	100	90
		50	100	100	100	100	100	100	100	100	100
	Chlorpyrifos 2.5G	50	100	35	15	50	*				
		100	100	50	20	55	*				
	Check	-	5	35	20	5	25	10	20	10	10
Windmill	Bifenthrin 0.2G	25	100	100	100	100	100	100	100	100	100
		50	100	100	100	100	100	100	100	100	100
	Commodore 1.5G	25	90	100	100	100	95	20	65	100	40
		50	100	100	100	100	85	55	80	100	85
	Force 1.5G	25	100	100	100	100	100	100	40	75	55
		50	100	100	100	100	100	100	100	90	100
	Chlorpyrifos 2.5G	50	100	0	0	0	*				
		100	100	90	0	0	*				
	Check	-	35	10	10	0	25	20	5	0	15

Table 3. Cont.

NURSERY	CHEMICAL	RATE (ppm)	% ALATE QUEEN MORTALITY AT INDICATED MONTHS PT		
			(27)	(30)	(33)
Green Forest	Bifenthrin 0.2G	25	†		
		50	†		
	Commodore 1.5G	25	†		
		50	†		
	Force 1.5G	25	†		
		50	†		
	Chlorpyrifos 2.5G	50	†		
		100	†		
	Check	-	†		
Wight	Bifenthrin 0.2G	25	100	100	100
		50	100	100	100
	Commodore 1.5G	25	90	95	100
		50	100	90	100
	Force 1.5G	25	70	35	5
		50	100	95	15
	Chlorpyrifos 2.5G	50	*		
		100	*		
	Check	-	20	45	0
Windmill	Bifenthrin 0.2G	25	100		
		50	100		
	Commodore 1.5G	25	45		
		50	65		
	Force 1.5G	25	10		
		50	95		
	Chlorpyrifos 2.5G	50	*		
		100	*		
	Check	-	0		

* Dropped due to decreased efficacy
† Pots were accidently destroyed by nursery workers

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 that have shown promise in preliminary trials into nursery potting media supplied by commercial nurseries and age the treated soil at the corresponding nursery. Several of these trials are currently underway in GA, MS, LA, and TX.

MATERIALS AND METHODS:

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 were composited, sent to the IFA lab in Gulfport, MS, and subjected to standard laboratory bioassay (Appendix II).

RESULTS:

Scimitar at 50 ppm and Talstar at 25 ppm have provided 27 mths of residual activity (Table 4). Force at 25 ppm provided 22 mths of activity and at 10 ppm 16 mths. Scimitar at 25 and 10 ppm afforded 22 mths and 14 mths of residual activity, respectively. The suSCon treated media began to show erratic results 7 mths after treatment. The trial will continue until activity of all treatments ceases.

Table 4. Residual Activity of Several Insecticides Incorporated in Louisiana Pacific Media and Aged at Turkey Creek Nursery.

INSECTICIDE	DOSE RATE (ppm)	% ALATE FEMALE MORTALITY AT INDICATED MONTHS POSTTREATMENT													
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Scimitar 10WP	10	100	100	100	100	100	100	100	100	100	95	100	100	100	90
	25	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
Force 1.5G	10	100	100	100	100	100	100	100	100	90	100	100	100	100	100
	25	100	100	100	100	100	100	100	100	100	100	100	100	100	100
suSCon Green	400	100	100	100	100	100	100	60	80	25	75	100	100	50	45
Talstar 0.2G	25	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	--	0	30	20	15	5	10	5	45	5	25	20	5	10	10

Table 4. Cont.

INSECTICIDE	DOSE RATE ppm	% ALATE FEMALE MORTALITY AT INDICATED MONTHS POSTTREATMENT												
		(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
Scimitar	10	80	100	85	100	60	15	15	15	30	20	*	-	-
10WP	25	100	100	100	100	100	100	100	30	95	80	95	95	35
	50	100	100	100	100	100	100	100	100	95	100	100	95	95
Force 1.5G	10	100	100	65	100	40	45	25	25	60	35	*	-	-
	25	100	100	100	100	100	100	100	100	85	50	45	95	30
suSCon Green	400	5	25	5	10	15	20	*	-	-	-	-	-	-
Talstar 0.2G	25	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	--	100[1]	5	5	5	15	5	25	20	35	20	25	5	5

* dropped due to decreased efficacy
[1] We assume that treated media was inadvertently labelled as check media somewhere in the handling process.

PROJECT NO: FA01G023

PROJECT TITLE: Evaluation of Reduced Rates of Bifenthrin for Treatment of Potting Media.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Anne-Marie Callcott, Homer Collins, Randy Cuevas, and Nursery Cooperators

INTRODUCTION:

Talstar® T&O 0.2G was registered in June 1992 for use in the Federal Imported Fire Ant Quarantine Program. The pesticide is incorporated into nursery media at 25 ppm (based on bulk density of media) and used in conjunction with the IFA-free nursery program. This product is extremely effective against IFA and has excellent residual at the above stated rate. However, bifenthrin, even with the recent cost reduction, is still more expensive than previously registered quarantine insecticides. Therefore, any reduction in initial dose rate and thus initial cost to the producer, would enhance the product's acceptance. This trial, conducted in various nurseries in the southeast, investigates the efficacy of reduced rates of bifenthrin.

MATERIALS AND METHODS:

Five locations were selected for this study. The study sites, along with the respective cooperator, are as follows:

Imperial Nursery, Quincy FL - Dr. Russ Mizell
Wight Nursery, Cairo GA - Jerry Lee
Univ. of Ga., Tifton GA - Mel Garber
McCorkle Nursery, Dearing GA - Mark Johnson
Lonestar Nursery, San Antonio TX - Dr. Bart Drees

These nurseries provided media, space, potting and labor in conjunction with representatives of FMC.

A sample of the media from each nursery site was submitted through the IFA Station to the USDA, APHIS, National Monitoring and Residue Analysis Laboratory

(NMRAL, Gulfport, MS) for bulk density determination prior to the initiation of the trial. Bulk density of the media is necessary to determine the quantity of product needed to acquire desired dose rates.

Treatments were initiated October - December, 1992. Talstar T&O 0.2G was incorporated on site into media supplied by that nursery using the protocol of the IFA Station. The chemical was incorporated into the media at rates of 12.5, 15 and 18 ppm using a cement mixer. Each load was blended for 15 minutes to insure thorough mixing. Amount of Talstar used to obtain the desired rates at each nursery is as follows (as determined by FMC using bulk density supplied by NMRAL):

Location	Bulk Density (lb/cu yd)	Pounds of Talstar 0.2G/cu yd Rounded Value (Calculated Value)			
		12.5 ppm	15.0 ppm	18.0 ppm	Check
Imperial Nursery	1111	7.0 (6.9)	8.0 (8.3)	10.0 (9.9)	0.0
Wight Nursery	842	5.0 (5.3)	6.0 (6.32)	7.5 (7.58)	0.0
Univ of Georgia (Mel Garber)	842	5.0 (5.3)	6.0 (6.32)	7.5 (7.58)	0.0
McCorkle Nursery	905	6.0 (5.66)	7.0 (6.79)	8.0 (8.15)	0.0
Lonestar Nursery	542	3.5 (3.5)	4.0 (4.1)	5.0 (4.9)	0.0
	560	3.5 (3.53)	4.0 (4.24)	5.0 (5.04)	0.0

Treated media was then placed in standard 6-inch nursery pots and subjected to normal agronomic practices; i.e. standard watering and fertilizer schedules. Plants were placed in pots with treated media at Imperial Nursery.

On a monthly basis, a composite of soil randomly collected from 2-3 pots in each treatment group was sent to the IFA Station in Gulfport, MS for bioassay (Appendix II).

RESULTS:

The plants growing in the treated media at Imperial Nursery were "potted up" (i.e. moved into a larger container) in Nov. 1993, and therefore the original treated media was lost. However, all rates were 100% effective for the 10 mths the trial was run, and no phytotoxicity was evident at any rate prior to "potting up" (Table 5).

Talstar rates in Lonestar media (12.5 - 18.0 ppm) were 100% effective through 16 mth and all rates have decreased in efficacy since that evaluation. All rates (12.5 - 25 ppm) were very effective for 17 mths in Univ. of Ga. media, with a small decrease in efficacy at 16 mths. However, results have been erratic for all rates since the 18 mth evaluation. All rates of Talstar in McCorkle media (12.5 - 18 ppm) were effective for 20 mths. No samples were received from McCorkle after this time, and we assumed the trial had been terminated at the nursery. All rates (12.5 - 25 ppm) in Wight media have been 100% effective through 23 mths.

One interesting note, Wight nursery media was used at the Univ. of Ga. site and these two sites have produced very different data indicating that incorporation or "growing" practices may affect the efficacy of bifenthrin.

Data from this, and other studies, was used to support the "tiered dose rate" system which was approved for program use on December 27, 1993.

Table 5. Residual Activity of Reduced Rates of Bifenthrin at Various Nurseries.

Location	Dose Rate (ppm)	% Mortality at Indicated Months PT												
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Imperial Nursery	12.5	100	100	100	100	100	100	100	100	100	100	-[1]		
	15	100	100	100	100	100	100	100	100	100	100	-		
	18	100	100	100	100	100	100	100	100	100	100	-		
	Check	75	0	5	10	30	0	30	20	0	15	-		
McCorkle	12.5	100	100	100	100	100	-[3]	100	100	100	100	100	100	100
	15	100	100	100	100	100	-	100	100	100	100	100	100	100
	18	100	100	100	100	100	-	100	100	100	100	100	100	100
	Check	5	10	5	0	50	-	85	5	10	20	10	0	20
Lonestar Nursery	12.5	100	100	100	100	100	100	100	100	95	100	70	100	85
	15	100	100	100	100	100	100	100	100	95	100	50	100	95
	18	100	100	100	100	100	100	100	100	100	100	40	100	95
	Check	10	10	15	0	65	30	30	55	25	15	20	15	5

Table 5. Cont.

Location	Dose Rate (ppm)	% Mortality at Indicated Months PT										
		(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Imperial Nursery	12.5	-[1]										
	15	-										
	18	-										
	Check	-										
McCorkle	12.5	100	100	100	-[3]	100	-[3]	100	-[4]			
	15	100	100	100	-	100	-	100	-			
	18	100	100	100	-	100	-	100	-			
	Check	10	0	10	-	15	-	15	-			
Lonestar Nursery	12.5	100	100	100	20	45	20	40	30	50		
	15	100	100	100	50	35	20	65	60	60		
	18	100	100	100	80	40	35	85	40	50		
	Check	0	10	0	20	5	10	5	15	25		

Table 5. Cont.

Location	Dose Rate (ppm)	% Mortality at Indicated Months PT												
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Wight	12.5	-	100	100	100	100	100	100	100	100	100	100	-[3]	100
Nursery[2]	15	-	100	100	100	100	100	100	100	100	100	100	-	100
	18	-	100	100	100	100	100	100	100	100	100	100	-	100
	25	-	100	100	100	100	100	100	100	100	100	100	-	100
	Check	-	10	20	0	0	0	10	35	15	20	20	-	5
Univ. of	12.5	100	100	100	100	100	100	100	100	90	100	100	100	100
Georgia	15	100	100	100	100	100	100	100	100	100	100	95	100	100
	18	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
	Check	0	0	25	10	5	0	10	0	15	5	10	20	5

Table 5. Cont.

Location	Dose Rate (ppm)	% Mortality at Indicated Months PT										
		(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Wight Nursery[2]	12.5	100	100	100	100	100	100	100	100	100	100	
	15	100	100	100	100	100	100	100	100	100	100	
	18	100	100	100	100	100	100	100	100	100	100	
	25	100	100	100	100	100	100	100	100	100	100	
	Check	5	15	25	45	20	10	25	30	10	0	
Univ. of Georgia	12.5	100	100	85	100	50	95	100	80	100	45	
	15	100	100	100	100	50	100	95	85	100	35	
	18	100	100	90	100	85	100	80	75	100	35	
	25	100	100	90	100	65	100	90	70	100	60	
	Check	0	10	25	5	10	20	40	25	30	15	

1 Dirt and plants at Imperial Nurseries were "potted up" in Nov. 1993; original treated media was lost.

2 Did not receive a one month sample from Wight Nursery

3 Did not receive a sample

4 Did not receive any samples past this date

PROJECT NO: FA01G053

PROJECT TITLE: Influence of Sand Content of Nursery Potting Media on Residual Activity of Bifenthrin and Tefluthrin.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, and Randy Cuevas

INTRODUCTION:

Historically, insecticidal treatments for nursery potting media were administered on a weight to volume basis, i.e. 1 lb of Dursban® 2.5G per cubic yard of media. However, this resulted in tremendous variations in the effective dose rates, with "lighter" media receiving far more actual toxicant than "heavier" media. In order to compensate for these differences. Talstar T&O Granular@, and tefluthrin 1.5G are applied at a rate of 25 ppm, based on the dry weight bulk density of the potting media. Potting media is a tremendously variable entity containing highly organic components such as milled pine bark, hardwood sawdust, rice hulls, sphagnum peat, etc. Undoubtedly, the most common component of all southern nursery media is pine bark. Some media contain sand in varying amounts, while others contain no sand. Ratio of sand to bark may vary from 1 part sand to 2 parts bark, to 1 part sand to 8 parts bark. Sand is an inert component that contributes little other than weight to the media. Pesticide binding to sand particles is not known to occur. However, the weight of the sand influences the amount of pesticide required because dose rates are bulk density dependent.

The current study investigates the impact of sand content. of potting media on the residual activity of bifenthrin (Talstar®) and tefluthrin (Fireban®) in nursery potting media.

MATERIALS AND METHODS:

On February 5, 1993 potting media comprised of green milled pine bark and coarse river sand'in varying ratios were prepared by tumbling the components in a portable cement mixer. Dry weight bulk density for the pine bark was 345 lb/yd^3, and 2704 lb/yd^3 for the sand. Each media was then treated with 3.915

grams AI insecticide/yd^3 of prepared media. Media components, ratios, bulk densities, and theoretical dose rates were as follows:

Treatment No.	Component ratios (Bark:Sand) V:V	Insecticide & rate of Appl.†	Bulk density of prepared media (lbs/yd^3)	Theoretical dose rate (ppm)††
1	0:1	bifenthrin 3.915	2705	3.2
2	1:1	"	1524	5.6
3	2:1	"	1131	7.6
4	3:1	"	935	9.2
5	6:1	"	682	12.6
6	8:1	"	607	14.2
7	1:0	"	345	25.0
8	0:1	tefluthrin 3.915	2704	3.2
9	1:1	"	1524	5.6
10	2:1	"	1131	7.6
11	3:1	"	935	9.2
12	6:1	"	682	12.6
13	8:1	"	607	14.2
14	1:0	"	345	25.0
15	0:1	untreated check	2705	0.0
16	1:0	"	345	0.0

† g AI per yd^3 of media.
†† Based on bulk density of the prepared media.

Treated media was placed into trade 1-gal plastic pots and weathered under simulated nursery conditions, including irrigation (ca. 1.5 inches/wk) plus rainfall. Two pots from each treatment were removed at monthly intervals and bioassayed against alate IFA queens.

RESULTS:

Talstar in all media mixes, except the sand only, showed excellent control for 20 mths (Table 6). We believe the 21 mth counts were inadvertently recorded incorrectly, i.e. the Talstar results were erroneously recorded on the Fireban data sheet and vice versa. This would be more in keeping with the overall results over time. If this were true, the higher rates of Talstar, 12.6 - 25.0 ppm, will have provided excellent control through 22 mths. Sand alone showed excellent control of IFA for 14 mths. However, the sand used in this study was coarse river sand. An organic content analysis, conducted by USDA, National Monitoring and Residue Analysis Laboratory, indicated that the sand contained 0.1% organic matter. Pesticide binding to the small amount of organic matter present may account for the good residual activity in the "pure" sand treatment.

Tefluthrin incorporated into 1:1 media showed decreased efficacy after 14 mths. All other rates provided good control through 17 mths. Tefluthrin in sand has been 100% effective for 22 mths; providing better control in this mineral media type than in any of the bark:sand media mixes.

DISCUSSION:

The dose rates in this trial were calculated using the total bulk density of the media (pine bark + sand). Based on that criteria, these results for bifenthrin agree with past results which were used to support the current tiered dose rate for quarantine treatments: i.e. lower dose rates provide less residual activity. Evaluated from this perspective, sand appears to have no effect on the efficacy of bifenthrin. However, if dose rate is based on the bulk density of only the pine bark portion of the media, theoretical dose rates increase proportionally with the amount of sand present, from 25 ppm in the pure pine bark to 50 ppm in the 1:1 media mix. Analyzed from this perspective, it appears that sand does affect the residual activity of bifenthrin since media treated at rates of 33, 37 and 50 ppm (those with pine bark:sand ratios of 3:1, 2:1 and 1:1, respectively) lost efficacy before rates of 29, 28 and 25 ppm (ratios of 6:1, 8:1 and 1:0, respectively).

In general, tefluthrin acted in the same manner as bifenthrin; the higher the dose rate based on total media bulk density, the longer the residual activity. The long activity of tefluthrin in sand would seem to indicate that sand aids in residual activity, however all pine bark:sand media mixes lost activity before the sand alone, discounting this theory. At this time, the long residual activity of tefluthrin in sand is unexplained.

Due to the high costs of the insecticides approved for IFA containerized quarantine treatments, nurserymen would prefer to disregard sand and base their application rates on the bulk density of the other components in their media mix. In other words, incorporate 25 ppm of bifenthrin or tefluthrin into their potting media based on the bulk density of all the components of the media except the sand. At this time, based on the data presented here, we can not support such an application rate change. We will initiate another trial in 1995 in which media will be treated at 25 ppm based on bulk density of pine bark alone (pine bark and pure masonry sand will be the only media components) in an effort to support an application rate change based on sand content.

Table 6. Effect of Sand Content of Potting Media on Efficacy of Bifenthrin and Tefluthrin.

Chemical	Media Ratio Bark:Sand	Dose Rate (ppm)	% Alate Queen Mortality at Indicated Months Post Treatment												
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Talstar	0:1	3.2	100	100	100	100	100	100	100	100	100	100	100	100	100
	1:1	5.6	100	100	100	100	100	100	100	100	100	100	100	100	100
	2:1	7.6	100	100	100	100	100	100	100	100	100	100	100	100	100
	3:1	9.2	100	100	100	100	100	100	100	100	100	100	100	100	100
	6:1	12.6	100	100	100	100	100	100	100	100	100	100	100	100	100
	8:1	14.2	100	100	100	100	100	100	100	100	100	100	100	100	100
	1:0	25.0	100	100	100	100	100	100	100	100	100	100	100	100	100
Fireban	0:1	3.2	100	100	100	100	100	100	100	100	100	100	100	100	100
	1:1	5.6	100	100	100	100	100	100	100	100	90	65	100	100	100
	2:1	7.6	100	100	100	100	100	100	100	100	100	85	100	100	100
	3:1	9.2	100	100	100	100	100	100	100	100	95	100	100	100	100
	6:1	12.6	100	100	100	100	100	100	100	100	100	100	100	100	100
	8:1	14.2	100	100	100	100	100	100	100	100	100	100	100	100	100
	1:0	25.0	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	Bark	0.0	0	0	20	0	10	30	0	30	35	0	10	0	0
	Sand	0.0	5	5	15	10	5	10	0	10	20	0	10	5	10

Table 6. Cont.

Chemical	Media Ratio Bark:Sand	Dose Rate (ppm)	% Alate Queen Mortality at Indicated Months Post Treatment										
			(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Talstar	0:1	3.2	100	65	65	85	100	45	20	10	65		
	1:1	5.6	100	100	100	100	100	100	100	5	75		
	2:1	7.6	100	100	95	100	100	100	95	80	80		
	3:1	9.2	100	100	95	100	100	100	100	55	85		
	6:1	12.6	100	100	100	100	100	100	100	80	100		
	8:1	14.2	100	100	100	100	100	100	100	85	100		
	1:0	25.0	100	100	100	100	100	100	100	65	100		
Fireban	0:1	3.2	100	100	100	100	100	100	100	100	100		
	1:1	5.6	100	65	50	25	15	15	30	95	40		
	2:1	7.6	100	100	100	100	55	100	90	95	80		
	3:1	9.2	100	100	100	100	85	65	55	100	45		
	6:1	12.6	100	100	90	85	70	60	80	100	65		
	8:1	14.2	100	100	90	100	95	90	45	100	35		
	1:0	25.0	100	100	100	100	65	100	80	100	100		
Check	Bark	0.0	0	15	5	25	5	45	5	15	15		
	Sand	0.0	0	20	15	15	10	35	10	10	15		

PROJECT NO: FA01G024

PROJECT TITLE: Comparative Toxicities of Four Commonly Used Quarantine Insecticides to Imported Fire Ant Alate Females.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally and Anne-Marie Callcott

INTRODUCTION:

The Federal Imported Fire Ant (IFA) Quarantine (7CFR §301.81) approves the use of five insecticides in several use patterns to prevent ant infestation of plant nursery stock. Bifenthrin can be used as a preplant incorporate, container drench or topical treatment. Emulsifiable chlorpyrifos may be used as a container drench or a balled-and-burlapped immersion treatment. Granular chlorpyrifos is used to treat field-grown nursery stock in conjunction with a fire ant bait (hydramethylnon or fenoxycarb), or to treat grass sod. Diazinon may be used in certain states under section 24(c) of FIFRA for treatment of containerized nonbearing blueberries and fruit and nut plants. Tefluthrin, a granular pyrethroid, received label approval from EPA for use as a preplant incorporate in May 1993, and obtained APHIS approval as a quarantine treatment in Sept. 1994. Prior to inclusion in the Federal IFA Quarantine, all of these chemicals underwent rigorous trials to determine efficacy rates and residual activity in nursery potting media under simulated and/or actual nursery conditions.

Little work to determine the actual toxicity (i.e. LC, LC) of these insecticides (excluding the baits) to IFA has been done. Oi (unpublished data) incorporated granular formulations of bifenthrin (0.2%) and tefluthrin (1.5%) into a typical nursery potting media at various dose rates and bioassayed the treated media to determined LC. The LC for bifenthrin was 5.17 ppm and for tefluthrin was 19.01 ppm. A study in 1979 (Collins 1980) determined that in local sandy topsoil, chlorpyrifos had a LC of 0.18 ppm and LC of 0.28 ppm for IFA workers. In 1987, studies using technical chlorpyrifos in local sandy topsoil showed a LC of 0.35 ppm to IFA workers and 1.75 ppm to alate females (Callcott et al. 1988). However. sandy topsoil and nursery potting media are very different materials: topsoil is primarily mineral in content whereas nursery potting media. regardless of origin, is primarily organic in composition. It is well documented that many factors including organic matter affects the efficacy of chlorpyrifos (Callcott 1989). Callcott & McAnally (1988) determined chlorpyrifos in Strong-Lite® potting media to have a LC_{99} of 1.98 ppm against IFA workers and 4.00 ppm against alate females. Eger & Hall (1988, unpublished data) found soil type to greatly affect the toxicity rate of chlorpyrifos to IFA workers; LC_{50} in sand was 0.067 ppm and in muck was 0.882 ppm.

In this trial, toxicity rates for chlorpyrifos, diazinon, bifenthrin and tefluthrin against IFA alate females will be determined in a variety of nursery potting media.

MATERIALS AND METHODS:

Technical material was obtained from the appropriate company for each of the chemicals to be tested: chlorpyrifos, diazinon, bifenthrin and tefluthrin. The nursery potting media used included two mixes from commercial nurseries, and one commercially available bedding mix. Table 7 shows media components and characteristics.

Test procedures described elsewhere were slightly modified (Banks et al. 1964, Collins & Ladner 1981, Collins et al. 1982). A stock solution for each chemical was prepared with acetone. Serial dilutions were then added to 50 to 100 g of media to obtain desired dose rates. Additional acetone, to bring total liquid to a level required for total media saturation, was added. Media was dried under a hood for 24 hrs prior to treatment. After treatment, the solvent was evaporated by drying under a hood for 2-4 hrs. Check media was treated with a proportional amount of acetone only and dried under a hood. All media was returned to 30% moisture prior to bioassay. Standard laboratory bioassays using IFA alate females were performed (Appendix II).

RESULTS:

The LC_{50} of Dursban against IFA alate females was determined to be approximately 2.4 ppm in the Flowerwood mix (Figure 1), 1.3 ppm in the MAFES mix (Figure 2) and 7.0 ppm in the Grace Sierra mix (Figure 3). These data support the theory that soil composition greatly effects the efficacy of chemicals used in preplant incorporation. Testing is currently being conducted to determine the LC_{50} of bifenthrin in the same soil mixes and will continue with the other compounds listed above.

Table 7. Components and Characteristics of Nursery Potting Media.

Media Type	Components	Bulk Density (lb/cu yd)	pH	% Organic Matter
MAFES mix Gulfport, MS	3:1:1 mix by volume of pine bark: sand: sphagnum peat moss	900	*	*
Flowerwood Nursery mix	19:3 pine bark:sand	920	*	*
Grace Sierra	Canadian sphagnum peat moss horticultural Vermiculite processed bark ash washed sand wetting agent	250	*	*

* not yet determined

Figure 1. Linear Regression for LC Rates of Chlorpyrifos in Flowerwood Media.

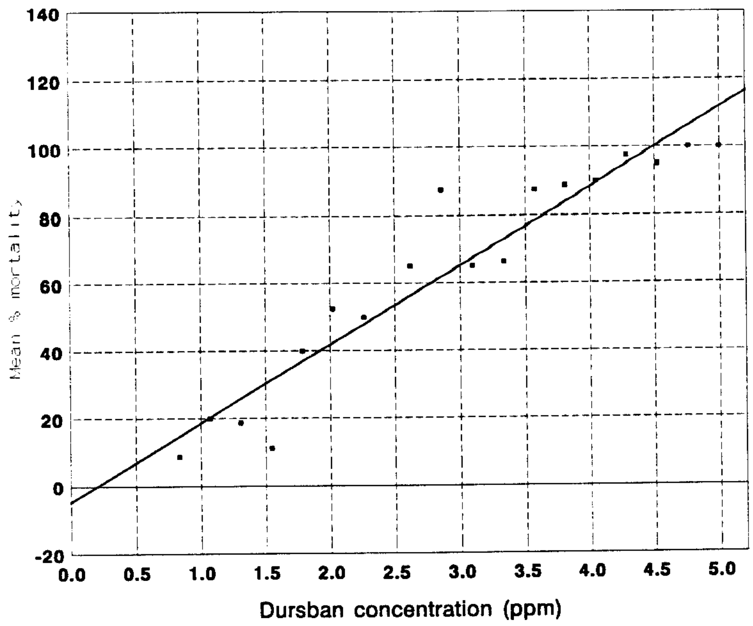


Figure 2. Linear Regression for LC Rates of Chlorpyrifos in MAFES Media.

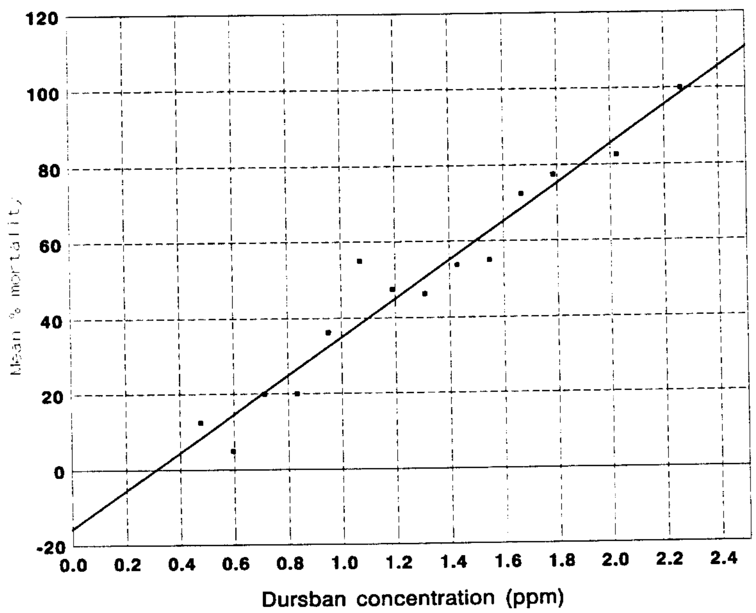
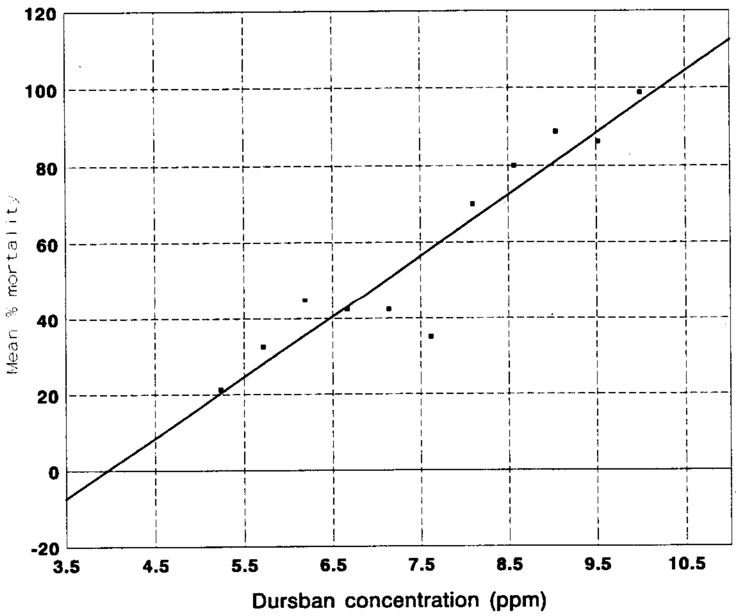


Figure 3. Linear Regression for LC Rates of Chlorpyrifos in Grace Sierra Media.



PROJECT NO: FA01G110

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

TYPE REPORT: Final

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, tefluthrin and chlorpyrifos 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 trial described herein.

MATERIALS AND METHODS:

Toxicants were blended into media on site at Greenleaf Nursery in media consisting of 5:2:1 mix of pine bark, sand and rice hulls. Mixing of toxicants into the media mixture was accomplished on 20 August, 1991, with 3.0 cu ft cement mixers. Force® 1.5G (tefluthrin) was incorporated into the Greenleaf mix at rates of 25 and 50 ppm. 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 (ca 18.4 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).

RESULTS:

All treatments provided excellent control through 20 months (Table 8). By month 21. Force (25ppm) efficacy had begun to degrade. By month 24. Force at 50 ppm had become inconsistent. Dursban (Labmix) rapidly degraded beginning at month 30 and dropped precipitously at month 31, at which point. the study was discontinued.

Table 8. 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)///(19)		(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)
			(1)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)
Force 1.5G	Greenleaf	25	100	100	100	55	45	90	95	55	10	5	15	5	0	0
	Greenleaf	50	100	100	100	100	100	100	85	100	20	90	80	25	25	20
Check	Greenleaf	--	15	10	10	0	5	5	0	5	15	5	0	5	0	0
Dursban 2.5G	IFA mix	per label[1]	100	85	100	100	100	100	100	100	60	100	100	100	65	5
Check	IFA mix	--	20	5	0	10	0	0	0	20	20	30	25	0	5	0

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

PROJECT NO: **FA01G083**

PROJECT TITLE: Phytotoxicity of Tefluthrin (Force® 1.5G) to Selected Woody Ornamental Plants.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Phytotoxicity trials are one further step in the testing process for all promising quarantine treatments tested at the IFA lab. Several phytotoxicity trials have already been conducted with tefluthrin with promising results. This test is being conducted to expand the data base. Previous tests utilized herbaceous as well as woody ornamentals and were terminated at either 90 or 180 days. While this time span is ideal for herbaceous plants, it does not include an entire growth cycle for woody perennials. This test will be conducted for 1 year (complete growth cycle).

MATERIALS AND METHODS:

Liners of 12 varieties of woody ornamental plants were transplanted into standard 1-gallon nursery containers containing either 1X (25ppm), 3X (75ppm) of tefluthrin, treated media or untreated media. Seven plants per rate per cultivar were used. Plant varieties used were as follows:

Rhododendron obtusum japonicum 'Coral Bells'	Coral Bells Azalea
Photinia serrulata	Chinese Photinia
Ligustrum recurvifolium	Curlyleaf Japanese Privet
X Ilex 'Needlepoint'	Needlepoint Holly
Rhododendron spp. 'Red Ruffles'	Red Ruffles Azalea
Buxus sempervirens 'Wintergreen'	Wintergreen Boxwood
Rhaphiolepis indica	Indian Hawthorn
Gardenia jasminoides 'Radicans'	Dwarf Gardenia
X *Juniperus* 'Blue Pacific'	Blue Pacific Juniper
X 17ex 'Carissa'	Carissa Holly
Cleyera japonica	Japanese Cleyera
Ilex vomitoria nana	Dwarf Yaupon Holly

Media consisted of pine bark, peat moss and river sand (3:1:1) with a dry weight bulk density of 750 lbs/cu yd. The following amendments were also added (per cu yd): 4 lb dolomite, 1 lb fertilizer (25-10-0), 1 lb superphosphate (0-20-0) and 1 lb micromix. Media was blended and treated with Force 1.5G (currently marketed as Fireban®) on June 28-29, 1993. Plants were transplanted on June 30, 1993. Plants were then subjected to normal nursery "growing on" practices for one year. A pulsating overhead irrigation system supplied ca 1-1½" water per week. At one year post-treatment 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:

An interim visual evaluation was made on December 17, 1993 (approximately six months post-treatment). No noticeable differences between the 1X, 3X and untreated blocks of each variety were observed. Final evaluation as noted above was conducted on June 30, 1994. Results are summarized in Table 9. Statistical analysis shows no significant difference in any rating except the top biomass weight of Japanese Cleyera and Dwarf Yaupon Holly. Analysis of the Dwarf Yaupon

Holly indicates possible growth enhancement at the 3X rate.

Five of the seven replicates in the 1X block of Japanese Cleyera were consistent with the 3X and check replicates. The two replicates that were below the norm were possibly planted too deep when transplanted thus causing retarded growth. No phytotoxicity was on any of the species tested in this trial.

Table 9. Comparison of Various Health Ratings to Determine Phytotoxicity of Tefluthrin to Selected Woody Ornamentals.

SPECIES	RATE	MEAN TOP BIOMASS RATING	MEAN TOP BIOMASS WT(g)	MEAN ROOT RATING
Coral Bells Azalea	1X	1.0a	24.0a	1.6a
	3X	1.0a	23.3a	1.7a
	CK	1.3a	18.7a	2.0a
Chinese Photinia	1X	1.1a	37.3a	1.4a
	3X	1.0a	33.3a	2.3a
	CK	1.0a	34.7a	1.9a
Curlyleaf Japanese Privet	1X	1.0a	61.0a	2.1a
	3X	1.0a	63.7a	2.1a
	CK	1.0a	59.9a	2.4a
Needlepoint Holly	1X	1.0a	63.1a	2.0a
	3X	1.0a	51.3a	1.7a
	CK	1.0a	57.4a	2.0a
Red Ruffles Azalea	1X	2.0a	27.7a	1.6a
	3X	2.0a	32.6a	2.0a
	CK	2.1a	27.6a	2.0a
Wintergreen Boxwood	1X	1.2a	38.4a	2.3a
	3X	1.3a	32.6a	2.0a
	CK	1.2a	31.7a	2.0a
Indian Hawthorn	1X	1.0a	37.4a	2.0a
	3X	1.0a	37.3a	2.1a
	CK	1.0a	40.3a	2.0a
Dwarf Gardenia	1X	1.6a	37.5a	1.9a
	3X	1.0a	31.3a	2.1a
	CK	1.0a	39.4a	2.0a
Blue Pacific Juniper	1X	1.1a	13.3a	2.1a
	3X	1.1a	17.6a	2.1a
	CK	1.0a	13.0a	1.9a

SPECIES	RATE	MEAN TOP BIOMASS RATING	MEAN TOP BIOMASS WT(g)	MEAN ROOT RATING
Carissa Holly	1X	1.2a	37.1a	2.0a
	3X	1.2a	34.0a	2.3a
	CK	1.2a	34.9a	1.9a
Japanese Cleyera	1X	1.3a	37.7a	2.3a
	3X	1.0a	61.6b	2.0a
	CK	1.0a	61.0b	1.9a
Dwarf Yaupon Holly	1X	1.2a	13.9a	1.7a
	3X	1.2a	24.3b	2.3a
	CK	1.2a	14.6a	1.9a

For each plant variety, means within a column followed by the same letter indicate no significant difference (Tukey's Test, P=0.05).

PROJECT NO: FA01G163

PROJECT TITLE: Relative Phytotoxicity of Tefluthrin [Fireban® 1.5G] to Selected Foliage and Woody Ornamental Plants, 1994.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Tim Lockley, Adolph J. Laiche, Jr. [Mississippi Agricultural & Forestry Experiment Station, Poplarville. MS] & James Stephenson [Alabama Ornamental Horticultural Substation, Mobile, AL].

INTRODUCTION:

Fireban 1.5G (tefluthrin) began to show promise as a preplant incorporated treatment for potting media in a preliminary efficacy trial initiated in December 1988. Subsequent trials led to registration of tefluthrin in May 1993. We studied potential phytotoxic effects of Fireban 1.5G in this and other studies (FA01G083 and FA01G212).

MATERIALS AND METHODS:

All experiments were carried out in cooperation with the Mississippi Agricultural and Forestry Experiment Station [MAFES], South Mississippi Branch, Poplarville, MS and the Alabama Ornamental Horticultural Substation, Mobile. AL.

TRIAL I:

Eight woody ornamental cultivars 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 18 August 1993 at rates of 1X (25 ppm) and 3X (75 ppm). On 29 March 1994, all plants were transplanted to 2 gallon capacity containers containing Fireban

1.5G at rates used in the original summer planting. On 27 May 1994, *Betula nigra* (river birch), *Cyrilla racemiflora* (Titi), and *Myrica cerifera* (wax myrtle) were pruned and weighed and fresh weight of the clippings were recorded. River birch, Titi, Wax Myrtle and *Gardenia* sp. were pruned and weighed on 18 July, 1994 and the fresh weight of the clippings for each plant were recorded.

On 6 October 1994, 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.

TRIAL II:

Nine selected woody ornamental cultivars were transplanted from liners into pots containing media into which Fireban 1.5G was incorporated at 25 ppm (1X) and 75 ppm (3X) on 13 September, 1993. Seven replicates/cultivar treatment were established in a randomized complete block design. Shoots and roots were observed for possible phytotoxicity. Plants were sacrificed on 19 October 1994 and evaluations made as described in Trial I.

TRIAL III:

Fourteen cultivars of foliage plants were transplanted from plugs and liners into 3 quart containers on 16 August, 1994 following procedures as described above. All plants were sacrificed and evaluated on 7 October 1994.

RESULTS AND DISCUSSION:

TRIAL I:

No significant differences were noted for top fresh weight or root structure for B. nigra, I. cornuta, L. sinense, or M. cerifera (Table 10). Higher shoot fresh weights were noted for C. leylandis, C. racemiflora, and Gardenia at the 1X rate and for root structure at the 1X and 3X rates for Q. virginiana. No phytotoxicity was indicted among any of the cultivars.

TRIAL II:

No significant differences were observed within cultivars for either fresh shoot weight or root structure (Table 11).

TRIAL III:

Among the 14 foliage cultivars, no significant differences in root structure were noted (Table 12). However, there were significant differences at the 1X treatment level for A. majus, Celosia sp., Spathiphyllum sp., S. podophyllum and V. tinus and at the 3X level of treatment for A. cathartica, A. majus, P x. hybrida, Spathiphyllum sp. and V. tinus. No phytotoxic response was observed within any of the cultivars tested.

Table 10. Relative Phytotoxic Response of Eight Selected Varieties of Woody Ornamental Plants in Media Incorporated with Granular Tefluthrin.

CULTIVAR	SHOOT FRESH WEIGHT [g]			ROOTS		
	CK	1X	3X	CK	1X	3X
Betula nigra River Birch	938.0a	876.3a	901.1a	2.0a	2.1a	2.1a
Cupressocyparis leylandis Leyland Cypress	784.6a	839.0b	795.1a	2.0a	2.0a	2.0a
Cyrilla racemiflora Titi	796.4a	999.8b	849.3a	2.0a	2.3a	2.1a
Ilex cornuta 'Anicet Delcambre'	251.2a	191.9a	231.9a	2.0a	2.0a	2.0a
Gardenia 'Mystery'	1442.2a	1549.0b	1493.3ab	2.0a	2.0a	2.0a
Ligustrum sinense 'Variegated'	164.4a	155.6a	179.3a	1.9a	2.0a	2.1a
Myrica cerifera Wax Myrtle	2518.7a	2523.8a	2592.4a	2.0a	2.0a	2.0a
Quercus virginiana Live Oak	384.8a	376.5a	388.7a	1.7a	2.0b	2.1b

Table 11. Relative Phytotoxic Response of Eleven Selected Varieties of Woody Ornamental Plants in Media Incorporated with Granular Tefluthrin.

CULTIVAR	SHOOT FRESH WEIGHT (g)			ROOTS		
	CK	1X	3X	CK	1X	3X
Abelia x _grandiflora_ 'sherwoodii'	121.1a	140.7a	138.9a	2.0a	2.1a	2.0a
Buxus sempervirens	36.0a	39.1a	38.9a	2.1a	2.1a	2.0a
Ilex cornuta 'fine line'	46.9a	41.4a	53.4a	2.0a	2.0a	2.0a
Ilex crenata 'bee hive'	138.6a	128.5a	134.3a	2.0a	2.0a	2.1a
Ilex crenata 'soft touch'	55.1a	53.1a	60.0a	1.9a	2.0a	2.0a
Ilex latifolia 'Wirt L. Winn'	52.6a	45.1a	49.7a	2.0a	2.1a	2.0a
Ilex vomitoria 'Stokes dwarf'	80.9a	78.1a	76.8a	2.0a	2.0a	2.1a
Rhododendron 'copperman'	121.4a	115.1a	116.0a	1.9a	2.1a	2.1a
Rhododendron 'Hershey's red'	134.3a	147.4a	129.3a	2.0a	2.0a	2.0a

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

Table 12. Relative Phytotoxic Response of Fourteen Selected Varieties of Foliage Plants in Media Incorporated with Granular Tefluthrin.

CULTIVAR	SHOOT FRESH WEIGHT (g) CK	1X	3X	ROOTS CK	1X	3X
Allamanda cathartica 'cherry jubilee'	45.4a	56.4ab	63.3b	2.0a	2.0a	2.0a
Antirrhinum majus 'snapdragon'	39.1a	50.0b	55.5b	2.0a	2.0a	2.0a
Celosia sp. 'kimono mix'	53.7a	59.9b	56.4ab	2.0a	2.1a	2.1a
Coleus sp. 'velvet wizard'	117.1a	119.2a	115.9a	2.0a	2.0a	2.1a
Lantana camara 'gold mound'	60.7a	61.9a	60.9a	1.9a	1.9a	2.0a
Melampodium paludosum 'showstar'	176.6a	188.3a	192.3a	2.0a	1.9a	2.1a
Musa acuminata 'rajapura dwarf'	149.1a	138.8a	158.3a	2.0a	2.0a	2.1a
Nandina purpurea 'dwarf'	10.4a	10.7a	9.9a	2.0a	2.1a	2.1a
Petunia x hybrida (single) 'ultra burgundy'	110.0a	113.6a	125.9b	2.1a	2.2a	2.0a
Spathiphyllum sp. 'petite'	3.7a	6.9b	12.4c	2.0a	2.0a	2.1a
Syngonium podophyllum 'robusta'	8.3a	12.8b	7.3a	1.9a	2.1a	1.9a
Tagetes sp. (deep orange) 'French janie'	136.7a	143.4a	137.9a	2.0a	2.0a	2.0a
Viburnum tinus 'Laurustinus'	28.9a	39.1b	35.6b	1.9a	2.1a	2.0a
Viola wittrockiana 'major giant'	46.4a	40.7a	42.6a	2.0a	2.0a	2.1a

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

PROJECT NO: FA01G032

PROJECT TITLE: Effect of Irrigation on a Controlled Release Formulation of Chlorpyrifos.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott

INTRODUCTION:

Incitec Ltd. (Brisbane, Australia) produces a controlled release formulation of chlorpyrifos for control of grass grubs. This formulation, suSCon® Green, contains 10% chlorpyrifos in a polymer matrix and is sized as a 1.0 mm particle. Several trials by the IFA Station using suSCon Green as a preplant incorporate have not been successful (FA01G139, FA01G020 and FA01G100), while one trial (FA01G210) conducted in Whiteville, NC provided 16 months residual activity when suSCon was incorporated at a rate of 100 ppm. The Whiteville study was conducted under actual nursery conditions and therefore subjected to a regular irrigation schedule. This trial was initiated to study the effects of two irrigation schedules on various application rates of suSCon Green and on its ability to release the active ingredient into the media.

MATERIALS AND METHODS:

suSCon Green was incorporated into MAFES mix media (3:1:1 pine bark: sand:sphagnum peat) at rates of 100, 200 and 400 ppm on February 11, 1992 using a portable cement mixer. Treated media was placed in standard one gallon plastic nursery pots. One group of pots (all treatment rates and untreated check media) was subjected to a standard irrigation schedule; ca. 1-1½ inches of irrigation per week in addition to natural rainfall. Another group (including check media) was subjected to 4 inches of irrigation per week in addition to rainfall. At monthly intervals, three pots from each treatment were composited and subjected to standard IFA alate queen bioassay (Appendix II).

RESULTS:

Media under a standard irrigation program regardless of treatment rate has maintained excellent activity against IFA alate females for 22 mths (Table 13). Media treated with 400 ppm of suSCon and subjected to excessive irrigation has shown erratic activity since the 10 mth posttreatment (PT) bioassay. The two lower rates receiving excessive irrigation became erratic around 15 mth PT. Thus, excessive irrigation does appear to accelerate the time release action of the suSCon carrier particle. This study also supports numerous other trials that indicate that chlorpyrifos residual activity regardless of formulation is enhanced in this particular media type.

Table 13. Residual Activity of suSCon Green when Subjected to Various Amounts of Irrigation.

Amount H_2O per week (inches)	Dose Rate (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)	(19)	(20)	(21)	(22)	(23)	(24)
1-1.5 (normal)	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
	200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	400	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Check	0	30	20	25	10	20	5	20	10	0	15	5	5	15	10	5	15	20	5	5	15	0	5	0
4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	100	100	65	75	25	50	0	15	0
	200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	90	100	85	100	40	55	20	90
	400	100	100	100	100	100	100	100	100	100	50	85	85	100	50	90	80	100	50	100	50	80	15	0	5
	Check	0	5	5	25	25	5	0	30	5	5	0	0	0	10	30	10	30	20	10	15	5	10	5	0

PROJECT NO: FA01G013

PROJECT TITLE: Residual Effects of suSCon® Green in Various Media.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

suSCon Green 10CR is a controlled release formulation of chlorpyrifos containing 10% active ingredient. This formulation is produced by Incitec Ltd. (Brisbane, Australia) and is used extensively against grass grubs in Australia and New Zealand. Several tests were conducted to determine residual activity when applied as a preplant incorporate. These first trials were conducted at the IFA lab in Gulfport, MS and were not successful (FA01G139, FA01G020, FA01G100). However one trial (FA01G210) conducted at Whiteville, NC provided 16 months residual activity when incorporated at 100ppm. Another trial (FA01G032) provided 24 months residual activity at 100, 200, and 400ppm under standard irrigation (1.0-1.5 inches/wk) and 10-15 months activity under excessive irrigation (4.0 inches/wk).

Numerous prior trials have shown that other chlorpyrifos formulations will vary in residual activity based on media type (FA01G069, FA01G200, and FA01G151). The purpose of this trial is to determine what effect, if any, media type has on this formulation of chlorpyrifos.

MATERIALS AND METHODS:

suSCon Green 10CR was mixed into 3 different media using two portable electric cement mixers:

Media	Producer	Composition	Bulk Density (lb/cu yd)
Grace Sierra	Grace Sierra Horticultural Prod. Milpitas, CA	sphagnum peat, perlite, vermiculite, bark ash, bark, sand, starter fertilizer, wetting agent	380
Green Forest	Green Forest Nursery Perkinston, MS	composted pine bark	564
MAFES	IFA Station mix Gulfport, MS	3:1:1 green pine bark: sphagnum peat: sand	749

Each media was blended in 1.5 cu yd increments at rates of 200 ppm and 400 ppm. Seventy-two one-gallon nursery containers were filled with media at each rate. Twenty-four containers were filled with each untreated media as a check. All pots were then placed out doors under a pulsating overhead irrigation system which supplied ca 1-1½" water per week. Three pots from each treatment were collected and composited monthly and a 80-100cc subsample was subjected to standard alate queen bioassay (Appendix II).

<u>RESULTS</u>:

suSCon mixed in the MAFES potting media maintained excellent control at 200 and 400 ppm through 22 and 24 months, respectively (Table 14). The Green Forest mixture maintained 100% control through 7 months at both rates with the exception of a drop to 75% at 4 months in the 400 ppm rate. The Grace Sierra mixture provided 100% mortality for only 3 months at both rates. Testing of both the Green Forest and Grace media was discontinued after 11 months. These results are consistent with previous trials utilizing other chlorpyrifos formulations in various media, i.e. media type affects residual activity of chlorpyrifos regardless of formulation.

Table 14. Efficacy of suSCon Green 10CR in Various Media Types.

Media Type	Dose Rate (ppm)	% Mortality to Alate Queens at Indicated Months Posttreatment																		
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(14)	(16)	(18)	(20)	(21)	(22)	(23)	(24)
Grace Sierra	200	100	100	100	85	75	30	25	45	40	15	5	*								
	400	100	100	100	50	85	55	50	60	25	45	25	*								
	Check	0	0	5	10	0	0	0	15	10	15	0									
Green Forest	200	100	100	100	100	100	100	100	65	25	20	15	*								
	400	100	100	100	75	100	100	100	85	75	20	20	*								
	Check	0	0	5	10	0	5	10	5	15	10	5									
MAFES	200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	95	90	80
	400	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Check	35	5	10	5	5	0	0	10	5	5	10	5	10	0	5	5	10	0	15	5

* dropped due to decreased efficacy

PROJECT NO: FA01G014

PROJECT TITLE: Release Rate of suSCon® Green as Determined by GLC Analysis.

TYPE REPORT: Interim

LEADERS/PARTICIPANTS: Homer Collins, Joe Ford (NMRAL)[2], Anne-Marie Callcott and Randy Cuevas

INTRODUCTION:

suSCon Green is a controlled release chlorpyrifos formulation manufactured by Incitec Ltd (Australia) and marketed in Australia, New Zealand, and other countries for control of white grubs and other soil pests. We have successfully controlled IFA in grass sod using this formulation. However, when incorporated into potting media, erratic results were obtained, depending upon the type of potting media in use. This trial was initiated to determine the rate of release of the insecticide from the carrier.

MATERIALS AND METHODS:

suSCon Green (10% code # G01014) was incorporated into MAFES potting media ("green" pine bark, sand and sphagnum peat moss) at a rate of 400 ppm in March 3, 1994. The treated media was placed in 1-gal nursery pots and aged outdoors under simulated nursery conditions (automatic irrigation). Twenty-four hours after incorporation, and on a monthly basis thereafter, 3 pots were composited and one 200 g sample and three 1,000 g samples were removed. The 200 g sample was subjected to standard IFA alate queen bioassay (Appendix II). From each of the 1,000 g samples, the suSCon granules were separated from the media by the following method.

Each 1.000 g treated media sample was spread in a thin layer in a laboratory tray and dried for 24 hrs under incandescent lights. The dried material was then sieved using Hubbard screen sieves, mesh sizes of 6, 10, 20 and 38 squares/linear inch. Material retained by the #38 screen were placed in a K_2CO_3 solution

[2] USDA, APHIS, BBEP National Monitoring & Residue Analysis Laboratory, 3505 25th Ave., Gulfport. MS

(specific gravity 1.12) and the material which floated skimmed off. This procedure allowed the sand to be separated from the lighter material which included the suSCon granules. The "skimmed" material was again air dried overnight. At this time, the granules were separated from the remaining media material by an airflow system. A Vidal Sassoon Cold Shot™ 1500 hand held hair dryer equipped with a rheostat (light dimmer) to control the air flow was used to provide an air flow system. An 11" polypropylene cylinder with a 1⅞" inner diameter (i.d.) was cut into two pieces; one 7¼" and one 3¾". A wire screen, with ca 0.4 mm openings, was placed between the pieces of cylinder and glued in place (Figure 4). The airflow system was assembled as shown in the figure. Small amounts of the material to be separated were poured into the cylinder and the dryer turned on with the rheostat set at a speed which will eject the lighter media material (small particles of peat moss and pine bark), but not the heavier suSCon granules. Any remaining media material was removed by hand.

Three 0.5 g sample of separated suSCon granules were submitted to NMRAL on a monthly basis and the percent of active ingredient remaining in the granules determined by NMRAL.

<u>RESULTS</u>:

suSCon Green has provided 9 mths of residual activity (Table 15). However, % chlorpyrifos in the granules removed from the aged potting media has decreased from a theoretical of 10% (actual 8% at 24 hrs PT) to 2.51% at 7 mths PT (Table 16), showing a gradual release rate, which has thus far not adversely affected the residual activity of the material. A comparison of residual activity and % chlorpyrifos content is shown in Figure 5.

Figure 4. Assembly of Airflow System Using Vidal Sassoon Cold Shot 1500 Hair Dryer.

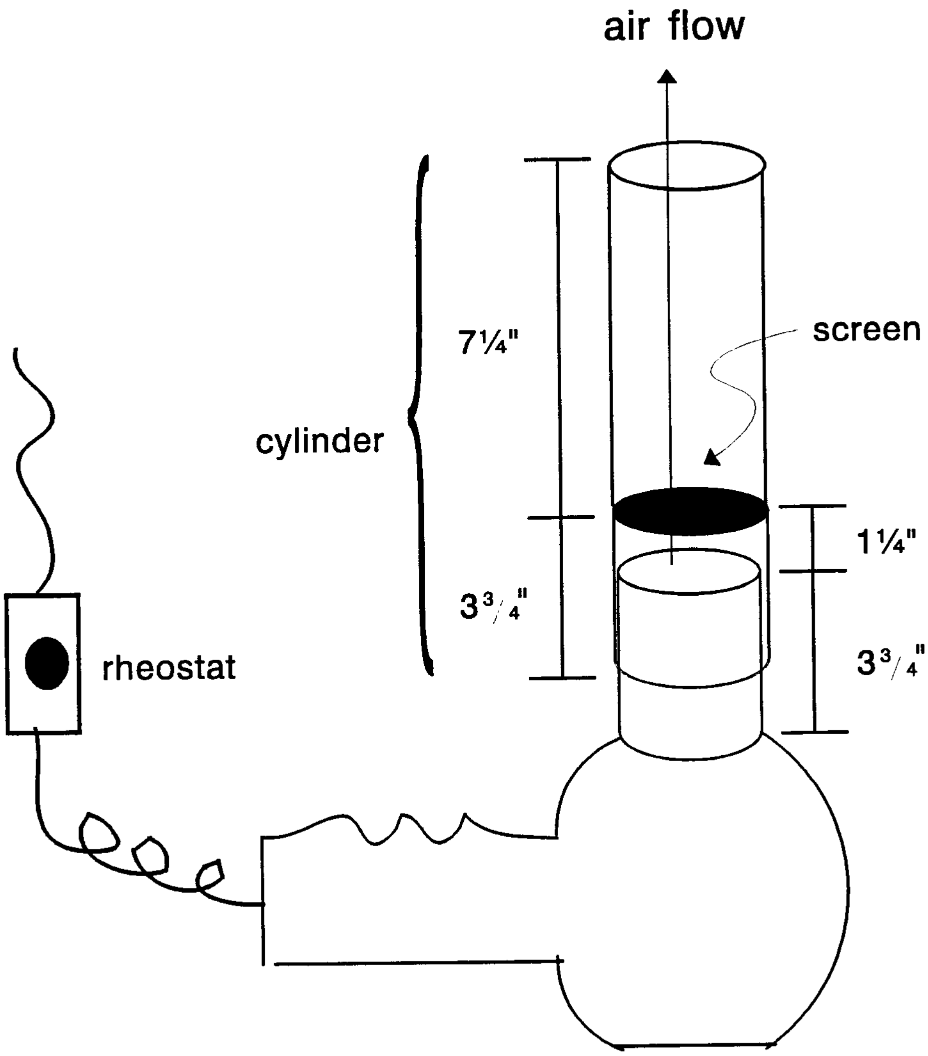


Table 15. Residual Activity of suSCon Green in MAFES Potting Media.

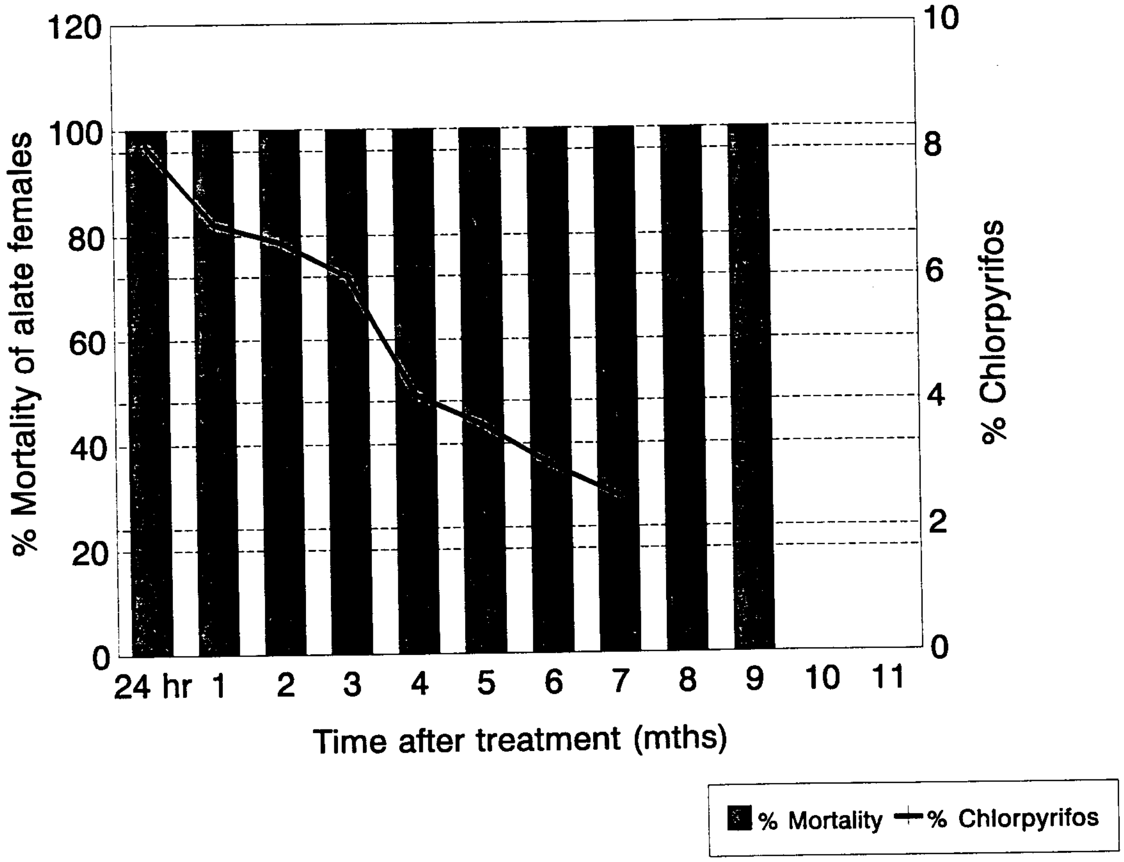
Treatment	% Mortality of Alate Females at Indicated Mths PT									
	(24 h)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
suSCon Green	100	100	100	100	100	100	100	100	100	100
Check	5	0	5	20	10	15	30	5	15	5

Table 16. Results of GLC Analysis of suSCon Granules Retrieved from Aged Potting Media.

Mean % chlorpyrifos content at indicated mths post treatment[1]									
(24 h)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8.07	6.85	6.55	6.00	4.10	3.63	3.01	2.51		

[1] mean of three 0.5g replicates

Figure 5. A Comparison of Residual Activity (% mortality) of suSCon Green and the Degradation Rate of Chlorpyrifos (% chlorpyrifos).



PROJECT NO: FA01G052

PROJECT TITLE: Effect of New Pine Bark vs. Old (Composted) Pine Bark in Nursery Media on Residual Activity of Chlorpyrifos.

TYPE REPORT: Final

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 great discrepancies compared 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 good control through 24 months. 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.

MATERIALS AND METHODS:

This trial was initiated on June 9, 1992 and four media types were evaluated. Media composition and bulk density are as follows:

Media	Composition	Bulk Density (lb/cu yd)
Green (fresh) pine bark	100% green pine bark	344
Composted (aged) 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

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.

Bioassay
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. A pulsating overhead irrigation system supplied ca 1-1½" water 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 (Appendix II).

RESULTS:

Particle Size

Particle size of the two types of pine bark used in the trial are 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

Bioassay

At 3 months post-treatment, the chlorpyrifos incorporated in the composted bark began to decline (Table 17). All other treatments remained at 100% efficacy through 15 months. After 15 months the mixed media containing composted pine bark also began to decline. Both treatments using green bark maintained 90% or better through 24 months. These results are an indication that the composting process of the bark may influence the residual properties of chlorpyrifos. These results may indicate that the presence of certain compounds (such as terpines) which eventually "weather" out of pine bark may somehow enhance residual activity of chlorpyrifos.

Table 17. Influence of Pine Bark Age on Residual Activity of Granular Chlorpyrifos.

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)	(19)	(20)	(21)	(22)	(23)	(24)
Green Bark Mix	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Composted Bark Mix	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	35	0	15	*					
Green Bark	100	100	100	100	100	100	100	100	100	100	90	100	100	100	100	100	90	100	95	100	100	100	100	100
Composted Bark	100	100	100	35	10	5	5	10	5	5	0	5	10	5	15	10	10	0	*					
Check	5	0	5	10	10	0	10	10	10	10	0	15	0	5	0	5	5	0	0	5	0	15	5	0

PROJECT NO: FA01G122

PROJECT TITLE: Residual Activity of Chlorpyrifos in Potting Media when Pine Bark was Used as an Inert Carrier for the Pesticide.

PROJECT TYPE: Interim

LEADER/PARTICIPANT(s): Tim Lockley, Lee McAnally, Randy Cuevas & James Stevenson (Ala. Hort. Exper. Substation)

INTRODUCTION:

In the late 1970's, experiments with chlorpyrifos at the IFA 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), the earlier results were repeatable. These results led to speculation that either sphagnum peat moss or pine bark was enhancing the residual of chlorpyrifos. This trial was begun to determine the potential of pine bark as a carrier to enhance residual activity of chlorpyrifos.

MATERIALS AND METHODS:

Green "new" pine bark was ground in a laboratory grinder (Model 4E, Quaker City Mill, Philadelphia, PA; Westinghouse 1/3 h.p. AC motor) 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 (2 - 4 mm). Chlorpyrifos was added to the milled bark 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 ground pine bark in a 2 cu ft cement mixer for 15 minutes. The formulated pine bark was then spread at a depth of 1-1½ inches in an open container and allowed to air dry for 48 hours. Sphagnum peat moss was screened and chlorpyrifos was formulated onto the screened peat as described above for the milled' pine bark.

Each of the components and component combinations was subjected to gas chromatographic (GC) analysis conducted at the National Monitoring and Residue

Analysis Laboratory in Gulfport, MS to insure accurate formulation.

Comparative studies were undertaken with the pine bark formulated material and other candidate treatments at the IFA lab in Gulfport, MS, Alabama Agricultural Experiment Station at Mobile, AL, and at the Florida State Horticultural Experiment Station 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 chlorpyrifos on pine bark formulation was incorporated into the media at the rate of 1.0 lb cu yd (83.3 ppm). Pine bark without chlorpyrifos was mixed in an equivalent amount for an untreated check. Two chlorpyrifos formulations, 2.5% on peat moss and suSCon® Green 10CR (Incitec Ltd., Brisbane, Australia), were selected for comparison and incorporated into Grace Sierra media at 83.3 and 400 ppm, respectively. The 2.5% chlorpyrifos on a peat moss carrier was formulated in much the same manner as the pine bark formulation and is described in FA01G012 (1992 IFA Annual Report). Force® 1.5G and Commodore® 10WP were incorporated at 25 ppm into 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).

RESULTS:

At 30 days post-treatment, all replicates at all sites caused 100% mortality to alate queens (Table 18). As replicates at the Homestead site were destroyed by Hurricane Andrew in late August 1992, only one sample was taken from that site. By month 2, of the chlorpyrifos mixtures, only the Mobile pine bark formulation 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 at 28 months. While green pine bark as a major media component appears to enhance residual activity of chlorpyrifos (FA01G052), it does not enhance the activity when used as an inert carrier for chlorpyrifos.

Table 18. Relative Efficacy of Three Chlorpyrifos and Two Synthetic Pyrethroid Formulations in Selected Media to IFA Alate Queens.

Test Site	Treatment		% Mortality to Alate IFA Queens at Indicated Months Posttreatment					
	Formulation	Rate (ppm)	(1)	(2)	(3)	(4)	///	(28)
Gulfport, MS	Force 1.5G	25	100	100	100	100		100
	Commodore 10WP	25	100	100	100	100		100
	suSCon Green	400	100	30	35	--		
	Peat Moss 2.5G	83	100	25	45	--		
	Pine Bark 2.5G	83	100	20	20	--		
Mobile, AL	Force 1.5G	25	100	100	100	100		100
	Commodore 10WP	25	100	100	100	100		100
	suSCon Green	400	100	70	50	--		
	Peat Moss 2.5G	83	100	80	15	--		
	Pine Bark 2.5G	83	100	100	65	--		
Homestead, FL	Force 1.5G	25	100	--*				
	Commodore 10WP	25	100	--*				
	suSCon 10CR	400	100	--*				
	Peat Moss 2.5G	83	100	--*				
	Pine Bark 2.5G	83	100	--*				
Check			0	35	20	0		0

* Trial destroyed by Hurricane Andrew

PROJECT NO: FA01G044

PROJECT TITLE: Granular Acephate Formulations as a Topical Treatment for Certification of Containerized Nursery Stock.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Acephate, registered as a soluble powder (75S), has long been touted as an individual mound treatment for control of IFA. Granular formulations of this product when incorporated into potting media have provided no residual activity against IFA (FA01G092). However, topical, or over-the-top, treatments have been successful at eliminating IFA colonies established in a container (FA01G072, FA01G152). To certify containerized stock that was to be shipped within a few days, a topical treatment that would eliminate any existing colony would be an additional quarantine tool for nurserymen to use to battle IFA.

MATERIALS AND METHODS:

Two granular acephate formulations were used; Orthene® 5G and Pinpoint™ 15G, both provided by Valent USA Corp., Walnut Creek, CA. The three potting media types used and their components and other information is listed in the following table:

Media Type	Components	Bulk Density (lb/cu yd)	pH	Percent organic matter
Flowerwood Nursery Mobile, AL	19:3 pine bark: sand 1.73 cu. yd. pine bark 0.27 cu. yd. sand 18.2 lbs. premix (13-6-6) 9.1 lbs. Dolomite 6.8 lbs. oyster shells	920	*	*
MAFES mix IFA Station, MS	3:1:1 pine bark: sand: peat moss	900	*	*
Grace Sierra media Milpitas, CA	Canadian sphagnum peat moss horticultural vermiculite processed bark ash washed sand wetting agent	250	*	*

* not yet determined

Elimination of established colonies:

Elimination of an established colony in a nursery pot was determined by infesting media-filled nursery pots with fragmented IFA colonies. Trade gallon pots were filled with potting media and placed on a brick in a 12" x 18" x 5" 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. Five replicates per treatment (media type and rate of application) were set up. 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 media-filled pot. The fragmented colonies were allowed to acclimate 3-5 days before treatment. Acephate 5G and 15G were applied topically at rates of 0.3 g AI/pot and 0.9 g AI/pot. After distributing the granular material evenly over the top of the potting media, 1" of water was immediately added, and subsequently added twice a week for the duration of the trial. Pots were inspected daily for mortality and were considered dead when less than 20 workers were present.

Residual activity:
Residual activity was determined by live insect bioassay using aged treated media. Trade gallon nursery pots were filled with each of the three media types. The pots were then treated topically with the rates mentioned above and immediately irrigated with 1" water. They were then placed outdoors to weather naturally and received ca. 1-1½" water per week from a pulsating overhead irrigation system. Three pots from each treatment were collected, composited, and subjected to an alate queen bioassay at 2, 5, 10, 15, 20, 25, and 30 days post-treatment. 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 moisture 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. Queen mortality was assessed after seven days of continuous confinement to the treated soil.

Leachability:
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 columns were filled with potting media. Columns were then moistened to near saturation. After 24 hours, the treatments described above were applied to three columns for each rate by evenly sprinkling the material onto the surface of each soil column. Immediately after treatment, 2" of irrigation water was applied to each column. Both Flowerwood media and Grace Sierra potting media were subjected to this test. Columns were maintained in the greenhouse and kept moist by the addition of 2" irrigation at 3 days post-treatment. On 2 and 7 days post-treatment, the masking tape was removed and cores were removed using a 1" soil corer. Cores at 6", 12", 18", 24", and 30" were collected from each replicate and then composited and subjected to alate queen bioassay as described above.

<u>RESULTS</u>:

Elimination of established colonies:
All rates of each treatment attained 75-95% mortality within 8 hours post-

treatment and 100% mortality within 24 hours.

Residual activity:
All treatments showed good results at 2 days posttreatment (Table 19). By 5 days posttreatment, rates in MAFES and Flowerwood media were showing reduced activity, but the treated Grace Sierra media still provided good residual activity. This is probably due the differences in application rates (ppm) between soil types caused by differences in dry weight bulk densities.

Leachability:
No treatment or rate gave better than 75% mortality at any depth in the Flowerwood soil (Table 20). In the Grace Sierra soil however, the 5G at the high rate and the 15G at both rates at the 6" depth provided 90-100% mortality at 2 days post-treatment and 75-95% mortality at 7 days post-treatment. Curiously, the 5G at the low rate provided only 25% mortality at 2 days post-treatment and 95% mortality at 7 days post-treatment.

DISCUSSION:

At the high rates of application used in this trial, 230 to +2500 ppm, granular acephate has proven very effective at eliminating existing colonies in containerized nursery stock, and does provide limited residual activity (2 days) at rates of less than 700 ppm. In the Grace Sierra media at rates of 847 and 2500 ppm, 5 to 10 days of residual activity is provided. Therefore, a granular acephate product applied topically at high enough rates, ca +1000 ppm, could provide another acceptable "treat & ship" quarantine treatment for containerized nursery stock.

Table 19. Residual Activity of Two Granular Acephate Formulations Applied Topically at Two Rates of Application.

MEDIA	FORMU-LATION	RATE OF APPLICATION		PERCENT ALATE QUEEN MORTALITY AT INDICATED DAYS POST-TREATMENT						
		g AI/pot	PPM	(2)	(5)	(10)	(15)	(20)	(25)	(30)
MAFES	5G	0.3	234.4	100	85	50	30	35	15	0
	5G	0.9	703.2	100	90	60	60	15	55	5
	15G	0.3	234.4	80	55	30	95	35	15	15
	15G	0.9	703.2	100	85	45	40	15	15	10
	Check	-	-	20	0	10	30	25	15	0
FLOWERWOOD	5G	0.3	227.8	100	95	30	65	30	25	15
	5G	0.9	683.4	100	85	50	45	55	40	30
	15G	0.3	227.8	100	20	30	30	55	70	30
	15G	0.9	683.4	100	100	65	35	40	40	20
	Check	-	-	70[1]	80[1]	25	45	40	20	10
GRACE	5G	0.3	847.2	100	100	90	70	5	30	5
	5G	0.9	2541.6	100	100	100	100	100	20	0
	15G	0.3	847.2	100	95	65	50	25	20	5
	15G	0.9	2541.6	100	100	95	85	30	35	5
	Check	-	-	70[1]	15	25	15	20	30	15

[1] unexplained high check mortality

Table 20. Leachability of Granular Acephate Through a Column of Media.

FORMULATION	RATE OF APPLICATION (g AI/ column)	DEPTH	% MORTALITY AT INDICATED DAYS PT			
			Grace Sierra Media		Flowerwood Media	
			(2)	(7)	(2)	(7)
5G	0.3	6	25	95	70	35
	0.3	12	5	10	10	20
	0.3	18	0	15	15	5
	0.3	24	5	0	5	20
	0.3	30	5	20	15	10
	0.9	6	100	95	75	15
	0.9	12	35	35	10	25
	0.9	18	15	30	10	10
	0.9	24	10	10	5	25
	0.9	30	5	5	5	30
15G	0.3	6	100	75	35	20
	0.3	12	5	5	0	20
	0.3	18	15	5	5	15
	0.3	24	0	5	10	15
	0.3	30	0	10	10	25
	0.9	6	90	95	15	45
	0.9	12	25	5	10	20
	0.9	18	5	20	10	15
	0.9	24	5	0	0	10
	0.9	30	0	0	10	20
CHECK	--	--	5	5	0	5

PROJECT NO: FA01G074

PROJECT TITLE: Evaluation of Candidate Potting Media Toxicants, 1994.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

An ongoing screening program to evaluate insecticides for use as quarantine treatments for nursery potting media has been conducted by the IFA Station since 1974. Silafluofen is a new product by Roussel Ulcaf, Montvale, New Jersey. This trial tested two formulations, a 0.5% dust preplant incorporated treatment and a 800g/Liter EC drench treatment.

MATERIALS AND METHODS:

Prep7ant incorporation treatment:
The dust formulation of the product was blended into nursery potting soil (MAFES mix. 750 pounds per cubic yard). A portable cement mixer (2 cu ft capacity) was used to blend the toxicant 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. Treatment rates used were 10. 25 and 50 ppm.

Drench Treatment:
One-gallon capacity plastic nursery pots were filled with untreated potting media as listed above. Drench solution was applied at a rate of 400 ml of finished solution per container. Containers were then placed outdoors to weather under simulated nursery conditions. Treatment rates used were 10, 50 and 100 ppm.

A pulsating overhead irrigation system supplied ca 1-1½" water per week. At monthly intervals, 2 pots from each treatment were composited and subjected to alate queen bioassay (Appendix II).

RESULTS:

At three months post-treatment the dust formulation was effective at the 50 ppm rate only (Table 21). The drench treatment was effective at all rates tested. Bioassays will be continued until the scheduled termination of this test (6 months post-treatment).

Table 21. Residual Activity of Silafluofen

Treatment	Rate (PPM)	% Mortality at Indicated Months Post-Treatment (1)	(2)	(3)	(4)	(5)	(6)
Dust	10	70	65	55			
	25	80	90	75			
	50	100	95	100			
Drench	10	100	100	100			
	50	100	100	100			
	100	100	100	100			
Check	--	5	10	0			

PROJECT NO.: FA01G153

PROJECT TITLE: Evaluation of Merit@2.5G Insecticide for RIFA Control in Nursery Potting Media.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Timothy C. Lockley & Lee McAnally

INTRODUCTION:

Merit, formerly BAY NTN® 33893, has received registration for control of numerous insect pests on woody ornamental plants. Previous studies by this laboratory indicated marginal potential for this product as a RIFA quarantine treatment or bait toxicant. Newer formulations have been developed and because of this, further evaluations were considered necessary. However, because of its extreme systemic activity, it was thought that any trials attempted should be made with living plants.

MATERIALS AND METHODS:

Merit 2.5G was incorporated into MAFES potting media at a rate of 25 ppm on 30 October 1993. The treated media was placed in standard gallon containers, and nine selected cultivars of woody ornamental plants [12 each] were transplanted into the treated media. Twelve pots containing treated media were left as controls. The media were subjected to normal climatic conditions and a pulsating overhead irrigation system supplied ca 1-1½" water per week. Alate queen bioassays were performed at thirty days post-treatment (Appendix II).

RESULTS AND DISCUSSION:

At 30 days post-treatment, samples of media were collected from each cultivar/container and composited by cultivar. Bioassays showed negligible mortality among all the cultivars as well as the control media. It was assumed that the initial ppm rate of 25 was insufficient and, on 7 December 1993, sufficient quantities of 2.5G NTN were added 'over-the-top' to each container to raise the dose rate to ca. 200 ppm. Bioassays of the increased rate were made at monthly intervals.

At one month post-treatment, all samples caused 100% mortality. However, at two months, all samples failed causing mortalities ranging from 15% to 65%. By month three, the highest mortality achieved by any of the samples was 35% and the study was discontinued.

PROJECT NO: FA01G202

PROJECT TITLE: Residual Activity of Drench Candidates, 1992.

TYPE REPORT: Final

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.

MATERIALS AND METHODS:

Fifty-four 6"x6" nursery containers for each treatment were filled with standard laboratory potting media (MAFES mix). 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. A pulsating overhead irrigation system supplied ca 1-1½" water per week. 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). Application rates and theoretical dose rates for each treatment are shown as follows:

Pesticide & Formulation	Rate of Application (g/l H_2O) or (ml/l H_2O)	Theoretical Dose Rate (ppm)
Demon® 40WP	0.394g/l	50ppm
	0.79g/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:

Both rates of Talstar have maintained excellent control of IFA for 18 mths (Table 22). Commodore at the 100 ppm rate has also maintained good control for 18 mths, while the 50 ppm rate has provided control for 12 mths. Both rates of Demon began to show erratic results at 7 months post-treatment.

Table 22. Effectiveness of Drench Candidates, 1992.

Treatment	Dose Rate (ppm)	Percent Mortality at Indicated Months PT																	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Demon® 40WP	50	100	100	100	100	100	100	85	85	90	80	80	100	50	80	35	65	100	15
	100	100	100	100	100	100	100	95	100	100	90	100	80	85	100	35	85	100	100
Commodore® 10WP	50	100	100	100	95	100	100	100	100	100	100	100	100	65	100	95	100	100	95
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	75	100
Talstar® 80 g/lF	50	100	100	95	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	100	100	100	100	100
Check		0	10	20	0	0	5	5	0	15	0	5	10	5	5	10	0	5	5

PROJECT NO: FA01G103

PROJECT TITLE: Residual Activity of Drench Treatments, 1993.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

Drench trials are part of the ongoing search for new and/or better toxicants for use in the IFA quarantine program. As new compounds are introduced. new trials are initiated. Compounds that have proven effective in previous trials are also included at different rates of application to determine the most advantageous rate. This is one such test in the ongoing series.

MATERIALS AND METHODS:

Fifty-four 6"x6" nursery containers for each treatment were filled with standard laboratory potting media. Drench solutions were applied to each container at a rate of 400 mls per container. All containers were then placed outdoors to weather under simulated nursery conditions. A pulsating overhead irrigation system supplied ca 1-1½" water per week. 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). All treatments listed below were treated on April 23, 1993 with the exception of Optem PT® 600 which was set up on October 23, 1993. Treatment rates and theoretical dose rates for each treatment are shown as follows:

CHEMICAL	COMMON NAME	AMOUNT OF CHEMICAL(ml)/LITER H_2O 10 PPM	25 PPM	50 PPM
BENGAL	*	0.88	2.24	0.4
FURY 1.5EC	zeta-cypermethrin	0.18	0.44	0.88
FURY 1.5EW	zeta-cypermethrin	0.18	0.44	0.88
PREVAIL FT	cypermethrin	0.13	0.33	0.66
OPTEM PT® 600	cyfluthrin	0.44	1.1	2.2

* (1R,3S)3((1'RS)(1'2'2'2'-tetra-bromoethyl)-2,2-dimethylcyclopropanecarboxylic acid, (S)-alpha-cyano-phenoxybenzyl ester

RESULTS:

The 50 ppm rate for Bengal provided good control (>85%) through 18 months (Table 23). The Fury EW formulation at 50 ppm provided 90% or better mortality through 11 months and the EC formulation provided 85% or better through 14 months. The 25 ppm rate for these three formulations has given somewhat erratic results while the 10 ppm appears to be too low to provide sufficient residual activity. Prevail does not appear to be effective at these rates but may provide control at higher rates. Optem PT® never achieved greater than 20% mortality through 3 months and was discontinued.

Table 23. Residual Activity of Candidate Drench Treatments.

Chemical	Dose Rate (ppm)	% Mortality of Alate Queens at Indicated Mths PT (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Bengal	10	100	95	100	75	75	80	95	100	100	100	100	80	50	35	10	---		
	25	100	100	90	85	95	100	100	100	100	85	100	90	75	70	45	20	---	
	50	100	100	100	100	100	100	100	100	100	100	100	95	100	100	100	100	85	95
Fury 1.5EW	10	100	100	90	10	45	5	0	45	40	---								
	25	100	100	100	100	75	50	45	65	85	90	60	35	45	---				
	50	100	100	100	100	100	95	100	100	100	100	90	75	65	45	20	---		
Fury 1.5EC	10	100	95	80	65	40	20	45	25	35	---								
	25	100	100	100	100	80	85	100	100	95	90	100	65	15	30	---			
	50	100	100	100	100	95	100	100	100	100	100	100	95	100	85	60	45	35	10
Prevail	10	70	55	45	5	30	0	25	30	25	---								
	25	95	90	40	45	55	20	15	40	50	---								
	50	100	95	90	100	80	90	70	100	95	100	80	55	25	10	---			
Optem	10	15	0	0	---														
	25	20	20	10	---														
	50	5	10	15	---														
Check	-	0	5	5	10	25	5	10	0	5	5	10	5	10	0	0	15	0	5

PROJECT NO: FA01G064

PROJECT TITLE: Acephate Drench for Containerized Plants.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Anne-Marie Callcott, Kirk Irby and Lee McAnally

INTRODUCTION:

For many years, one of the mainstays of the Federal IFA Quarantine has been a chlorpyrifos drench treatment for containerized plants. Diazinon or bifenthrin are also acceptable for this use pattern in certain states under FIFRA Sect. 24C. These drench treatments are heavily used in "treat and ship" situations. However, DowElanco, who holds most of the chlorpyrifos EC labels for this quarantine use pattern, is removing nursery uses from these labels due to the new worker protection standards. Therefore, new products must be evaluated to replace this product. Acephate 75S is currently labelled for IFA mound control in homeowner situations, and the registrant has expressed support for quarantine uses as well. This laboratory has had some success with a granular formulation of acephate used as an over the top treatment for IFA infested containerized pots (FA01G072, FA01G152 and FA01G044). The original chlorpyrifos drench treatments were certified for only 30 days, therefore a replacement for this treatment does not need to have a long residual period but does need to (1) eliminate any females attempting to found a colony in the pot within 10-30 days of treatment, (2) eliminate an existing colony infesting a pot and (3) prevent a colony from moving into the pot for 10-30 days.

MATERIAL AND METHODS:

Three media types were used throughout this study. The components and bulk densities of the media are listed as follows:

Media Type	Producer	Components	Bulk Density (lb/cu yd)
MAFES	IFA Station Gulfport, MS	3:1:1 sphagnum peat moss:pine bark:sand	950
Grace Sierra Metro Mix 360	Grace Sierra Milpitas, CA	Canadian sphagnum peat moss horticultural vermiculite processed bark ash washed sand wetting agent	250
Flowerwood	Flowerwood Nursery Mobile, AL	19:3 pine bark: sand 1.73 cu. yd. pine bark 0.27 cu. yd. sand 18.2 lbs. premix (13-6-6) 9.1 lbs. Dolomite 6.8 lbs. oyster shells	920

Residual activity against alate females:

Test I

On Oct. 28, 1994 standard trade gallon nursery pots were filled with the above types of nursery media. The filled pots were left for 3-5 days under simulated nursery conditions (ca 1-½" irrigation per week) to allow the media to become fully saturated before treating. Individual pots of each media type were then drenched using acephate 75S at 25, 50, 100, 150, 200 and 300 ppm. The highest labelled rate of acephate is 6.04 g/gal H_2O. Our 300 ppm rate does exceed this rate, but only by 0.35 g/gal in the MAFES media and 0.15 g/gal in the Flowerwood media. Each pot was drenched with a volume of solution equal to 1/5 the volume of the pot (i.e. 400 ml solution). Media from 3 pots of each treatment was collected, composited and subjected to standard alate female bioassay (Appendix II) at weekly intervals.

Test II

Results from the first test showed no acceptable residual activity 7 days after treatment. Therefore, a second test was established to determine residual activity between 1 and 7 days after treatment. Media used was MAFES and Grace Sierra Metro Mix (listed above). On Nov. 22, 1994, trade gallon pots were filled with media. The filled pots were left for 3-5 days under simulated nursery conditions (ca 1-½" irrigation per week) to allow the media to become fully saturated before treating. Individual pots of each media type were drenched on Nov. 29 using acephate 75S at 100, 150, 200 and 300 ppm. Each pot was drenched with a volume of solution equal to 1/5 the volume of the pot (i.e. 400 ml solution). Media from 3 pots of each treatment was collected, composited and subjected to standard alate female bioassay (Appendix II) at daily intervals.

Test III

Due to excessive rainfall over the period of Test II (see results), the exact same test will be repeated. Pots will be drenched on Jan. 23, 1995 and bioassayed daily thereafter for seven days.

Additional studies

Further studies addressing elimination of an existing colony and prevention of colony relocation into a pot will be initiated only if acceptable results are obtained with the above mentioned trials.

RESULTS:

Residual activity against alate females:

Test I

No acceptable residual activity was noted at any rate in any media against IFA alate females at 7 days posttreatment (PT).

Test II

As shown in Table 24, results were marginal at best. The 300 ppm rate in the MAFES mix did provide 95% control 1 day PT. However, no acceptable control was observed in any rate after that time. Prior to the 1 day bioassay, ca 3.5" rainfall occurred. This quantity of rain may have promoted excessive leaching of the product, and led to the poor results. Therefore, this test will be repeated.

Table 24. Residual Activity of Acephate 75S Used as a Drench.

Media	Rate (ppm)	% Mortality at Indicated Days PT		
		(1)	(2)	(3)
Grace Sierra	100	45	5	30
	150	80	10	20
	200	70	40	35
	300	40	15	25
	Check	0	0	10
MAFES	100	75	40	40
	150	90	10	30
	200	65	80	40
	300	95	15	45
	Check	5	5	0

PROJECT NUMBER: FA01G173

PROJECT TITLE: Insecticide Treated Nursery Pot Liners as Mechanical and Chemical Exclusionary Barriers to Imported Fire Ants in Containerized Nursery Stock.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Tim Lockley & Peter van Voris (Batelle Pacific Northwest Laboratories)

INTRODUCTION:

Traditionally, long residual insecticides have been incorporated into nursery potting media to prevent infestation of imported fire ants in containerized nursery stock. Currently, bifenthrin (Talstar@) and tefluthrin (Fireban®) are registered for this use pattern. Bifenthrin is incorporated at rates from 10 to 25 ppm for varying periods of certification (6 months to indefinite). Fireban is also labelled at rates from 10 to 25 ppm for slightly different certification periods.

The creation of an effective, long-1asting chemical barrier that requires no formulation on the part of the grower could go a long way in: (1) reducing the use of insecticides, (2) reducing overall costs in material and man hours to the grower and (3) presenting a consistent, long-lasting barrier to the transport of imported fire ants.

MATERIALS AND METHODS:

Nursery pot liners were formed at Batelle Pacific Northwest Laboratories, Richland, WA in September 1993. Reemay® spunbonded poly ester (2470) and Typar® spunbonded polypropylene style 3401G were glued for liners for 6-inch containers. The liners were then painted with chlorpyrifos or cyfluthrin. Both insecticides were dissolved in methyl isobutyl ketone (26 grams AI/85 mls MIK). Two thirds of each solution was absorbed by the 2470 fabric; the remaining third was taken up by the 3401G fabric.

The liners were transported to the IFA lab at Gulfport where they were placed in standard gallon containers with untreated media and placed outdoors to age under simulated nursery conditions. A pulsating overhead irrigation system supplied ca 1-1½" water per week. Half of the treated and untreated liners were perforated at the sites of the four drain holes at the bottom of each container so as to allow free access for RIFA workers. At monthly intervals, the pots were removed from the can yard and placed in a desiccation tray with a colony of RIFA to determine repellant efficacy of each treatment. Untreated 2470 and 3401G fabric liners were used as controls. After 72 hours exposure, containers were removed and examined for the presence or absence of RIFA.

RESULTS AND DISCUSSION:

At 9 months, no successful occupations of any container containing a cyfluthrin-treated liner have been accomplished by RIFA (Table 25). Liners treated with chlorpyrifos lasted through 8 months. In those tests where RIFA were given a choice between treated and untreated containers, only the untreated containers held RIFA at the end of the test. In those tests in which RIFA were given choices among treated containers, no successful occupations occurred among cyfluthrin treated liners. Those few workers that tried to enter the cyfluthrin pots died within 10-15 minutes of exposure. When given the single option of entering a cyfluthrin container or having the entire colony die of desiccation, invariably, the colony would move to a point in the arena furthest from the treated pot where, after 48-72 hours, all ants and brood would be dead.

Some unsuccessful attempts were made, prior to month 9, to occupy those containers with liners treated with chlorpyrifos. At month 9, containers with chlorpyrifos treated liners began to lose efficacy. Container with liner #205 was partially invaded but abandoned in favor of complete colonization of #207. Examination of the media in both treatments showed presence of worker brood in #207. No immatures were found in association with container #205. Also, significant disturbance of the media was noted in container #209. A substantial amount of the media was removed from the container and placed adjacent a drain hole. Workers built a mound structure at the base of the container and moved brood into both the exteriorized mound and the container.

These initial results show a strong potential for these types of barriers as a quarantine weapon against RIFA. Additional studies will be conducted in 1995.

Table 25. Repellency of Nursery Pot Liners Treated with Cyfluthrin or Chlorpyrifos.

			PERCENT REPELLENCY OF TREATED MATERIALS TO COLONIES OF RED IMPORTED FIRE ANTS						
					MONTHS POST-TREATMENT				
LINER #	FABRIC #	PESTICIDE	24 HRS	48 HRS	(1)///(6)		(7)	(8)	(9)
200	3401G	Cyfluthrin	100	100	100	100	100	100	100
201	3401G	Cyfluthrin	100	100	100	100	100	100	100
202	2470	Cyfluthrin	100	100	100	100	100	100	100
203	2470	Cyfluthrin	100	100	100	100	100	100	100
204	3401G	Chlorpyrifos	100	100	100	100	100	100	100
205	3401G	Chlorpyrifos	100	100	100	100	100	100	0
206	3401G	Chlorpyrifos*	100	100	100	100	100	100	100
207	3401G	Chlorpyrifos*	100	100	100	100	100	100	0
208	2470	Chlorpyrifos	100	100	100	100	100	100	100
209	2470	Chlorpyrifos	100	100	100	100	100	100	0
210	2470	Chlorpyrifos*	100	100	100	100	100	100	100
211	2470	Chlorpyrifos*	100	100	100	100	100	100	100
CHECK	2470	Untreated	0	0	0	0	0	0	0
CHECK	3401G	Untreated	0	0	0	0	0	0	0

*Coated with an acrylic spray after drying.

PROJECT NO: FA04G013

PROJECT TITLE: Evaluation of "BioBarrier" as an Exclusionary Device for Red Imported Fire Ants in Field Grown Nursery Stock.

TYPE REPORT: Final

PROJECT LEADER/PARTICIPANTS: Tim Lockley, Lee McAnally, Avel Ladner, & Randy Cuevas.

INTRODUCTION:

Numerous woody ornamental plants are produced as field grown crops. An important consideration in field production of woody plants is the development of a fibrous, compact root system (Burdett & Martin 1982). Plants with properly developed root systems are easier to harvest, easier to transplant, and have a better chance of survival in the landscape (Ingram et al. 1987). Numerous methods are used to create a compact root ball: pruning with a "U-blade" (Davidson et al. 1988); fabric root-control bags (Reiger & Whitcomb 1985); et cetera.

A relatively recent development in root pruning has been chemical barriers (Burdett & Martin 1982). A timed-release formulation of trifuralin (dinitroanaline herbicide) placed on a geotextile fabric has been developed to protect streets, sewers and sidewalks from tree root damage (BioBarrier, Reemay Corp.). BioBarrier is currently under trial as a method of root pruning for field-grown ornamental plants. By lining the planting hole with BioBarrier, it is believed that a grower could promote fibrous root development without mechanical pruning.

Imported fire ants (IFA) are repelled by a number of chemicals (Hays et al. 1982, Franke 1983, Williams & Lofgren 1983). Tests undertaken at the IFA lab at Gulfport, MS indicated repellant qualities with BioBarrier. Because of the initial success of the first study, a trial was undertaken to determine the feasibility of using BioBarrier as a method of excluding IFA colonies from field-grown woody ornamentals.

MATERIALS AND METHODS:

Rooted 3-gallon containers of crepe myrtles (10), flowering dogwoods (8), live oaks (12), NASA hollies (10), English hollys (8), Japanese hollys (10), azaleas (8), gardenias (10), and Leyland cypress (10) were transplanted on 17 March 1993. Half of the plants were placed in planting holes with BioBarrier and half placed in untreated holes. The holes were excavated by shovel to a depth ca. 0.5 m. The planting holes were ca. 25% greater in circumference than the root ball. In the treated holes, BioBarrier was placed along and attached to the outer wall with 6p galvanized nails. The plant was placed in the center of the hole and the excavated soil was used to refill the hole. Control plants were transplanted following the same procedure as described above but without Biobarrier.

RESULTS:

An initial survey was conducted 6 months post-planting to determine the level of natural infestation between treated and untreated cultivars. Among the 43 cultivars with Biobarrier, only one (an azalea) showed any RIFA activity. An examination of the mound showed the majority to be outside of the Biobarrier circle. Approximately 20% of the above surface tumulus extended within the exclusion zone. Among the controls, 11 were infested with RIFA at the time of the examination and 8 others showed signs of having been infested.

At 12 months post-planting, another examination was undertaken for natural infestation. Again, of the 43 treated cultivars, only one (once again an azalea) was infested with RIFA. As previously observed, the majority of the colony was outside the exclusion zone. Among the controls, 12 were actively infested and 11 showed signs of having been infested.

These data would seem to indicate that Biobarrier can act as an exclusionary device against RIFA colonies moving into the root zone of field grown ornamentals. However, when these same cultivars were artificially infested, activity of RIFA colonies were not noticeably different between treated and controls although some differences were noted among cultivars (Table 26).

Table 26. Comparative Activity of RIFA Colonies Within Selected Cultivars Using Biobarrier as an Exclusionary Device Two Weeks Post-Infestation.

CULTIVAR	BIOBARRIER		CONTROL	
	ACTIVE	INACTIVE	ACTIVE	INACTIVE
Quercus virginiana Live Oak	2	4	1	5
Rhododendron x 'Pride of Mobile'	4	1	1	4
Gardenia jasminoides 'Mystery'	2	3	1	4
Ilex crenata 'Compacta' Japanese Holly	0	5	3	2
Lagerstroemia indica 'Natchez' Crepe Myrtle	2	3	2	3
X Cupressocyparis leylandi Leyland Cypress	2	2	1	3
Cornus florida Dogwood	1	4	3	1
Ilex x attenuata 'Nasa'	1	4	4	1
Ilex aquifolium 'Augustifolia' English Holly	2	2	2	2
Total	15	28	18	25

PROJECT NO: FA01G034

PROJECT TITLE: Subsurface Application of suSCon® Green for Control of Imported Fire Ants in Commercial Grass Sod.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, Avel Ladner. Lee McAnally, Randy Cuevas

COOPERATORS: Mr. Eric Green, Green's Turf Farm, Dothan, AL
Mr. Steve Strickland, Canaan Industries, Dothan, AL
Mr. Peter May, Incitec, Ltd.. Brisbane. Australia
Dr. Pat Cobb, Extension Entomol. Dept., Auburn University. AL

INTRODUCTION:

suSCon® Green is a controlled release formulation of chlorpyrifos produced by Incitec Ltd., Brisbane, Australia. This product is used in several countries for multi-year control of white grubs and other soil pests. Season-long control of imported fire ants has been achieved at rates of 3 to 5 lbs AI per acre when applied as a broadcast surface treatment to grass sod (Collins & Callcott 1993, Callcott & Collins, 1995). However, surface applications of suSCon Green, and other pesticides, are susceptible to UV and other forms of chemical degradation. Subsurface placement of pesticides theoretically result in several benefits, including reduction in the amount of pesticide required to control the target pest, reduced surface residues, reduced potential for run-off, reduced drift. and possibly extended residual activity. Niemczyk (1993) reviewed subsurface placement of pesticides and concluded that this technology is worthy of increased and continued consideration. Studies to date with subsurface placement of pesticides have concentrated on control of white grubs and mole crickets in golf course fairways and athletic fields. Fire ant control with this relatively new technology has not been investigated.

The current study compares efficacy of surface versus subsurface application of suSCon Green for control of imported fire ants in grass sod.

MATERIALS AND METHODS:

A granular slit applicator (subsurface applicator) manufactured by Canaan

Industries, Dothan, AL, was used to place suSCon Green at a depth of approximately 0.75 inches beneath the soil surface in a non-production field of Tifway 419 grass on April 5, 1994. Surface applications of suSCon Green were applied with a Herd® granular applicator (Model GT-77) mounted on a Suzki ATV. Application rates were 4 lb AI per acre (40 lbs of formulated product) for both treatments. Prior to pesticide application, 1-acre test plots were established on the Eric Green turf farm near Dothan, AL. IFA population estimates were made in the center of each 1-acre plot using both total colony counts and the population indexing system described by Harlan et al. (1981) and modified by Lofgren and Williams (1982). Each treatment, including untreated check plots, was replicated 4 times. Posttreatment ratings of each test plot were conducted at 6 to 12 week intervals to evaluate the effect of each treatment on the IFA population. Normal agricultural practices including mowing, fertilization, etc. continued as usual throughout the course of this study. Plot ratings will be terminated when treated plots become reinfested by IFA. Treatment means were statistically analyzed using ANOVA and Tukey's Test.

RESULTS:

The fire ant population averaged 55.7 nests per acre prior to application. The first posttreatment evaluation was conducted on May 17, 1994, which was 6 weeks after application. Six and one half inches of rainfall were recorded from the date of application until the first rating interval. Both application procedures (surface broadcast and subsurface placement) provided greater than 95% control of imported fire ants at 6, 12, 18, 26 and 40 weeks post-application (Table 27). Plot counts will continue until test plots become reinfested.

Table 27. Control of Imported Fire Ants with Surface Broadcast and Subsurface Applications of suSCon Green. Dothan, AL. 1994.

Insecticide Placement	Avg. % Chg. in Pretreatment Pop. Index @ indicated wks PT †					
	(6)	(12)	(18)	(26)	(40)	(52)
Surface	-95.9a	-97.7a	-100a	-95.3a	-97.0a	
Subsurface	-99.6a	-99.7a	-100a	-99.2a	-97.8a	
Untreated Check	-17.5b	-14.5b	-46.5b	-10.5b	-17.0b	

† Average of 4 replicates per treatment.

PROJECT NO: FA01G133

PROJECT TITLE: Microplot Trials to Evaluate Candidate Insecticides for Control of Imported Fire Ants in Commercial Sod, 1993.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Tim Lockley, Homer Collins, Anne-Marie Callcott, Lee McAnally, Avel Ladner, & Randy Cuevas.

INTRODUCTION:

In 1993, commercial sod growers were restricted to the use of only two registered insecticides [Pageant™ DF or Dursban® 50W] for the control of imported fire ants with a certification period of only 42 days post-treatment. Currently, only Dursban 50W is registered for grass sod. In an attempt to expand the arsenal available to growers, tests were undertaken in September of 1993 to evaluate six candidate insecticides for efficacy and residual activity

MATERIALS AND METHODS:

Application of all materials was made on 7 September 1993 at the Pearl River Sod Farm near Wiggins, Stone Co., MS. A trailer mounted boom system was used for liquid applications. The boom sprayer consisted of 5 TeeJet TSS4 nozzles spaced at intervals of 36 inches and overlapped by 5 TSS3 spray tips. Both pumps and both booms operated at 20 psi. Rate of output was ca. 32.0 gallons finished spray/acre. Applications of granular materials were made using a hand-held radial seed spreader. Materials were applied to plots measuring 15' x 100' at rates indicated in Table 28. Soil samples were collected by wheel-type core sampler. Approximately 300 soil cores (0.5" x 1.0") from each plot were collected at six-week intervals. Samples from each like-treated plot were composited and then bioassayed with alate RIFA queens (Appendix II).

RESULTS:

Optem® PT 600, Bengal®, and Fipronil 1.5G demonstrated insufficient efficacy at 4 weeks post-treatment to continue their trials (Table 28). Commodore@1GR initially showed weak mortality rates, improved significantly when evaluated at week 10, but never provided consistent control. Pageant 50DF was effective through 10 weeks. Bistar™ 1.75EC and Force® 1.5G have shown consistent efficacy through 27 weeks post-treatment. Trials were discontinued after 31 weeks due to decreased efficacy in all treatments.

Table 28. Candidate Insecticides Applied at Varying Rates/Formulations to Commercially Grown Grass Sod.

Candidate	Rate lbs AI/ Acre	% Mortality to IFA Alate Queens at Indicated Weeks Posttreatment				
		[4]	[10]	[19]	[27]	[31]
Pageant 50DF	8.000	100	100	60	10	-[1]
BiStar 1.75 EC	0.250	100	100	100	100	35
	0.500	100	100	100	100	70
Optem PT 600	0.250	10	60	-[1]	-	-
Bengal	0.160	0	75	-[1]	-	-
Force 1.5G	2.000	100	100	100	100	85
Commodore 1GR	0.500	25	90	90	85	-
Fipronil 1.5G	0.044*	0	30	-[1]	-	-
	0.088**	0	40	-[1]	-	-
Untreated Check		0	70	10	0	55

* Equivalent to 50 g/ha (rate used in other insect control trials)
** Equivalent to 100 g/ha (rate used in other insect control trials)
[1] dropped due to decreased efficacy

PROJECT NO: FA01G054

PROJECT TITLE: Evaluation of Merit® (imidacloprid) for IFA Control in Commercial Sod, 1994.

TYPE REPORT: Final

PROJECT PARTICIPANTS: Timothy C. Lockley, Homer Collins, Avel Ladner, Lee McAnally. Randy Cuevas and Kirk Irby

INTRODUCTION:

Currently, Dursban® 50WP (DowElanco, Greenfield, IN) is the only product available to the commercial sod grower for certification under the USDA Imported Fire Ant Quarantine. The labelled rate for both formulations is 8 lb AI/acre.

Recently, imidacloprid (Merit®) has received registration for application to turf for control of white grubs (0.5 lbs AI/acre). Imidacloprid is a systemic and contact insecticide developed by Miles Inc. It has a primary activity on sucking insects. Tests run at the IFA lab in Gulfport indicate only a moderate degree of toxicity to RIFA alates; however, RIFA workers seem to be repelled by imidacloprid at very small dose rates. Tests conducted at other labs on field soils indicate a soil half-life of slightly less than 150 days (Mullins 1993). With its high degree of repellency to fire ants coupled with a relatively long half-life in soil, imidacloprid would seem to have good potential for residual control of IFA. For these reasons, imidacloprid was evaluated at the rate registered for control of white grubs in commercial sod (0.4 lbs AI/acre).

MATERIALS & METHODS:

Test plots were located at the Pearl River Sod Farm in Stone County. MS in a field recently ribboned for harvesting of centipede grass. Much of the field (ca. 50-60%) had been harvested in mid-Spring and most of the ribboned area had been reestablished by the grass. Few areas of bare ground were present. Plots were laid out in one acre squares (210' x 210') with three replicates each of treated and check. RIFA population levels were assessed prior to treatment and at succeeding intervals of 6 weeks post-treatment (Lofgren & Williams 1982). Treatments of Merit 0.5G at 0.4 lbs AI/acre were applied on 1 August, 1994 utilizing a Herd GT-77 Seed Spreader (Herd Seeder Co., Logansport, IN) mounted on a Ford tractor. A swath width of 21 feet was assigned and the vehicle operated at ca. 4.0 mph.

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

RESULTS:

Results of this trial are shown in Table 29. At 6 weeks post-treatment, no significant differences were displayed between treated and untreated plots. Both showed a typical "crash" in population levels commonly observed in late summer. By week 12, treated plots had begun to return to pretreatment levels. Untreated plots had exceeded pretreatment levels by 241.3%. At week 18, the treated plots continued to have levels below pretreatment populations while untreated plots continued to show significant increases in their numbers. Results of this trial would indicate that Merit 0.5G would seem to have limited potential for quarantine control of RIFA in commercial grass sod.

Table 29. Effects of Merit 0.5G on Established Colonies of RIFA in Commercial Grass Sod.

	WEEKS POST-TREATMENT		
TREATMENT	(6)	(12)	(18)
Merit	-78.3a	-24.0a	-13.5a
Untreated	-51.9a	+241.3b	+281.8b

Means in columns followed by the same letter are not significantly different (Tukey's test, $P=0.05$).

PROJECT NO: FA02G014

PROJECT TITLE: Population Dynamics of RIFA Colonies Treated with Fenoxycarb Bait.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott, Homer Collins, Avel Ladner, Randy Cuevas. Lee McAnally and Tim Lockley

INTRODUCTION:

Fenoxycarb fire ant bait (Award" or Logic@, Ciba Crop Protection, Greensboro. NC) is an insect growth regulator which reduces the size of the ovaries in reproducing queens (Glancey & Banks 1988), causing a shift in brood production from worker brood to sexual brood (Banks et al. 1983. Banks et al. 1988 and Callcott & Collins 1992). Glancey et al. (1989) stated that alate females exposed to fenoxycarb in their early larval instar stage or earlier did not develop ovaries thus reducing the potential of alate females from a treated nest to mate and found a new colony. Death of the treated colony occurs because workers lost through attrition are not replaced, and with no workers the queen is not cared for and also eventually dies.

In this study, we documented the effects of fenoxycarb on the population dynamics of field colonies of IFA with the intention of using the results in a "hands-on" display presentation. This study was presented as a display at the 1994 Annual ESA meeting in Dallas, TX in December, 1994.

MATERIALS AND METHODS:

Field populations

A six-acre field infested with a monogynous IFA (*Solenopsis invicta* Buren) population averaging 116 colonies/acre in Harrison Co., MS was treated with Award™ fire ant bait at a rate of 1.5 lb/acre on April 26, 1994. The bait was applied using a Herd@GT-77 spreader mounted behind a farm tractor. Prior to treatment, three ¼-acre circular subplots were established in the above mentioned field and pretreatment assessments of RIFA populations were made according to procedures described by Harlan et al. (1981) and later modified by

Lofgren & Williams (1982). In an adjacent field, three subplots were also established and assessed as untreated checks. Prior to treatment, five mounds within the area to be treated (but outside the assessment area) and five nests within the check area (also outside the assessment area) were excavated, placed in 3-gal plastic pails, and transported to the laboratory. Population assessments and mound excavations were performed at six week intervals after treatment in both treated and untreated areas until reinfestation of the treated area occurred.

Population dynamics

Ants were separated from the nest tumulus using the desiccation tray technique described by Markin (1968). The volume of ants, including all developmental stages, collected from each mound were measured and then the ants preserved in ethanol. Each preserved colony was placed in a glass jar with ca 250 ml ethanol and stirred with a magnetic stirrer. As the ants were suspended by the stirring motion, a 5 cc subsample was removed by dipping a 1.2 cc spoon into the mixture 3-6 times. Each aliquot was then emptied into a calibrated beaker with a screen bottom. This allowed the ethanol to drain and thereby accurately obtain a 5 cc ant subsample. The 5 cc subsample was placed on filter paper and the excess ethanol drawn off through a Buchner funnel. Each subsample was then placed under a hood for 1 hr prior to evaluation.

Ants and brood in each subsample were categorized by life stage: eggs, small larvae, worker pupae, sex larvae, sex pupae, minor workers, major workers, males, alate females, or gravid queens. From this data, percentage of each life stage at each sampling interval was determined. The five subsamples obtained each collection period were then composited into one jar as a sample of life stages present.

Student's t-test was used to determine significant differences between treated and check data ($P=0.05$).

<u>RESULTS</u>:

Field populations

Fenoxycarb bait decreased the population of the treated area by 100% over an 18 week period (Table 30). By 24 weeks posttreatment, the presence of small colonies containing worker brood in the treated area indicated reinfestation.

The volume of ants present in nest tumulus collected from fenoxycarb treated colonies decreased significantly as compared to untreated colonies at 12 and 18 weeks posttreatment (Table 31). By 24 weeks posttreatment, reinfestation was evident and the mean volume of ants collected per nest in the treated vs. untreated areas was no longer significantly different, although the mean volume of ants from treated nests was numerically less than that from untreated nests.

Population dynamics

Life stages present in pretreatment populations were not significantly different (Fig. 6). Six weeks after treatment, there were no worker pupae present in the treated population, demonstrating the early effect of the fenoxycarb bait (Fig. 7). Twelve and 18 weeks posttreatment, no treated colonies were collected due to efficacy of the bait treatment. Colonies from the untreated check plots contained a full caste composition of worker pupae, sexual larvae and pupae, and minor and major workers (Fig. 8 and 9). By 24 weeks posttreatment, caste composition of colonies present in the treated area were not significantly different from those in the untreated area except in the case of worker pupae (Fig. 10). However, worker pupae were present in the colonies from the treated area, indicating healthy, reproducing colonies.

Table 30. Effect of Fenoxycarb Bait on Imported Fire Ant Field Populations.

Treatment	Mean % change in population index at indicated posttreatment interval (wks)[1]			
	(6)	(12)	(18)	(24)
Fenoxycarb Bait	-89.9a	-100a	-100a	-94.4a
Check	-27.4b	-45.8b[2]	-63.3b[2]	-15.2b

[1] Means within a column followed by the same letter are not significantly different (t-test, P=0.05).

[2] High check mortality probably due to hot, dry conditions of midsummer.

Table 31. Effect of Fenoxycarb Bait on Quantity of Imported Fire Ants Collected in Treated Fields.

Treatment	Mean volume of ants collected at indicated wks posttreatment (cc)[1]				
	(0)	(6)	(12)	(18)	(24)
Fenoxycarb Bait	125a	65a	0a	0a	72a
Check	130a	105b	130b	75b	136a

[1] Means within a column followed by the same letter are not significantly different (t-test, P=0.05).

Figure 6. Percent of Life Stages Present in Fenoxycarb Treated vs. Untreated Check Plots.

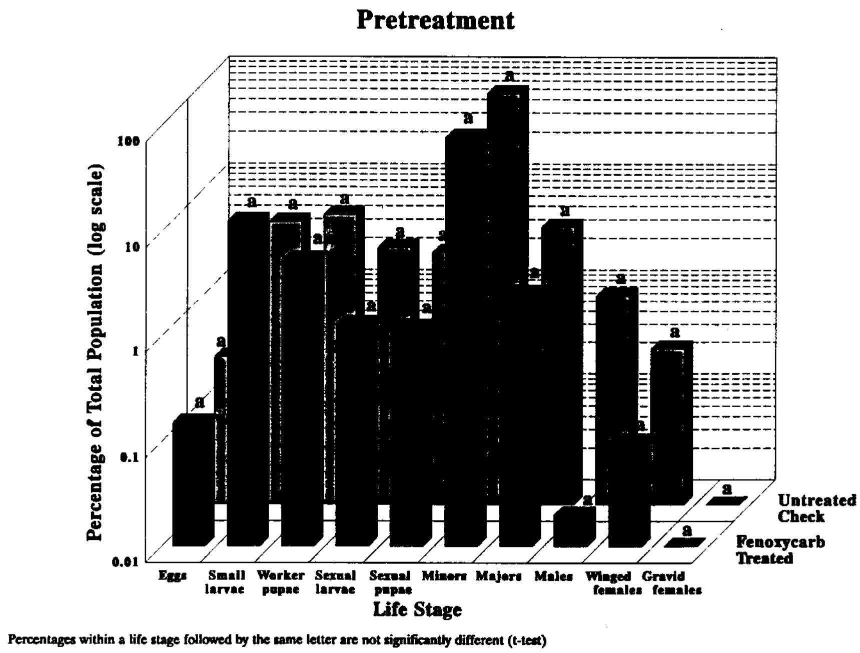


Figure 7. Percent of Life Stages Present in Fenoxycarb Treated vs. Untreated Check Plots.

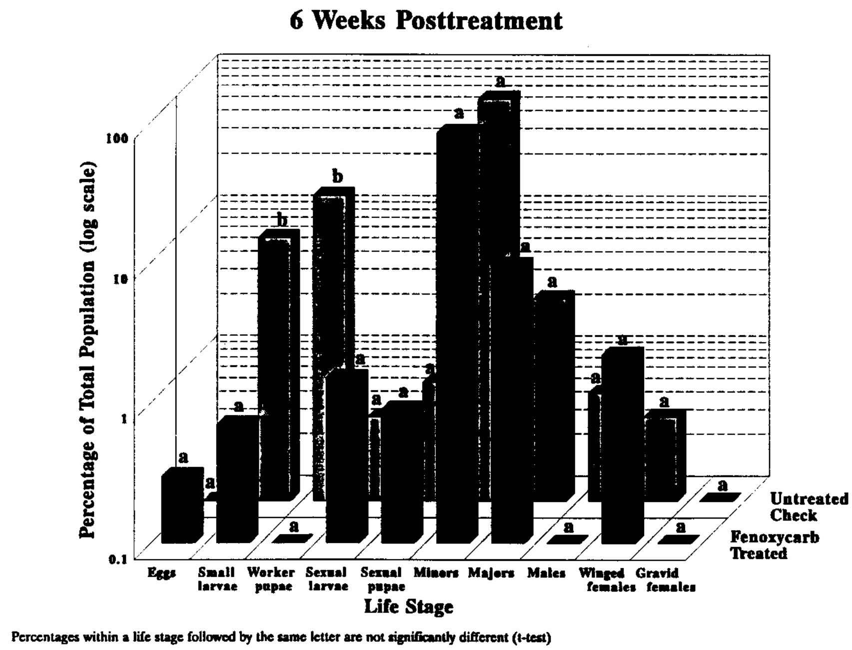
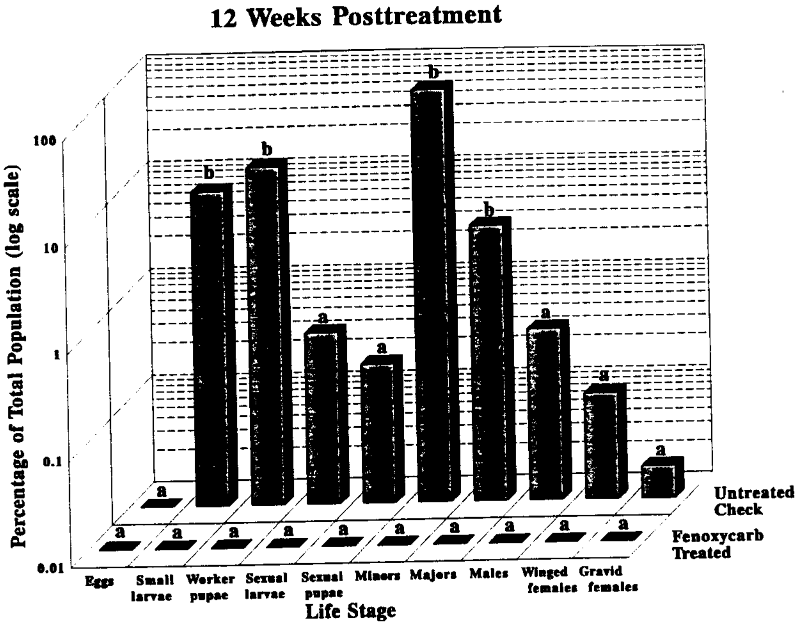
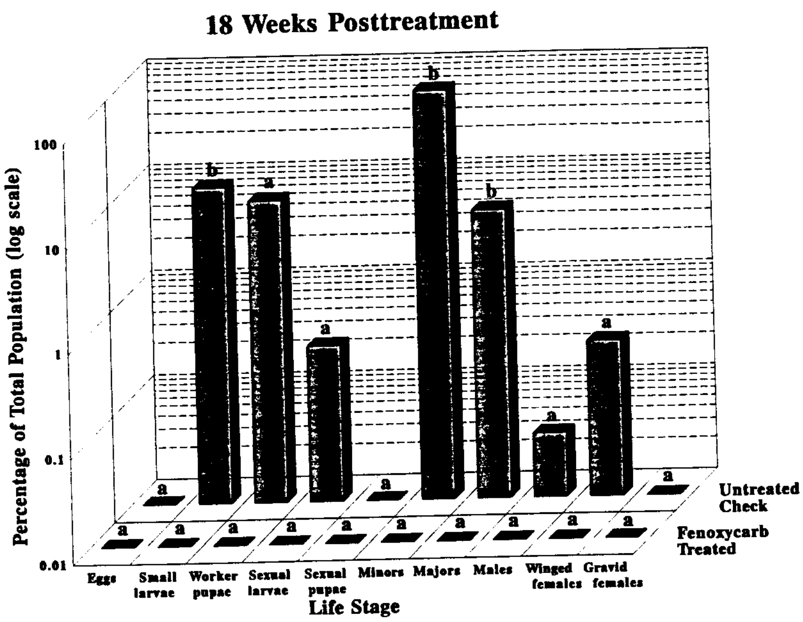


Figure 8. Percent of Life Stages Present in Fenoxycarb Treated vs. Untreated Check Plots.



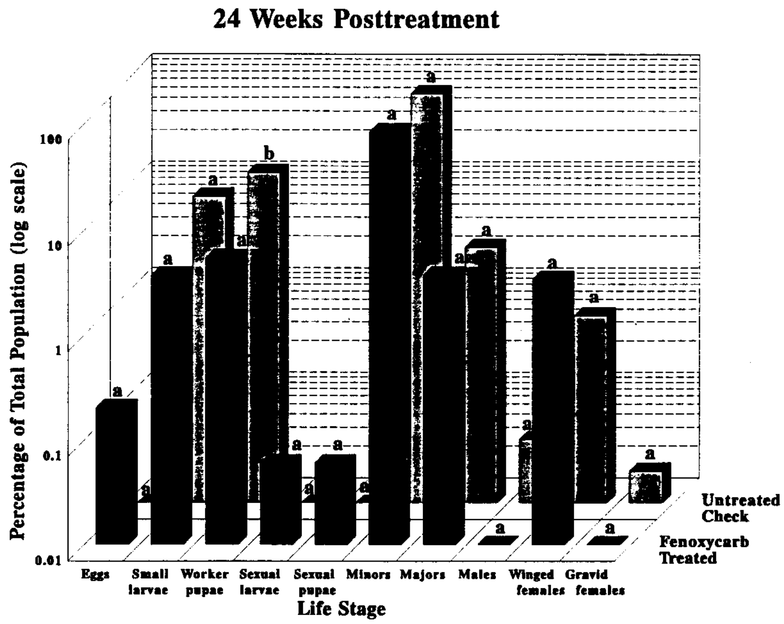
Percentages within a life stage followed by the same letter are not significantly different (t-test)

Figure 9. Percent of Life Stages Present in Fenoxycarb Treated vs. Untreated Check Plots.



Percentages within a life stage followed by the same letter are not significantly different (t-test)

Figure 10. Percent of Life Stages Present in Fenoxycarb Treated vs. Untreated Check Plots.



Percentages within a life stage followed by the same letter are not significantly different (t-test)

PROJECT NO: FA02G024

PROJECT TITLE: Efficacy of Fire Ant Baits When Blended into Various Fertilizer Formulations.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Homer Collins. Anne-Marie Callcott, Avel Ladner, Randy Cuevas, Lee McAnally

INTRODUCTION:

Due to the low rate of application (1.0 - 1½ 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. Early attempts to control fire ants with a blend of fire ant baits and conventional fertilizers were not successful (1984 IFA Station Annual Report). It was hypothesized that the loss in efficacy was due to the dust granules from the fertilizer which adhered to the bait particles rendering then unpalatable to the ants. In 1992. Award® fire ant bait was blended with a controlled release fertilizer formulation, which was essentially non-dusty. This fertilizer did not adversely affect the efficacy of the bait (1993 IFA Station Annual Report - FA02G022). Thus continued efforts were warranted using other fire ant baits and other fertilizer formulations.

MATERIALS AND METHODS:

Trial I - Amdro® and fertilizer blends:
American Cyanamid engaged two fertilizer companies to blend Amdro fire ant bait into one of their fertilizer formulations, package it and ship it to various cooperators in the southeast, who would then apply the bait-fertilizer blend. The blends that we received for application, rates of application, etc. are as follows:

Fertilizer Formulation	Formulator	Rate of Application
POLY-S 37-0-0	O.M. Scott & Sons Co. 14111 Scottslawn Rd. Marysville, OH 43040	103 lb/acre
Polyon Mini 37-0-11	Pursell Industries, Inc. P.O. Box 540 Sylacauga, AL 35150	125 lb/acre

On June 3, 1994, both fertilizer and bait blends were applied at the appropriate rates to pasture land in Harrison Co., MS using a Herd® GT-77 Spreader mounted on a farm tractor. Test plots for the Pursell blend consisted of four 1-acre plots, each with a ¼-acre circular subplot located in the center in which population counts were conducted. The Scott blend test was applied to two acres in which were located three ¼-acre circular subplots since we received only enough material to treat two acres. Four control plots were treated with Amdro only at a rate of 1.5 lb/acre using a shop built granular applicator mounted on a farm tractor (Collins 1988). Prior to treatment and at six week intervals after treatment, population assessments were made. The population index system used was described by Harlan et al. (1981) and later modified by Lofgren & Williams (1982). Differences in treatment means were separated by Tukey's test (P=0.05).

Trial II - Award® and fertilizer blends:
Ciba Geigy Corp., with their Award fire ant bait, has also been involved in the effort to successfully blend fire ant baits with fertilizers to facilitate application. One fertilizer plus Award blend was tested this year.

Fertilizer Formulation	Formulator	Rate of Application
33-0-11 Mini + Award® Fire Ant Bait	Pursell Industries, Inc. P.O. Box 540 Sylacauga, AL 35150	100 lb/acre

This blend was applied to four 1-acre test plots on July 28, 1994 using the methods described above. Award bait only was also applied to four 1-acre plots at 1.5 lb/acre using the above mentioned shop built spreader.

RESULTS:

Trial I - Amdro® and fertilizer blends:

At 12 weeks posttreatment (PT), all treatments provided their best control and were not significantly different from each other (Table 32). However, both fertilizer plus Amdro blends were numerically less effective than the Amdro standard at 12 weeks; the blends providing 85.0% and 76.3% reduction in pretreatment population index vs. 96.8% reduction provided by the Amdro standard. By 18 weeks PT, all plots regardless of treatment, had become reinfested.

Trial II - Award® and fertilizer blends:

While fairly good control, ca. 80% decrease in population index, has been maintained by both the fertilizer + Award and the Award only treatments (Table 33), colony or mound mortality has not been significantly decreased (Table 34). At no time has either treatment decreased the number of mounds in the treated area by more than 40%. These results may have been an effect of the late application in the middle of the hot, dry summer.

Table 32. Efficacy of Amdro Fire Ant Bait when Blended with Different Fertilizer Formulations.

Fertilizer + Bait	Rate of Application (lb/acre)	% change in population index at indicated wks PT[1]		
		(7)	(12)	(18)
Pursell + Amdro	125.0	-71.2a	-76.3a	-23.5ab
Scott + Amdro	103.0	-47.3ab	-85.0a	-51.8a
Amdro Std	1.5	-93.2b	-96.8a	-53.3a
Check	0.0	-6.5c	-44.0b	18.6b

[1] Means within a column followed by the same letter are not significantly different according to Tukey's studentized range (HSD) test (P=0.05).

Table 33. Efficacy of Award Fire Ant Bait When Blended with Different Fertilizer Formulations - Change in Population Index.

Fertilizer + Bait	Rate of Application (lb/acre)	% change in population index at indicated wks PT[1]				
		(6)	(12)	(18)	(24)	
Pursell + Award	100.0	-86.7a	-64.5a	-85.5a	-87.3a	
Award Std	1.5	-85.7a	-82.7a	-85.0a	-83.1a	
Check	0.0	-1.0b	74.6b	112.2b	97.6b	

Table 34. Efficacy of Award fire Ant Bait when Blended with Different Fertilizer Formulations -Decrease in Number of Colonies.

Fertilizer + Bait	Rate of Application (lb/acre)	% decrease in no. mounds present at indicated wks PT[1]				
		(6)	(12)	(18)	(24)	
Pursell + Award	100.0	23.7a	5.3a	37.7a	26.0a	
Award Std	1.5	32.4a	26.0a	29.4ab	10.7a	
Check	0.0	25.1a	6.3a	3.1b	0.0a	

[1] Means within a column followed by the same letter are not significantly different according to Tukey's studentized range (HSD) test (P=0.05).

PROJECT NO: FA02G032

PROJECT TITLE: Fenoxycarb Formulation Trials, 1992 and 1993

TYPE REPORT: Final

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 fenoxycarb 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 trials in 1992, and two additional trials in 1993.

MATERIALS AND METHODS:

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 1988). 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 prior to and at 6 week intervals 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.

Test III:

Test III plots were treated on May 7, 1993 using the above mentioned methods on untreated areas of the same property mentioned above. Treatments included a 0.75% AI fenoxycarb formulation (FL-930883), a 1.0% AI fenoxycarb formulation (FL-930884), and an Amdro standard. Four replicates of each treatment were applied at 1.5 lb/acre.

Test IV:

Test IV plots were treated on August 3, 1993 using the previously described methods on the same property. Treatments included only one experimental formulation (a 1.0% formulation - FL931171), and an Award standard. Four replicates of each treatment were applied at 1.5 lb/acre.

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 35). Reinfestation was apparent in all plots at the 18 week count and the trial was terminated.

Test II:

Results show no difference in efficacy of the various formulations used through 54 weeks (Table 36). The best control for all formulations was found 47 weeks PT, with reinfestation evident at 54 weeks PT. The slow rate of reinfestation in these plots is unexplained.

Test III:

Eighteen weeks of excellent control (>85%) was obtained with the two formulations in this trial (0.75% & 1%) for 18 weeks (Table 37). By 24 weeks PT, reinfestation was noted.

Test IV:

Results show no significant difference between the experimental formulation and the Award standard through 51 weeks PT (Table 38). The best control of FL931171 was at 18 weeks PT. Again, the slow rate of reinfestation of these plots is unexplained.

Table 35. 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

Table 36. Efficacy of Various Award Formulations, 1992. Test II.

Treatment	% Change in Population Index at Indicated Weeks PT[1]								
	(6)	(12)	(18)	(25)	(30)	(38)	(42)	(47)	(54)
921414	-86.1a	-86.1a	-83.2a	-83.1a	-80.5a	-89.0a	-84.4a	-96.7a	-82.0a
921424	-89.2a	-88.9a	-93.2a	-89.8a	-89.4a	-95.0a	-95.9a	-98.7a	-83.4a
921425	-81.6a	-81.0a	-80.3a	-70.3a	-78.5a	-85.7a	-75.8a	-91.9a	-85.6a
Check	+0.6a	+44.9b	+7.6b	+15.6b	-26.3b	+38.0b	+14.8b	+1.8b	-35.3b

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

Table 37. Efficacy of Various Fenoxycarb Formulations, 1993. Test III

Treatment	% Change in Population Index at Indicated Weeks PT[1]			
	(7)	(12)	(18)	(24)
Award 0.75%	-94.7a	-100a	-96.3a	-74.0a
Award 1.0%	-93.8a	-100a	-85.7a	-11.2a
Amdro	-96.4a	-97.9a	-76.8a	3.9a
Check	-32.1b	-40.4b	-33.9b	-37.3a

Table 38. Efficacy of Various Fenoxycarb Formulations, 1993. Test IV

Treatment	% Change in Population Index at Indicated Weeks PT[1]								
	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(51)	(56)
FL931171	-87.2a	-95.3a	-99.3a	-98.6a	-96.9a	-97.5a	-95.5a	-91.3a	-94.2a
Award Std	-84.4a	-96.4a	-97.9a	-94.8a	-89.4a	-97.7a	-100a	-90.9a	-56.2a
Check	13.5b	3.9b	-49.3b	9.2b	54.3b	74.8b	42.8b	8.0b	-50.6a

[1] 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: FA02G034

PROJECT TITLE: Award® Formulation Trial, 1994

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott, Homer Collins, Avel Ladner, Randy Cuevas. Lee McAnally

INTRODUCTION:

For the past few years, Ciba Geigy Corp.' has been testing new formulations of its Award fire ant bait. Some of these formulations include lower rates of active ingredient, lower rates of oil, different carriers, etc. Since 1992 we have tested a number of formulations (1993 IFA Station Annual Report - FA02G032).

MATERIALS AND METHODS:

A 1% fenoxycarb formulation designated CGA-114597 1GR-A was applied to four 1-acre test plots at 1.5 lb/acre on June 3, 1994 using a shop built granular applicator mounted on a farm tractor (Collins 1988). A standard Award formulation was also applied at 1.5 lb/acre to four 1-acre plots. Each 1-acre test plot had a ¼-acre circular subplot located in the center which was used for population assessments. IFA population assessments were made prior to treatment and at 6 week intervals after treatment. Population index methods described by Harlan et al. (1981) and modified by Lofgren and Williams (1982) were used. Mean changes in population index were analyzed by Tukey's test (P=0.05).

RESULTS:

Both the original and new fenoxycarb formulations gave >94% control at 18 weeks after treatment (Table 39). By the 24 week assessment, reinfestation was noted.

Table 39. Efficacy of CGA-114597 1GR-A (1% fenoxycarb fire ant bait).

Treatment	Mean % change in population index at indicated wks posttreatment			
	(6)	(12)	(18)	(24)
CGA-114597 1GR-A	-89.2a	-91.1a	-94.4a	-73.8a
Standard Award	-93.7a	-97.6a	-96.0a	-84.9a
Untreated Check	1.4b	-44.0b	18.6b	66.1b

PROJECT NO: FA02G044

PROJECT TITLE: Control of Imported Fire Ants Around Poultry Production Houses, 1994.

TYPE REPORT: Final

LEADERS/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, Avel Ladner, and Lee McAnally.

COOPERATORS: McCarty Farms, (Forest, MS), American Cyanamid Company, (Princeton, NJ), and Ciba Corporation (Greensboro, NC)

INTRODUCTION:

Due to their omnivorous feeding habits, fire ants are capable of inflicting damage to a variety of crops, wildlife, and other lifeforms. A considerable amount of anecdotal evidence indicates that fire ants cause several types of damage to poultry production. In some instances, baby chicks are directly stung by the ants. Foraging worker ants are also attracted to the feed, and in some cases have been known to cause electrical shorts in various types of equipment. However, very little research on these effects have been conducted, and damage has not been fully documented. Most of the studies that have been conducted have concentrated on determining the level of fire ant control following various insecticide applications. Lovelace and Kissam (1991) reported that the primary problem with fire ants in South Carolina turkey grow-out houses was that ants build their mounds outside the houses and forage on dead birds inside the houses. This creates problems for farm workers that collect dead birds and work in the houses. Wright, Bochat, & Parker (1991), and Wright and Parker (1992), found that similar problems occur in Texas broiler houses. They also reported that broiler growers on some poultry farms reportedly spend $300 to $500 per house per year for control of fire ants. Sparks (1991) found that a control program consisting of a broadcast application of LOGIC@bait in combination with spot treatment with ORTHENE® provided good control of fire ants outside chicken houses in Barrow County, Georgia.

MATERIALS AND METHODS:

This study was conducted in three phases. Phase I consisted of a mail-out questionnaire which was sent to 100 Mississippi broiler producers in March 1994. This questionnaire assisted in determining the magnitude of the problem, and hopefully will enable an economic analysis of the cost of fire ant control as currently conducted. In Phase II we attempted to obtain and document photographic evidence of the damage caused by fire ants. Interviews with growers and on-site visits to chicken houses were made.

Phase III was a comparison of bait control technology. Both broadcast treatments and spot treatments with AMDRO® (American Cyanamid Company, Princeton, NJ), and LOGIC® (Ciba Geigy Corporation, Greensboro, NC) were made on June 14 and 15, 1994. Effectiveness of the following treatments was determined:

TREATMENT NO.	TREATMENT PROCEDURE	APPL. RATE (Per Label)
1	Spot treat with Amdro	5 Tablespoons/nest
2	Spot treat with Logic	3 Tablespoons/nest
3	Broadcast with Amdro†	1.5 lbs./acre
4	Broadcast with Logic†	1.5 lbs./acre
5	Untreated Check	-

† Broadcast treatments were one "swath" in width, (ca. 20' with the Herd® GT-77 granular applicator).

Each treatment was replicated 5 to 7 times. Spot treatments were applied to all 4 sides of each house; any fire ant nest within 5' of the exterior wall was treated at labelled rates of application. Likewise, strip treatments were applied to all 4 sides of each house at the labelled rate of application. Prior to application, the fire ant population was determined by counting and characterizing each fire ant nest within 5' of the exterior walls using the population indexing system described by Lofgren and Williams (1982). Posttreatment population assessments were conducted at 8 week intervals. Spot treatments were applied manually, and broadcast treatments were applied with a

Herd GT-77 granular applicator mounted on a Suzuki® ATV. Experimental data was statistically analyzed using Analysis of variance and an LSD test (P=0.05) for each post-treatment rating interval.

RESULTS:

In Phase I of the study, 27 of the 100 questionnaires were returned, and all respondents indicated that fire ants were a problem on their farm. The most common complaint was that the ants accumulated on dead birds and stung workers who were in the process of removing them. Premature rusting and deterioration of tin around the base of house was also frequently mentioned. From this group, 10 growers were selected to participate in Phase III.

Phase II was not completed to our satisfaction. Photographs of actual damage were difficult to obtain. However, all growers had many anecdotes to share.

Data collected in Phase III is shown in Tables 40 & 41. At 8 weeks after treatment, all treatments had significantly decreased the population indices as compared to the untreated check populations. However, there was no significant difference between numbers of colonies present in the treated and untreated plots (i.e. colony mortality). At 16 and 24 weeks after treatment, no differences in treated and untreated populations were detected.

Limited, but unsatisfactory, control was achieved with both Amdro and Logic in this study. The superabundance of alternate food sources, such as chicken feed, fly pupae, etc., may have rendered both baits less attractive, therefore were not ingested.

Table 40. Activity of Fire Ant Baits Applied as a Broadcast or Individual Mound Treatment Around Poultry Broiler Houses: Effect on Population Index.

Treatment	Application	Mean % change in population index †		
		(8)	(16)	(24)
Amdro	broadcast[1]	-66.5a	-39.3a	-30.7a
	ind. mound[1]	-65.0a	-55.3a	-31.7a
Logic	broadcast[1]	-76.8a	-66.7a	-36.4a
	ind. mound[2]	-86.6a	-59.1a	-43.2a
Check[3]		-29.8b	-48.1a	-42.1a

Table 41. Activity of Fire Ant Baits Applied as a Broadcast or Individual Mound Treatment Around Poultry Broiler Houses: Effect on number of Colonies Present.

Treatment	Application	Mean % Decrease in No. Colonies †		
		(8)	(16)	(24)
Amdro	broadcast[1]	36.9a	20.8a	31.0a
	ind. mound[1]	40.3a	26.3ab	29.0a
Logic	broadcast[1]	49.8a	58.1b	40.2a
	ind. mound[2]	51.2a	34.3ab	31.1a
Check[3]		30.4a	39.1ab	34.7a

† means within a column followed by the same letter are not significantly different according to LSD test, P=0.05.

[1] mean of 6 replicates
[2] mean of 5 replicates
[3] mean of 7 replicates

PROJECT NO: FA05G013

PROJECT TITLE: Ecological Studies of an Isolated Imported Fire Ant Population in Eastern Tennessee.

TYPE REPORT: Interim

LEADERS/PARTICIPANTS: Homer Collins[3], David F. Williams[4], David Oi[4], Tim Lockley[3], Randy Cuevas[3], R.G. Milam[5] and others

INTRODUCTION:

Red imported fire ants (RIFA). *Solenopsis invicta*, currently infest over 275,000,000 acres in 11 states and Puerto Rico. A congener species *S. richteri*, inhabits a relatively small area in northwestern Alabama. northeastern Mississippi, and southern Tennessee. Interbreeding between *S. invicta* and *S. richteri* occurs and results in the production of a fertile hybrid form. Range expansion primarily by S. *invicta* and the hybrid form, by both natural and artificial means, continues. Recent isolated infestation in Phoenix, AZ (Collins unpublished), several sites in Virginia (Waller 1993), and numerous sites in Tennessee (Milam unpublished), are suggestive that acclimation to harsh environments may result in continued range expansion by this serious pest. Many scientists have speculated that hybrid vigor may enable the hybrid to survive in colder areas than either parental form.

In December 1992 an isolated infestation approximately 3000 acres in size was detected approximately 45 miles northeast of Chattanooga, TN near the town of Calhoun, TN. A wood pulp processing plant (Bowater Corporation) appears to be the source of the infestation. The original infestation may have been introduced onto the plant site on construction equipment or material; however this cannot be proven. This population appears to be well adapted and thriving. A site visit by HLC and RGM in April 1993 revealed numerous large nests in open areas, presence of alate forms, and generally healthy colonies.

Various ecological studies of this isolated population were initiated in 1993

[3] USDA, APHIS, PPQ, Imported Fire Ant Station, Gulfport, MS.
[4] USDA, ARS, MAVERL, Gainesville, FL
[5] USDA, APHIS, PPQ, Nashville, TN

in an effort to learn more about this highly adaptable insect. Results of these studies could lead to better estimates of the ultimate range of imported fire ants.

MATERIALS AND METHODS:

Four different, but interrelated, studies were conducted. Winter kill, seasonal life cycle, survivability of incipient colonies/newly mated queens under sub-optimal temperatures, and impact of RIFA on local myrmecofauna were determined.

WINTER KILL: Winter kill (survival) of colonies in the Calhoun, TN infestation were compared to a control site at Gulfport, MS. Population estimates in eight 0.25 acre test plots were made in October 1993 at each site using the population indexing system described by Harlan et al. (1981) and modified by Lofgren and Williams (1982). Test plots were re-evaluated in April, July and October, 1994. Maximum and minimum temperatures, humidity, rainfall, and soil temperatures (if possible) will be collected at both sites. Mean number of colonies present at each site was compared with a *t*-test, as were mean population indices.

SEASONAL LIFE CYCLE: Markin and Dillier (1971) reported on the seasonal life cycle of RIFA along the Gulf Coast of Mississippi. Techniques and procedures used in that study were utilized to compare life cycle of RIFA in Calhoun, TN with Gulfport, MS. Briefly, those procedures consisted of monthly collections of field colonies of RIFA (n=4) and using the desiccation technique described by Markin (1968) to separate all life stages of the ant from the associated nest tumulus. Separated colonies were then preserved in 500 ml high density polyethylene bottles filled with isopropyl alcohol. The preserved colonies were thoroughly mixed using a magnetic stirrer, and while the solution was mixing, a 5 ml subsample removed by dipping a ¼ tsp spoon into the mixture 3-6 time. Each "spoonful" was dumped into a calibrated beaker with a screen bottom. This allowed the alcohol to drain off and to accurately obtain a 5 ml ant subsample. The 5 ml subsample was then placed on filter paper and the excess alcohol drawn off through a Buchner funnel. Finally, each subsample was dried under a hood for 1 hr prior evaluation. Each life stage present was then enumerated. From this data, the percentage of all life stages present on each sample date was determined for each location.

SURVIVABILITY OF QUEENS & INCIPIENT UNDER SUBOPTIMAL TEMPERATURES IN THE LABORATORY: Bioclimatic chambers programmed for sub-optimal developmental temperatures (Williams 1990) will be used to compare nesting success of ants collected near Calhoun, TN with those collected in Gainesville, FL. Newly mated queens will be collected serendipitously following mating flights. Also, small incipient colonies will be field collected by shovelling the entire nest tumulus into plastic pails. Ants will then be transported to Gainesville, FL for laboratory rearing in bioclimatic chambers. Colonies will be subjected to temperature regimes that mimic average monthly conditions in several U.S. cities including Calhoun, TN (negative control), Gainesville, FL (positive control), Nashville, TN, Washington D.C., and St. Louis, MO. Nesting success will be based on colony development rates (colony weight per time). An analysis of variance will be used to compare development rates among the various temperature regimes and collection locations.

IMPACT OF RIFA ON LOCAL MYRMECOFAUNA: Fire ants readily compete with different arthropod species including other ants (Porter & Savignano 1990). Ant species diversity in the RIFA infested area of Calhoun, TN will be compared with a non-infested control area of similar or identical habitat approximately 10-20 miles from the RIFA infested area. Collections were made at monthly intervals for the length of the study. Two collection procedures were utilized.

<u>Bait transect</u>: Transects, 200 meters in length (n=4), were placed in similar habitats at both infested and uninfested sites, i.e. open fields, old field successional habitats, etc. These transects were used for both bait and pitfall traps. Bait and pitfall stations were alternated along each transect at 5 m intervals. Each bait transect was comprised of 10 bait stations, five baited with canned sausage and five baited with maple syrup. Baits were placed in snap-top vials, and were left in place for 1 hr prior to collecting. Collections were immediately frozen and returned to the IFA laboratory in Gulfport, MS for sorting and identification. Bait transects will provide a measure of the abundance and diversity of ants that might compete for food

resources with RIFA.

Pitfall traps: Pitfall traps were also employed to collect ants and other arthropods in both the RIFA infested and a nearby non-infested site. These traps will indicate the abundance and diversity of ants and other arthropods that may not be attracted to the diurnally placed baits used in the bait transect. A total of 10 pitfall traps located along the 200 meter transect were utilized at each site. Each transect traversed similar habitats and efforts were made to include as much habitat diversity as possible. "Permanent" type pitfalls were utilized. Pitfall traps at each site consisted of test tubes containing 70% ethanol placed in preset PVC sleeves spaced 10 meters apart along the transect. Traps were collected ca. 24 hrs after placement. All samples from the site were composited, placed in a 50 cc polyethylene bottles, and mailed to the IFA laboratory in Gulfport, MS for sorting and identification.

The number of ant species in the RIFA-infested and non-infested sites will be compared by chi-square analyses. Ant abundance will be compared by analyses of variance or analogous nonparametric tests.

RESULTS:

WINTER KILL: Winter kill data collected thus far has been compiled. Both sites in October 1993 had similar population indices and numbers of colonies present (Figures 11 & 12). By April 1994 the Tennessee site had significantly lower IFA populations and colony numbers compared to the Mississippi site, indicating notable winter kill. These Tennessee populations did not rebound as expected over the summer months, but remained at very low levels. The Mississippi site showed a large reduction in population index and number of colonies at the July 1994 assessment. This mid-summer drop in IFA populations appears to be a natural phenomenon in the hot dry summer climate of south Mississippi (pers. obs.). Populations had rebounded well by the October 1994 counts. Assessments at both sites will continue for the course of the study.

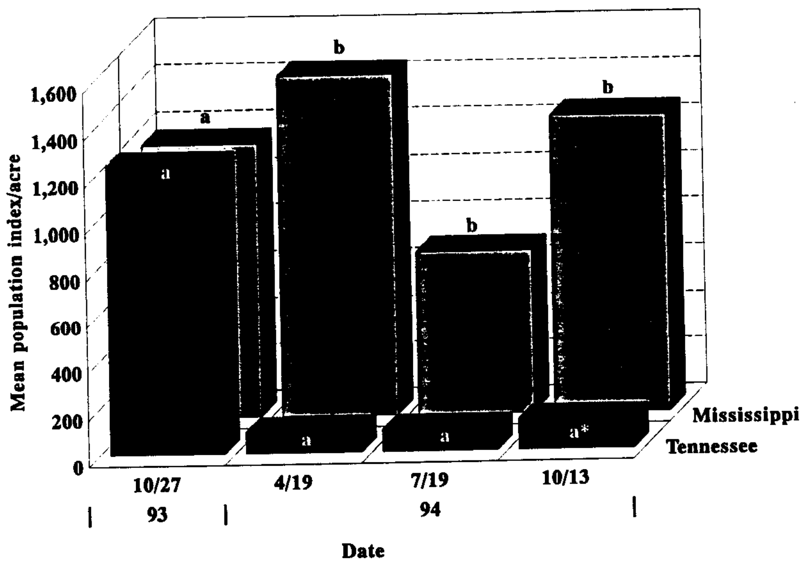
SEASONAL LIFE CYCLE: The dramatic reduction in IFA colonies in the Tennessee plots over the winter of 1993-1994, made colony collection for this portion of the study somewhat difficult. In February and June, 1994, no colonies were collected. In May, 1994, only three colonies were evaluated to determine life stages present, and in July, 1944, only two colonies were evaluated. Gravid females and eggs were rarely collected. The biology of the insect precludes easy collection of gravid females and our extraction technique may be the cause of the low egg numbers. The mesh screens used in the process may not have been fine enough to retain all the eggs in the samples.

Preliminary life stage data shows some interesting trends. In the immature forms, small larvae were produced year round, with a drop in production in the winter months (January-March) at both sites (Figures 13 & 14). The Mississippi site experienced a cessation in worker pupae production in January, 1994, while the Tennessee site ceased worker pupae production for three winter months. Minor workers were the most abundant life stage year round in both sites. The most interesting trend at this time is that of the alate females. At the Tennessee site alate females were collected year round, while at the Mississippi site, where climatic conditions seem more suitable for continuous alate female production, no alate females were collected December, 1993 through February, 1994.

SURVIVABILITY OF QUEENS & INCIPIENT UNDER SUBOPTIMAL TEMPERATURES IN THE LABORATORY: This portion of the study is being conducted at USDA, ARS, MAVERL, in Gainesville, FL. Eight alate queens in Chattanooga, TN were sent by overnight mail to Gainesville, FL in June 1984. Alate queens were collected in Gainesville within a week of receiving the Tennessee queens. When eggs were observed, queens from each location were placed in temperature chambers that followed the average monthly temperatures of either Orlando, FL, or Chattanooga, TN. After 3 months (October), the Florida queens had produced small colonies under both temperature regimes, but all the eggs from the Tennessee queens did not hatch or were eaten. It was assumed that the Tennessee queens had not mated and the study was terminated.

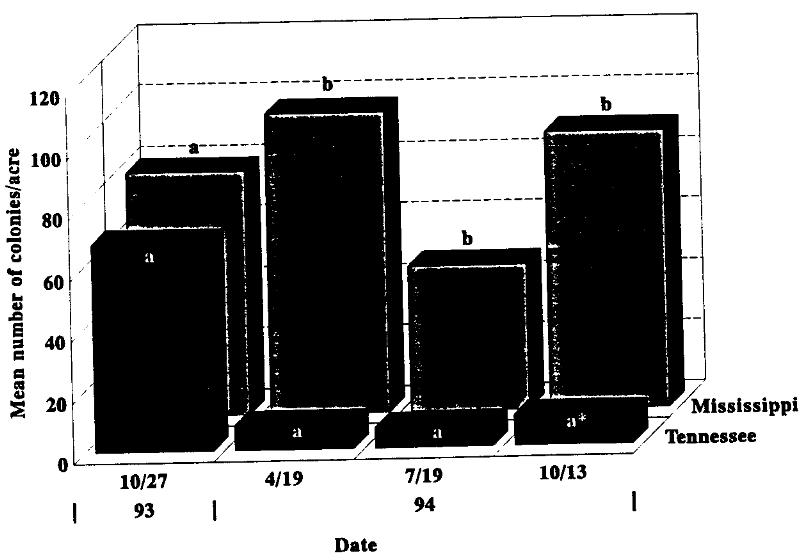
IMPACT OF RIFA ON LOCAL MYRMECOFAUNA: This data has not been analyzed at this time.

Figure 11. IFA Population Indices Over Time at Two Climatically Different Sites.



Means within a date followed by the same letter are not significantly different (t-test, P=0.05)
* Mean of 7 replicates - one plot lost due to construction

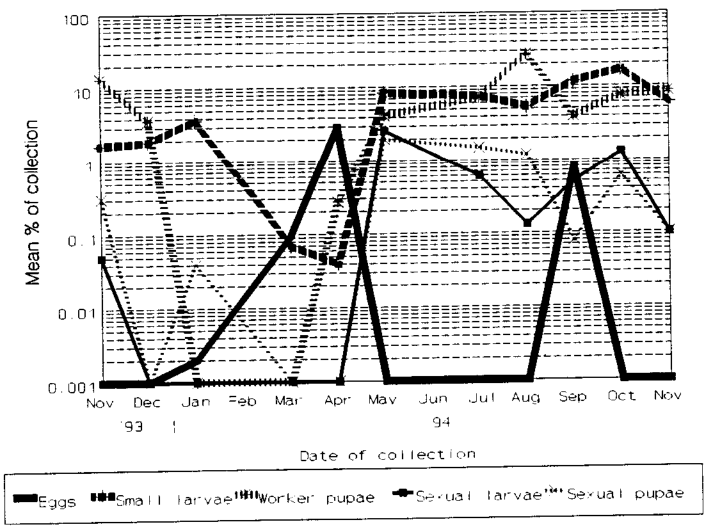
Figure 12. Number of Colonies Present Over time at Two Climatically Different Sites.



Means within a date followed by the same letter are not significantly different (t-test, P=0.05)
* Mean of 7 replicates - one plot lost due to construction

Figure 13. Life Stage Data for Immature Forms Collected at Tennessee and Mississippi Sites.

Percentage of immature forms present in Tennessee plots over time



No TN collections were made in Feb 94 or June 94

Percentage of immature forms present in Mississippi plots over time

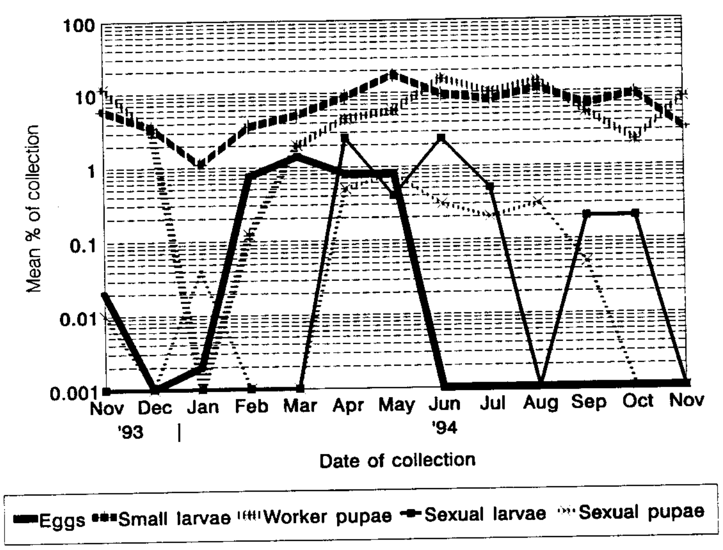
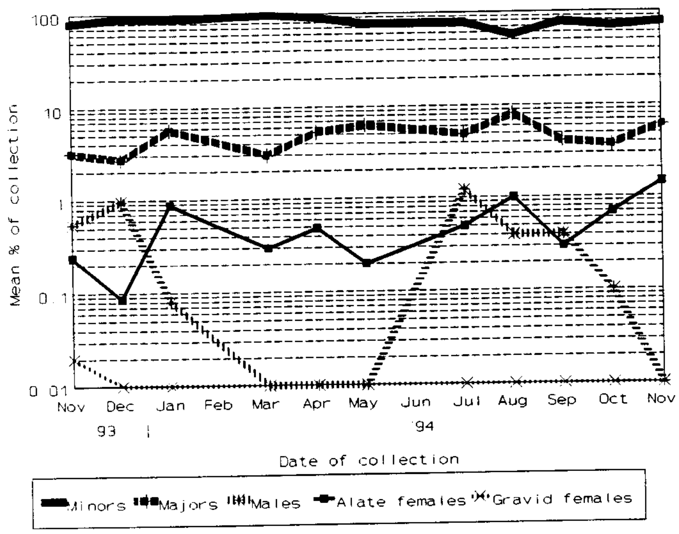


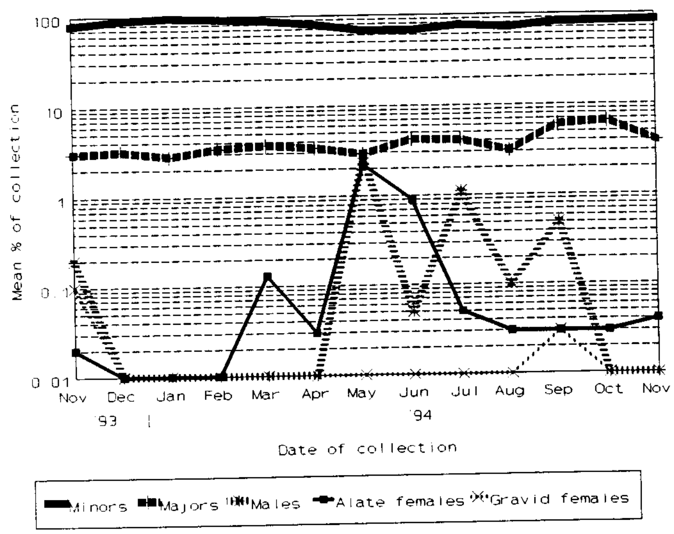
Figure 14. Life Stage Data for Adult Forms Collected at Tennessee and Mississippi Sites.

Percentage of adult forms present in Tennessee plots over time



No Tn collections were made in Feb 94 or June 94

Percentage of adult forms present in Mississippi plots over time



PROJECT NO: FA04G014

PROJECT TITLE: Bait Station Tests for Control of IFA in Nurseries.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Tim Lockley and Peter van Voris (Battelle Pacific Northwest Laboratories)

INTRODUCTION:

In order to achieve compliance under the Fire Ant Free Nursery program within the Federal quarantine, commercial nurseries must meet certain criteria. Among these is the requirement to periodically broadcast a labelled fire ant bait within the confines of their growing area. The efficacy of these baits is influenced by a number of climatic factors such as soil temperature, soil moisture, precipitation, etc. (Lofgren et al. 1964, Porter and Tschinkel 1987). Baits such as Amdro (American Cyanamid Co., Princeton, NJ) and Award (Ciba Corp., Greensboro, NC) must be collected by foraging IFA workers soon after application in order to prevent photolysis of the active ingredient (Vander Meer et al. 1982). Applicators are warned not to apply baits to areas that are wet from dew, rain or irrigation. This, along with other climatic factors, limits the "windows of opportunity" commercial nurserymen have to apply these baits effectively. If applied under less than optimal conditions, the efficacy of the baits can be drastically retarded. Although the influence of dew on the efficacy of Award was shown to be negligible (Collins et al. 1993), the large quantities of water applied as over head irrigation in a commercial nursery could cause broadcast bait granules to "melt" before a foraging worker could locate it. The development of a time-released. "permanent" bait station, protected from the vagaries of nature, could reduce the effects of climate and could serve as a continuous source of prophylactic control of incipient colonies of IFA.

MATERIALS AND METHODS:

Six formulations on polyethylene slabs were prepared by Battelle labs for evaluation. The formulations tested were as follows:

Sample ID	Formulation
F1-94	1% fenoxycarb
F2-94	1% fenoxycarb + 5% soy oil
F3-94	3% fenoxycarb
F4-94	3% fenoxycarb + 10% soy oil
F5-94	10% fenoxycarb + 20% soy oil
C4-94	0% fenoxycarb + 10% soy oil

Whole colonies of RIFA were collected from the field, returned to the IFA lab and starved for one week prior to exposure to the formulated slabs. Feeding responses were determined by periodic counts of IFA workers observed to be actively feeding.

RESULTS AND DISCUSSION:

In the first trial, after an initial attract response by RIFA workers, formulations F1-94 and F3-94 were ignore by the ants. All colonies responded positively to all formulations containing soy oil. At one hour post-exposure, the highest response was made to formulation C4-94 followed by F5-94, F4-94 and F2-94 respectively. Most feeding occurred along the cut edges of the slabs. At 24 hours post-exposure, the highest feeding response was made to formulation F5-94 followed by F4-94, C4-94 and F2-94 (Table 42).

In the second test, 12 new colonies were exposed to the formulated slabs. Feeding at one hour post-exposure followed the same pattern as in the first trial. Subsequent observations at 24, 48, 72 hours and at 7 and 14 days post-exposure showed continuous but modest feeding on all test materials containing oil (Table 43).

After 14 days of exposure to feeding by RIFA, each slab was examined under magnification to determine damage. Significant damage was noted for one slab each of F4-94 and F5-94. The first indication of feeding damage to the single F5-94 slab was observed at day 4 when a fine powder was seen around the edges of the sample. This powder continued to slowly increase throughout the fourteen days of the trial. With the F4-94 slab, no feeding damage was noted through day 11. However, on day 14 (following a weekend) significant damage was noted to the slab. No significant amount of powder residue was noted. Sections of the plastic along the edges were cut out. Other slabs containing oil were, under magnification, noted to have sustained some feeding damage. The majority of the damage to these slabs was minor and occurred along the edges. Some feeding marks were noted on the surface of the slabs usually above a bubble situated just below the surface of the slab.

Table 42. Feeding Response of Foraging RIFA Workers to Various Formulated Bait Stations, Test 1.

SAMPLE ID	NO. RIFA WORKERS FEEDING 1 HR.	24 HRS.
F1-94	0	0
F2-94	14.25	4.75
F3-94	0	0
F4-94	76.75	22.00
F5-94	89.00	22.75
C4-94	93.75	6.25

Table 43. Feeding Response of Foraging RIFA Workers to Various Formulated Bait Stations, Test 2.

SAMPLE ID	NO. RIFA WORKERS FEEDING					
	HOURS POST-EXPOSURE				DAYS POST-EXPOSURE	
	(1)	(24)	(48)	(72)	(7)	(14)
F1-94	0	0	0	0	0	0
F2-94	12.0	3.5	8.5	2.0	6.5	0.8
F3-94	0	0	0	0	0	0
F4-94	69.3	8.0	4.5	2.0	3.5	5.8
F5-94	83.5	19.0	12.5	12.0	19.0	23.8
C4-94	88.0	18.8	4.8	5.5	6.8	8.0

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APPENDIX I

A. PUBLICATIONS:

Callcott, A.-M. & H.L. Collins. 1995. RIFA quarantine treatments in commercial grass sod, 1993. Arthropod Manage. Tests. (in press)

Callcott, A.-M., H.L. Collins & T.C. Lockley. 1995. Factors influencing residual activity of chlorpyrifos against imported fire ants (Hymenoptera: Formicidae) in nursery potting media. Proc. of Southern Nurserymen's Assoc. (in review)

Collins, H.L. & A.-M. Callcott. 1995. Spot insecticide treatments for red imported fire ant (Hymenoptera: Formicidae) control: how effective are they? J. Entomol. Sci. (in review)

B. PRESENTATIONS:

Callcott, A.-M. 3/94. "1993 field trials for control of imported fire ants." 57th Mtg. Georgia Entomol. Soc. & 39th Mtg South Carolina Entomol. Soc. Charleston, SC.

Callcott, A.-M. 5/94. "1993 field trials." *In*: Proceedings, 1994 Imported Fire Ant Research Conference. Mobile, AL.

Callcott, A.-M. 12/94. "Impact of fenoxycarb bait on nest population and caste composition of imported fire ants." Display presentation. ESA Annual Meeting. Dallas, TX.

Collins, H.L. 4/94. "Fighting the fire ant in it's homeland." Southern Plant Board Mtg. San Juan, Puerto Rico.

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Lockley, T.C. 6/94. Invited paper. MS Turfgrass Assoc., Biloxi, MS.

Lockley, T.C. 10/94. "Control of IFA." MS Agric. Forestry & Exper. Station Field Day. Poplarville, MS.

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Tim Lockley gave numerous imported fire ant informative presentations to various schools and organizations as requested.

McAnally, L. 5/94. "Residual activity of drench treatment candidates (1991-1993)." *In*: Proceedings, 1994 Imported Fire Ant Research Conference. Mobile, AL.

C. <u>AWARDS</u>:

Collins, H.L. 1/94. Certificate of Appreciation. USDA, ARS. "For prompt action to deliver humanitarian technical assistance to the citizens of Envira, Brazil for the control of fire ants which had plagued that area of the Amazon." by M.E. Carter, Area Director.

Collins, H.L. 9/94. Group Award for Excellence. USDA. "For emergency response to control life-threatening fire ants in Envira, Brazil, in the Amazon Basin." by Mike Espy, Secretary of Agriculture.

Collins, H.L. 12/94. Entomological Society of America (ESA) Distinguished Achievement Award in Regulatory Entomology. George Teetes, ESA President.

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.