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U.S. DEPARTMENT OF AGRICULTURE

ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
OXFORD PLANT METHODS CENTER

IMPORTED FIRE ANT STATION

3505 25th Avenue
Gulfport, MS 39501

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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 1996

FY 1995 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.

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SECTION I

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

PROJECT NO: FA01G022

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

TYPE REPORT: Final

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 1. 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. By 6 mths PT, all chlorpyrifos rates at all sites were ineffective.

The pots at Green Forest Nursery were accidently destroyed by workers at the nursery before the 18 month test. At that time, all treatments, except chlorpyrifos, were 100% effective.

Commodore at 25 ppm in Wight media showed reduced efficacy at 24 mths PT, while the 50 ppm rate has shown fairly good results through 45 mths. On the other hand, Commodore in Windmill media, at both rates, showed reduced and highly erratic results from the 15 mth PT evaluation until the evaluations were discontinued at 39 mths PT.

Fireban, at 25 ppm in Wight media, showed reduced efficacy at 18 mths, and was erratic until evaluations were discontinued at 42 mths PT. The 50 ppm rate was very effective for 30 mths. In Windmill media, Fireban at 25 ppm was effective through 15 mths, and the 50 ppm rate also showed good efficacy through 27 mths. However, the 50 ppm rate may have been effective longer: bioassay results for Windmill media at 30 and 33 mths PT were misplaced by lab personnel. By 36 mths PT, the 50 ppm Fireban rate had decreased to 50% efficacy.

Bifenthrin in Wight media at 25 ppm was effective for 36 mths, and at 50 ppm was effective for 45 mths. In Windmill media, Talstar at 25 ppm was effective for 27 mths. Again, this rate may have been effective for up to 33 mths, since the bioassay results were misplaced, but the 36 mth bioassay indicated only 55% efficacy. The 50 ppm rate was effective for 36 mths.

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 1. 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	†		
	Fireban 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
	Fireban 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
	Fireban 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 1. Cont.

NURSERY	CHEMICAL	RATE (ppm)	% ALATE QUEEN MORTALITY AT INDICATED MONTHS PT						
			(27)	(30)	(33)	(36)	(39)	(42)	(45)
Green Forest	Bifenthrin 0.2G	25	†						
		50	†						
	Commodore 1.5G	25	†						
		50	†						
	Fireban 1.5G	25	†						
		50	†						
	Chlorpyrifos 2.5G	50	†						
		100	†						
	Check	-	†						
Wight	Bifenthrin 0.2G	25	100	100	100	100	80	95	100
		50	100	100	100	100	100	100	100
	Commodore 1.5G	25	90	95	100	100	--	90	100
		50	100	90	100	100	95	100	100
	Fireban 1.5G	25	70	35	5	15	25	*	
		50	100	95	15	95	30	*	
	Chlorpyrifos 2.5G	50	*						
		100	*						
	Check	-	20	45	0	0	30	20	35
Windmill	Bifenthrin 0.2G	25	100	††	††	55	10	*	
		50	100	††	††	100	40	*	
	Commodore 1.5G	25	45	††	††	75	*		
		50	65	††	††	80	*		
	Fireban 1.5G	25	10	††	††	25	*		
		50	95	††	††	50	25	*	
	Chlorpyrifos 2.5G	50	*						
		100	*						
	Check	-	0	††	††	40	5	*	

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

PROJECT NO: FA01G172

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

TYPE REPORT: Final

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:

As indicated in Table 2, Talstar at 25 ppm provided 32 mths of residual activity. Scimitar at 50 ppm provided 27 mths of activity while at 25 and 10 ppm, afforded 22 mths and 14 mths of residual activity, respectively. Force at 25 ppm provided 22 mths of activity and at 10 ppm 16 mths. The suSCon treated media began to show erratic results 7 mths after treatment.

Table 2. Residual Activity of Several Insecticides Incorporated in Louisiana Pacific Media and Aged at Turkey Creek Nursery, Houston, TX.

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)	(15)	(16)	(17)
Scimitar 10WP	10	100	100	100	100	100	100	100	100	100	95	100	100	100	90	80	100	85
	25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Force 1.5G	10	100	100	100	100	100	100	100	100	90	100	100	100	100	100	100	100	65
	25	100	100	100	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	5	25	5
Talstar 0.2G	25	100	100	100	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	100[1]	5	5

Table 2. Cont.

INSECTICIDE	DOSE RATE ppm	% ALATE FEMALE MORTALITY AT INDICATED MONTHS POSTTREATMENT														
		(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
Scimitar 10WP	10	100	60	15	15	15	30	20	*	-	-	-	-	-	-	-
	25	100	100	100	100	30	95	80	95	95	35	95	90	90	30	15
	50	100	100	100	100	100	95	100	100	95	95	75	100	100	100	65
Force 1.5G	10	100	40	45	25	25	60	35	*	-	-	-	-	-	-	-
	25	100	100	100	100	100	85	50	45	95	30	100	100	100	40	15
suSCon Green	400	10	15	20	*	-	-	-	-	-	-	-	-	-	-	-
Talstar 0.2G	25	100	100	100	100	100	100	100	100	100	100	70	100	100	100	100
Check	--	5	15	5	25	20	35	20	25	5	5	20	10	15	15	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: FA01G123

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

TYPE REPORT: Final

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:

Results are summarized in Table 3. Bifenthrin was effective for 19 mths at the 10 ppm rate and 23 mths at the 15 & 25 ppm rates. Fipronil at 5 ppm was effective for 8 mths, and at 10 ppm for 13 mths. The 25 ppm rate was effective for 23 mths. All other rates (100 & 300 ppm) were effective through 24 months. Commodore at 10 and 15 ppm showed erratic results. However, the 25 ppm rate of Commodore was effective for 19 mths. Force at 5 & 10 ppm was effective through 20 months and 25 ppm was effective through 24 months.

Table 3. 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

Table 3. Cont.

Chemical	Dose Rate (ppm)	% Mortality to Alate Females at Indicated Months Posttreatment							
		(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Bifenthrin 0.2G on peanut hulls	10	100	100	100	85	80	75	100	70
	15	100	100	100	100	100	100	100	90
	25	100	100	100	100	100	100	100	90
Commodore 1G on sand	10	100	95	70	75	15	30	55	40
	15	100	90	85	30	30	70	80	60
	25	100	100	100	85	60	55	95	60
Force 1.5G	5	95	100	100	100	55	50	90	20
	10	100	100	100	100	85	100	100	90
	25	100	100	100	100	100	100	100	100
Fipronil 1.5G	5	---	---	---	---	---	---	---	---
	10	75	100	100	100	100	90	100	30
	25	100	100	100	100	100	100	100	80
	100	100	100	100	100	100	100	100	100
	300	100	100	100	100	100	100	100	100
Check	-	5	0	5	15	0	20	45	0

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 (1994 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 4 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 1.3 ppm in the MAFES mix (Figure 1), 2.4 ppm in the Flowerwood mix (Figure 2) and 7.0 ppm in the Grace Sierra mix (Figure 3). These data support the theory that soil composition greatly influences the efficacy of chlorpyrifos when used in preplant incorporation.

Bifenthrin has been tested in the Grace Sierra mix and the MAFES mix resulting in LC_{50} rates of 2.0 and 3.0 ppm, respectively (Figures 4 & 5). There is much less variance between media types with bifenthrin than there was with chlorpyrifos, indicating less influence of media type on efficacy of this insecticide. Bifenthrin will also be tested in Flowerwood media.

Testing will continue with the other compounds previously listed.

Table 4. 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	4.0	*
Flowerwood Nursery mix	19:3 pine bark:sand	920	5.8	*
Grace Sierra	Canadian sphagnum peat moss horticultural Vermiculite processed bark ash washed sand wetting agent	250	6.6	*

* not yet determined

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

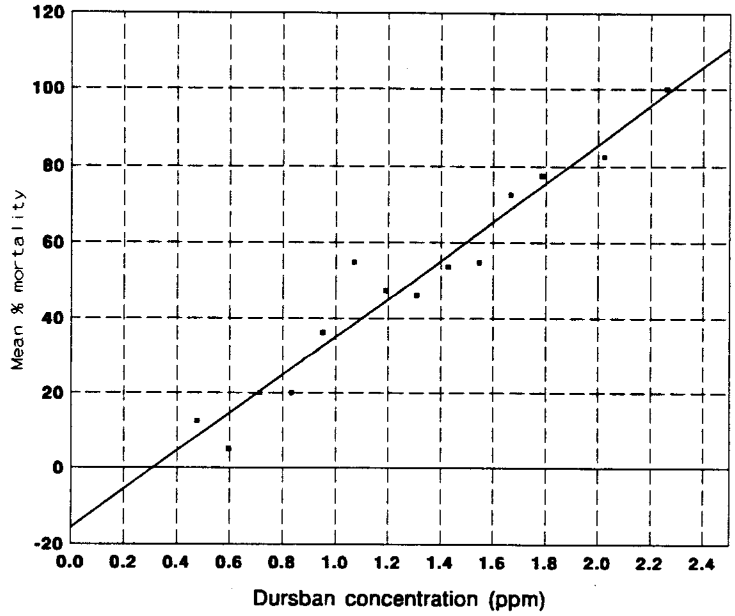


Figure 2. Linear Regression for LC Rates of Chlorpyrifos in Flowerwood Media.

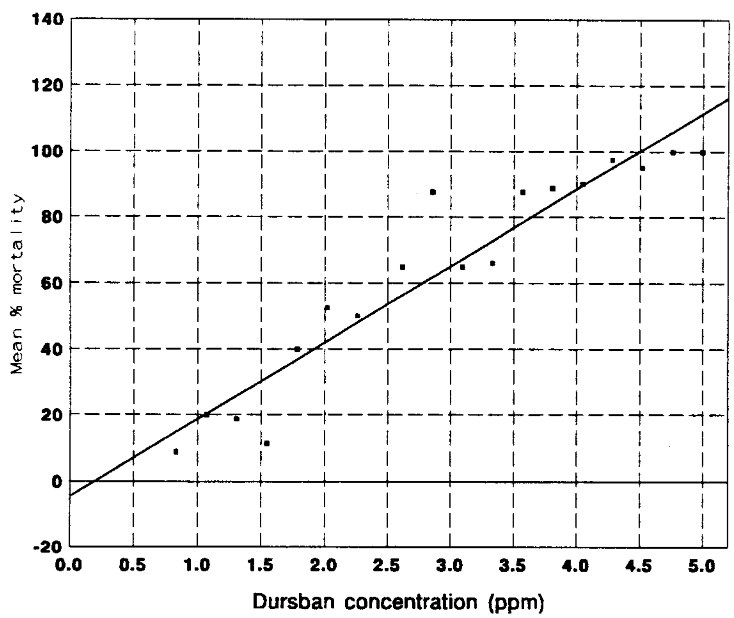


Figure 3. Linear Regression for LC Rates of Chlorpyrifos in Grace Sierra Media.

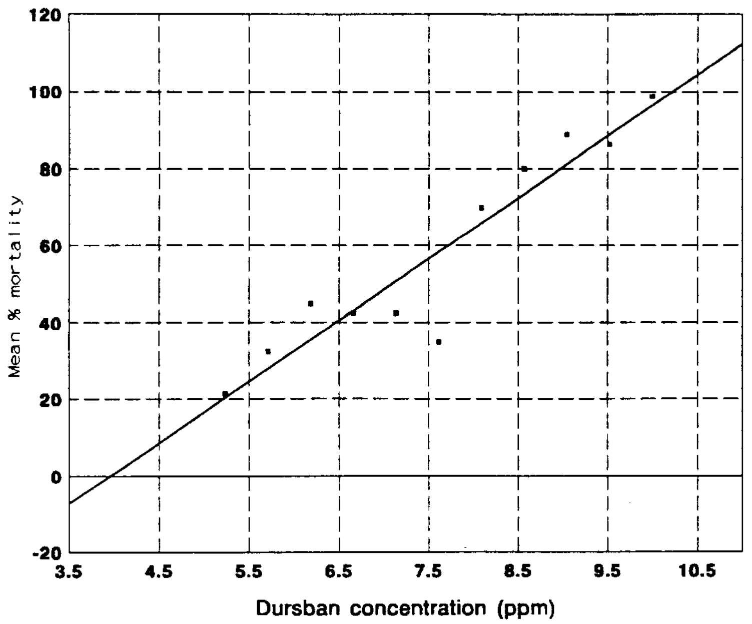


Figure 4. Linear Regression for LC Rates of Bifenthrin in Grace Sierra Media.

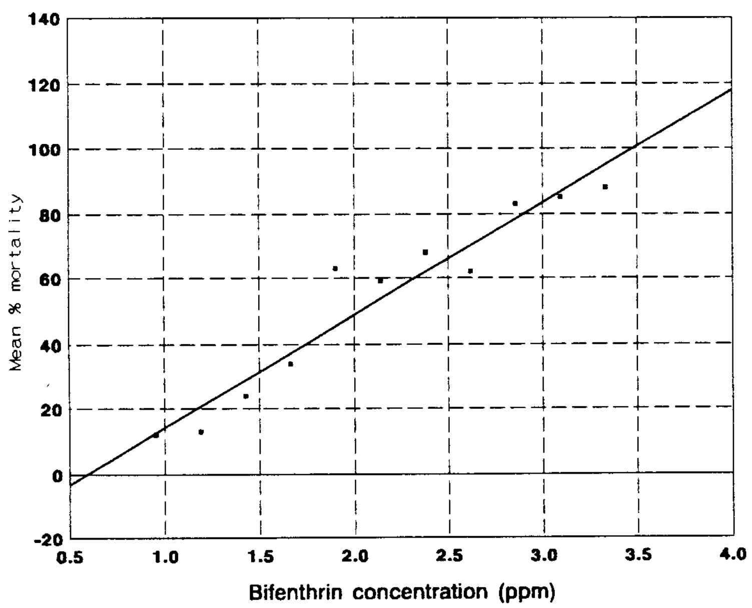
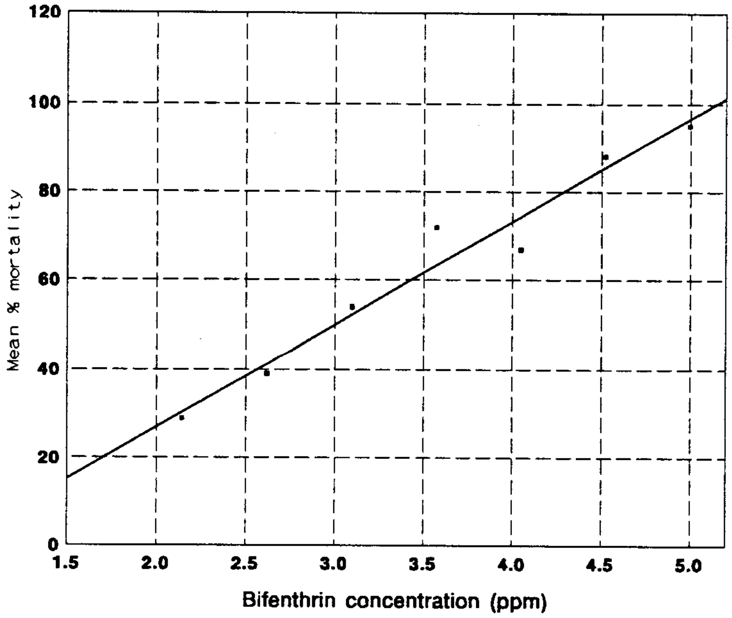


Figure 5. Linear Regression for LC Rates of Bifenthrin in MAFES Media.



PROJECT NO: FA01G023

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

TYPE REPORT: Final

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).

<u>RESULTS</u>:

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 decreased in efficacy after 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 were erratic for all rates after 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 were terminated at the nursery. The 12.5 ppm rate in Wight media provided excellent control through 27 mths, while the 15 - 25 ppm rates were very effective through 35 mths.

One interesting note, Wight nursery media was used at both the nursery site and the Univ. of Ga. site, but 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 Nursery[2]	12.5	-	100	100	100	100	100	100	100	100	100	100	-[3]	100
	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 Georgia	12.5	100	100	100	100	100	100	100	100	90	100	100	100	100
	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	100
	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	5	15	25	45	20	10	25	30	10	0	5
Univ. of Georgia	12.5	100	100	85	100	50	95	100	80	100	45	100
	15	100	100	100	100	50	100	95	85	100	35	100
	18	100	100	90	100	85	100	80	75	100	35	95
	25	100	100	90	100	65	100	90	70	100	60	40
	Check	0	10	25	5	10	20	40	25	30	15	0

Table 5. Cont.

Location	Dose Rate (ppm)	% Mortality at Indicated Months PT										
		(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)
Wight Nursery[2]	12.5	100	100	100	95	100	100	75	100	80	100	100
	15	100	100	100	100	100	95	100	100	100	100	100
	18	100	100	100	80	100	100	100	100	100	100	100
	25	100	100	100	100	100	100	95	100	100	100	100
	Check	0	0	30	10	20	20	0	10	5	5	0
Univ. of Georgia	12.5	-										
	15	-										
	18	-										
	25	-										
	Check	-										

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: FA01G145

PROJECT TITLE: Evaluation of Bifenthrin 0.2G on a New Inert Carrier

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Anne-Marie Callcott and Kirk Irby

INTRODUCTION:

Talstar® T&O Granular (FMC Corp.) is currently registered and approved for use in the Imported Fire Ant Federal Quarantine as a preplant incorporation treatment. Rates and certification periods range from 10 ppm for a 6 mth certification to 25 ppm for continuous certification (7CFR §301.81). The product currently on the market is formulated on an inert sand carrier. Formulators are always evaluating new carriers for a variety of reasons, including better mix-ability, easier handling, etc. In 1995, FMC formulated bifenthrin on an organic type carrier at 0.2% for evaluation.

MATERIALS AND METHODS:

Original Talstar T&O Granular (0.2G on a sand carrier) and bifenthrin 0.2G on an organic carrier were incorporated into standard nursery potting media at rates of 10, 12, 15 and 25 ppm. The standard MAFES mix used by the IFA Laboratory (3:1:1 pine bark:peat moss:sand) was used. Treated media was placed into trade gallon pots and weathered under simulated nursery conditions, including irrigation (ca 1½ inches/week) plus rainfall. Three pots from each treatment were collected monthly and subjected to a standard alate female bioassay (Appendix II).

RESULTS:

Results to date show 100% efficacy regardless of carrier or rate of application through 5 months posttreatment (Table 6).

Table 6. Efficacy of Bifenthrin 0.2% on an Organic Carrier (SPG95-07) vs. the Standard Sand Carrier (Talstar T&O).

Formulation	Rate of Application	Mean % mortality to alate females at indicated months PT					
		(1)	(2)	(3)	(4)	(5)	(6)
Talstar T&O	10	100	100	100	100	100	
	12	100	100	100	100	100	
	15	100	100	100	100	100	
	25	100	100	100	100	100	
SPG95-07	10	100	100	100	100	100	
	12	100	100	100	100	100	
	15	100	100	100	100	100	
	25	100	100	100	100	100	
Untreated Check	---	5	20	5	15	5	

PROJECT NO: FA01G155

PROJECT TITLE: Evaluation of SpinOut® Technology in Combination with Bifenthrin as a Quarantine Procedure for Containerized Nursery Stock.

TYPE REPORT: Interim

PROJECT LEADER: Randy Cuevas

INTRODUCTION:

SpinOut root growth regulator technology was developed by Griffin Corporation, Valdosta, GA. When applied to the inner surface of a nursery container, SpinOut inhibits the root tips when they reach the container sides. As the plant continues to produce new lateral roots, SpinOut serves as a growth regulator to the new roots, thus helping to produce a very fibrous root system. SpinOut is a liquid flowable that can be applied with a variety of airless sprayers. The active ingredient is 7.1% copper hydroxide. SpinOut treated containers have been tested one year after treatment with out any loss of activity. It has been hypothesized that fire ant colonies enter nursery containers through the drain holes in the bottom of pots (H. L. Collins, personal communication). Use of the SpinOut technology in which an insecticide such as bifenthrin replaces, or is used in conjunction with copper hydroxide, might prevent IFA invasion of nursery containers. The current study was designed to evaluate the potential of SpinOut technology used in concert with bifenthrin to prevent invasion of treated nursery containers by RIFA colonies.

METHODS AND MATERIALS:

Treatment of Containers – Standard trade one gallon nursery containers (Lerio Corp., Mobile. AL) were treated by Griffin Corporation with various concentrations of bifenthrin in SpinOut (0.25% AI, 0.5% AI, and 1.0% AI). The pots were shipped to this laboratory. and received on September 27, 1995. On October 2, 1995 25 pots of each bifenthrin concentration were filled with a standard growing medium comprised of pine bark, sphagnum peat and sand

(3:1:1)[1]. After the pots were filled with media, they were placed in a simulated can yard and aged under simulated nursery conditions. Irrigation was provided through an automatic overhead pulsating irrigation system programmed to deliver 1.0-1.5 inches of water per week. In addition to the supplemental irrigation, all pots received natural rainfall.

Bioassay – Treatments were bioassayed in the laboratory with field collected RIFA colonies. One container from each treatment series was placed at one end of a 2' x 8' test arena. Sides of the test arena were talced to prevent ants from climbing out and escaping. An untreated check container filled with media was placed at the distal end of the arena. A field collected colony complete with associated soil and nest tumulus was then placed in the center of the arena. Overhead incandescent bulbs slowly desiccated the nest so that the ants were encouraged to migrate to the more moist containers. Therefore the colony had an equal opportunity to move into either a SpinOut treated pot or the untreated check colony. Pots were observed at 24 hour intervals for 7 days after introduction, and the estimated number of workers successfully invading each pot recorded.

RESULTS:

All rates of bifenthrin in the SpinOut technology have successfully prevented IFA infestation in nursery pots for 3 months.

[1] This is the standard media used by Miss. Agr. Forestry Expt. Stn., Popularville, MS, and adopted by us for many such trials.

PROJECT NO. FA01G053

PROJECT TITLE: Influence of Sand Content of Nursery Potting Media on Residual Activity of Bifenthrin and Tefluthrin, 1993.

TYPE REPORT: Final

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 Fireban® 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 (Appendix II).

RESULTS:

Bifenthrin in all media mixes, except the sand only, showed excellent control for 20 mths (Table 7). 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 24 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 very effective for 24 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 the theoretical dose rate is based on the amount of pine bark only, all media were treated at 25 ppm, except the sand only. From this perspective, it does appear that large quantities of sand (i.e. ½ to ⅛ of the total volume of the media) do have some adverse affect on bifenthrin.

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 all media components except the sand in an effort to support an application rate change based on sand content.

Table 7. 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 7. 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	55	70
	1:1	5.6	100	100	100	100	100	100	100	5	75	100	100
	2:1	7.6	100	100	95	100	100	100	95	80	80	85	100
	3:1	9.2	100	100	95	100	100	100	100	55	85	100	100
	6:1	12.6	100	100	100	100	100	100	100	80	100	100	100
	8:1	14.2	100	100	100	100	100	100	100	85	100	100	100
	1:0	25.0	100	100	100	100	100	100	100	65	100	100	100
Fireban	0:1	3.2	100	100	100	100	100	100	100	100	100	95	100
	1:1	5.6	100	65	50	25	15	15	30	95	40	15	0
	2:1	7.6	100	100	100	100	55	100	90	95	80	25	65
	3:1	9.2	100	100	100	100	85	65	55	100	45	50	50
	6:1	12.6	100	100	90	85	70	60	80	100	65	75	0
	8:1	14.2	100	100	90	100	95	90	45	100	35	55	80
	1:0	25.0	100	100	100	100	65	100	80	100	100	35	15
Check	Bark	0.0	0	15	5	25	5	45	5	15	15	15	10
	Sand	0.0	0	20	15	15	10	35	10	10	15	0	10

PROJECT NO. FA01G035

PROJECT TITLE: Influence of Sand Content of Commercial Nursery Potting Media on Residual Activity of Bifenthrin and Tefluthrin, 1995.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, Jim Berry (Flowerwood Nursery, Mobile, AL), Lee McAnally Kirk Irby

INTRODUCTION:

Historically, insecticidal treatments for nursery potting media were administered on a weight to volume basis, i.e. 1 1b 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 rates of 10 to 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.

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 their media except the sand. However, in a trial initiated in 1993 (FA01G053), we found that large quantities of sand, and the bulk density that it adds. appeared to affect the efficacy of both bifenthrin and tefluthrin. In that trial, insecticides were incorporated into media of various pine bark to sand ratios at 3.915 g AI/cu (equivalent to 25 ppm in pure pine bark).

The current study also investigates the impact of sand content of potting media on the residual activity of bifenthrin (Talstar®) and tefluthrin (Fireban®) in commercial nursery potting media blended and aged on site. In this trial, insecticides were be incorporated at a rate of 25 ppm based on the bulk density of all media components except the sand.

MATERIALS AND METHODS:

Two media types were used in this trial: Flowerwood Nursery media (Mobile, AL) and MAFES media. Flowerwood Nursery provided the bark component of their 19:3 (pine bark:sand) basic potting mix. The MAFES mix is a 3:1:1 (pine bark:peatmoss:sand) potting media used by the IFA Station. The IFA lab provided masonry sand for the sand component. At the IFA Station, lab personnel blended the candidate toxicants into the potting media at 25 ppm, based on the bulk density of the non-sand components. The ratios of other media components to sand was as indicated in Table 8. The two products currently registered for IFA quarantine use, bifenthrin (Talstar T&O® Granular 0.2%) and tefluthrin (Fireban® 1.5%) were used as test toxicants. After blending, treated media was potted up in trade gallon nursery pots and aged under simulated nursery conditions of irrigation (ca 1-1½ inches of irrigation per week).

At monthly intervals, three pots from each treatment rate were collected and composited. IFA personnel subjected the treated media to a standard alate female bioassay as described in Appendix II.

RESULTS:

Results are summarized in Table 8. All treatments have provided 100% efficacy through 6 months.

Table 8. Effect of Sand Content in Nursery Media on Residual Activity.

TREATMENT			PERCENT MORTALITY AT INDICATED MONTHS POST-TREATMENT						
INSECTICIDE	SOIL TYPE	RATIO	1	2	3	4	5	6	7
TALSTAR	MAFES	1:0	100	100	100	100	100	100	
		1:1	100	100	100	100	100	100	
		2:1	100	100	100	100	100	100	
		3:1	100	100	100	100	100	100	
		6:1	100	100	100	100	100	100	
		8:1	100	100	100	100	100	100	
	FLOWERWOOD	1:0	100	100	100	100	100	100	
		1:1	100	100	100	100	100	100	
		2:1	100	100	100	100	100	100	
		3:1	100	100	100	100	100	100	
		6:1	100	100	100	100	100	100	
		8:1	100	100	100	100	100	100	
	SAND	0:1	100	100	100	100	100	100	
FIREBAN	MAFES	1:0	100	100	100	100	100	100	
		1:1	100	100	100	100	100	100	
		2:1	100	100	100	100	100	100	
		3:1	100	100	100	100	100	100	
		6:1	100	100	100	100	100	100	
		8:1	100	100	100	100	100	100	
	FLOWERWOOD	1:0	100	100	100	100	100	100	
		1:1	100	100	100	100	100	100	
		2:1	100	100	100	100	100	100	
		3:1	100	100	100	100	100	100	
		6:1	100	100	100	100	100	100	
		8:1	100	100	100	100	100	100	
	SAND	0:1	100	100	100	100	100	100	
CHECK	SAND		0	20	0	0	5	5	
	FLOWERWOOD		55	35	5	20	5	15	
	MAFES		10	0	5	15	25	10	

PROJECT NO: FA01G163

PROJECT TITLE: Relative Phytotoxicity of Tefluthrin [Fireban® 1.5G] to Selected Foliage and Woody Ornamental Plants, 1993-1995.

TYPE REPORT: Final

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

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 Fireban in June 1993. We've studied potential phytotoxic effects of Fireban 1.5G in this and other studies and have found no negative potential for this product.

MATERIALS AND METHODS:

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

TRIAL I:
Ten 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 29 March 1995 at rates of 1X [25 ppm] and 3X [75 ppm]. On 13 October 1995 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:

Eleven 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 23 April 1995. Seven replicates/cultivar treatment were established in a randomized complete block design. Shoots and roots were observed for possible phytotoxicity. Plants were sacrificed on 1 November 1995 and evaluations made as described in Trial I.

TRIAL III:

Six cultivars of foliage plants were transplanted from plugs into 3 quart containers on 10 April 1995 following procedures as described above. All plants were sacrificed and evaluated on 10 October 1995.

RESULTS AND DISCUSSION:

TRIAL I:

Significant differences were noted in root structure of *Callimistron* 'Red Cluster' and 'Cirtinus' as well as for *Juniperus* 'Andora'. Higher shoot fresh weights were noted for *Rhaphiolepis* 'Elizabeth' at the 3X rate and for the 1X and 3X rates for *Juniperus* 'Andora'. No phytotoxicity was indicted among any of the cultivars (Table 9).

TRIAL II:

Significant positive differences were observed within four of the cultivars for fresh shoot weight and seven of the cultivars for root structure (Table 10).

TRIAL III:

Among the six cultivars, no significant differences in fresh top weight or root structure were noted (Table 11). No phytotoxic response was observed within any of the cultivars tested.

Table 9. Relative Phytotoxic Response of Ten Selected Varieties of Woody Ornamental Plants of Media Incorporated Granular Tefluthrin.

CULTIVAR	SHOOT FRESH WEIGHT [g]			ROOTS		
	CK	1X	3X	CK	1X	3X
Acer rubrum	4393a	5001a	4821a	2.1a	2.0a	2.1a
Magnolia 'D.D. Blancher'	5893a	5636a	5607a	2.0a	2.1a	2.3a
Magnolia 'Little Gem'	5071a	5143a	5107a	2.1a	2.3a	2.1a
Callistemon 'Red Cluster'	6201a	6409a	6811a	1.4a	2.6b	2.8b
Callistemon citrinus	5929a	6071a	5821a	2.3a	3.0b	2.9b
Raphiolepis 'Elizabeth'	187a	191a	237b	2.6a	2.9a	2.6a
Juniperus 'Andora'	204a	294b	272b	1.9a	2.4b	2.4b
Juniperus chinensis 'Pfitzerana'	217a	266a	231a	2.3a	2.3a	2.6a
Ilex 'Mary Nell'	191a	192a	189a	2.4a	2.4a	2.4a
Ilex vomitoria	4587a	4893a	4679a	2.3a	2.6a	2.4a

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

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

	SHOOT FRESH WIEGHT (g)			ROOTS		
	CK	1X	3X	CK	1X	3X
Rhododendron 'Sherwood Red'	79.7a	82.6a	72.0a	2.0a	2.4b	2.0a
Rhododendron 'Christmas Cheer'	133.7a	151.7a	131.9a	2.3a	2.7a	2.7a
Rhododendron 'Girards Rose'	105.1a	110.6a	108.3a	2.6a	2.4a	2.4a
Rhododendron 'Mrs. G.G. Gerbing'	148.3a	144.3a	136.9a	2.6a	2.6a	3.0b
Rhododendron 'Fashion'	98.4a	138.3b	124.9b	2.3a	2.9b	2.9b
Rhododendron 'White Gumbo'	96.3a	118.9ab	132.6b	2.6a	2.6a	2.7a
Ilex crenata 'Green Cluster'	95.6a	100.6a	98.3a	3.0a	2.9a	2.9a
Gardenia jasminoides 'Daisy'	254.6a	267.4a	251.1a	2.6a	3.3b	3.3b
Lantana camara 'New Gold'	244.0a	244.9a	259.4a	2.6a	2.7a	2.5a
Juniperus conferta 'Blue Pacific'	201.1a	248.6b	242.9b	2.7a	2.7a	3.0a
Buddleia davidii 'Royal Red'	124.0a	164.3b	210.0c	2.3a	3.0b	2.7c

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

Table 11. Relative Phytotoxicic Response of Six Selected Varieties of Ornamental Plants to Media Incorporated Granular Tefluthrin.

	SHOOT FRESH WEIGHT (g)			ROOTS		
CULTIVAR	CK	1X	3X	CK	1X	3X
Oleander 'Calypso'	90.3a	84.4a	79.6a	2.6a	2.7a	2.6a
Ixora coccinea 'Red'	89.6a	79.7a	77.3a	2.4a	2.5a	2.6a
Albizia julibrissin	49.7a	44.2a	44.3a	2.5a	2.4a	2.5a
Gelsemium sempervirens	80.1a	77.8a	79.6a	2.4a	2.4a	2.5a
Cestrum nocturnum	127.9a	30.6a	120.9a	2.8a	2.7a	2.9a
Cortaderia selloana	192.6a	211.4a	217.1a	3.0a	3.0a	3.1a

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

PROJECT NO: FA01G025

PROJECT TITLE: Evaluation of Fipronil as a Potting Media Toxicant Under Actual Nursery Conditions.

TYPE REPORT: Interim

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

COOPERATORS: Flowerwood Nursery (Loxley, AL), Wight Nursery (Cairo, GA), Georgia Dept. of Agric., Windmill Nursery (Folsom, LA) and Louisiana Dept. of Agric.

INTRODUCTION:

Fipronil is a broad spectrum pyrazole insecticide under development by Rhone-Poulenc Ag. Co. The insecticide acts on the central nervous system of the insect and enters by ingestion or contact. Thus, fipronil has shown excellent control of a variety of foliar and soil insects (Colliot et al. 1992).

In 1993, the IFA lab initiated a trial using fipronil as a preplant incorporated treatment against IFA (FA01G123). The product in this trial provided 24 months of excellent control at rates of 100 and 300 ppm. The 25 ppm rate provided 23 months of residual activity and rates of 5 and 10 ppm provided 8 and 13 months of residual activity, respectively.

Products which show promise as potting media treatments for control of IFA are further evaluated by subjecting them to actual nursery conditions. However, due to cost restrictions, plants will not be included in the pots with treated media. Colliot et al. (1992) reported no phytotoxicity on any crops tested and our lab currently has a phytotoxicity trial underway (FA01G015).

MATERIALS AND METHODS:

Three nurseries cooperated in this trial: Wight Nursery (Cairo, GA), Windmill Nursery (Folsom, LA), and Flowerwood Nursery (Mobile, AL). IFA lab personnel blended fipronil granular insecticide into media provided by each nursery on site. The media contained all fertilizer and nutrients normally used by the nursery. After blending, treated media was potted up in trade gallon nursery pots and aged on site under normal conditions of irrigation and other cultural practices. Fipronil 0.1G (EXP 60818A) was incorporated at rates of 5, 10, 25 and 50 ppm.

The Flowerwood trial was initiated on April 25, 1995 and the Wight trial on August 9, 1995. The Windmill trial was initiated on October 24, 1995.

At monthly intervals, three pots from each treatment rate were collected, composited, and sent to the IFA lab. IFA personnel subjected the treated media to a standard alate female bioassay as described in Appendix II.

RESULTS:

At Flowerwood Nursery, 4 mths of residual activity has been achieved with the 10 ppm rate and 8 mths of activity with the 25 and 50 ppm rate (Table 12). At Wight Nursery, all rates provided excellent activity at 4 mths after treatment. The Windmill treated media has provided ≥95% mortality at 2 mths after treatment at rates of 10 ppm and higher.

Table 12. Efficacy of Fipronil Incorporated into Nursery Potting Media and Aged Under Actual Nursery Conditions.

Nursery	Rate (ppm)	% Mortality to Alate Females at Indicated Mths PT								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flowerwood	5	95	45	50	30	15	20	0	5	
	10	100	100	100	95	65	10	100	100	
	25	100	100	100	100	100	100	100	100	
	50	100	100	100	100	100	100	100	100	
	Check	80	20	5	0	0	5	10	0	
Wight	5	100	100	100	100					
	10	100	100	100	100					
	25	100	100	100	100					
	50	100	100	100	100					
	Check	10	10	15	25					
Windmill	5	0	65							
	10	95	100							
	25	100	100							
	50	100	100							
	Check	5	0							

PROJECT NO: FA01G015

PROJECT TITLE: Phytotoxicity of Fipronil 1.5G to Selected 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. Fipronil has demonstrated promising efficacy at low rates. This test was conducted using herbaceous and woody ornamental plants.

MATERIALS AND METHODS:

Liners of 5 varieties of woody ornamental plants were transplanted into standard 1-gallon nursery containers containing either 1X (25 ppm), 3X (75 ppm) or untreated media. Liners of 2 varieties of herbaceous plants were transplanted into 4 inch pots containing media as described above. Two sets of the herbaceous plants were used. One set was sacrificed at 100 days. The other set was transplanted from the 4 inch pots to 1-gallon containers at the same time to be sacrificed after one year. The time interval to potting up was determined by the growth rate of the plants. One herbaceous cultivar (Marble Queen Pothos) was planted directly into 1-gallon containers because liners were already in 3 inch pots from wholesaler. Seven plants per rate per cultivar were used.

Media consisted of pine bark, peat moss and river sand (3:1:1) with a dry weight bulk density of 1000 lbs/cu. yd. The following amendments were also added (per cu yd): 4 lb dolomite, 3 lb controlled release (3-4 month) fertilizer (17-6-12 plus minors), 1 lb superphosphate (0-20-0). Media was blended and treated with fipronil 1.5G on January 30, 1995. Plants were transplanted on January 31, 1995, with the exception of the Boxwood and Pothos which were transplanted on February 14 & 21, 1995 respectively. Plants were then subjected to normal nursery "growing on" practices. A pulsating overhead irrigation system supplied ca 1-1½" water per week. The herbaceous plants were maintained in the greenhouse and manually watered until weather conditions allowed placement outdoors. At 100 days post-treatment one set of herbaceous plants was sacrificed. The other set of herbaceous plants and the woody plants were be sacrificed at one year post-treatment or sooner if ready to be potted up to the next size. Final 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.

Plant varieties used were as follows:

Rhododendron spp.	Formosa Azalea
Buxus sempervirens 'Wintergreen'	Wintergreen Boxwood
Gardenia jasminoides 'Radicans'	Dwarf Gardenia
Ilex cornuta 'Burfordi Dwarf'	Dwarf Burford Chinese Holly
Raphiolepis indica	Indian Hawthorn
Fatsia japonica	Fatsia, Japanese Aralia
Scindapsus aureus 'Marble Queen'	Marble Queen Pothos
Rademachera spp.	China Doll

RESULTS:

No significant differences were noted in the two cultivars sacrificed at 100 days post-treatment (Table 13). When grown out in 1 gallon containers and sacrificed at a later date, the only significant difference appeared in the top biomass of the *Fatsia*, where the checks weighed significantly less than the treated plants (Table 14). However, this does indicate that the treatment had no adverse effect on these two cultivars.

Three of the woody cultivars showed significant differences in top weights (Table 15). However, no significant differences were noted in the top rating or the root rating of any cultivar. In the azaleas, the 1X and 3X rates did considerably better than the checks, possibly indicating an enhanced top growth rate. The *Gardenia* checks were better than the 1X plants which were better than the 3X plants. This is probably not as signicant as it seems due to wide variations within each treatment block. The Boxwood 1X plants were better than the checks which were better than the 3X. Again, these differences may be due wide variations within each treatment.

In general, these data indicate that fipronil at a rate of 25 ppm does not adversely affect these particular herbaceous and woody ornamentals. However, at the 75 ppm rate (3X), there was a slight decrease in top biomass weight of the *Gardenia* species. This may be due to normal variations in growth rates, since root growth and general plant health were normal. More phytotoxicity trials will be initiated in the future.

Table 13. Ratings for Cultivars Grown in 4-in. Containers and Sacrificed at 100 Days Post-treatment.

SPECIES	RATE	MEAN TOP BIOMASS RATING	MEAN TOP BIOMASS WT(g)	MEAN ROOT RATING
	1X	1.0a	10.3a	2.3a
Fatsia japonica	3X	1.0a	8.1a	2.0a
(Japanese Aralia)	CK	1.0a	8.1a	2.0a
	1X	1.0a	7.5a	2.0a
Rademachera spp.	3X	1.0a	9.5a	2.3a
(China Doll)	CK	1.0a	7.3a	2.0a

Means within a cultivar followed by the same letter are not significantly different (LSD test, P=0.05).

Table 14. Ratings for Cultivars Grown in 4-in. Gontainers and Potted Up to 1-gal. Containers.

SPECIES	RATE	MEAN TOP BIOMASS RATING	MEAN TOP BIOMASS WT(g)	MEAN ROOT RATING
Fatsia japonica	1X	1.7a	19.6a	2.1a
(Japanese Aralia)	3X	1.7a	21.6a	2.0a
sacrificed at 6 months	CK	2.9a	9.2b	1.4a
Rademachera spp.	1X	1.1a	53.1a	2.0a
(China Doll)	3X	1.1a	47.8a	2.0a
sacrificed at 9 months	CK	1.1a	53.1a	2.1a

Means within a cultivar followed by the same letter are not significantly different (LSD test, P=0.05).

Table 15. Ratings for Cultivars Grown in 1-gal. Containers.

SPECIES	RATE	MEAN TOP BIOMASS RATING	MEAN TOP BIOMASS WT(g)	MEAN ROOT RATING
Raphiolepis indica	1X	1.0a	76.5a	1.9a
(Indian Hawthorn)	3X	1.0a	74.5a	2.0a
	CK	1.0a	88.6a	2.3a
Rhododendron spp.	1X	1.9a	22.9b	1.4a
(Azalea)	3X	2.0a	24.8b	1.7a
	CK	2.1a	9.4a	1.8a
Ilex cornuta	1X	1.0a	52.1a	2.0a
'Burfordi Dwarf'	3X	1.0a	57.1a	1.7a
Dwarf Burford Holly	CK	1.0a	59.3a	2.1a
Gardenia jasminoides	1X	1.0a	90.0ab	2.0a
'Radicans'	3X	1.0a	77.1b	2.0a
Dwarf Gardenia	CK	1.0a	104.4a	2.1a
Buxus sempervirens	1X	1.0a	54.5a	2.1a
'Wintergreen'	3X	1.0a	43.96b	2.1a
Wintergreen Boxwood	CK	1.0a	48.4ab	1.9a
Scindapsus aureus	1X	1.6a	191.3a	2.3a
'Marble Queen'	3X	1.0a	162.8a	2.0a
Marble Queen Pothos*	CK	1.0a	139.4a	1.9a

Means within a cultivar followed by the same letter are not significantly different (LSD test, P=0.05).

*Sacrificed at 8 months post-treatment

PROJECT NO: FA01G074

PROJECT TITLE: Evaluation of Candidate Potting Media Toxicants, 1994

TYPE REPORT: Final

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 AgrEvo Environmental Health, 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 supposed to be 10, 50 and 100 ppm, however, due to severe miscalculation, rates were actually 1300, 6500 and 13000 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:

Results are summarized in Table 16. At six months post-treatment the dust formulation was effective at the 50 ppm rate all six months. The 25 ppm rate began to show 100% mortality at 4 months post-treatment and remained until the scheduled termination at six months. The 10 ppm rate never exceeded 70% mortality. The drench treatment was effective at all rates tested.

Table 16. Residual Activity of Silafluofen

Treatment	Rate (PPM)	% Mortality at Indicated Months Post-Treatment (1)	(2)	(3)	(4)	(5)	(6)
Dust	10	70	65	55	35	15	10
	25	80	90	75	100	100	100
	50	100	95	100	100	100	100
Drench	1300	100	100	100	100	100	100
	6500	100	100	100	100	100	100
	13000	100	100	100	100	100	100
Check	--	5	10	0	5	0	0

PROJECT NO: FA01G115

PROJECT TITLE: Residual Activity of Drench Candidates. 1995.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Lee McAnally and Kirk Irby

INTRODUCTION:

Drench trials are a part of the ongoing search for new and/or better toxicants for use in the IFA quarantine program. While granular incorporation treatments are commonly used by large nurseries which routinely ship outside the quarantine area, drench treatments are used by smaller nurseries which ship limited quantities of plant material outside the quarantine area. This lab routinely tests new compounds and products not currently registered for IFA use. Tame® 2.4EC (fenpropathrin) is an insecticide/miticide registered by Valent Corp. (Walnut Creek, CA) for use as a foliar treatment on containerized plants for control of spider mites, aphids, whitefly, etc. Silafluofen is a new product by AgrEvo Environmental Health (Montvale, NJ) we tested earlier as a drench and obtained 100% efficacy for 6 mths at rates of 1,300, 6,500 and 13,000 ppm (excessively high rates due to miscalculation - FA01G0074).

MATERIALS AND METHODS:

Trade gallon nursery pots were filled with MAFES mix and set in a simulated can yard allow the media to become fully saturated before the drench was added. Drench solution were applied to each container at a rate of 400 ml drench solution per container. All containers were then aged under simulated nursery conditions. A pulsating overhead irrigation system supplied ca 1-1½" water per week. At monthly intervals, three pots from each treatment were composited and subjected to standard IFA alate female bioassay (Appendix II).

Tame:
Rates used were in accordance with labelled rates; 8 fl oz/100 gal H_2O and 16 fl oz/100 gal H_2O. These rates are equivalent to ca 48 and 93 ppm respectively in the MAFES media.

Silafluofen:

The formulation evaluated in this trial was an 80% EC formulation (800 g AI/L). Rates used were 5, 10, 15 and 25 ppm.

RESULTS:

Tame:

The low rate of Tame has consistently shown 70-80% mortality through 5 months posttreatment (Table 17). However, this is not an acceptable level of control for quarantine drench treatments. The higher rate, ca. 93 ppm, has provided 90-100% control through 6 mths.

Silafluofen:

Rates of 25 ppm and lower were not effective at any time in this trial (Table 18).

Table 17. Efficacy of Tame as a Containerized Drench Treatment.

Rate of Application (ppm)	Mean % mortality to alate females at indicated mths PT					
	(1)	(2)	(3)	(4)	(5)	(6)
48	70	80	70	75	85	40
93	90	100	100	100	100	100
Untreated Check	10	5	0	10	0	0

Table 18. Efficacy of Silafluofen as a Containerized Drench Treatment.

Rate of Application (ppm)	Mean % mortality to alate females at indicated mths PT		
	(1)	(2)	(3)
5	5	5	15
10	5	0	5
15	25	10	30
25	10	10	30
Untreated Check	0	10	15

PROJECT NO: FA01G135

PROJECT TITLE: Residual Activity of Cyfluthrin on Various Carriers.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Cyfluthrin has been shown to be an effective potting media drench treatment in sever'al previous trials (FA01G080 & FA01G111). Application rates of 100 and 200 ppm were effective for 14 months (FA01G080) while 50 ppm was effective for 13 months (FA01G111). Other tests with incorporated granules at lower rates (50 ppm and below) have provided less than satisfactory results. This test is being undertaken to test several different granular formulations on different carriers at the 100 ppm rate.

MATERIALS AND METHODS:

Each formulation was blended into standard lab potting media (3:1:1, pine bark: peat moss: sand) using portable electric cement mixers. The rate of application for all formulations was 100 ppm. Due to limited amounts of formulations available, different quantities of treated media were available for testing. The formulations therefore were evaluated for different time periods.

After thorough blending, each treatment was placed in 1-gallon nursery containers and placed outdoors under simulated nursery conditions. At monthly intervals 2 pots from each treatment were collected, composited, and subjected to alate queen bioassay.

RESULTS:

Results to date are summarized in Table 19. At 6 months post-treatment all formulations have provided excellent control.

Table 19. Efficacy of Cyfluthrin on Different Carriers Incorporated into Standard Nursery Potting Media at 100 ppm.

FORMULATION (Carrier)	% Mortality at Indicated Months Post-treatment					
	1	2	3	4	5	6
Bentonite	100	100	100	100	100	100
KB	100	100	100	100	100	100
SB	100	100	100	95	100	100
CB	100	100	100	100	100	100
UB	100	100	100	100	100	100
Untreated Check	25	10	5	0	15	5

PROJECT NO: FA01G044

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

TYPE REPORT: Final

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:
Results are summarized in Table 20. All treatments showed good results at 2 days posttreatment. 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:
Results are summarized in Table 21. No treatment or rate gave better than 75% mortality at any depth in the Flowerwood soil. 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 20. 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 21. 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: FA01G105

PROJECT TITLE: Efficacy of Pinpoint®15G as a Topical Treatment.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Lee McAnally, Kirk Irby

INTRODUCTION:

Pinpoint is a granular acephate formulation produced by Valent Corp. (Walnut Creek, CA). Use patterns include a containerized treatment for control of aphids, mealybugs, azalea lacebug and ants, including IFA. Application methods are a manual application (topical) and a broadcast application. Pinpoint is also registered for treatment of ants, again including IFA, on turfgrass and non-crop areas, using an individual mound treatment. We have evaluated this product in the past for incorporation and topical treatment applications for possible inclusion in the Federal quarantine treatment manual (FA01G092, FA01G072, FA01G152 AND FA01G044). While Pinpoint does eliminate existing colonies from media in nursery pots, we have not had much success with the product retaining any residual activity. For any treatment to be included in the Federal quarantine as a pre-ship treatment ("treat-and-ship"), the product must (1) eliminate existing IFA colonies, (2) eliminate any females attempting to found a colony in the pot within, a minimum, of 10 days of treatment, (3) prevent a colony from moving into the pot for a minimum of 10 days.

MATERIALS AND METHODS:

Two media types were used in this trial: Grace Sierra potting media with a bulk density of ca 250 lb/cu yd, and MAFES mix with a bulk density of ca 900 lb/cu yd. Two rates of application were used; ½ or ¾ tsp/pot. 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. Using a measuring spoon, each pot was treated with one of the two application rates. Media from 3 pots of each treatment was collected, composited and subjected to standard alate female bioassay (Appendix II) at daily intervals for 5 days (first trial) and 3 days (second trial)

RESULTS:

Results are summarized in Tables 22 & 23. Two trials were initiated because of heavy rainfall immediately following treatment of the first trial. Extremely low mortality was encountered in the first trial and was thought to be caused by excess water. However, the second trial also did not provide acceptable results. Because of unacceptable results, no further testing of this product for IFA Quarantine use was initiated.

Table 22. Efficacy of Pinpoint®15G as a Topical Treatment, First Trial

SOIL TYPE	RATE	% MORTALITY AT INDICATED DAYS POST-TREATMENT				
		1	2	3	4	5
GRACE	1/2 TSP	25	55	40	60	80
	3/4 TSP	45	45	50	80	45
MAFES	1/2 TSP	40	35	30	70	45
	3/4 TSP	50	20	70	40	25

5 inches rain fell less than 24 hours after treatment
approximately 0.2 inches H2O from irrigation system first night
system turned off after rain

Table 23. Efficacy of Pinpoint®15G as a Topical Treatment, Second Trial

SOIL TYPE	RATE	%MORTALITY AT INDICATED DAYS POST-TREATMENT		
		1	2	3
GRACE	1/2 TSP	100	85	85
	3/4 TSP	100	100	80
MAFES	1/2 TSP	100	100	65
	3/4 TSP	45	95	45

1.5 inches rain within 24 hours of treatment
approximately 0.6 inches H2O from irrigation system

PROJECT NO: FA01G064

PROJECT TITLE: Acephate Drench for Containerized Plants.

TYPE REPORT: Final

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, has removed 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 below:

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 1-1½" 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 were drenched on Jan. 23, 1995 and bioassayed daily thereafter for nine 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.

Test III

Acephate in Grace Sierra media gave marginal and unsatisfactory control of IFA queens (Table 25). In the MAFES media, 90% or greater control was achieved for 5 days with both the 200 and 300 ppm rates.

DISCUSSION:

While Test III showed fairly good control of IFA in the MAFES media for 5 days, the results of Test II indicate that excessive rainfall or irrigation will severely reduce the efficacy of the acephate drench, even at 300 ppm. It is also evident from these trials that media type has some effect on the efficacy of the product. Acephate in Grace Sierra, the pre-bagged commercial bedding media, even when at the highest available rate of 300 ppm, never provided acceptable control. Another area of concern which impacts the possible use of this product as a containerized drench quarantine treatment are the Worker Protection Standard requirements. There is a restricted-entry interval (REI) of 24 hours for all agricultural uses, which includes nursery treatments. In general, we look for a minimum of 10 days of residual activity for a containerized treat-and-ship treatment to allow for a 24-48 REI and time in transit. From the results of this study, we do not believe that acephate 75S meets the criteria necessary for a quarantine pre-ship drench treatment for containerized nursery stock. Therefore, we do not plan to initiate any further trials with acephate 75S as a drench treatment.

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

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

Table 25. Residual Activity of Acephate 75S Used as a Drench, Test III.

Media	Rate (ppm)	% Mortality at Indicated Days PT								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Grace Sierra	200	55	50	90	75	95	10	65	45	0
	300	90	65	90	65	95	40	5	15	20
	Check	10	0	0	0	0	10	10	0	0
MAFES	200	100	100	90	100	100	90	50	55	25
	300	90	95	100	95	100	50	100	75	35
	Check	0	0	0	0	0	0	0	0	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: Final

LEADER/PARTICIPANT(s): Tim Lockley, Lee McAnally, Randy Cuevas & James Stephenson (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 squares11inear 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 formulation was incorporated into the media at the rate of 1.0 lb AI/cu yd (83.3 ppm). Pine bark without chlorpyrifos was mixed in an equivalent amount for an untreated check. 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 in media (3:1:1 pine bark: 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 26). 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 test retained 100% efficacy. By month 3, no chlorpyrifos treated media maintained sufficient efficacy and after month 4 was discontinued. Both Force and Commodore continued to cause 100% mortality through 36 months, the point at which all available treated media had been evaluated.

Table 26. Relative Efficacy of Three Chlorpyrifos and Two Synthetic Pyrethroid Formulations in Selected Media to IFA Alate Queens.

Test Site	Treatment Formulation	Rate (ppm)	% Mortality to Alate IFA Queens at Indicated Months Posttreatment (1)	(2)	(3)	(4)	///	(36)
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: FA01G014

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

TYPE REPORT: Final

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 (specific gravity 1.12) and the material which floated skimmed

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

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 6). 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.

RESULTS:

suSCon Green provided 100% control of IFA through 14 months posttreatment (PT) (Table 27). After a substantial drop in efficacy at 15 months PT, good control was maintained through 19 months PT.

The percent chlorpyrifos present in the granules removed from the aged potting media decreased from a theoretical of 10% (actual 8% at 24 hrs PT) to 0.31% at 14 months PT (Table 28). From 15-22 months PT, the results are somewhat variable. It appears from this data that when the percent of chlorpyrifos remaining in the control release granule falls below about 0.30%, efficacy against IFA becomes erratic (Figure 7).

Figure 6. Assembly of Airflow System Using Vidal Sassoon Cold Shot 1500 Hair Dryer.

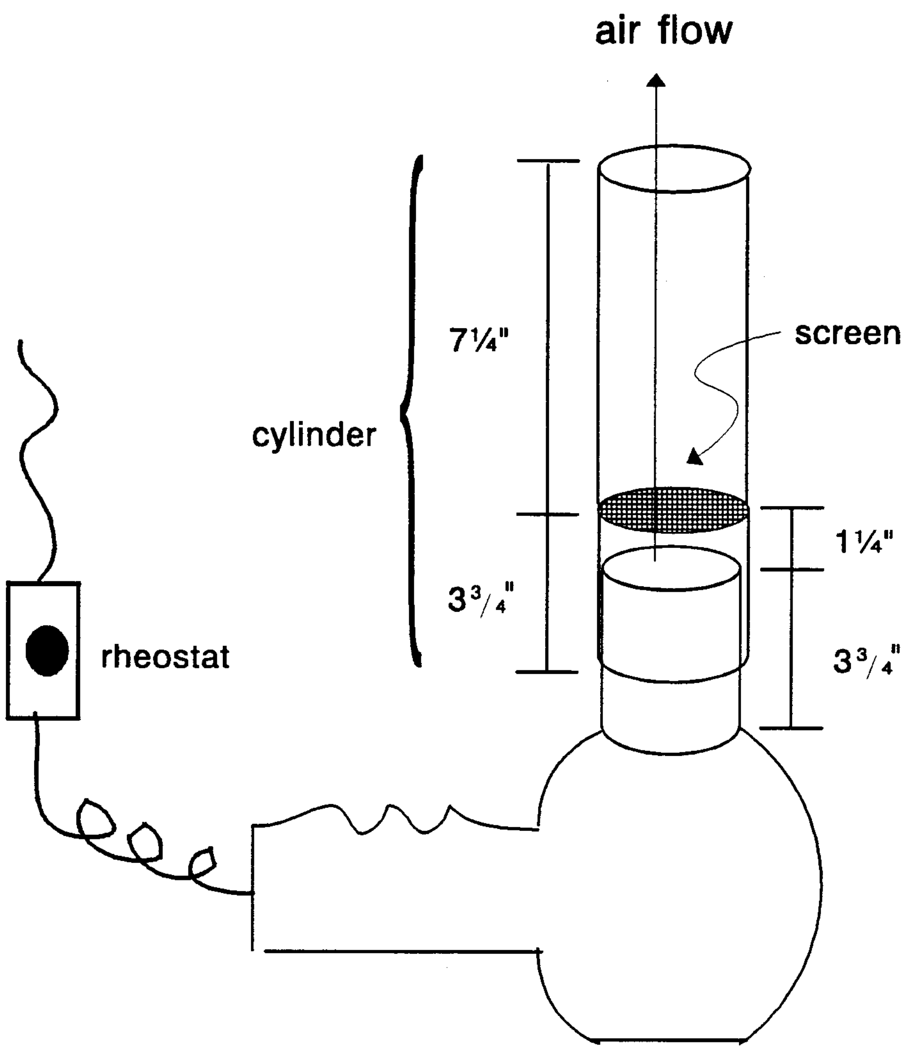


Table 27. Residual Activity of suSCon Green in MAFES Potting Media.

Treatment	% Mortality of Alate Females at Indicated Mths PT													
	(24 h)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
suSCon Green	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	5	0	5	20	10	15	30	5	15	5	15	5	0	20

Treatment	% Mortality of Alate Females at Indicated Mths PT								
	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
suSCon Green	100	40	100	95	100	95	10	40	15
Check	10	30	20	10	10	15	25	10	0

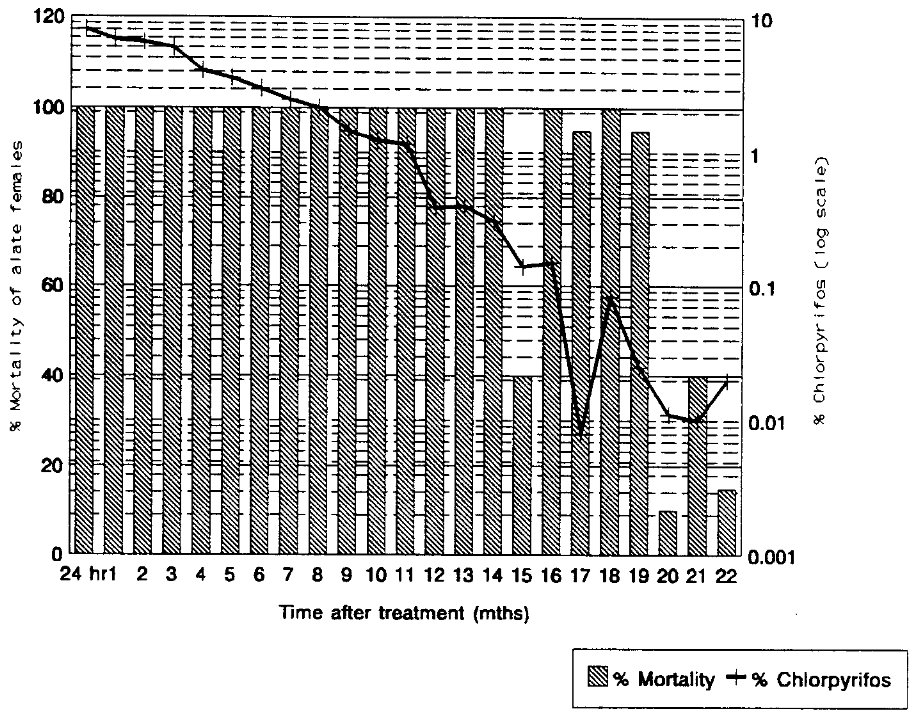
Table 28. Results of GLC Analysis of suSCon Granules Retrieved from Aged Potting Media.

Mean % chlorpyrifos content at indicated mths post treatment[1]													
(24 h)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
8.07	6.85	6.55	6.00	4.10	3.63	3.01	2.51	2.19	1.46	1.23	1.16	0.39	0.40

Mean % chlorpyrifos content at indicated mths post treatment[1]								
(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
0.31	0.14	0.15	0.008	0.083	0.025	0.011	0.01	0.02

[1] mean of three 0.5g replicates

Figure 7. A Comparison of Residual Activity (% mortality) of suSCon Green and the Degradation Rate of Chlorpyrifos (% chlorpyrifos).



PROJECT NO: FA01G085

PROJECT TITLE: Residual Activity of suSCon® Green in Different Types of Nursery Potting Media.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Numerous prior studies conducted by this laboratory have conclusively shown that the residual activity of chlorpyrifos, regardless of formulation, is media dependent (Callcott et al. 1995). Similar effects have been observed when suSCon Green is incorporated into a limited number of media (McAnally 1995). In that study, suSCon green incorporated into the media at 400ppm was active against alate IFA queens for 24 months in MAFES potting media versus only 3 months is Grace Sierra media. Theoretically **it** may be possible to compile a list of media in which suSCon Green can be expected to provide the long residual activity required of an effective IFA quarantine treatment. Some growers might then opt to use a given media treated with suSCon green in lieu of other treatment options.

MATERIALS AND METHODS:

Potting media from 10 different sources (commercial nurseries that custom blend their own media, bulk media from firms that sell media, and commercially bagged media) were acquired. Exact media composition was not available for all mixes, especially the commercially pre-bagged mixes (Table 29). suSCon Green was incorporated into each media at a rate of 400ppm based on the dry weight bulk density of the media. Certain characteristics of each media including pH, % organic matter, bulk density, ion exchange capacity, etc. was determined by the Mississippi State University Soil Testing Laboratory (Mississippi State, MS). After treatment, media was placed in one-gallon plastic nursery containers and weathered outdoors under simulated nursery conditions (black groundcloth culture, overhead pulsating irrigation system). At monthly intervals, three pots from each treatment was destructively sampled and subjected to a standard alate queen bioassay (Appendix II).

RESULTS:

Results to date show 3 months of residual activity in three of the potting media; MAFES, Mobile, and Wight (Table 30). All other media gave at least one month of activity.

Soil analyses indicate that high hydrogen ion content in the soil, and thus low pH, is very important in the prolonged activity of chlorpyrifos (Table 31). Past trials investigated the role of the pH of the irrigation water on chlorpyrifos degradation (1990 IFA Annual Report - FA01G079), but not the pH of the media itself. The technical data sheet for Dursban® insecticides (Form No. 134-289-R585, Dow Chemical U.S.A., Agric. Prod. Dept., Midland, MI) shows a negative relationship between pH of water and half-life of chlorpyrifos in water (pH 7, half-life 35 days; pH 5, half-life 63 days). However, it does not address the effect of soil pH on the half-life of the insecticide in soil.

This trial will continue and additional soil analyses will be done quarterly to help link residual activity of chlorpyrifos to soil pH. However, if low soil pH is necessary for IFA control with chlorpyrifos in containerized nursery stock, this will not be an acceptable option for nursery growers since most amend their media to a pH of ca. 7 for plant health.

Table 29. Composition and Producer of Various Media Mixes.

Media Name	Abbreviation for Future Tables	Composition	Producer/ Address
Wight Nursery	Wight	4:1 bark:sand	Wight Nursery P.O. Box 390 Cairo, GA 31728
Flowerwood Nursery	Flowerwood	ca. 19:3 bark:sand	Flowerwood Nursery P.O. Box 7 Loxley, AL 36551
Reliable Peat Montage Blend	Montage Blend	50% Florida Peat 20% Hardwood Bark 20% Cypress Chips 10% Hardwood Dust 10% sand	Reliable Peat Co. Hwy. 50 W Wintergreen, FL
Reliable Peat Florida Peat	Florida Peat	100% Reede Sedge Florida Peat	Reliable Peat Co. Hwy. 50 W Wintergreen, FL
Reliable Peat Potting Soil	Reliable Potting	50% Florida Peat 20% Cypress Chips 20% Hardwood Dust 10% Hardwood Bark 10% sand	Reliable Peat Co. Hwy. 50 W Wintergreen, FL
Fafard Mix No. 2-S	Fafard	contains sphagnum peat moss, hort. vermiculite and polybeads	Conrad Fafard Inc. P.O. Box 790 Agawam, MA 01001
Mobile Media	Mobile	3:1 pinebark:sand	Alabama Agric. Exper. Station Mobile, AL
Grace Metro Mix 360	Metro Mix		Grace Sierra Hort. Products Co. 1001 Yosemite Dr. Milpitas, CA 95035
Premier Pro-Mix BX	Pro-Mix		manufactured for: Premier Brands Inc Red Hill, PA 18076
MAFES Media	MAFES	3:1:1 bark:peat: sand	USDA, APHIS, PPQ IFA Station Gulfport, MS 39501

Table 30. Residual Activity of suSCon Green 10CR in Various Potting Media.

Media Type	% Mortality to Alate Females at Indicated Mths PT					
	(1)	(2)	(3)	(4)	(5)	(6)
MAFES	100	100	100			
Mobile	100	100	100			
Wight	100	100	100			
Flowerwood	100	100	55			
Reliable Potting	100	45	25			
Montage Blend	100	25	40			
Florida Peat	100	55	50			
Fafard	100	15	25			
ProMix	100	95	75			
MetroMix	100	25	100			

Table 31. Presence of Hydrogen in the Media As Indicated by Various Soil Analyses.

Media Type	Presence of Hydrogen at Indicated Months Post treatment								
	pH			CEC (meq/100 g)			% Base Saturation		
	0	3	6	0	3	6	0	3	6
MAFES	4.0	5.3		10.4	7.0		79.0	65.6	
Mobile	4.3	5.0		5.9	4.8		56.9	58.2	
Wight	6.0	6.9		1.5	1.6		19.0	14.7	
Flowerwood	5.8	6.7		2.4	2.1		14.9	14.9	
Reliable Potting	5.8	7.7		1.2	0.0		6.2	0.0	
Montage Blend	6.5	7.7		0.3	0.0		1.5	0.0	
Florida Peat	6.8	8.1		0.4	0.0		2.9	0.0	
Fafard	5.7	8.1		0.6	0.0		7.2	0.0	
ProMix	6.1	7.3		1.5	0.0		11.7	0.0	
MetroMix	6.6	7.3		0.0	0.0		6.5	0.0	

PROJECT NO: FA01G055

TITLE: Evaluation of suSCon Green® for Control of IFA in Field Grown Nursery Stock.

TYPE REPORT: Interim

COOPERATORS: Incitec Ltd., Harrison County Farm, Auburn Ala. Experiment Station, Imported Fire Ant Station

PARTICIPANTS: Homer Collins, Avel Ladner, and Randy Cuevas

INTRODUCTION:

suSCon Green, a controlled release formulation of chlorpyrifos provides multi-year control of several species of white grubs when applied in furrow in sugarcane (May and Boehm, 1986). Control is best achieved by applying this product to the drill at planting or in the early stages of crop growth. The granules are applied in a band 15 cm wide across the center of the drill, no more than 5 cm above the set, and at least 10 cm below the soil surface when the drill is leveled off at fill in. The granule band is then not disturbed in any subsequent tillage operation.

This technology was investigated for control of imported fire ants which often infest field grown nursery stock. IFA frequently nest directly in contact with the roots and trunks of woody ornamental plants. Small incipient colonies pose a regulatory threat when infested plants are shipped outside the quarantine area. At the current time, effective and practical quarantine treatments for this type of plant material are not available.

METHODS AND MATERIALS:

Test site for this study was the County Farm Property which is owned and maintained by the Harrison County, Mississippi Sheriff's Department. Plots consisted of rows 6' wide x 50' long. Each plot was thoroughly disked (tilled) to prepare a seed bed. A furrow ca. 12" x 12" deep was then opened with a moldboard plow, and "liners" of various species of woody ornamental planted at 36" intervals along each plot. suSCon Green was applied to four plots (replicates) at a rate equivalent to 4 lbs AI/acre while four other plots served as untreated controls. suSCon Green granules were applied in a

12" band 2" below the set, and then covered with 4-5" of soil which was manually raked into place. After planting, vegetation control in each plot was maintained by periodic mowing. Supplemental irrigation water was applied by underground drip irrigation system. Efficacy of the suSCon against IFA was determined by closely inspecting each plot at three-month intervals for a minimum of two years. All active IFA colonies in each plot were enumerated and categorized on the population index scale described by Lofgren and Williams (1982). At the completion of the trial, treatment means will be statistically analyzed with a *t*-test.

RESULTS:

No fire ant colonies were detected in treated plots at 3 and 6 months posttreatment. Untreated control plots contained 2 colonies at 3 months posttreatment, and 5 colonies at 6 months. Therefore, preliminary results of this study indicate that suSCon Green applied to the base of field grown nursery stock may prevent establishment of fire ant colonies.

PROJECT NO: FA05G015

PROJECT TITLE: Mode of Infestation by Imported Fire Ant Founding Queens in Establishing Colonies in Containerized Nursery Stock.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Tim Lockley

INTRODUCTION:

Artificial spread of the imported fire ant (IFA) has long been associated with the movement of infested nursery stock (Culpepper 1953). Various insecticidal treatments including chlorinated hydrocarbons, chlorpyrifos and synthetic pyrethroids have been used to render nursery stock IFA free. Although some infestations may also occur by movement of whole colonies into containers; it is assumed that the majority of nursery stock becomes infested by newly mated queens which alight seeking suitable brood cell sites after their nuptial flight. Mating flights have been reported from every month of the year (Rhoades and Davis 1967); but Markin et al. (1972) theorized that late season flights do not usually result in successful colony founding. However, this conclusion is based upon observations in the field, and not specifically in nursery containers.

The objective of this study is to determine mode of infestation of containerized nursery stock.

MATERIALS AND METHODS:

Standard gallon containers were filled with untreated media and exposed under standard horticultural practices to potential colonization by newly mated fire ant queens and/or established colonies. A total of three hundred pots were used at each of three geographically separated sites (Mississippi State University Horticultural Research Farm, Mississippi State, MS; MAFES Horticultural Research Station, Poplarville, MS; and Auburn University Horticultural Research Station, Mobile, AL). One hundred containers were covered with fine mesh screen to preclude entry via landing on the surface of the media; one hundred pots had their drain holes covered with the same mesh material to preclude entry from through the base of the container and one hundred were left 'untreated' as a control. Media was kept uniformly moist through the use of drip irrigation. Each container was examined quarterly for the presence of fire ant colony establishment. Trials were initiated at the Mississippi State site in June 1994, at the Poplarville and Mobile in September 1994.

RESULTS:

At the Mississippi State site, two category 7 colonies were noted 6 months post-exposure in containers with screened tops and in two of the controls. An examination at 9 months showed the continued presence of fire ant colonies in the two control pots. No activity was noted within the treatments. At 12 months post-exposure, only one of the originally infested control pots still contained an active colony the other one had been abandoned. However, two other control pots, as well as two of the top covered containers, contained active category 7 fire ant colonies. No activity was noted throughout the twelve month period within the containers with covered drain holes. At the Poplarville site, no activity was noted until 6 months post exposure. At that point, a category 9 colony moved into and along side of 10 of the top-covered containers. This colony remained at that location for the following 6 months at which time the trial was terminated. At the Mobile site, no activity was noted among any of the treatments or controls until the ninth month of exposure when a category 7 colony was observed within one of the top covered containers. At month 12, the pot had been abandoned and no other activity was observed.

These limited observations would seem to indicate that the preferred mode of infestation for newly mated fire ant queens is entry through drain holes at the base of the containers. Other trials conducted over longer periods at other sites may be necessary to confirm these initial findings.

PROJECT NO: FA05G075

PROJECT TITLE: Biobarrier as a Prophylactic Against Infestation of Containerized and Ball & Burlap Nursery Stock.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Timothy C. Lockley and Lee McAnally

INTRODUCTION:

Over the years, the spread of imported fire ants has been primarily associated with the movement of infested containerized and ball & burlap nursery stock. Various treatment regimens have been developed to prevent these infestations. Although the majority of infestations occur when a newly-mated queen establishes her brood cell at the base of the plant or in the container, some nursery stock is infested by the movement of established colonies. Biobarrier (Reemay Corp., Nashville, TN) was developed as a method of controlling invasive roots in pipes. Lately, it has found numerous uses in the nursery industry for control of weeds in landscaping projects and as root control in field-grown nursery stock. Fire ants are chemically sensitive and respond negatively to even small quantities of various biocides.

Two separate projects were established at Mississippi State University and MAFES Horticultural Research Station, Poplarville, MS and at the Harrison County Work Farm to evaluate Biobarrier as a potential tool in restricting movement of imported fire ants.

MATERIALS AND METHODS:

PROJECT I:
At each site, three replicates of untreated Typar spun woven cloth and three replicates of Biobarrier were placed in a field with an established imported fire ant population ca. 50 colonies/acre. Each replicate was covered with ca. 10-15 mm of sand to protect the cloth from degradation from uv radiation. Ten containers per replicate were planted with liners of *Cleyera* sp. at the Mississippi State site and *Ilex* sp. at the MAFES site. Plants were maintained under normal horticultural practices and were examined quarterly for the presence of imported fire ant colonies.

PROJECT II:

On 8 May 1995, twenty Biobarrier Root Control Bags were placed in the ground at the Harrison Count Work Farm and back filled with soil. Each bag then had a woody ornamental plant transplanted into it. Each bag was positioned in such a way that the inert plastic strip remained above ground and the remainder (the "active" portion of the bag) was below the soil surface. Plants were watered through an underground drip irrigation system and examined monthly for imported fire ant colony activity.

RESULTS:

PROJECT I:

The initial examination of the containers, 3 months into the trial, showed no sign of fire ant activity in any of the replicates at either site. At 6 months post-exposure, three containers on the Typar fabric held active fire ant colonies (categories 7, 8 & 9) at the Mississippi State site and two containers on Typar at the MAFES site each held a category 8 colony. At the time of the third examination nine months into the trial, no active colonies could be found at the Mississippi State site. The two colonies first noted at month 6 at the MAFES site, however, remained established within the same containers. At the fourth and last examinations 12 months post-exposure, one active (cat. 9) colony was found in a previously uninfested container on the Typar fabric at the Mississippi State site; while at the MAFES site, the two category 8 colonies previously observed remained in the same containers. Trials at both sites were terminated at month 12.

PROJECT II:

At 6 months post planting, no fire ant activity has been observed at any of the plants contained in the Biobarrier bags. Examinations will continue for at least 12 more months.

PROJECT NO: FA05G055

PROJECT TITLE: Biobarrier as a Prophylactic Treatment for Control of Phytophera Root Rot in Blueberry and Its Effects on Populations of Imported Fire Ants in Commercially Grown Blueberry Orchards.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Timothy C. Lockley/Barbara J. Smith

INTRODUCTION:

Phytophera Root Rot (Phytophera *cinammoni*) is a major pest of blueberries in commercial orchards in the southeastern United States and causes considerable economic losses every year (Caruso & Ramsdell 1995). The mode of transmission of phytophera is from wild host plants the blueberries. Standard practice is to spray various biocides to either kill the pathogen or the host plant. By restricting the development of the wild hosts, the effects of the phytophera on commercial blueberries can be limited to acceptable economic levels. Biobarrier (Reemay Corp., Nashville, TN) is designed to eliminate weedy species from landscaping by emitting small amounts of Treflan herbicide over extended periods. Imported fire ants, although not a direct pest of blueberries, also play a major deleterious role in commercial blueberry fields by clogging drip irrigation systems and stinging field workers and customers in "pick-your-own" fields. Biobarrier has shown significant potential to repel active fire ant colonies (FA05G045). Tests were undertaken at the USDA-ARS-Small Fruits Research Laboratory in Poplarville, MS to determine the effects Biobarrier would have on the phytophera pathogen. In conjunction with this trial, Biobarrier was also examined for its effects on imported fire ants and the movement of colonies of this pest ant.

MATERIALS & METHODS:

Blueberries/treatments were established in April 1995 as shown in Table 32. Plot design for the Biobarrier treatment is shown in Table 33. Plants were spaced ca. 1.0 m apart. Peatmoss was incorporated into the plantings with the exception of the Tung Press Cake treatment. Post planting treatments of Ridomil and Subdue will be applied in the spring of 1996. Plants were visually rated for phytophera root rot symptoms every 3 months and were assayed for the presence of *Phytophera cinammoni* every 6 months. Fire ant populations were determined every 6 months.

RESULTS:

At 6 months post-planting, the presence of fire ant colonies was indicated within four untreated plots: Misty-None; Misty-Ridomil Post; Gulfcoast-Ridomil Post; & Tifblu Tungcake. All but the Misty-None were located on raised beds. No sign of fire ant activity was indicated in the Biobarrier plots.

TABLE 32. Phytophera Root Rot/Fire Ant Experimental Protocol

No.	Treatments Chemical	Bed Height	Cultivars Tifblue	Gulfcoast	Misty	Reville	Other*	TOTAL
1	None	Raised	4	4	4	4	27	43
2	None	Flat	4	4	3	3	0	14
3	Ridomil Prep	Raised	4	4	4	3	0	15
4	Ridomil Prep	Flat	4	4	4	3	0	15
5	Ridomil Post	Raised	4	4	4	3	0	15
6	Ridomil Post	Flat	4	4	4	3	0	15
7	Subdue Post	Raised	4	4	4	3	0	15
8	Biobarrier	Raised	4	4	4	3	0	15
9	Tung Press Cake	Raised	4	4	4	3	0	15

* Other cultivars :Georgia Gem; Pearl River; Magnolia; Marimba; Cooper; Premier.

TABLE 33. Phytophera Root Rot Study Biobarrier Plot Protocol

CULTIVAR	REP	NO.	BED HEIGHT	ROW	PLOT
Gulfcoast	1	8	Raised	4	31
Misty	1	8	Raised	4	33
Reville	1	8	Raised	4	32
Tifblue	1	8	Raised	4	34
Gulfcoast	2	8	Raised	3	23
Misty	2	8	Raised	3	24
Reville	2	8	Raised	3	22
Tifblue	2	8	Raised	3	25
Gulfcoast	3	8	Raised	3	9
Misty	3	8	Raised	3	8
Reville	3	8	Raised	3	6
Tifblue	3	8	Raised	3	7
Gulfcoast	4	8	Raised	1	29
Misty	4	8	Raised	1	30
Tifblue	4	8	Raised	1	31

SECTION II

DEVELOPMENT OF QUARANTINE TREATMENTS FOR GRASS SOD

PROJECT NO: FA01G034

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

TYPE REPORT: Final

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

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 compared 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 Suzuki 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 (depending upon season of the year), 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 were terminated when treated plots became reinfested by IFA. Treatment means were statistically analyzed using ANOVA and Tukey's Test.

RESULTS:

As shown in Table 34, both treatment procedures provided excellent control at each rating interval until reinfestation of all test plots was observed 82 weeks after application. In this particular trial, subsurface placement of the suSCon Green did not increase efficacy or extend the residual activity of the product.

Table 34. Control of Imported Fire Ants with Surface Broadcast and Subsurface Applications of suSCon Green. Dothan, AL. 1994.

Insecticide Placement	Average % Change in Pretreatment Pop. Index @ indicated wks PT [1]									
	(6)	(12)	(18)	(26)	(40)	(52)	(58)	(66)	(74)	(82)
Surface	-95.9a	-97.7a	-100a	-95.3a	-97.0a	-87.0a	-83.8a	-93.1a	-82.3a	+16.1a
Subsurface	-99.6a	-99.7a	-100a	-99.2a	-97.8a	-98.8a	-84.0a	-82.4ab	-86.1a	+20.9a
Untreated Check	-17.5b	-14.5b	-46.5b	-10.5b	-17.0b	+51.2b	-11.6b	-53.0b[2]	-84.5a[2]	-2.5a
Rainfall prior to count, inches[3]	6.5	5.5	17.7	7.4	6.0	16.0	5.9[4]	3.4	4.9	na

Means within a column followed by the same letter are not significantly different (Tukey's test, P=0.05)

1 Average of 4 replicates per treatment

2 High check mortality probably due to hot, very dry summer conditions; 66 wk count on 7/11 and 74 wk count on 9/7.

3 Rainfall not cumulative but shown as rainfall between previous count and date recorded

4 Rainfall data from National Weather Service at Dothan regional airport, Dothan, AL

PROJECT NO: FA01G065

PROJECT TITLE: Quarantine Treatments for Commercial Grass Sod, 1995.

TYPE REPORT: Final

COOPERATORS: FMC Corporation. Incitec Ltd., Valent Corp., Madison Turf Farm

PARTICIPANTS: Homer Collins, Avel Ladner, Anne-Marie Callcott, Randy Cuevas

INTRODUCTION:

In addition to regulating movement of nursery stock outside the IFA quarantine area, Federal Quarantine 301.81 specifies that commercial grass sod may not be moved outside the regulated area unless treated with an approved insecticide. At the current time, only DURSBAN 50 W-N® is both labelled by EPA and approved by PPQ for this use pattern. Additional options are needed to provide producers with supplementary treatments that can be integrated into their individual management practices. Several candidate treatments were evaluated in 1995.

METHODS AND MATERIALS:

Test plots were located at the Madison Turf Farm near Gulfport, Ms. All plots were established in common centipede grass. Soil was a light sandy loam. Each RIFA infested test plot was 1 acre in size (210' x 210'). All active RIFA colonies within a 0.25 acre efficacy plot located in the center of each treatment plot were counted and categorized on a population index scale described by Lofgren and Williams (1982). Liquid treatments were applied on July 20-21, 1995, with a 16-foot roller pump boom sprayer calibrated to deliver 30 gallons of finished spray per acre. Granular formulations were applied with a Herd GT-77® Granular Applicator mounted on a Suzuki® ATV on July 19, 1995. Each treatment, (except for suSCon starch) including an untreated check, was replicated 3 times. Products and rates of application are listed below. Posttreatment population assessments were made at 6 week intervals until reinfestation occurred.

Product/Formulation	Producer	Rate - lb AI/acre	Rate - amt product/acre
Talstar Flowable	FMC Corp.	0.1 0.2 0.4	19.19 oz 567.52 ml 38.38 oz 1135.03 ml 76.76 oz 2270.06 ml
SPG95-07 (experimental granular bifenthrin)	FMC Corp.	0.4	200.0 lb
Dursban 50W	Dow Elanco	4.0	8.0 lb
Pinpoint 15G (acephate)	Valent	5.0	33.33 lb
suSCon starch (Dursban)	Incitec	3.3	33.0 lb
Untreated Check		0.0	0.0

Due to the amount of product available, the SPG95-07 was applied to ½-acre plots, and the suSCon starch granules were applied to only one 1-acre plot. One of the Pinpoint plots received 55 lb/acre through misapplication.

RESULTS:

This sod farm does not supplement rainfall with irrigation. All granular plots received 1.1" rain the evening of the application. Prior to the first posttreatment count, all plots received an additional 6.2" rainfall. At six weeks posttreatment, all treatments reduced populations and number of colonies significantly more than the untreated check (Table 35 & 36).

Prior to the 12 weeks posttreatment, an additional 3.9" of rain fell. At this count, only Talstar flowable at 0.4 lb AI/acre and Dursban 50W were significantly different from the check in population reduction (Table 35), while these two treatments along with the suSCon starch treatment provided significantly greater reductions in number of colonies than the untreated check (Table 36).

At 18 weeks posttreatment, while several treatments were significantly different from the untreated check, only the Talstar flowable at 0.4 lb

AI/acre and the suSCon starch treatment maintained an acceptable control of IFA; >97% reduction in pretreat population indices and colony numbers (Table 35 & 36). Reinfestation was noted in all other treatment plots.

The ambiguity of the statistics in this trial is a result of the extreme variability within some of the treatments as evidenced by the high standard deviations. This variation makes definite comments on efficacy of the candidate treatments somewhat difficult. However, it is evident that the Talstar Flowable applied at 0.4 lb AI/acre has shown excellent, repeatable control of IFA for up to 18 weeks and Dursban 50W applied at 4.0 lb AI/acre for up to 12 weeks. The suSCon 10G on a starch granule has also shown excellent results for 18 weeks, and the product should be tested again under replicated conditions.

Table 35. Efficacy of Various Products Applied to Grass Sod for Control of Imported Fire Ants.

Treatment	Rate of Application (lb AI/acre)	% Change in Population Index ± SD		
		(6)	(12)	(18)
Talstar Flowable	0.1	-77.8 ± 9.2ab	-62.2 ± 6.4ab	-8.5 ± 60.4ab
	0.2	-99.3 ± 1.2a	-64.5 ± 47.2ab	-29.6 ± 86.4a
	0.4	-100 ± 0.0a	-100 ± 0.0a	-97.8 ± 3.8a
SPG95-07 (Talstar G)	0.4	-95.6 ± 3.9ab	-60.2 ± 23.3ab	-41.2 ± 32.0a
Dursban 50W	4.0	-98.3 ± 1.7a	-100 ± 0.0a	-57.6 ± 35.4a
Pinpoint 15G	5.0	-71.1 ± 31.8b	5.7 ± 87.6b	85.6 ± 61.4b
suSCon on starch 10G*	3.3	-99.4ab	-100ab	-100a
Check	---	-35.1 ± 18.7c	8.5 ± 64.9b	87.6 ± 101.3b

* only one plot treated
Means within a column followed by the same letter are not significantly different (LSD test, P=0.05).

Table 36. Efficacy of Various Products Applied to Grass Sod for Control of Imported Fire Ants.

Treatment	Rate of Application (lb AI/acre)	% Decrease in No. Colonies		
		(6)	(12)	(18)
Talstar Flowable	0.1	76.4 ± 12.9ab	63.2 ± 6.5abc	25.0 ± 43.3ab
	0.2	95.8 ± 7.2a	66.8 ± 40.6abc	53.6 ± 46.7bcd
	0.4	100 ± 0.0a	100 ± 0.0a	97.0 ± 5.3d
SPG95-07 (Talstar G)	0.4	94.6 ± 5.0a	56.3 ± 22.8abc	39.6 ± 35.6abc
Dursban 50W	4.0	91.2 ± 7.9a	100 ± 0.0a	57.0 ± 30.3bcd
Pinpoint 15G	5.0	60.4 ± 31.2b	38.3 ± 38.3bc	0.0 ± 0.0a
suSCon on starch 10G*	3.3	96.7ab	100ab	100cd
Check	---	32.8 ± 19.2c	22.2 ± 38.5c	0.0 ± 0.0a

* only one plot treated
Means within a column followed by the same letter are not significantly different (LSD test, P=0.05).

SECTION III

POPULATION SUPPRESSION TRIALS

PROJECT NO: FA02G045

PROJECT TITLE: Efficacy of Various Hydramethylnon Fire Ant Bait Formulations, 1995.

TYPE REPORT: Final

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

INTRODUCTION:

Traditionally, imported fire ant baits are composed of soybean oil plus an active ingredient impregnated onto a corn grit carrier. In 1995, we tested two new hydramethylnon bait formulations. Both of these baits contained hydramethylnon as the active ingredient, but varied in other ways. American Cyanamid (Wayne, NJ) supplied us with an experimental queen pheromone enhanced Amdro® bait (0.73% hydramethylnon). MaxForce® Ant Killer Granular Bait, also contains 1% hydramethylnon, but is formulated on a carrier containing proteins, fats, sugars, oils and carbohydrates, including ground-up silk worm larvae. This product is marketed by The Clorox Company (Oakland, CA).

MATERIALS AND METHODS:

Laboratory bait acceptance trials:
In order to evaluate attractiveness of the various formulations, a standard bait acceptance trial was performed. Our method was modified from the procedure described by Lofgren et al. (1961). Field collected colonies were brought to the laboratory in plastic dish pans, and allowed to acclimate for 3-4 days prior to testing. A standard bait was prepared by mixing fresh soybean oil and pregelled defatted corn grits in a 30%:70% weight to weight ratio. The candidate baits included MaxForce, the pheromone enhanced Amdro formulation and a standard commercial Amdro formulation. These baits were subjected to two bait acceptance trials: one trial using "normally" starved ants (3-4 days), and one using ants which had been excessively starved for 14 days. Four grams of a candidate bait contained in a petri dish were placed on the surface of each of five test colonies. Simultaneously, four grams of the freshly prepared standard bait in an identical dish were placed approximately 4-5 inches from the candidate bait. Foraging workers were then provided a

free choice to feed on the bait of their preference. After a 24 hour feeding period, the dishes were removed and the amount of each bait consumed was determined by weighing.

The acceptance ratio for each candidate bait compared to the standard bait was computed as follows:

$$\text{Acceptance ratio} = \frac{\text{No. g. candidate consumed}}{\text{No. g. standard consumed}}$$

A mean acceptance ratio with a value equal to or greater than 1.0 indicates that a given candidate is equally or more attractive than the standard bait.

A second acceptance trial was performed where the queen pheromone enhanced Amdro and MaxForce were the candidates baits, and commercial Amdro was the standard. The above procedure was used except that only "normally" starved ants were used.

A final bait acceptance trial compared all three hydramethylnon baits to each other. Four g. of each bait was introduced into each of 5 "normally" starved colonies by the method previously described. After a 24 hour feeding period, the dishes were removed and the amount of each bait consumed was determined by weighing. Differences between the mean amounts of each bait consumed were separated by ANOVA and LSD test (P=0.05).

Field trial:
Plots were established in Harrison Co., MS. The pheromone enhanced Amdro, and standard Amdro were applied at 1.5 lbs/acre. The MaxForce bait was applied at ca 2 lbs/acre due to difficulties calibrating this particular formulation. Each treatment was applied to three 1-acre test plots May 25, 1995 using a shop-built spreader (Collins 1988) on a farm tractor. Prior to application, a ¼-acre circular subplot in the center of each 1-acre test plot was evaluated according to Harlan et al. (1981) as later modified by Lofgren & Williams (1982). Plots were evaluated at 6 week intervals after treatment until reinfestation occurred.

RESULTS:

Laboratory bait acceptance trials:

Hydramethylnon baits compared to a non-toxic standard bait: Under the "normal" conditions, only the MaxForce bait was more attractive than the standard non-toxic bait (Table 37). Under excessive starvation, all baits were equally as attractive to the ants as the standard it was compared to (Table 37).

MaxForce and pheromone enhanced Amdro compared to a standard Amdro bait: Both MaxForce and the pheromone enhanced Amdro baits were more attractive than the standard commercial Amdro bait in two laboratory trials (Table 38).

Hydramethylnon baits compared to each other: In two separate trials, different results were obtained. In trial I, the amount of MaxForce consumed by test colonies was significantly greater than the amount of pheromone enhanced Amdro or standard commercial Amdro consumed (Table 39). On average, the ants consumed 97.5% of the MaxForce bait compared to 43% and 52% of the pheromone enhanced Amdro and standard commercial Amdro, respectively.

In trial II, no bait was consumed in a significantly greater quantity than the others (Table 39). The ants consumed an average of 63% of the MaxForce provided, 71.5% of the pheromone enhanced Amdro, and 37% of the standard commercial Amdro.

Field trial:

At 6 weeks after treatment, all treatments provided 96.6 to 99.4% reduction in pretreatment population indices (Table 40) and 86.7 to 95.8% reduction in pretreatment number of colonies (Table 41). At 12 and 18 weeks after treatment, all treatments maintained >90% reduction in population indices and >81% reduction in number of colonies. By 24 weeks after treatment, reinfestation was noted in all plots. The high check mortality at the 12 and 18 week counts is indicative of the time of year the count was taken; mid-August and September when it is extremely hot and dry in south Mississippi and we normally see a decrease in IFA activity (unpublished data). However, the excessively high mortality seen in the untreated check plots question the validity of these results. High check mortality similar to this trial were experienced in all trials conducted in south Mississippi in the summer of 1995.

DISCUSSION:

MaxForce was more attractive than other baits in laboratory bait acceptance trials. Although some variation occurred in some rating intervals, in general, MaxForce also provided numerically better control in the field. However, the difference was not statistically significant.

Table 37. Attractiveness of Hydramethylnon IFA Bait Formulations Compared to a Non-Toxic Standard Bait.

Bait Formulation	Mean acceptance ratio* ± SD	
	Normal conditions	Excessive starvation
MaxForce	1.35 ± 0.71	1.06 ± 0.12
Pheromone Enhanced Amdro	0.67 ± 0.16	0.98 ± 0.05
Standard Amdro	0.62 ± 0.24	1.0 ± 0.0

* an acceptance ratio of 1 or greater indicates that the candidate bait is equally or more attractive than the standard non-toxic bait

Table 38. Attractiveness of MaxForce and Pheromone Enhanced Amdro to Standard Commercial Amdro.

Bait Formulation	Mean acceptance ratio* ± SD	
	Trial I	Trial II
MaxForce	6.38 ± 6.94	2.82 ± 2.26
Pheromone Enhanced Amdro	2.59 ± 3.21	1.67 ± 1.40

* an acceptance ratio of 1 or greater indicates that the candidate bait is equally or more attractive than the standard commercial Amdro bait

Table 39. Comparison of Attractiveness of Three Hydramethylnon Baits.

Bait Formulation	Mean Amount Consumed* (g)	
	Trial I	Trial II
MaxForce	3.90 ± 0.10a	2.52 ± 0.70a
Pheromone Enhance Amdro	1.72 ± 0.61b	2.86 ± 0.76a
Standard Amdro	2.08 ± 0.71b	1.48 ± 0.24a

Means within a column followed by the same letter are not significantly different (LSD test, P=0.05).

Table 40. Efficacy of Various Fire Ant Baits Against Field Populations of Imported Fire Ants.

Treatment	Mean % change in population index*			
	(6)	(12)	(18)	(24)
MaxForce	-99.4a	-98.3a	-99.4a	-67.3a
Standard Amdro	-99.2a	-98.4a	-98.9a	-83.9a
Pheromone Amdro	-96.6a	-90.8a	-97.6a	-73.8a
Check	-47.5b	-62.9b	-81.5b	-63.0a

* Means within a column followed by the same letter are not significantly different (Tukey's test, P=0.05).

Table 41. Efficacy of Various Fire Ant Baits Against Field Populations of Imported Fire Ants.

Treatment	Mean % decrease in number of colonies*			
	(6)	(12)	(18)	(24)
MaxForce	95.8a	88.5a	95.8a	57.1a
Standard Amdro	94.3a	96.3a	92.7a	79.8a
Pheromone Amdro	86.7a	81.2a	94.3a	71.3a
Check	31.1b	47.1b	70.8b	51.9a

* Means within a column followed by the same letter are not significantly different (Tukey's test, P=0.05).

PROJECT NO: FA02G024

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

TYPE REPORT: Final

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 42). 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, was maintained by both the fertilizer + Award and the Award only treatments through 24 weeks PT (Table 43), colony or mound mortality was not significantly decreased (Table 44). At no time did either treatment decrease 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 42. 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 43. 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)	(30)
Pursell+Award	100.0	-86.7a	-64.5a	-85.5a	-87.3a	-79.3a
Award Std	1.5	-85.7a	-82.7a	-85.0a	-83.1a	-19.5ab
Check	0.0	-1.0b	74.6b	112.2b	97.6b	103.0b

Table 44. 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)	(30)
Pursell+Award	100.0	23.7a	5.3a	37.7a	26.0a	9.7a
Award Std	1.5	32.4a	26.0a	29.4ab	10.7a	11.7a
Check	0.0	25.1a	6.3a	3.1b	0.0a	7.8a

[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: FA02G015

PROJECT TITLE: Efficacy of Award Fire Ant Baits When Blended into Controlled Release Fertilizer Formulations.

TYPE REPORT: Interim

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

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 other dry 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). In 1994, Award blended into Pursell fertilizer gave marginal control of IFA (FA02G024 - this report). These poor results were probably due to the product being applied in the hottest, driest part of the summer (late July).

This year, Ciba again supplied us with premixed Award and controlled release fertilizer to test the efficacy of the bait when blended with fertilizer.

MATERIALS AND METHODS:

Laboratory bait acceptance trial:
To evaluate attractiveness of various IFA bait formulations, a standard bait

acceptance trial is performed (Appendix III). On May 30, 1995, an experimental formulation of fenoxycarb (CGA-114597), as well as the standard Award formulation were subjected to bait acceptance trials; one trial using "normally" starved ants (3-4 days), and one using ants which had been excessively starved for 14 days.

Field trial:
Two fenoxycarb formulations were blended by Pursell Incorporated into two fertilizer types and shipped to our laboratory for evaluation. Standard Award fire ant bait (1% fenoxycarb) and CGA-114597 1GR (1% fenoxycarb) were used in this trial. All treatments and rates of application are listed below:

Bait/ Fertilizer Formulation	Rate of Application
Award/Polyon™ 33-0-11	100 lb/acre
Award/Polyon 35-0-0	100 lb/acre
Award Std	1.0 lb/acre
CGA-114597 1GR/Polyon 33-0-11	100 lb/acre
CGA-114597 1GR/Polyon 35-0-0	100 lb/acre
CGA-114597 1GR Std	1.0 lb/acre
Untreated Check	----

Each treatment was applied to three 1-acre test plots May 25, 1995 using either a Herd GT-77® spreader on a Suzuki® four-wheeler (bait/fertilizer treatments) or a shop-built spreader (Collins 1988) on a farm tractor (bait only treatments). Prior to application, a ¼-acre circular subplot in the center of each 1-acre test plot was evaluated according to Harlan et al. (1981) as later modified by Lofgren & Williams (1982). Plots were evaluated at 6 week intervals after treatment.

RESULTS:

Laboratory bait acceptance trial:
Under the "normal" conditions, both fenoxycarb baits were less attractive than the standard non-toxic bait (Table 45). Under excessive starvation, both baits were as acceptable to the ants as the non-toxic standard.

Field trial:

Results to date are shown in Tables 46 & 47. All treatments provided excellent control through 24 weeks posttreatment, except the Award blended with the 35-0-0 fertilizer. This treatment was very effective through 18 weeks, but began to show signs of reinfestation at 24 weeks posttreatment. By 33 weeks posttreatment, both bait formulations blended with the 35-0-0 fertilizer showed positive signs of reinfestation. Both bait formulations blended with the 33-0-11 showed slight indications of reinfestation at this time. Little or no infestation was noted in the plots treated with the bait formulations alone.

The high check mortality at the 12 and 18 week counts is indicative of the time of year the count was taken; mid-August and September when it is extremely hot and dry in south Mississippi and we normally see a decrease in IFA activity (unpublished data). However, the excessively high mortality seen in the untreated check plots question the validity of these results. High check mortality similar to this trial were experienced in all trials conducted in south Mississippi in the summer of 1995.

Table 45. Attractiveness of Two Fenoxycarb Bait Formulations.

	Mean acceptance ratio ± SD*	
Formulation	Normal conditions	Excessive starvation
CGA-114597	0.53 ± 0.34	1.0 ± 0.0
Award Standard	0.21 ± 0.10	0.90 ± 0.13

* an acceptance ratio of 1 or greater indicates that the candidate bait is as attractive or more attractive than the standard non-toxic bait

Table 46. Efficacy of Various Fertilizer plus Fenoxycarb Bait Against Imported Fire Ants Populations.

Treatment	Mean % change in population index*					
	(6)	(12)	(18)	(24)	(33)	(39)
Award Std	-90.7a	-99.0a	-99.8a	-98.5a	-100a	
33-0-11 + Award	-94.9a	-99.1a	-99.7a	-98.4a	-95.7ab	
35-0-0 + Award	-92.2a	-98.1a	-98.7a	-82.3b	-77.6d	
CGA-114597	-92.7a	-98.6a	-99.8a	-98.3a	-97.1ab	
33-0-11 + CGA	-92.5a	-97.5a	-99.5a	-96.7a	-89.0bc	
35-0-0 + CGA	-90.3a	-95.5a	-99.2a	-95.1a	-83.0cd	
Check	-47.5b	-62.9b	-81.5b	-63.0c	-43.0e	

* Means within a column followed by the same letter are not significantly different (Tukey's test, P=0.05).

Table 47. Efficacy of Various Fertilizer plus Fenoxycarb Bait Against Imported Fire Ants Colonies.

Treatment	Mean % decrease in number of colonies*					
	(6)	(12)	(18)	(24)	(33)	(39)
Award Std	35.6a	90.7a	98.4a	98.3a	100a	
33-0-11 + Award	66.0a	93.2a	97.5a	92.2ab	94.4a	
35-0-0 + Award	43.7a	83.2a	95.1a	72.7b	66.4c	
CGA-114597	58.8a	90.7a	98.8a	90.6ab	95.7a	
33-0-11 + CGA	53.2a	86.9a	96.8a	94.6a	88.0ab	
35-0-0 + CGA	34.9a	78.3a	93.5a	94.6a	75.7bc	
Check	31.1a	47.1b	70.8b	51.9c	34.0d	

* Means within a column followed by the same letter are not significantly different (Tukey's test, P=0.05).

PROJECT NO: FA02G055

PROJECT TITLE: Efficacy of Fire Ant Baits Blended with Inert Carriers or Fertilizers to Facilitate Application.

TYPE REPORT: Final

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 this problem would be to blend the bait with a bulk material to allow for application at higher rates (i.e. ca 100 lbs/acre). Another 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). In 1994, Award blended into Pursell fertilizer gave marginal control of IFA (1994 IFA Station Annual Report - FA02G024). These poor results were probably due to the product being applied in the hottest, driest part of the summer (late July).

In 1995, O.M. Scott & Sons Co. (Marysville, OH) supplied us with premixed fire ant bait and bulk cob material to test the efficacy of the bait when applied with this additional bulk material. They also formulated a Logico/Poly S fertilizer (38.1-0-0) blend.

MATERIALS AND METHODS:

Both Logic (fenoxycarb) and Amdro (hydramethylnon) were blended by O.M. Scott's into an untreated bulk cob material and shipped to our station for application. Logic was blended with Poly S fertilizer at the company and also shipped to our station for application. Standard Award and Amdro fire ant baits were applied as standards. All treatments and rates of application are listed below:

Formula	Bait/Material Blended With	Rate of Application
S-5060	1.5 lb Logic/Poly S	114 lb/acre
S-6143	1.5 lb Logic/Cobs	114 lb/acre
S-6144	1.5 lb Amdro/Cobs	114 lb/acre
S-6363	1.0 lb Logic & 1.0 lb Amdro/Cobs	114 lb/acre
Award Standard		1.5 lb/acre
Amdro Standard		1.5 lb/acre
Untreated Check		----

Each treatment was applied to three 1-acre test plots on June 28 and 29, 1995 using either a Herd GT-77® spreader on a farm tractor (bulk bait & bait/fertilizer treatments) or a shop-built spreader (Collins 1988) on a farm tractor (bait only treatments). Prior to application, a ¼-acre circular subplot in the center of each 1-acre test plot was evaluated according to Harlan et al. (1981) as later modified by Lofgren & Williams (1982). Plots were evaluated at 6 week intervals thereafter until reinfestation occurred.

RESULTS:

At six weeks after treatment, all treatments, except the Amdro blended with cobs, had significantly reduced population indices compared to the untreated check (Table 49). However, only the Amdro standard treatment had significantly reduced the total number of colonies compared to the untreated check (Table 48).

Prior to the 12 week posttreatment count, two plots were lost due to field improvements initiated by the landowners; one Logic+Amdro with cobs, and one check plot. The extremely hot and dry summer caused 89.3% reduction in the pretreatment population index with a corresponding 37.3% colony mortality in the check plots (Tables 48 & 49), making the treatment data hard to interpret. While all treatments, except the Amdro blended with cobs, showed >94% reduction in population index compared to pretreatment populations, none were significantly different from the check population.

By the 18 week PT count, reinfestation was noted on most of the plots. Populations on the check plots had rebounded nicely. The Logic plus fertilizer, Logic blended with cob, and the Award standard still showed significant reductions in population indices compared to the untreated check (Table 49). However, in regard to colony reduction, there was no significant difference between any of the treatments and the check (Table 48).

At 18 weeks PT, numerous small incipient colonies (very small category 7 colonies) were noted on most test plots. These small colonies were the result of reinfestation of the plots by newly mated queens which invaded the plots soon after application. This phenomenon frequently occurs in plots 16-20 weeks after application and obfuscates interpretation of the test results. Unfortunately in this particular trial, excessively high (and very unusual) untreated check mortality also occurred at the 12 week PT evaluation, which also makes interpretation of the data difficult.

The most heavily reinfested plots at the 18 week PT count were Amdro standard and the Logic and Amdro blended with cob plots with 12.7 and 7.50 mean no. incipient colonies/plot, respectively. Conversely, some plots, Logic plus fertilizer and Logic blended with cobs, contained relatively few incipient colonies (0.33 and 1.0 mean no. incipient colonies/plot, respectively). If the incipient colonies are ignored, then control (colony mortality) ranged from 87.2% to 54.1%.

Table 48. Efficacy of Various Fire Ant Baits Blended with Cobs to Facilitate Application and One Bait/Fertilizer Blend - Decrease in Colony Number.

Treatment	% Decrease in Colony Number		
	(6)	(12)	(18)[1]
Award std	44.6a	87.9a	87.2a
Logic + Poly S	39.8a	48.5a	83.1a
Logic/Amdro w/ cobs	22.2a	57.8a	82.8a
Logic w/ cobs	17.1a	56.5a	78.9a
Amdro w/ cobs	9.9a	34.9a	64.6a
Amdro std	97.9b	92.3a	54.1a
Check	16.8a	37.3a	32.1a

Means within a column followed by the same letter are not significantly different (Tukey's test, P=0.05).

[1] Small incipient colonies resulting from reinfestation of plots were not included in this data.

Table 49. Efficacy of Various Fire Ant Baits Blended with Cobs to Facilitate Application and One Bait/Fertilizer Blend - Change in Population Index.

Treatment	% Change in Population Index		
	(6)	(12)	(18)[1]
Award std	-92.2a	-97.6a	-89.2a
Logic + Poly S	-91.0a	-93.8a	-97.9a
Logic/Amdro w/ cobs	-83.2a	-94.1a	-87.7ab
Logic w/ cobs	-86.2a	-94.6a	-90.7a
Amdro w/ cobs	-59.1b	-76.9a	-72.5ab
Amdro std	-99.8a	-95.0a	-57.5ab
Check	-38.6b	-89.3a	-32.0b

Means within a column followed by the same letter are not significantly different (Tukey's test, P=0.05).

[1] Small incipient colonies resulting from reinfestation of plots were not included in this data.

PROJECT NO: FA02G025

PROJECT TITLE: Control of Imported Fire Ants Around Broiler Production Houses, 1995.

TYPE REPORT: Final

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

COOPERATORS: Mr. & Mrs. Guy Berry, Mr. & Mrs. Pat Barr, Mr. & Mrs. Jr. Johnson, Mr. & Mrs. Barry Johnson, Mr. & Mrs. Jimmy Parkman, American Cyanamid Company (Princeton, NJ), and Clorox Co. (Dallas, TX)

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.

Broiler production houses provide excellent ecological niches for IFA colonies. Houses are typically 50' in width x 400' in length, oriented in an east/west direction. The concrete slab foundations, in combination with the roof overhangs, mitigate weather conditions, and numerous house fly pupae, darkling beetles, other insects, chicken feed, etc. provide an abundant and continuous food supply. Houses are typically surrounded by permanent pastures which are grazed often by cattle. Ants nest directly in contact with the concrete slab foundation as well as the surrounding pastures.

In 1994, the IFA Station initiated a trial testing the efficacy of Logic® and Amdro® fire ant baits applied as individual mound treatments and broadcast treatments against IFA around broiler production houses (1994 IFA Annual Report - FA02G044). Regardless of application method, control of IFA was marginal. The superabundance of alternate food sources, such as chicken feed, fly pupae, etc., may have rendered both baits less attractive, and therefore they were not ingested.

This year, 1995, we tested three different formulations of hydramethylnon for control of IFA around poultry houses.

MATERIALS AND METHODS:

Baits used in this trial were MaxForce® ant killer granular bait (1% hydramethylnon, Clorox Co.) and a queen pheromone enhanced formulation of Amdro® (American Cyanamid Company). Both baits, along with a standard commercial Amdro formulation, were applied as broadcast treatments around broiler production houses in central Mississippi at a rate of 1.5 lb/acre on May 17, 1995. Treatments were one "swath" in width, (ca. 20') applied with a Herd® GT-77 granular applicator mounted on a Suzuki® ATV. Each treatment was replicated 5 times. 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 6 week intervals. From this data, both colony mortality and decrease in the population index were calculated. Experimental data were statistically analyzed using Analysis of variance and an LSD test (P=0.05) for each post-treatment rating interval.

RESULTS:

At six weeks posttreat MaxForce® provided 68.5% colony mortality which was statistically different from the untreated check (Table 50). The pheromone enhanced Amdro provided 47.2% colony mortality and the standard Amdro gave 38.6% kill. Neither the pheromone enhanced Amdro nor the standard commercial formulation were statistically different from the untreated check. All three formulations reduced the pretreatment population indices by 70.6 to 75.1% depending upon the formulation (Table 51). These decreases were all statistically different from the untreated checks.

By 12 weeks posttreatment, the level of control provided by the pheromone enhanced formulation had increased to 64.5% colony mortality, whereas all other treatments decreased drastically. This drastic decrease in control at 12 weeks may have been due to the plot design used in this trial. As previously stated, each treatment was applied as a single swath (i.e. 20') around the periphery of each house. As the IFA population in the treated areas decreased, this highly favorable habitat may have induced rapid invasion by untreated colonies in the immediately adjacent areas that did not receive treatment. We cannot, however, explain why the level of control increased in the pheromone enhanced Amdro plots while decreasing drastically in all others.

At 18 weeks posttreatment, colony mortality ranged from 6.7% in the Amdro treated plots to 19.6% in the pheromone enhanced Amdro treated plots, however these rates were not significantly different from the check (Table 50). Mean population indices in the Amdro, Maxforce and untreated check plots had increased to levels above that of the pretreat indices (Table 51). The pheromone enhanced Amdro treated plots had a mean population index just below the pretreat population index.

In 1996, additional trails utilizing a different test plot design will be conducted. Rather than using individual houses as the experimental unit, the entire farm will be treated as one replicate. This will prevent migration of untreated colonies into test plots, if that is indeed occurring.

Table 50. Efficacy of Bait Treatments Applied Around Broiler Production Houses, 1995 – Colony Mortality.

Treatment	Mean no. colonies - pretreat[1]	Mean % colony mortality		
		(6)	(12)	(18)
Pheromone/Amdro	26.6	47.2ab	64.5a	19.6a
MaxForce	17.8	65.8a	20.4b	13.7a
Amdro	16.6	38.6ab	23.0b	6.7a
Untreated Check	13.0	19.5b	16.7b	0.0a

[1] Average of 5 replicates.
Means within a column followed by the same letter are not significantly different (LSD test, P=0.05).

Table 51. Efficacy of Bait Treatments Applied Around Broiler Production Houses, 1995 – Population Index Reduction.

Treatment	Mean pop. index - pretreat[1]	Mean % decrease in pretreat pop. index		
		(6)	(12)	(18)
Pheromone/Amdro	294	-75.1a	-72.5a	-3.3a
MaxForce	204	-71.2a	-2.4ab	28.4a
Amdro	214	-70.6a	-21.1ab	26.1a
Untreated Check	158	-14.8b	38.3b	75.2a

[1] Average of 5 replicates.
Means within a column followed by the same letter are not significantly different (LSD test, P=0.05).

PROJECT NO: FA02G065

PROJECT TITLE: Evaluation of Silafluofen as a Bait Toxicant for Imported Fire Ant Control, 1995.

TYPE REPORT: Final

PROJECT PARTICIPANTS: Homer Collins

INTRODUCTION:

Most insecticides are not suitable for use as bait toxicants against imported fire ants due to the very stringent efficacy requirements. Stringer et al. (1964) noted that an effective bait toxicant must (1) exhibit delayed kill over at least a 10-fold dosage range and preferably above a 100-fold dosage range, (2) be rapidly transferred from one ant to another via trophallaxis and kill the recipient, and (3) not be repellent to foraging ants. Very few insecticides possess all three characteristics, and only those that do qualify for use in fire ant baits. At last tally, more than 7,000 compounds have been tested as fire ant bait toxicants (Vander Meer et al. 1986. Banks et al. 1992). However, only five of these toxicants have ever been commercialized, and two of those are no longer marketed.

MATERIALS AND METHODS:

Silafluofen (AgrEvo Environmental Health, Montvale, NJ) was tested as a bait toxicant for control of red imported fire ants (RIFA) in the laboratory using techniques and procedures described by Lofgren et al. (1967). A stock solution containing 1% silafluofen (v/v), was prepared by mixing the toxicant into soybean oil. On June 6, 1995 concentrations of 1.0, 0.1, and 0.01% soybean oil/toxicant baits soaked onto 2mm cotton balls were offered to IFA workers in the laboratory. No feeding was observed on the 1.0 and 0.1% baits, and minimal feeding was observed on the 0.01% bait. The lack of feeding is an indication of repellency at these concentrations. In less than 24 hours, all ants confined in test chambers with silafluofen baits were dead (Table 52). Although the ants could have received a lethal dose through direct contact with the bait, observations indicated that fumigant action led to demise of the test insects.

A second trial was initiated on June 9 in which dose rates of 100, 50, 25, 10, and 1ppm were tested. Due to the weekend, observations were not made until Monday, June 12. At that time, concentrations of 100, 50, 25, and 10ppm provided 100% mortality in all replicates, i.e., delayed toxicity was not observed (Table 53). Ants confined in test chambers containing 1 and 0ppm were normal (0 and 5% mortality respectively). At the termination of the trial (14 days), the 1% bait provided 73.3% kill.

A third trial to evaluate rates of 1, 5, and 10ppm was initiated on June 13. Mortality was assessed at 0, 1, 3, 7, and 14 days after introducing the baits. The 10ppm rate provided 100% mortality after 7 days. Five ppm resulted in 98.3% mortality at 14 days, and 1 ppm gave 78.3% control after 14 days (Table 54).

Test IV. - Toxicity of 5ppm silafluofen/soybean oil bait to whole colonies in the laboratory.

Results of the worker tests indicated delayed toxicity at 10ppm and lower. Therefore it was deemed advisable to conduct additional trials with silafluofen. Six field collected IFA colonies were established in the laboratory on June 14, 1995. Collections were made by shovelling the nest tumulus and as much of the nest (all castes) into a plastic pail. After allowing to acclimate for six days a 5ppm bait was prepared and used to saturate a 2mm diameter cotton ball which was placed in a petri dish on the nest surface of 3 colonies; while the other three colonies served as untreated checks. Ants in the treated colonies were observed heavily feeding upon the bait in less than one hour. Feeding continued throughout the day. By seven days posttreatment, large "bone piles" (cadavers of dead workers) were stacked on the surface of the treated nests. At 14 days posttreatment the ant colonies appeared to be severely weakened and large bone piles were evident, however the colonies could not be considered "dead". The colonies were maintained for 6 weeks, at which time the trial was terminated. Although the colonies were severely weakened, none were rated as "dead".

Test V. - Toxicity of 25ppm silafluofen/soybean oil bait to whole colonies in the laboratory.

Results of test IV showed that a higher dose rate was indicated, since large numbers of ants died, but complete colony kill was not obtained. A dose rate of 25ppm was selected, and procedures described in test IV were repeated on three colonies which had been collected on June 30, and then starved and allowed to acclimate to the laboratory. The 25ppm baits were only slightly fed on relative to the untreated checks, indicating that this concentration is repellent to feeding workers. Colonies were observed for 6 weeks, and then discarded. All treated colonies survived, but exhibited a strong aversion behavior towards the bait.

RESULTS:

These results indicate that silafluofen is a Class III Toxicant in the classification system described by Lofgren et al. (1967), i.e. it is repellent to feeding worker ants at concentrations greater than 10ppm, and provides delayed activity over a very narrow dose range. These laboratory results suggest that silafluofen would not be effective as a bait for control of imported fire ants in the field.

However, these results confirm that silafluofen is highly toxic to IFA. That attribute, in combination with it's relative stability in nursery potting media, suggest that this product is a good candidate for use as a quarantine treatment for containerized nursery stock. It should also be tested as a broadcast treatment for commercial grass sod.

Table 52. Toxicity of Silafluofen/Soybean Oil Baits to IFA Workers

	% Kill @ indicated interval (Days post-treat)				
Conc. (ppm, v/v)	0	1	3	7	14
10,000	100				
1,000	100				
100	100				
0	0				

Table 53. Toxicity of Silafluofen/Soybean Oil Baits to IFA Workers

Conc. (ppm, v/v)	% Kill @ indicated interval (Days post-treat)				
	0	1	3	7	14
100			100	-	
50			100	-	
25			100	-	
10			100	-	
5			20	100	-
1			0	10	73.3
0			5	10	10

Table 54. Toxicity of Silafluofen/Soybean Oil Baits to IFA Workers.

Conc. (ppm, v/v)	% Kill @ indicated interval (Days post-treat)				
	0	1	3	7	14
10	0	38	67	100	-
5	0	8	12	72	98.3
1	0	2	2	43	78.3
0	0	7	10	18	25

PROJECT NO: FA01G125

PROJECT TITLE: Preliminary Testing of ATI-720CA - an Azadirachtin Formulation.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Kirk Irby and Anne-Marie Callcott

INTRODUCTION:

In a past trial with azadirachtin (FA02G020), activity on IFA lab colonies was evident when 1 liter of solution was applied at 100 ppm. Field trials were negated by drought conditions. Baits were repellant at concentration greater than 0.01%, and field trials using azadirachtin baits showed little or no control. In 1995, AgriDyne Technologies, Inc. (Salt Lake City, UT) provided us with a new formulation of azadirachtin for preliminary testing against IFA.

MATERIALS AND METHODS:

Fifteen IFA mounds were collected in the field and transported to the laboratory in 3-gallon plastic pails. These colonies were allowed to acclimate for 3-5 days prior to treatment. ATI-720CA was applied to the top of 10 of the mounds at a rate of 100 g/mound. Five of the treated mounds immediately received 500 ml of H_2O to water in the material. The other five treated mounds were not immediately watered. Five mounds remained as untreated checks. All mounds were watered as needed and feed weekly, beginning one week after treatment, to sustain the colony. Colonies were evaluated daily for activity and survival.

RESULTS:

Three days after treatment, activity within all treated colonies, regardless of water treatment, had slowed compared to the untreated check colonies. Worker ants were sluggish and slow to respond to external stimuli. After 14 days, one of the treated-watered in replicates was dead (some of the ants may have climbed out of the pail, but there were numerous dead ants in the nest tumulus when examined). From the 11th day after treatment until the end of the trial, the other treated colonies were still slow to respond to stimuli, but once they responded, appeared as active as the untreated checks. At the end of the trial, 25 days after treatment, all the pails were dumped and the nest tumulus examined. In the surviving treated colonies, all the ants were congregated in the bottom of the pail. This, along with the slow response time noted earlier, indicates that the ants were trying to avoid the chemical. Ants escaped from one of the check colonies at 7 days after treatment. All other check colonies remained active throughout the trial.

Rates used in this preliminary laboratory trial did not produce significant mortality in the confined IFA colonies. However, the ants did try to avoid the product by moving into the bottom of the nest tumulus. In the field, IFA mounds may extend up to 1 m or more into the soil, giving them even more room to move to avoid the product. Higher rates of application may provide higher and more consistent rates of mortality.

SECTION IV

MISCELLANEOUS PROJECTS

PROJECT NO: FA02G075

PROJECT TITLE: Myrmecofauna of the Pascal Gill Farm, Harrison Co., MS.

TYPE REPORT: Final

LEADER/PARTICIPANTS(s): Homer Collins, Tim Lockley, and Anne-Marie Callcott

INTRODUCTION:

Inoculative releases of potential biological control agents for imported fire ants should be preceded by firm data on the magnitude of the fire ant population as well as good knowledge on the presence and relative abundance of non-target myrmecofauna. The USDA, APHIS, PPQ Imported Fire Ant Laboratory has conducted dozens of field studies with a variety of bait toxicants at the Pascal Gill Farm in Saucier, MS over a period of 6.5 years (Collins et al. 1992, Callcott and Collins 1992, Collins and Callcott 1995, see also unpublished IFA Station Annual Reports 1989-1994.) Therefore, historical data on fire ant populations at this site was available from our files. Additionally, a survey of other ant species by one of us (TCL), was initiated in September, 1995. This project was conducted in anticipation of the possibility of using this farm for future releases of candidate biological control agents such as phorid flies and/or *Thelohania solenopsae*.

DESCRIPTION OF THE FARM:

The property described herein is located in Section 1, Township 5S, Range 12W of Harrison County. MS. This 174 acre tract of land is comprised of gently rolling hills which are predominantly covered by common bahia grass (*Paspalum notatum*), interspersed with dog fennel (*Eupatorium capillifolium*). Various species of oak including red oak, water oak, etc. occur on the uplands. Other upland tree species include Long-leaved pine (*Pinus palustris* Mill). and Chinese Tallow-trees (*Sapium* sebiferum (L.) Rox). Poorly drained bottom lands that contain intermittent streams are heavily vegetated with numerous species of forbs, shrubs and trees, including ferns, pitcher plants, swamp popular (*Populus heterophylla* L.), sweet bay (*Magnolia virginiana* L.), and others. Five small farm ponds averaging ca. 0.5 ha each have been constructed and are scattered about the grounds. The property has been used for beef cattle production for the past eighteen years. The fire ant population is comprised of totally monogynous *Solenopsis invicta* Buren colonies.

THE FIRE ANT POPULATION:

Pesticide plot counts dating from June, 1989 to October, 1995 were retrieved from our historical files and searched for pretreatment population plot counts and untreated check data. Each of these data points (N=561), was converted from number of active RIFA colonies per 0.25 acre test plot to total number of colonies per ha, and then plotted with number of active RIFA colonies/ha on the y axis, against the date on the x axis (Figure 8). These data reflect both annual and seasonal population trends. Colonies were much more abundant in late winter and early spring than in the hotter, drier months of late summer and fall.

Population indices (Lofgren and Williams 1982) were also plotted against time, and reflect a trend similar, if not identical, to the total number of colony data (Figure 9).

MYRMECOFAUNAL SURVEY:

Surveys employing bait stations (protein and carbohydrate baited), pitfall traps, and manual searches (especially for arboreal species), were conducted in September and October 1995 by one of us (TCL).

Site Descriptions:

SITE I - Located in the northeast corner of the farm. This site runs longitudinally east to west with ca. 16.0 acres of open pasture. Site is bordered to the north and east by deciduous dominant woodlands and to the south and west by improved pasturage. Traps were run from the north treeline to south fenceline ca. 1/3 of the distance from the eastern end of the field.

SITE II - A low, wet deciduous stand of trees located in the east central part of the farm. The stand runs generally north to south and consists predominantly of oaks. The site is bordered east, west and south by pasturage. Traps were run along the western edge of the treeline. Arboreal baited traps were run on the trunks of a mature red cedar and pin oak.

SITE III - Site consisted of a stand of mature red cedars and oaks located in a pasture in the southeastern corner of the farm. Traps were run through the grove from ca. WNW to ESE.

SITE IV - Located along the northern bank of the eastern-most pond. Traps were set from a small stand of young trees east along the pond's edge to a fence line.

SITE V - A low, wet woods located in the north central section of the farm. Traps were run north to south from the northern most pasture through the woods into the southern pasture. Arboreal bait traps were placed on a mature oak and a sweet bay tree within the deepest part of the woods.

SITE VI - Site located along the western edge of the central pond. Traps were run from the middle of the pond edge north onto the pond bank. Arboreal traps were placed on a mature pine and oak on the north edge of the pond.

SITE VII - Site is a pasture located ca. 150 m NNW of site VI. Traps run north to south from woods margin to lone dogwood tree.

SITE VIII - Pitcher plant bog with some small scattered trees. Bog located in low area of northwestern pasture ca. 200 m W of site VII. Traps were run along the middle length of the bog.

SITE IX - Low deciduous woods located ca. 50 m NNW of site VIII. Woods run east to west. Traps run from north pasture through woods into south pasture. Arboreal baited traps run on oak and sweet bay.

SITE X - Stand of mature oaks with barren ground located along southern edge of pond. Grove surrounded by pastures on all but pond side. Traps run from northern pasture through oaks into south pasture. Arboreal traps set on two mature oaks and one fallen, dead oak.

SITE XI - Located at southwestern pond. Traps run along entire length of western pond dam. Site within mature, mixed woods. Arboreal traps placed on young oak (ca. 7 m) and mature pine (ca. 20 m).

SITE XII - Located along heavily wooded hillside in southwest corner of farm. Consists of mixed mature woods with little understory and moderate leaf mulch. Arboreal traps placed on mature oak, pine and dogwood.

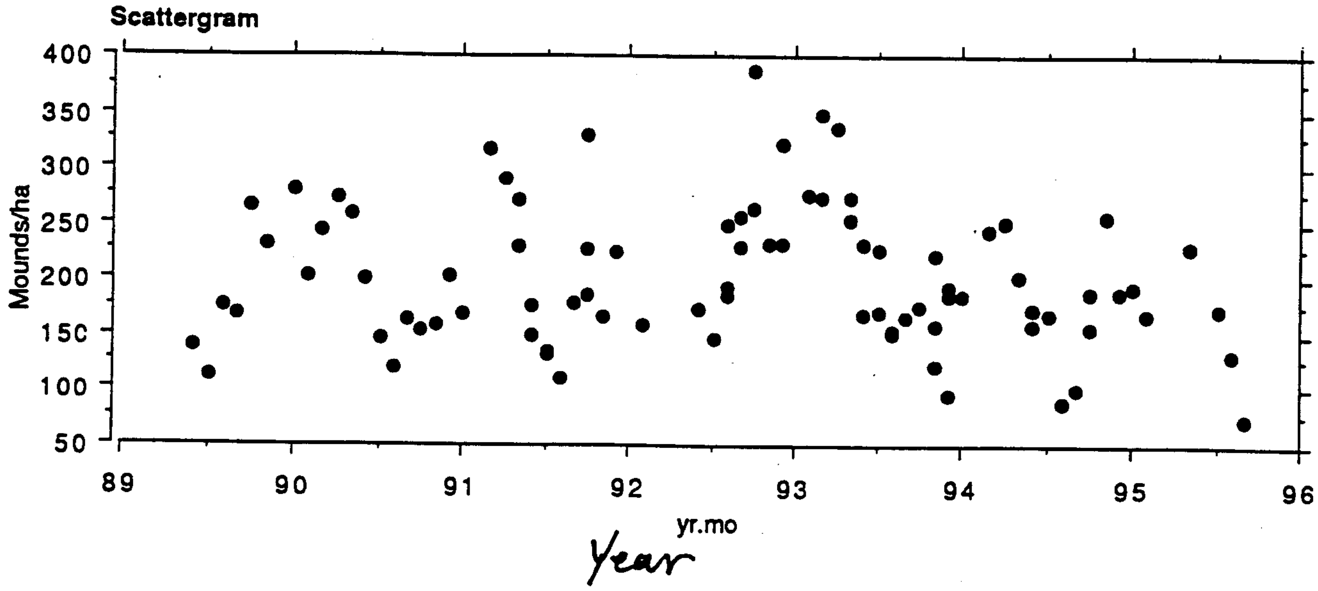
Trap Methods:
A set of 5 pitfall traps were run per site. Traps were spaced at ca. 5 m intervals and their position marked with survey flags. The traps were snap-topped vials with a ca. 25 mm wide mouth. Traps were buried flush with the soil surface. Approximately 20 cc of 80% ethanol was placed in each trap. Traps were left in the field for ca. 24 hours before retrieval. A series of baited traps were run concurrently with the pitfall traps. Baits used were an undiluted honey (listed as sugar bait) and Armour brand Vienna Sausage (chicken and pork in beef stock). Ca. 10 cc of honey or 2 g of sausage were placed in individual snap-topped vials and placed within 2 m of pitfall traps 1, 3 and 5 sequentially. Baited traps were left in place 1 - 2 hrs and then retrieved. Baited traps were run on 27 September 1995. Pitfalls were set on the 27th and retrieved on the 28th of September. Manual collections were made on 2 October, 1995. All samples were returned to the IFA lab in Gulfport and frozen to preserve the specimens. Samples were separated, ants were examined under magnification and counted.

DISCUSSION:

A total of 22 ant species was collected (Table 55 & 56). The most predominant species was *S. invicta* and was the only species to be collected at all sites. *Pheidole dentigula* was also captured in large numbers on protein baits. Some species such as *Aphaenogaster treatse*, *Formica dolosa* and *Camponotus americanus* were exceedingly rare and are represented by a single specimen at only one site.

Figure 8. Historical IFA Colony for the Gill Farm, Harrison Co., Mississippi. a) Annual history. b) Seasonal history.

a)



b)

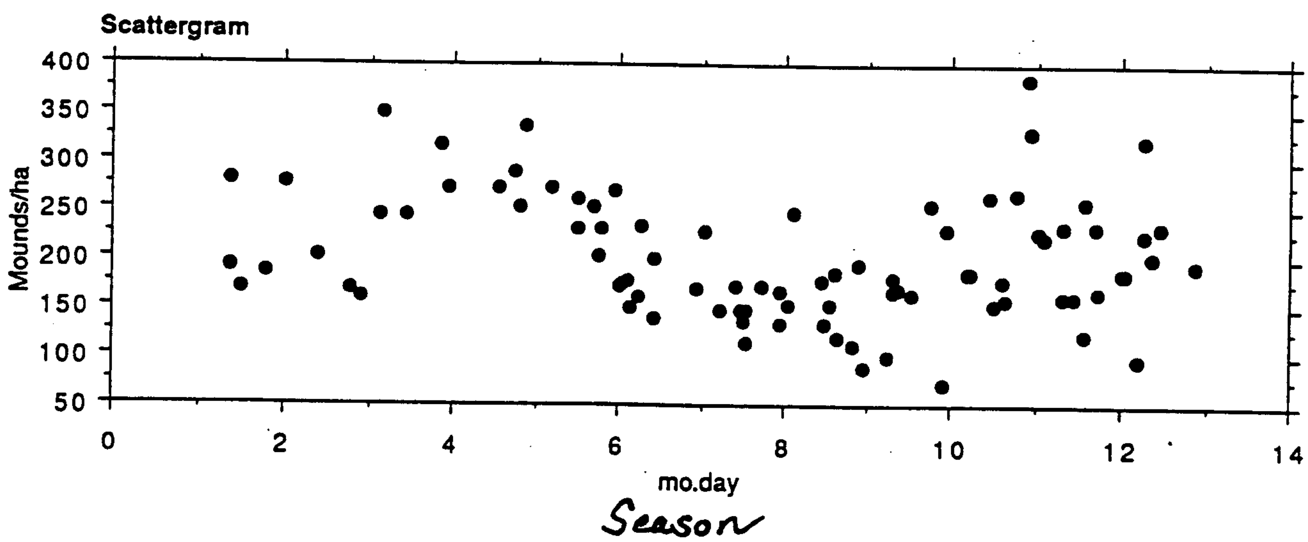
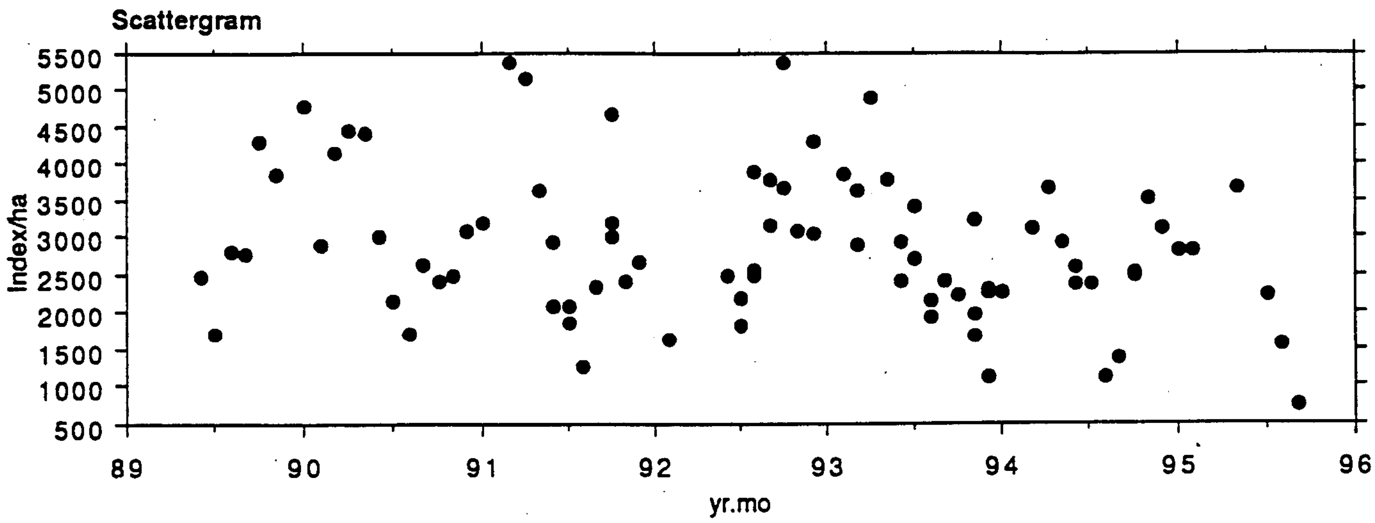


Figure 9. Historical IFA Population Indices for the Gill Farm, Harrison Co., Mississippi. a) Annual history. b) Seasonal history.

a)



b)

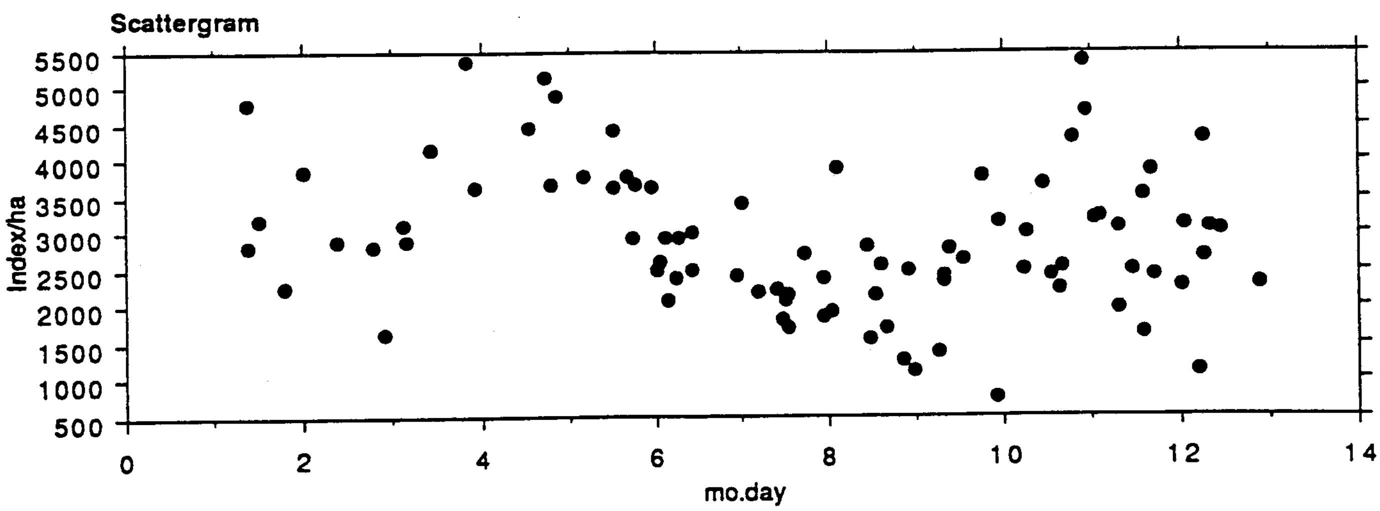


Table 55. Number of Ants Collected in Each Trap Type per Site.

SITE I	PITFALLS	PROTEIN BAIT	SUGAR BAIT
Solenopsis invicta	26	342	10
Solenopsis molesta	2		
Pheidole sp. A	7		15
Cyphomyrmex rimosus	1		
Paratrechina arenivaga	2		

SITE II	PITFALLS	PROTEIN BAIT	SUGAR BAIT
S. invicta	40	768	17
Pheidole sp. A	5		
P. arenivaga	1		
Forelius sp.	1		
Pheidole dentigula		317	
Pheidole moerens		356	
Brachymyrmex sp.			35

SITE III	PITFALLS	PROTEIN BAIT	SUGAR BAIT
S. invicta	65	148	139
Pheidole sp. A	24		
C. rimosus	1		

SITE IV	PITFALLS	PROTEIN BAIT	SUGAR BAIT
S. invicta	11	357	42
Pheidole sp. A	1		1

SITE V	PITFALLS	PROTEIN BAIT	SUGAR BAIT
S. invicta	5	338	5
Pheidole sp. A	1		
Aphaenogaster texana var. carolinensis	1		
Ph. dentigula		116	413
Brachymyrmex sp.			36

SITE VI	PITFALLS	PROTEIN BAIT	SUGAR BAIT
S. invicta	42	119	5
Pheidole sp. A	1		5
Ph. dentigula		372	

Table 55. Cont.

SITE VII	PITFALLS	PROTEIN BAIT	SUGAR BAIT
S. invicta	30	456	320
Pheidole sp. A	3		
Pheidole sp. B	2		
Brachymyrmex sp.	1		
Ph.dentigula		174	8

SITE VIII	PITFALLS	PROTEIN BAIT	SUGAR BAIT
S. invicta	21	713	56
Pheidole sp. A		72	

SITE IX	PITFALLS	PROTEIN BAIT	SUGAR BAIT	HAND CAPTURED
S. invicta	189	146	8	
Pheidole sp. A	7		7	
Brachymyrmex sp.	6	5		
Camponotus pennsylvanicus	2	9	1	
Dorymyrmex bureni				16

SITE X	PITFALLS	PROTEIN BAIT	SUGAR BAIT
S. invicta	100	1201	10
Pheidole sp. A	3		
Brachymyrmex sp.			17

SITE XI	PITFALLS	PROTEIN BAIT	SUGAR BAIT	HAND CAPTURED
S. invicta	73	1	51	
S. molesta	1			
Pheidole Sp. A	41	3		
Camponotus americanus	1			
Formica dolosa	1			
C. rimosus	1			10
A. lamellidans	16			45 w/brood
A. treatse	1			
Pheidole sp. C	3			
Pheidole floridana		332		

Table 55. Cont.

SITE XII	PITFALLS	PROTEIN BAIT	SUGAR BAIT	HAND CAPTURED
S. invicta	6	606		
Pheidole sp. A			6	
Pheidole sp. B	17		26	
Pheidole sp. C	4		2	
Pheidole sp. D	9			
Ph. dentigula		368		
Ph. metallescens				1
Ph. tysoni			10	
A. t. var. carolinensis	3		7	
A. lamellidans	5		8	5
C. pennsylvanicus	1			14 w/brood
C. rimosus				12

Table 56. Total Collection of Ant Species.

SPECIES	SITE #	TOTAL	PITFALL	PROTEIN	SUGAR	HAND
Solenopsis invicta	I	378	26	342	10	
	II	825	40	768	17	
	III	352	65	148	139	
	IV	410	11	357	42	
	V	348	5	338	5	
	VI	166	42	119	5	
	VII	806	30	456	320	
	VIII	790	21	713	56	
	IX	343	189	146	8	
	X	1311	100	1201	10	
	XI	125	73	1	51	
	XII	612	6	606	-	
Solenopsis molesta	I	2	2			
	XI	1	1			
Pheidole sp. A*	I	22	7		15	
	II	5	5			
	III	24	24			
	IV	2	1		1	
	V	1	1			
	VI	6	1		5	
	VII	3	3			
	VIII	72		72		
	IX	14	7		7	
	X	3	3			
	XII	6			6	
Pheidole sp. B**	VII	2	2			
Pheidole sp. C	XI	3	3			
	XII	6	4		2	
Pheidole sp. D	XII	9	9			
Pheidole sp. E	XII	10		10		
Pheidole dentigula	II	317		317		
	V	529		116	413	
	VI	372		372		
	VII	182		174	8	
	XII	368		368		
Pheidole floridana	XI	376	41	335		
Pheidole metallescens	XII					1

Table 56. Cont.

SPECIES	SITE #	TOTAL	PITFALLS	PROTEIN	SUGAR	HAND
Pheidole moerens	II	356		356		
	XII	10			10	
Cyphomyrmex rimosus	I	1	1			
	III	1	1			
	XI	7	7			10
	XII					12
Aphaenogaster texana var. carolinensis	V	1	1			
	XII	10	3		7	
Aphaenogaster lamellidans	XI	16	16			45
	XII	13	5		8	4
Aphaenogaster treatse	XI	1	1			
Brachymyrmex sp.	II	35			35	
	V	36			36	
	VII	1	1			
	IX	11	6	5		
	X	17			17	
Paratrechina arenivaga	I	2	2			
	II	1	1			
Forelius sp.	II	1	1			
Formica dolosa	XI	1	1			
Camponotus americanus	XI	1	1			
Camponotus pennsylvanicus	IX	12	2	9	1	
	XII	1	1			13
Dorymyrmex bureni	IX					16

* Pheidole sp. A near dentigula; **Pheidole sp. B near floridana

PROJECT NO: FA05G035

PROJECT TITLE: The Ants of Mobile County, Alabama: a twenty and 75-year perspective.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Tim Lockley/Kirk Irby

INTRODUCTION:

Black and red imported fire ants first arrived in the United States ca. 1918 and 1940, respectively. Both species entered this country through the port of Mobile, AL. Currently, the black imported fire ant (*Solenopsis richteri*) is isolated in extreme northeast Mississippi, northwest Alabama and a few counties in Tennessee. The red imported fire and, S. *invicta,* has spread throughout the southeastern United States from Norfolk VA to the Florida Keys and west into eastern Texas. Currently, 12 states and commonwealths and Puerto Rico are infested. As this pest has spread, **it** has depauperized native species of ants (Porter & Savignano 1990). Some native species of ants (as well as some other imported species) however seem to be able to compete successfully with IFA (Lofgren et al. 1975). Glancey et al. (1976) conducted a survey of Mobile Co., AL in 1974 to determine what effect IFA had upon native species in the area longest infested by fire ants. Their data indicated that a total of 16 species had been able to survive over 50 years of occupation by IFA. A survey was conducted using the same three transects traveled by the Glancey team to determine **if** any significant changes had occurred in ant populations in the ensuing 20 + years since the last survey.

MATERIALS AND METHODS:

Three semi-parallel roads running ca. north-south through Mobile County were selected as the study transects. Bait stations were established at ca. 0.5 mile intervals. Two baits (Vienna sausage and honey) were used. The baits were placed in a separate snap-top container and set ca. 1.0 m apart at each bait station along the transect for ca. **1** hour. Baiting was carried out in beginning ca. 08:30 and continuing until ca. 14:00. After retrieval. the containers were placed in a cooler and returned to the Gulfport MS Imported Fire Ant Station for identification. Data were compared with that reported by

Glancey et al. in 1976.

RESULTS & DISCUSSION:

From 580 traps at 290 sites, 24,347 ants were collected. They were represented by 21 species from 10 genera (Table 57). *Solenopsis invicta*, *Linepithema humilis*, *Pheidole fallax obscurithorax*, *Pheidole moerens* and *Brachymyrmex* spp. represented 97.9% of all ants collected. Five species were reported in the new survey that were not collected by the previous search (*Odontomachus sp.*, *P. fallax obscurithorax*, *P. floridana*, *P. metallescens*, and *P. tysoni*). Three species collected by Glancey were not found in the current survey (*Aphaenogaster texana*, *Crematogaster clara* and *Tetramorium guineese*) (Table 58). Since the initial survey in 1974, numbers of the red imported fire ant had declined sharply (Table 59). In 1974, RIFA represented 84.3% of all the ants collected and was recovered from 37.6% of the sites baited. In 1995, numbers of RIFA had fallen to 47.0% of the total number of ants and they were collected from only 25.9% of the sites. During this same period, the Argentine Ant had increased its numbers from 13.1% of the total in 1974 to 41.5% in 1995. In 1974 it had been collected from only 8.5% of the sample sites; in 1995, these sites had increased to 27.9% of the total. Another introduced species, *P. fallax obscurithorax*, represented 3.4% of the total ants taken but was collected at 17.2% of the sites. This ant had not been collected by Glancey in his survey; but had been introduced into southern Alabama ca. during the same period as RIFA.

A possible explanation for the decline in RIFA numbers and distribution may be the rapid urbanization of Mobile County; yet, the decline was consistent throughout the rural, suburban and urban areas. The two dominant and the senior subdominant species are all introduced and the fluctuations in numbers and sites collected may be results of competition among "weeds". Does this fluctuation occur throughout the monogyne range of RIFA? It will require similar surveys over similar periods of time to answer that question. If RIFA populations are inherently unstable, or are subject to pressure by other competitive species, then perhaps RIFA isn't the environmental juggernaut it is supposed to be. Further collections will be made in April 1996.

Table 57. Mycrofauna of Mobile Co., Alabama Collected by Protein and Sugar Baits.

TAXON	PROTEIN BAIT No.	% Collect	No.	% Collect	SUGAR BAIT No.	% Collect	No.	% Collect
S. invicta	11085	50.4	118	40.7	5070	41.1	80	27.5
L. humilis	8685	39.5	63	21.7	5557	45.1	65	22.4
P. fallax obscurithorax	797	3.6	16	5.5	371	3.0	39	13.5
P. moerens	502	2.3	3	1.0	358	2.9	5	1.7
Brachymyrmex sp.	91	*	2	*	761	6.2	36	12.4
D. bureni	144	*	2	*	113	*	7	2.4
P. dentata	194	*	1	*				
Forelius sp.	114	*	2	*	32	*	2	*
P. floridana	145	*	1	*				
M. minimum	105	*	1	*	1	*	1	*
M. viridun	75	*	1	*				
S. molesta	68	*	3	1.0				
F. dolosa	1	*	1	*	23	*	1	*
Pheidole sp. A	2	*	2	*	21	*	1	*
P. arenivaga					15	*	1	*
P. tysoni	5	*	1	*				
C. pennsylvanicus	1	*	1	*	4	*	2	*
Pheidole sp. B					3	*	3	1.0
Odontomachus sp.	1	*	1	*	1	*	1	*
C. castaeus					1	*	1	*
C. abdominalis floridanus					1	*	1	*
TOTAL	22015		290		12332		290	

* = less than 1.0%

Table 58. Comparative Collections of the Myrmycofauna of Mobile Co., AL: 1974 & 1995.

TAXON	1974	1995
Odontomachus sp.		X
Aphaenogaster nr. texana	X	
Crematogaster clara	X	
Monomorium minimum	X	X
M. viridum	X	X
Pheidole dentata	X	X
P. fallax obscurithorax		X
P. floridana		X
P. metallescens		X
P. moerens	X	X
P. tysoni		X
Pheidole spp.	X	X
Solenopsis invicta	X	X
S. molesta		X
Tetramorium guineese	X	
Dorymyrmex sp.	X	
D. bureni		X
Forelius sp.		X
Linepithema humilis	X	X
Brachymyrmex sp.	X	X
Camponotus abdominalis floridanus		X
C. castaeus		X
C. pennsylvanicus	X	X
Formica dolosa	X	X
Paratrechina arenivaga		X

Table 59. Dominant and Subdominant Species of Ants Collected from Mobile Co., AL - 1974 and 1995.

	Percent Collected		Percent of Sites	
TAXON	1974	1995	1974	1995
Solenopsis invicta	84.3	47.0	37.6	25.9
Linepithema humilis	13.1	41.5	8.5	27.9
Pheidole fallax obscurithorax	0.0	3.4	0.0	17.2
P. moerens	0.9	2.5	0.3	2.9
Brachymyrmex sp.	*	2.5	*	12.8

* less than 0.01%

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], Tim Lockley[3], Anne-Marie Callcott[3], Randy Cuevas[3], David Oi[5], R.G. Milam[6] and others

INTRODUCTION:

Red imported fire ants (RIFA), *Solenopsis invicta*, currently infest over 281,000.000 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

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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 of 1994 and 1995. Maximum and minimum air temperatures and rainfall were 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 teaspoon into the mixture 3-6 time. Each "spoonful" or aliquot 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 to 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) were used to compare nesting success of ants collected near Calhoun, TN with those collected in Gainesville, FL. Newly mated queens were collected serendipitously following mating flights. Also, small incipient colonies were field collected by shovelling the entire nest tumulus into plastic pails. Ants were then transported to Gainesville, FL for laboratory rearing in bioclimatic chambers. Colonies were 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 was based on colony development rates (colony weight per time). An analysis of variance was 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 non-infested 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.

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 10 & 11). By April 1994 the Tennessee site had significantly lower IFA populations and colony numbers compared to the Mississippi site, indicating notable winter kill. Temperatures at the Tennessee site between December 20, 1993 and January 20, 1994 averaged a high of 39.8°F (range 16°-58°F) and a low of 23.7°F (range 0°-42°F) (Figure 12). During the end of this period there were 7 days in a row in which the high temperature did not exceed 34°F (avg. high = 27.7°F, range 16°-34°F; avg. low = 8.1°F, range 0°-16°F). On February 8, 1994, Greg Adyelotte (USDA, APHIS, PPQ Officer, Knoxville, TN) observed considerable mound mortality, and stated that it was very difficult to find active mounds (temperature range on 2/8 was 58°-67°F). This dramatic decline, indicating winter kill, was quantitatively noted in our April 1994 population assessment which showed 87% colony mortality between October 1993 and April 1994.

The Tennessee populations did not rebound as expected over the summer months of 1994, but remained at very low levels, with only small increases in population indices and colony number between April and October. Average high temperatures in the summer months of June, July, and August 1994, were 87.4°F (range 75°-95°F), 86.6°F (range 73°-94°F), and 87.4°F (range 73°-90°F), respectively. Rainfall during those months was 3.38, 8.13, and 6.17 inches, respectively.

In April 1995, there was a drop in both population indices and colony numbers in the Tennessee plots compared to the previous fall count (October 1994), again indicating some over winter kill this season. There was ca. 60% colony mortality between October 1994 and April 1995. Temperatures were not as extreme over this winter season. Lowest temperatures were recorded between January 20, 1995 and February 20, 1995 when the average high was 45.1°F (range 26°-67°F) and the average low was 31.2°F (range 10°-52°F). With only 2 exceptions (26°F on February 8, 1995 and 32°F on February 12, 1995), high temperatures exceeded 32°F everyday this winter season.

IFA populations finally began to rebound over the summer of 1995. By October 1995, populations had risen substantially compared to the previous year, and both population indices and colony numbers were not significantly different from that of the Mississippi population. At the Tennessee site, the average high temperatures in the summer months of June, July, and August 1995, were 84.8°F (range 70°-93°F), 89.4°F (range 82°-96°F), and 92.5°F (range 83°-100°F), respectively. Rainfall during these months was 2.70, 2.46, and 4.68 inches, respectively.

The Mississippi site showed a large reduction in population indices and number of colonies at the July 1994 assessment (Figures 10 & 11). 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. There was another dramatic decrease in populations at the July 1995 assessment reinforcing the observation of this summer decline phenomenon. However, populations did not rebound in October 1995 as they had the previous year. 1995 was an exceptionally hot, dry and long summer in south Mississippi which probably attributed to the slow recovery. Temperature and rainfall data will be obtained and assessed as with the Tennessee data, to determine any associations between these factors and IFA populations at the Mississippi site. IFA population and colony 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 and December 1994, only three colonies were evaluated to determine life stages present, and in July 1994, only two colonies were evaluated. In 1995, no colonies in Tennessee were collected in May, and in July only three 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 (through Nov. 1995) shows some interesting trends. In the immature forms, small larvae were produced year round, with a drop in production in the winter months (December-March) at both sites (Figure 13). In general, there was no significant differences between small larvae production in Mississippi vs. Tennessee colonies (15/22 similar), however, when there was a difference, Mississippi colonies contained significantly more small larvae than did the Tennessee colonies in 6 of the 7 significant comparisons (t-test, $P<0.05$). Mississippi colonies contained more small larvae in March 1994 and 1995, April 1995, August 1994, November 1993 and December 1994. Only in August 1995 were there more small larvae in the Tennessee colonies. The Mississippi site experienced a cessation in worker pupae production in January 1994, and a substantial drop in February 1995, while the Tennessee site ceased or substantially dropped worker pupae production January through March 1994, and December 1994 through March 1995.

Sexual larvae presence fluctuated at both sites. In general, sexual larvae were present in the Mississippi colonies in the spring to early summer (April-July 1994 and March-June 1995) and again late summer through fall (September-October 1994 and August-October 1995). In the Tennessee colonies, sexual larvae presence followed a similar pattern, but slightly later in the season. While the Mississippi colonies contained significantly more sexual larvae than the Tennessee colonies in April 1994 and significantly more sexual larvae and pupae in April 1995, the Tennessee colonies contained significantly more sexual brood than the Mississippi colonies in May 1994 (t-test, $P<0.05$). Unfortunately, no samples were collected in May 1995. However, this trend indicates that major springtime production of sexual brood in southern

Mississippi is in April, a full month before the major production in Tennessee.

Minor workers were the most abundant life stage year round in both sites, and in general, minor production was similar at both sites (Figure 14). However, in January 1994, the Mississippi colonies had significantly more minors than the Tennessee colonies and in March 1994, the Tennessee colonies had significantly more present (t-test, $P<0.05$). The most interesting trend at this time is that of the alate females. At the Tennessee site alate females were present continuously from November 1993 through March 1995. The only time alate females were not collected in Tennessee was April 1995 and August through September 1995. 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, or in January, April or November 1995. However, only in November 1994 were there significantly more alate females produced in the Tennessee colonies (t-test, $P<0.05$).

SURVIVABILITY OF QUEENS & INCIPIENT UNDER SUBOPTIMAL TEMPERATURES IN THE LABORATORY: This portion of the study was conducted at USDA, ARS, MAVERL, in Gainesville, FL. Eight alate queens in Chattanooga, TN were sent by overnight mail to Gainesville, FL in June 1994. 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.

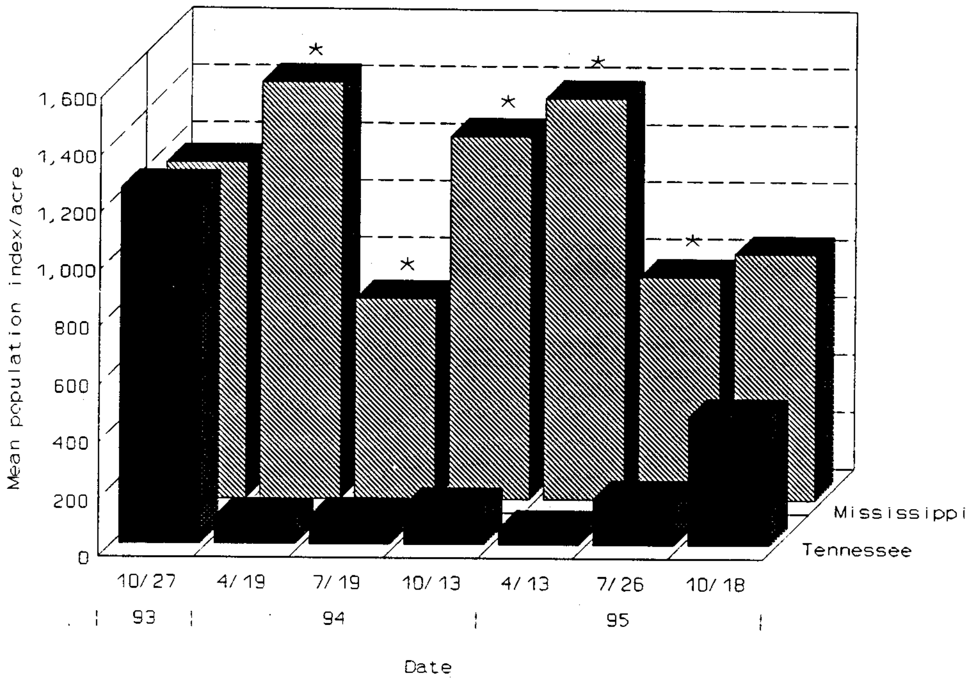
IMPACT OF RIFA ON LOCAL MYRMECOFAUNA: For this report, data from all trap types at a site were combined. A total of 10,643 ants (including IFA) were collected in the IFA infested area (Table 60) compared to 5,322 in the non-IFA infested area (Table 61), through November 1995. Excluding IFA in the infested site, 8,397 other ants were collected. Total number of species collected from October 1993 through November 1995, excluding IFA, was 26 in the infested plots, and 30 in the non-infested plots, of which 22 species were common to both sites.

We arranged the data seasonally for presentation: spring = March, April, May; summer = June, July, August; fall = September, October, November; winter = December, January, February. Over the winter months no ants were collected in any of the traps, so this data has been omitted from that presented here. The number of non-IFA species collected in both infested and non-infested plots varied seasonally. Within a year's cycle, more species of ants were collected in the summer months in both the IFA-infested (2.83 in summer 1994 and 5.5 in summer 1995) and the non-infested plots (4.89 in summer 1994 and 7.67 in summer 1995) (Figure 15). Significantly more species of non-IFA ants were collected in the non-infested plots in the spring of 1994 and the summer of 1995 than in the IFA-infested plots.

The most common ants collected in the infested area were *Forelius* sp. A, *F. pruinosis*, and *Solenopsis invicta*, with 29.7%, 27.3%, and 21.1%, respectively, of the total number of ants collected through November 1995 (Table 60). *Forelius* sp. A was most prevalent in the spring of 1994, after the extremely cold winter of 1993-1994 had severely depleted the IFA populations (Figure 16), indicating a negative, though insignificant correlation between the two species (df=14, r=-0.23, P=0.39). On the other hand, *F. pruinosis* was most prevalent in the summer of 1995 when IFA populations had increased dramatically. In this case, a positive, though again insignificant, correlation was indicated (df=14, r=0.21, P=0.46). However, at the beginning of this trial, fall of 1993, when the IFA population was at its strongest, no *F. pruinosis* were present and only a few *F.* sp. A were present (Table 60, Figure 16). As of November 1995, there was no correlation between IFA density and number of other ant species present (df=16, r=0.089, P=0.73).

In the non-IFA infested area, the most common ants were *Forelius* sp. A, *Monomorium minimum*, and *Crematogaster clara* with 28.1%, 19.3%, and 16.4%, respectively, of the total number of ants collected between October 1993 and November 1995 (Table 61).

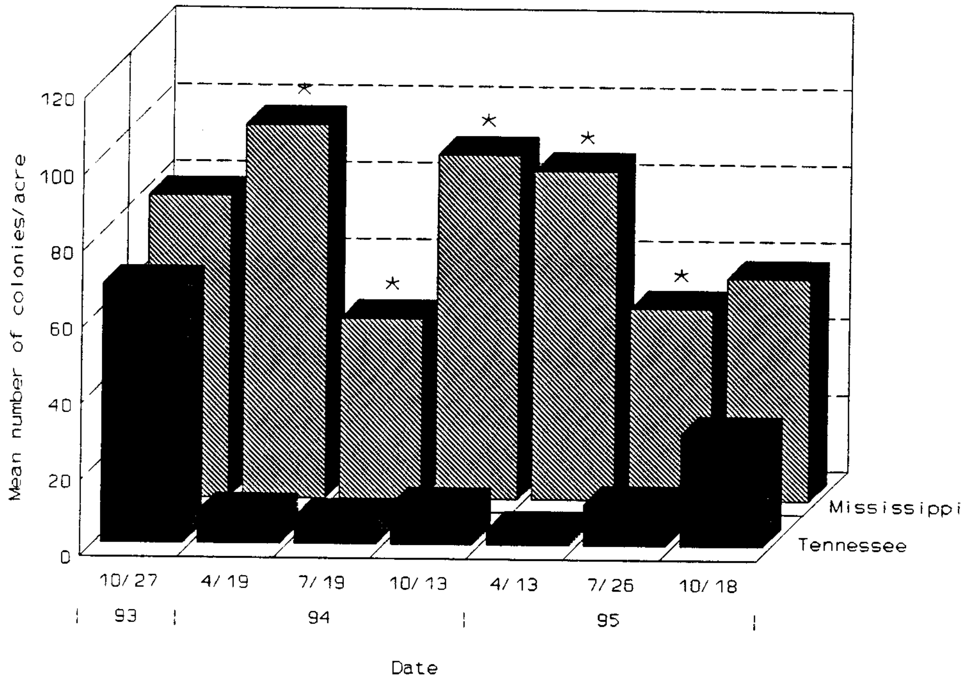
Figure 10. IFA Population Indices Over Time at Two Climatically Different Sites.



* denotes significant difference between sites (t-test, P=0.05)

Tn. site - one plot lost to construction prior to 10/13/94

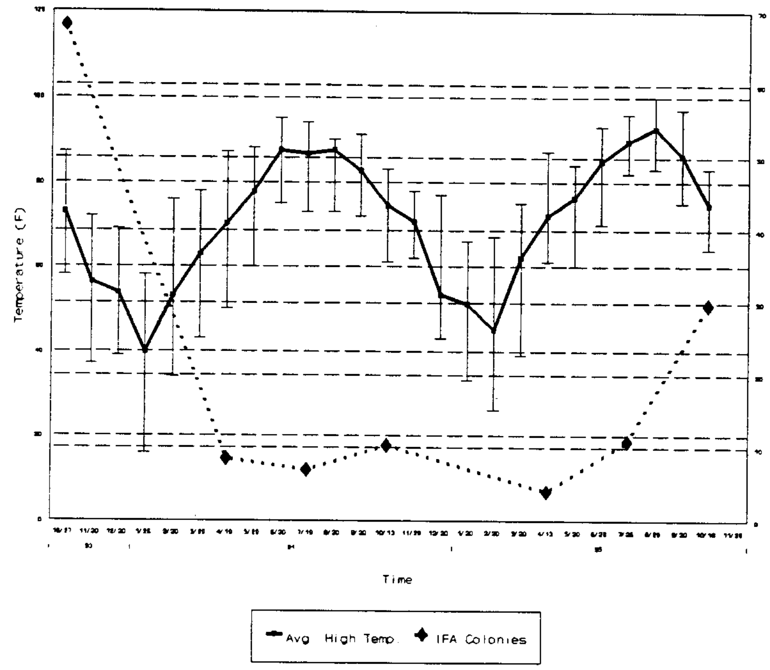
Figure 11. Number of Colonies Present Over time at Two Climatically Different Sites.



* denotes significant difference between sites (t-test, P=0.05)
Tn site -one plot lost to construction prior to 10/13/94

Figure 12. Trends of Temperature vs. Number of IFA Colonies Present in Tennessee: a) High Temperatures, b) Low Temperatures.

a)



b)

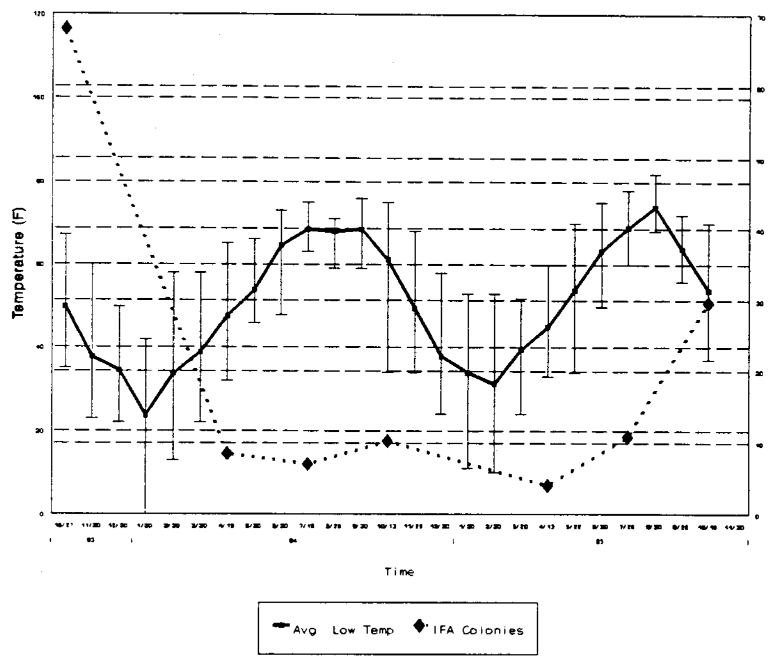
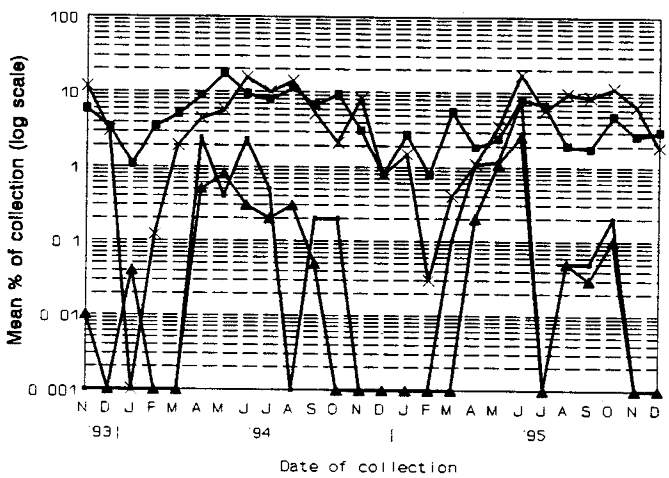


Figure 13. Life Stage Data for Immature Forms Collected at Mississippi and Tennessee Sites; a) Mississippi, b) Tennessee.

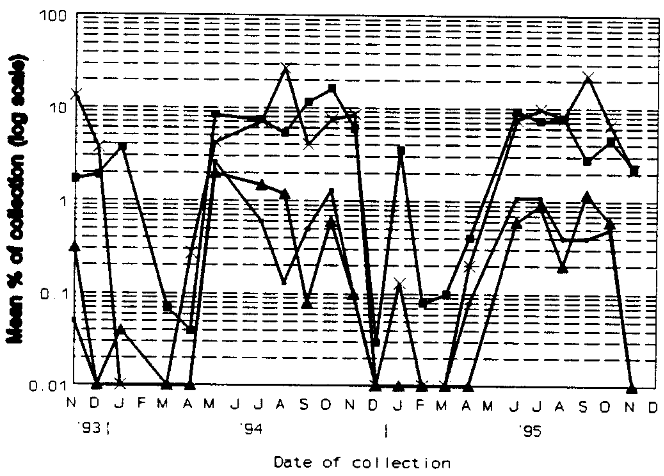
a)

Percentage of immature forms present in Mississippi plots over time



b)

Percentage of immature forms present in Tennessee plots over time

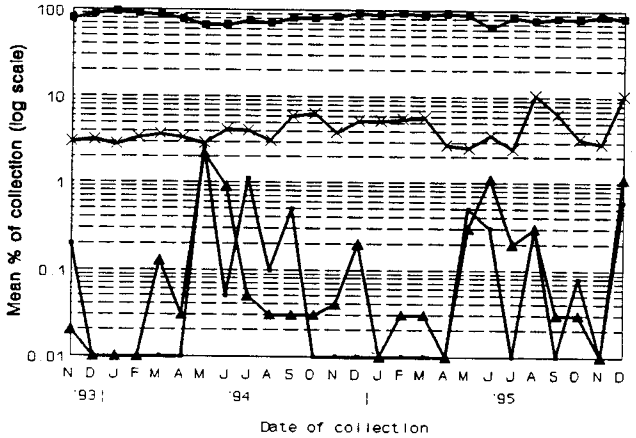


No TN collections were made in Feb 94, June 94, or May 95.

Figure 14. Life Stage Data for Adult Forms Collected at Mississippi and Tennessee Sites; a) Mississippi, b) Tennessee.

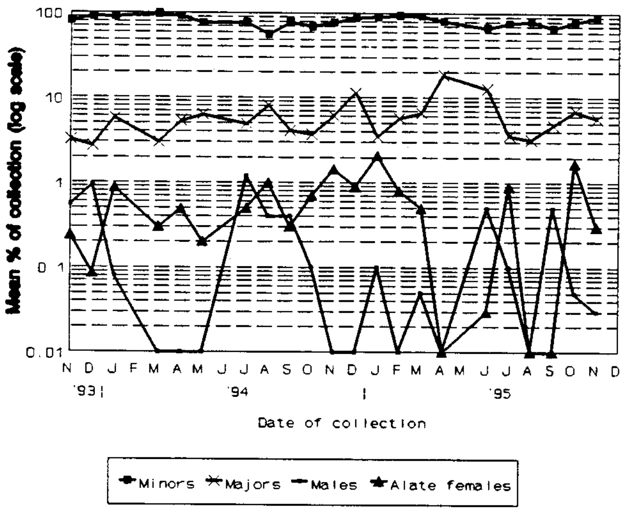
a)

Percentage of adult forms present in Mississippi plots over time



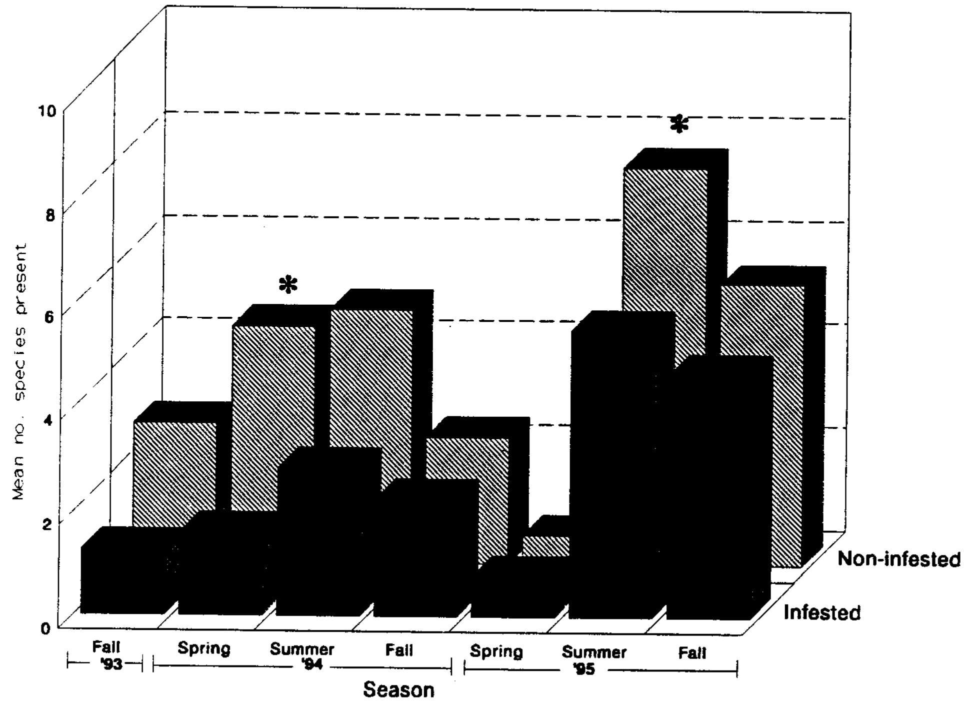
b)

Percentage of adult forms present in Tennessee plots over time



No Tn collections were made in Feb 94, June 94, or May 95.

Figure 15. Number of Non-IFA Ant Species Present in IFA Infested vs. Non-infested Plots.



* indicates significant difference (t-test, P=0.05)

Figure 16. Number of Most Abundant Ant Species Present in IFA-infested Plots.

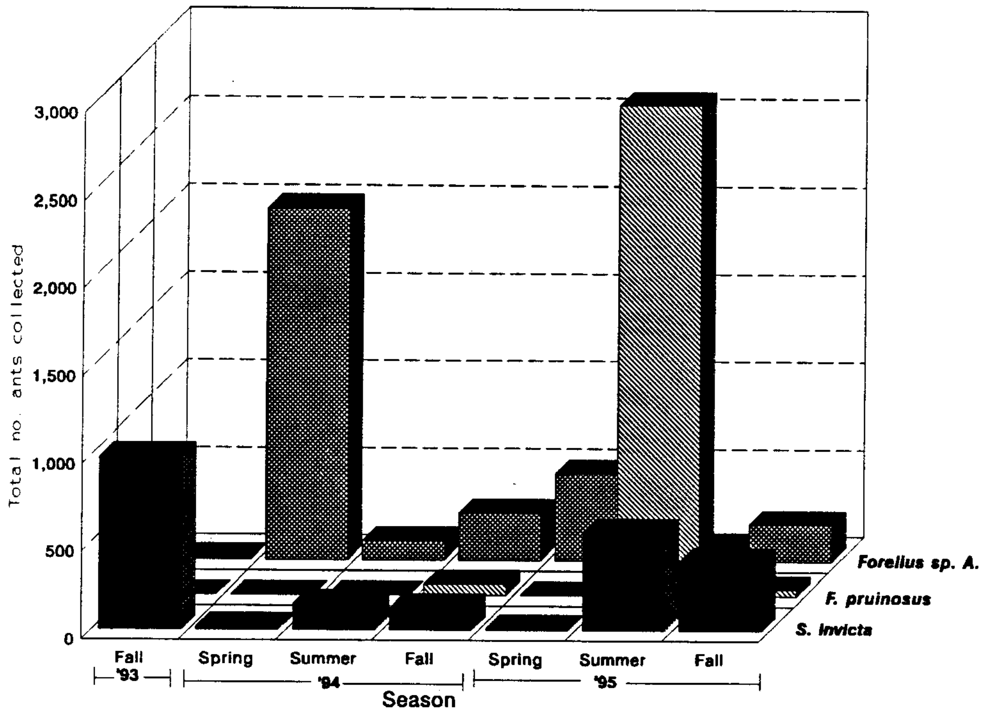


Table 60. Mean no. of ants trapped in bait and pitfall traps seasonally in INFESTED plots.

Species name	1993	1994			1995				PERCENT
	Fall	Spr	Summ	Fall	Spr	Summ	Fall	TOTAL	OF TOTAL
Aphaenogaster sp. A.			1			2		3	0.03
A. lamellidens								0	0.00
A. treatae								0	0.00
Crematogaster sp. A.								0	0.00
C. ashmeadi		7			45			52	0.49
C. clara		6	1			430	66	503	4.73
C. lineolata		1	49					50	0.47
C. missouriensis	2	1	7			3	2	15	0.14
Forelius sp. A.	8	2006	105	268	496	74	206	3163	29.72
F. sp. B.						1		1	0.01
F. sp. C.						58		58	0.54
F. pruinosus				63		2800	38	2901	27.26
Formica sp. A.								0	0.00
F. sp. B.								0	0.00
F. dolosa		4						4	0.04
Labidus sp. A.				36			137	173	1.63
Lasuis sp. A.							1	1	0.01
L. neoniger								0	0.00
Leptothorax sp. A.		13						13	0.12
L. pergandei			14			1	5	20	0.19
Monomorium sp. A.		2						2	0.02
M. minimum		257	1			58	35	351	3.30
Paratrechina sp. A.			1	2				3	0.03
P. faisonensis			51	9		8	9	77	0.72
P. parvula			1					1	0.01
P. terricola	5	1	66	1	1	28	13	115	1.08
Pheidole sp. A.	4						1	5	0.05
P. dentata	3			1		8	129	141	1.32
P. tysoni		16	6	14		4	18	58	0.54
P. vinelandica	5	3	36	12	2	96	63	217	2.04
Proceratium silaceum				1		2		3	0.03
Tapinoma sessile								0	0.00
Trachyomyrmex sp. A.								0	0.00
S. molesta	3		185	13		237	29	467	4.39
S. invicta	984	18	152	128	10	558	395	2246	21.10
S. richteri								0	0.00
TOTAL	1014	2335	676	548	554	4309	1206	10643	

Unidentified species (i.e. identified to sp. A, B or C) will be idnetified by experts in each genus as available.

Table 61. Mean no. of ants trapped in bait and pitfall traps seasonally in NONINFESTED plots.

Species name	1993	1994			1995			TOTAL	PERCENT OF TOTAL
	Fall	Spr	Summ	Fall	Spr	Summ	Fall		
Aphaenogaster sp. A.		1						1	0.02
A. lamellidens		1	27					28	0.53
A. treatae	11		6	14	1	38	9	79	1.48
Crematogaster sp. A.		27		1			2	30	0.56
C. ashmeadi				2	85			87	1.64
C. clara	3	235	7			616	12	873	16.41
C. lineolata		265	99					364	6.84
C. missouriensis	1	2	3	1			6	13	0.24
Forelius sp. A.		518	836	5	4	47	86	1496	28.12
F. sp. B.						43		43	0.81
F. sp. C.								0	0.00
F. pruinosus	2					299	6	307	5.77
Formica sp. A.		14				1		15	0.28
F. sp. B.		4						4	0.08
F. dolosa	2	22	23			19	8	74	1.39
Labidus sp. A.								0	0.00
Lasuis sp. A.			9					9	0.17
L. neoniger		6	19					25	0.47
Leptothorax sp. A.		15	2				4	21	0.39
L. pergandei	8	39	24	4	1	53	12	141	2.65
Monomorium sp. A.		1						1	0.02
M. minimum	1	3	502	7	3	504	9	1029	19.34
Paratrechina sp. A.					2	3		5	0.09
P. faisonensis	4			1		2	2	9	0.17
P. parvula								0	0.00
P. terricola				1				1	0.02
Pheidole sp. A.	10	2				2	1	15	0.28
P. dentata	53	5	7	5		112	44	226	4.25
P. tysoni	10		70	3		57	35	175	3.29
P. vinelandica	15		144	3		54	13	229	4.30
Proceratium silaceum								0	0.00
Tapinoma sessile				1				1	0.02
Trachyomyrmex sp. A.						1		1	0.02
S. molesta			1			16	3	20	0.38
S. invicta								0	0.00
S. richteri								0	0.00
TOTAL	120	1160	1779	48	94	1866	255	5322	

PROJECT NO.: FA05G045

PROJECT TITLE: Seasonal Food Preference of *Solenopsis invicta* Among Seeds of Wildflowers Native to the Southeastern United States.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Timothy C. Lockley

INTRODUCTION:

Until recently, no serious attempts had been made to study the role of seed-eating ants in the domestic economy of plant populations. Risch and Carroll (1986) demonstrated a decided preference by *Solenopsis geminata* for grass seeds. Their study showed that this preference was partly frequency dependent. Nest mound size and numbers were found to be greatest in plots experimentally seeded to high grass density (Risch & Carroll 1984).

Feeding on crops by imported fire ants was first reported by Lyle and Fortune (1948). The effects of the red imported fire ant on individual plant species and species communities are poorly documented. Those few studies that have been undertaken have been restricted to agricultural crops such as cucumber and sunflower (Stewart and Vinson 1991), sorghum and corn (Glancey et al. 1979, Drees et al. 1991, Harlan et al. 1981b), soybeans (Adams et al. 1983), eggplant (Adams 1983), okra (Smittle et al. 1983), cabbage, citrus. peanuts potatoes, sweet potatoes and watermelon (Lofgren 1986). A review of the literature shows no data on the effects of fire ants on native wildflowers.

MATERIALS AND METHODS:

Seeds of 139 species of wildflowers native to the southeastern United States were placed on moistened filter paper in a grid pattern (5 x 5) in a 100mm petri dish (one species per dish). A control consisted of 25 soybean (*Glycene max*) seeds placed on moistened filter paper in separate 100mm petri dishes. The dishes were transported to the field where they were set at ca. 1.0 m intervals. The dishes were covered loosely with aluminum foil bowls to keep out rain and vertebrate seed predators. The dishes were set out in an area of high S. *invicta* density (ca. 50 mounds/acre) for 24 h. Four replicates of each were made in each trial at monthly intervals from September 1994 through

September 1995. At 24 h., dishes were returned to the IFA lab where any remaining seeds were sorted and examined under magnification for signs of feeding damage. Absence or presence of feeding damage to the soybean seeds was used as an indicator of IFA feeding activity.

RESULTS AND DISCUSSION:

One hundred thirty-nine species of wildflower seeds in 88 genera belonging to 31 families were evaluated as potential food sources for the red imported fire ant. Thirty-one species were fed upon during the summer months; twenty-two species during the spring, and 16 and 11 species during the fall and winter seasons, respectively. Seven species were fed upon in all four seasons. Four species were fed upon during three of the seasons, and five species during two seasons. Of the 139 species of wildflower seeds evaluated, 38.9% (n=54) were selected for predation by *S. invicta* workers. These species represented 45.4% of the genera (n=39) and 59.4% (n=19) of the families (Table 62).

Table 62. Seasonal Feeding Response of RIFA to Seeds of Selected Wildflowers Native to the Southeastern United States.

TAXON	SUMMER	FALL	WINTER	SPRING
AMARYLLIDACEAE				
Zephyranthes atamasco				
ANACARDIACEAE				
Rhus copallina				
R. glabra				
ASCLEPIADACEAE				
Asclepias incarnata	*****			
A. tuberosa				
A. viridiflora				
APIACEAE				
Ammi majus				
ASTERACEAE				
Achillea filipendulina	*****	*****	*****	*****
A. millefolium	*****	*****	*****	*****
Aster divaricatus				
A. grandiflorus				
A. novae-angliae	*****			
A. oblongifloius				
A. patens				
Centaurea americana				
C. cyanus		*****		
Chrysanthemum leucanthemum		*****		
C. maximum			*****	
Chrysopsis graminifolia				
C. mariana				
Chicorium intybus	*****	*****		*****
Coreopsis lanceolata				
C. tinctoria	*****	*****		*****
Cosmos bipinnatus		*****		
C. sulphureus				
Dimorphotheca aurantiaca	*****	*****	*****	*****
Dracopsis amplexicaulis				
Echinacea purpurea	*****			
Engelmannia pinnatifida		*****		
Eupatorium coelestinum	*****			
E. fistulum				
E. purpureum				
E. rugosum				
Gaillardia amblyodon				
G. aristata				
G. pulchella				

Table 62. Cont.

TAXON	SUMMER	FALL	WINTER	SPRING
ASTERACEAE cont'd.				
Helianthus maximilliani	*****			
H. simulans	*****			
H. tomentosus	*****			
Layia platyglossa	*****			
Liatris aspersa				
L. microcephala				
L. micronata				
L. pycnostachya				
L. spicata		*****		
L. squarrosa				
Machaeranthera tanacetifolia	*****			
Ratiba columnaris				
Rudbeckia amplexicaulis		*****		
R. fulgida				
R. hirta				
R. triloba	*****			
Silphium dentatum				
Solidago caesia				
S. nemoralis				
S. odora				
S. rugosa				
S. sempervirens				
S. sphacelata				
Stokesia laevis				
Veronia altissima				
V. arkansana				
BRASSICACEAE				
Hesperis matronalis		*****		
Iberis umbellata				
Lobylaria maritima				
CAESALPINACEAE				
Chamaecrista fasciculata				
CAMPANULACEAE				
Lobelia cardinalis	*****			*****
L. silphitica				*****
CARYOPHYLLACEAE				
Gypsophila muralis				
Silene armeria	*****	*****		*****

Table 62. Cont.

TAXON	SUMMER	FALL	WINTER	SPRING
FABACEAE				
Babtisia lactea				
B. pendula				
Lathyrus latibolius				
Lupinus perennis				
L. texensis				
Petalostemum purpureum				
Phaseolus coccineus				
Thermopsis villosa				
FUMARIACEAE				
Dicentra eximia				*****
GENTIANACEAE				
Sabatia campestris				*****
HYDROPHYLLIACEAE				
Nemophila insignis				*****
N. maculata	*****			
Phacelia bipinnatifida				
P. campanularia	*****			*****
P. tanacetifolia			*****	
IRIDACEAE				
Belamcanda chinensis				
Sisyrinchium angustifolium				
LAMIACEAE				
Monarda citriodora				*****
M. didyma				
Pycnanthemum incanum				
Salvia coccinea	*****			*****
S. farinaceae				
LILIACEAE				
Camasia scilloides				
LINACEAE				
Linum rubrum				
LOGANACEAE				
Gelsenium sempervirens				
MALVACEAE				
Lavatera trimestris	*****			

Table 62. Cont.

TAXON	SUMMER	FALL	WINTER	SPRING
MIMOSACEAE				
Desmanthus barbatus			*****	
D. illinoensis			*****	
ONAGRACEAE				
Oenothera lamarckiana				*****
O. missouriensis	*****			
O. rhombipetela		*****		
O. speciosa	*****			*****
PAPAVERACEAE				
Eschscholzia californica	*****	*****		*****
Papaver rhoeas	*****	*****	*****	*****
PASSIFLORACEAE				
Passiflora incarnata				
POACEAE				
Andropogon gerardi	*****			
A. glomeratus	*****			*****
A. scoparius				*****
Chasmanthium latifolium	*****			
Eragrostis spectabilis	*****			
Erianthus giganteus				
E. strictus				
Hystrix pastula	*****			
Panicum virgatum				
Sorghastum nutans				
POLEMONIACEAE				
Gilia tricolor				
Ipomopsis rubra	*****			
Phlox drummondii				
RANUNCULACEAE				
Anemone virginiana				
Aquilegia canadensis				
Dephinium ajacis				
SAXIFRAGACEAE				
Tiarella cardifolia				*****

Table 62. Cont.

TAXON	SUMMER	FALL	WINTER	SPRING
SCROPHULARIACEAE				
Agalinis heterophylla				
Castilleja indicisa				
Chelone glabra				
Collinsea verna				
Linaria morocanna	*****	*****	*****	*****
Paulownia tomentosa				
Penstemon australis			*****	
P. smalli				*****
P. strictus				
Verbascum thapsus				
UMBELLIFERAE				
Daucus carota				
Eryngium leavenworthii				
E. yuccafolium				
Osmorhiza claytoni				
VERBENACEAE				
Verbena tenuisecta				
VIOLACEAE				
Viola cornuta				
V. x wittrockii				

PROJECT NUMBER: FA02G035

PROJECT TITLE: Evaluation of Imidacloprid as a Seed Protectant Against the Red Imported Fire Ant (RIFA).

TYPE REPORT: Final

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

COOPERATORS: Gustafson, Inc., Plano, TX.

INTRODUCTION:

Imported fire ants are important seed predators of a variety of crops including corn (Glancey et al. 1979), soybeans (Adams et al. 1983. Apperson and Powell 1983), grain sorghum and corn (Drees et al. 1991, 1992), cucumber and sunflower (Stewart and Vinson 1991). Other crops are fed on at various other stages of development such as tubers of Irish potatoes (Adams et al. 1988), and trunks, flowers and leaves of young citrus transplants (Adams 1986). Germinating seeds have been treated with insecticides such as heptachlor, lindane, and others to prevent damage (Parker 1989). The use of other insecticides such as in-furrow applications of carbofuran (Furadan 15% Granules, FMC Corp., Philadelphia, PA) to control other pests such as larvae of the spotted cucumber beetle may also protect seeds from foraging fire ant workers. Lorsban® 15G (15% granular chlorpyrifos, Dow Chemicals U.S.A., Midland, MI) is labelled for fire ant suppression in corn, milo, and sorghum.

Gaucho™ 480 (imidacloprid, Gustafson, Inc., Plano, TX) is labelled as a seed treatment for sorghum for early season protection against aphids, chinch bugs, fire ants, and wireworms. It can also be applied to cotton seeds (delinted only), for early season protection of seedlings against injury by early season thrips and aphids.

Gaucho was evaluated in the current study as a seed protectant for corn. soybeans, sorghum, okra, sunflower, and peanuts.

MATERIALS AND METHODS:

Test plots were located in a RIFA infested field in Harrison County, MS.

Standard test plot surveys (Collins and Callcott 1995) were conducted to determine the extent of the population (number of active colonies per acre). Test plots were prepared by multiple disking seed beds 6.0′ x 12.5′ (width x length) with a farm tractor. Supplemental irrigation was provided as needed, and a complete fertilizer (8-8-8) was applied at a rate of 400 lbs per acre prior to planting. Weed control, either mechanical or chemical, was not used due to possible repellent or disturbance effects on fire ants. Five crops including corn, sunflower, peanuts, soybeans, and grain sorghum were planted in a CRD with 5 replicates per crop on June 5, 1995. Each replicate consisted of 25 seeds which were manually planted at 6″ spacings in a 0.5″ furrow and then covered with soil. Treatments included Gaucho applied at a rate of 8 fl oz flowable per 100 weight of seed, plus an untreated check. Percent germination within each test plot was determined when seedlings were at the 4 to 6 true leaf stage.

Wet weight standing biomass of each plant at the 4-6 true leaf stage in each test plot was determined by severing the plant at the soil line, and weighing the above-ground portion of each plant. Treatment means for each crop were statistically analyzed by means of a t-test.

Wireworms (Elateridae) also feed on germinating seed. The wireworm population immediately adjacent to the test plots was sampled by removing twelve 8" x 8" x 4" sod plugs. Each plug was then torn apart by hand and closely observed for wireworms.

RESULTS:

Fire ant populations in the planting area averaged 46.6 mound/acre with a mean population index of 726.7 (3 replicates). No wireworms were found in the 12 sod plugs which were examined. A significantly greater percentage of treated seeds germinated in all crops except sunflower (Table 63). However, germination rates varied greatly between crop types; 90.4% of peanut seeds germinated while only 29.6% of sunflower seeds germinated. Standing biomass of the plants at the 4 to 6 leaf stage was also significantly greater for plants from treated seeds for all crops except peanut (Table 64). While the treated peanut plants weighed numerically more than the untreated plants (7.68g vs 3.51g), weights of the treated plants were highly variable as evidenced by the high SEM, thus accounting for the statistical insignificance between the treated and untreated weights.

In summary, Gaucho treated crops, except sunflower, demonstrated significantly higher level of germination than the untreated controls. Also, the standing biomass of all Gaucho treated crops at the 4-6 leaf stage was significantly greater than the corresponding controls, except for peanuts. These results suggest that Gaucho effectively protected germinating seeds of corn, sorghum, peanuts, and soybeans against seed predation by imported fire ants.

ACKNOWLEDGEMENTS: Terry Pitts (Gustafson) provided the Gaucho used in this trial. Kirk Irby, Lee McAnally and Tim Lockley assisted with the field work.

Table 63. Germination of Gaucho Treated Seeds versus Untreated Seeds of Several Crops.

Crop	Mean % Germination ± SEM*	
	Treated	Untreated
Corn	79.2 ± 3.9a	44.8 ± 12.5b
Sorghum	48.0 ± 7.0a	18.4 ± 8.9b
Sunflower	29.6 ± 7.1a	28.0 ± 6.3a
Peanut	90.4 ± 2.4a	76.0 ± 2.5b
Soybean	62.4 ± 7.8a	28.0 ± 8.5b

* Mean of 5 replicates; each replicate contained 25 seeds.

Means within a row followed by the same letter are not significantly different according to a t-test (P=0.05).

Table 64. Comparison of Wet Weights of Plants Grown from Gaucho Treated Seeds versus Untreated Seeds of Several Crops.

Crop	No. Plants	Mean Weight (g) ± SEM	
		Treated	Untreated
Corn	Trt = 98 Untrt = 71	1.35 ± 0.08a	1.07 ± 0.09b
Sorghum	Trt = 39 Untrt = 23	0.75 ± 0.09a	0.36 ± 0.06b
Sunflower	Trt = 27 Untrt = 35	2.20 ± 0.20a	1.27 ± 0.08b
Peanut	Trt = 113 Untrt = 87	7.68 ± 3.80a	3.51 ± 0.11a
Soybean	Trt = 78 Untrt = 35	1.15 ± 0.05a	0.69 ± 0.05b

Means within a row followed by the same letter are not significantly different according to a t-test (P=0.05).

PROJECT NO: FA05G025

PROJECT TITLE: Evaluation of Physical Barriers to Prevent Passage of IFA Workers.

TYPE REPORT: Final

PROJECT LEADER/PARTICIPANTS: Randy Cuevas and Kirk Irby

INTRODUCTION:

Physical barriers may be one way to prevent or limit impact of IFA on people. pets, and animals by denying access of the ant to buildings, lawn furniture, pet feeding bowls or other areas. Efficacy of three barriers was compared in a small laboratory trial. Fluon® coating (ICI Americas), a Teflon product (Environ Safe™, Auburn, PA), and talcum powder (Johnson & Johnson) were tested to determine their ability to prevent foraging IFA workers from gaining access to a highly attractive food source.

MATERIALS AND METHODS:

Twenty-five field collected IFA colonies were individually shoveled into 12" x 14" x 8" plastic pans and transported to the laboratory where they were allowed to acclimate for 7 days prior to testing. Water was provided as needed to maintain optimum moisture levels, but no food was supplied to the colonies until the day of the trial. Foraging platforms were fashioned from 1½" diameter PVC pipe sectioned into 14" lengths and fitted with a flat foraging area at one end (Figure 17). Each platform was equipped with one of the barriers which was located between the nest surface and the food source. The teflon barriers were applied in two different ways: (1) applied directly to the PVC pipe with a "shoe polish" type applicator provided by the manufacturer, and (2) applied to a 2" wide piece of adhesive backed aluminum tape which was first tightly affixed to the PVC pipe and then treated using the shoe polish applicator. The fluon barrier was applied directly to the PVC pipe with a clean shoe polish applicator. Fluon and teflon barriers were allowed to dry at room temperature for 1 hr prior to testing. The talcum powder was applied by liberally dusting the PVC pipe with a cotton swab which was covered with talcum powder. Each barrier was 2" in width. At each test interval, one platform was inserted vertically in each nest, and a food source (ca 1 g of freshly diced mealworm) was placed on the top of the platform. Each barrier, along with a series of platforms with no barrier, was replicated five times. At various "exposure intervals", from 30 min to 48 hrs, the number of ants that successfully crossed the barrier in order to feed on the mealworms was recorded. Efficacy of the barriers was first evaluated 1 hour after the barriers were applied, and thereafter at various intervals after weathering outdoors under natural conditions (Figure 18) until ants were able to penetrate all replicates of each type of barrier.

RESULTS:

Teflon on aluminum tape
Immediately after application, only 2 of the 5 replicates provided an adequate barrier to IFA (Table 65). However, at 10 and 40 days, after aging outdoors under natural conditions of rainfall and sun, the teflon on tape prevented IFA from reaching the food source. After 70 days of aging, the barriers on 2 of the 5 replicates were penetrated by the ants.

Teflon directly on PVC pipe
Teflon applied directly to the pipe, was penetrated by IFA in one replicate immediately after application. No teflon barriers were penetrated after aging for 10, 40 and 70 days.

Talcum directly on PVC pipe
Talcum powder provided an adequate barrier against IFA for 40 days. At the 70 day test, the barrier on one talcum replicate was penetrated.

Fluon directly on PVC pipe
The fluon barrier was highly effective at each test interval (0, 10, 40 and 70 days).

Untreated check
Foraging ants accessed 5/5 replicates within 30 min at each test interval. These results suggest that fluon was the most effective barrier tested, followed by the teflon applied directly to the PVC pipe.

Table 65. Efficacy of physical barriers to prevent passage of imported fire ants.

Treatment	Days after treatment - rainfall incurred and results							
	0 days		10 days		40 days		70 days	
	Cumul. Rainfall	Results	Cumul. Rainfall	Results	Cumul. Rainfall	Results	Cumul. Rainfall	Results
Teflon on tape	0	at 30 mins 3/5 reps penetrated	4.8	not penetrated	9.1	not penetrated	24.1	between 4 & 24 hrs 2/5 reps penetrated
Teflon on PVC pipe		at 30 mins 1/5 reps penetrated		not penetrated		not penetrated		not penetrated
Fluon on PVC pipe		not penetrated		not penetrated		not penetrated		not penetrated
Talcum powder on PVC pipe		not penetrated		not penetrated		not penetrated		between 24 & 48 hrs 1/5 reps penetrated
Check PVC pipe not treated		at 30 mins 5/5 penetrated		at 30 mins 5/5 penetrated		at 30 mins 5/5 penetrated		at 30 mins 5/5 penetrated

Figure 17. Diagram of test arena.

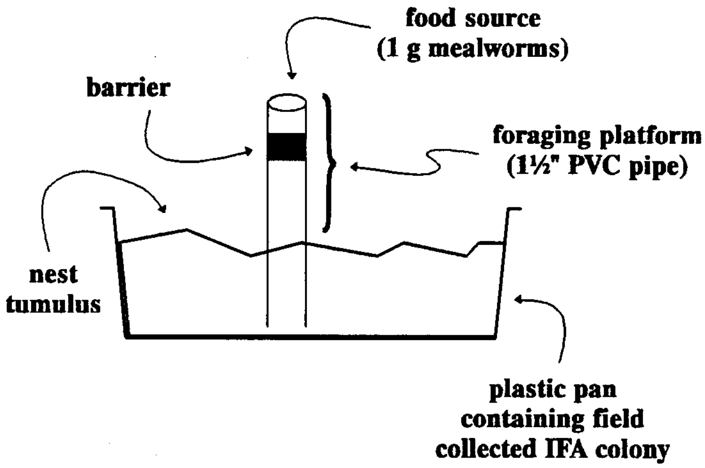


Figure 18. Foraging platforms with barriers being aged outdoors.

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APPENDIX I

A. <u>PUBLICATIONS</u>:

Callcott, A.-M. & H.L. Collins. 1995. RIFA quarantine treatments in commercial grass sod, 1993. Arthropod Management Tests. 20: 304.

Callcott, A.-M., H.L. Collins, & T.C. Lockley. 1995. Factors influencing residual activity of chlorpyrofos against imported fire ants (Hymenoptera:Formicidae) in nursery potting media. Proc. South. Nurserymen. Conf. 40: 158-177.

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B. PRESENTATIONS:

Callcott, A.-M., H.L. Collins, & T. Lockley. 12/94. Impact of fenoxycarb bait on nest population and caste composition of imported fire ants. Ent. Soc. Amer. Meeting. Dallas, TX. (Poster).

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Lockley, T.C. [Invited Paper] The Ant That Ate The South: history, control and economic impact of the red imported fire ant. Ann. Meeting of the Amer. Argon. Soc., Seattle, WA.

Lockley, T.C. Food Preferences of the Red Imported Fire Ant Among Seeds of Wildflowers Native to the Southeastern United States. Ann. Meeting of the Entomol. Soc. Amer., Dallas, TX.

Lockley, T.C. [Invited Paper-Keynote Speaker] The history and significance of imported fire ants in the southeast United States. Mississippi Junior Academy of Sciences, Biloxi, MS.

Lockley, T.C. [Invited Paper] Imported fire ants, their medical importance and control. Mississippi Mosquito Control Commission Annual Meeting, Jackson, MS.

Lockley, T.C. Seed predation by the red imported fire ant. Mississippi Academy of Sciences, Biloxi, MS.

Lockley, T.C. [Invited Paper] The Ant That Ate The South: history, control and economic impact of the red imported fire ant. Gulf Coast Community College, Perkinston, MS.

Lockley, T.C. [Invited Paper] The Ant That Ate The South: history, control and economic impact of the red imported fire ant. J. L. Scott Marine Education Center.

Lockley, T.C. Seed predation by the Red Imported Fire Ant in the Southeastern United States. Imported Fire Ant Conference, San Antonio, TX.

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.

APPENDIX III

PROTOCOL FOR CONDUCTING BAIT ACCEPTANCE STUDIES

Introduction: A laboratory bioassay for feeding acceptance is a standard test used to determine the relative attractancy of various IFA baits or components of baits. Field-collected captive ant colonies are given a free choice to select and feed on either a candidate bait (the bait under evaluation) or a freshly prepared standard bait. It is assumed that the ants will indicate their preference by consuming greater quantities of the bait of their choice.

Collection of Ant Colonies: Fragments of colonies containing all life forms (workers, immature, winged sexuals and occasionally, the mated queen) are collected from infested fields by shoveling a portion of the nest tumulus into a plastic dishpan. The colonies are then transported into the laboratory and allowed to acclimate and rebuild the nest structure for 3-4 days prior to testing.

Preoaration of the Standard Bait: A standard bait known to be attractive to ants is prepared by mixing fresh soybean oil and pregelled defatted corn grits 30%:70% w/w. The standard bait is prepared one day prior to the test.

Candidate Bait: The candidate bait is any potentially attractive oil, experimental bait formulation, or formulated bait which may have deteriorated due to storage. etc. Each candidate bait is tested on five different colonies, and the results reported as an average response of all colonies.

Bioassay: Four grams of a candidate bait contained in a plastic petri dish are placed on the surface of each of the 5 test colonies. Simultaneously, 4 grams of the freshly prepared standard bait in an identical dish are placed approximately 4-5 inches from the candidate bait. Foraging workers are then provided a free choice to feed on the bait of their preference. After a 24 hour feeding period, the dishes are removed and the amount of each bait consumed is determined by weighing.

Computation of Acceptance Ratio: An acceptance ratio for each candidate bait is computed in the following manner:

$$\frac{\text{No. grams candidate consumed}}{\text{No. grams standard consumed}} = \text{acceptance ratio}$$

An acceptance ratio with a value of less than 1.0 indicates that a given candidate is less attractive than the standard. Values equal to or greater than 1.0 indicates that a candidate is equally or more attractive than the standard.

Lofgren et al. (1961) Jour. Econ. Ent. 54:1096-1100, reported on the evaluation of 222 different food materials, and provided a list of those which gave an acceptance ration of 0.75 or higher. By convention, this figure has become the minimum ratio recognized as acceptable by most IFA researchers.