1993
ANNUAL REPORT

U.S. DEPARTMENT OF AGRICULTURE

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

PLANT PROTECTION AND QUARANTINE

WHITEVILLE PLANT METHODS CENTER

IMPORTED FIRE ANT STATION

3505 25th Avenue
Gulfport, MS 39501

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Debbie Elder	Secretary (10/93 - Present)

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

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

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

Compiled and Edited by:

Anne-Marie Callcott and Homer L. Collins

January 1994

FY 1993 OBJECTIVES

IMPORTED FIRE ANT STATION
GULFPORT, MS

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

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

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

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

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

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

C O N T E N T S

SECTION I

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

SECTION II

DEVELOPMENT OF QUARANTINE TREATMENTS FOR GRASS SOD

SECTION III

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SECTION IV

MISCELLANEOUS PROJECTS

SECTION I

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

PROJECT NO: FA01G061

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

TYPE REPORT: Final

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

INTRODUCTION:

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

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

MATERIALS AND METHODS:

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

The second half of the media was then placed over the first half, and the final half of the insecticide solution applied. After application, treated media was "turned" 4 times in perpendicular directions. Four different rates of Talstar ranging from 5 to 50 ppm were tested. All rates were based on the dry weight bulk density of Strong-Lite, and were applied at a volume of 1 liter finished spray per 3.0 cu ft of media. Dursban 4E was applied at a rate of 11.2 g AI/cu yd (64.5 ppm) as a standard. All treatments were applied on 4/24/91. Treated media was then placed in 6"x6" plastic pots and weathered in a simulated nursery environment. A pulsating overhead irrigation system supplied ca. 1-1½" water per week. At monthly intervals, 2 pots were randomly selected and destructively sampled by bioassaying with alate queens (Appendix II).

RESULTS:

Results are shown in Table 1 and indicate Talstar 10WP, applied at rates of 10 and 25 ppm, show good residual 20 months after treatment. A rate of 50 ppm retained good activity through 24 months.

Table 1. Evaluation of a "Spray-on" Procedure for Treatment of Potting Media with Talstar 10WP.

Applic. Rate (PPM)	% Mortality of Alate Queens at Indicated Months PT[1]																							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
5	100	100	60	60	100	90	60	100	100	100	85	55	50	100	35	30	25	35	35	20	*			
10	100	95	100	100	100	100	100	100	100	100	100	90	80	100	100	100	100	100	95	90	75	75	85	85
25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	100	95	90	85	85	90
50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	100	90	90
Dursban 4E (65 PPM)	25	20	0	10	15	35	5	--	--	30	--	--												
Check	10	20	5	10	0	10	0	5	10	5	0	10	10	10	0	5	0	10	5	5	10	15	5	15

[1] Standard bioassay procedure described in Appendix II.

PROJECT NO: FA01G110

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

MATERIALS AND METHODS:

TRIAL I:

Toxicants were blended into a media mixture formulated by Greenleaf Nursery on site (5:2:1 mix of pine bark, sand and rice hulls). Mixing of toxicants into the media mixture was accomplished on 1/23/90, with 3.0 cu ft cement mixers. Dursban® 10G and Lorsban® 15G were mixed at the labelled rate (11.2 g AI/cu yd). suSCon® Green and Talstar® 10WP (bifenthrin) were incorporated at rates of 25, 50 and 100 ppm. Capture@ 0.2G (bifenthrin) was mixed at rates of 25 and 50 ppm and Triumph® 1G was incorporated at a rate of 150 ppm. Plots of each treatment were established on site and were subjected to normal horticultural practices. Samples were collected at monthly intervals by the Texas Dept. of Agriculture personnel and bioassayed at the Gulfport IFA Lab (Appendix II).

TRIAL II:

On 20 August, 1991, Force® 1.5G (tefluthrin) was incorporated at 25 and 50 ppm into the custom media described above and formulated on site at Greenleaf

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

RESULTS:

In Trial I, Triumph 1G sustained efficacy for only 1 month (Table 2). Dursban 10G at the standard rate, suSCon Green at 25 and 50 ppm remained active for only 2 months. By month 4, suSCon Green (100 ppm) and Lorsban 15G had begun to deteriorate. Both bifenthrin formulations (Talstar 10WP and Capture 0.2G) continue to show 100% efficacy for 42 months at all rates. Trial I was discontinued at 42 months when the samples were no longer available.

In Trial II, all treatments provided excellent control through 20 months (Table 3). By month 21 Force (25ppm) efficacy had begun to degrade. By month 24 Force at 50 ppm had become inconsistent. Dursban began to show inconsistency at about the same point in time (month 26). The trial will continue until such time as all chemicals show declines through two separate monthly bioassays.

Table 2. Degradation of Candidate Insecticides in a Commercial Nursery Environment, Trial I.

CANDIDATE	RATE [PPM]	% Mortality to Alate Queens at Indicated Post-Treatment Intervals (Months)																
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	///	(23)	(25)	(30)	(32)	(33)	(34)	(35)	///	(42)
Capture 0.2G	25	100	100	100	100	100	100	100		100	100	100	100	100	45	100		100
	50	100	100	100	100	100	100	100		100	100	100	100	100	100	100		100
Talstar 10WP	25	100	100	100	100	100	100	100		100	100	100	20	100	75	100		100
	50	100	100	100	100	100	100	100		100	100	100	95	100	100	100		100
	100	100	100	100	100	100	100	100		100	100	100	100	100	100	100		100
suSCon Green	25	100	100	95	85	35	10	5[1]										
	50	100	100	90	60	40	20	5[1]										
	100	100	100	100	35	65	45	20[1]										
Dursban 10G	STD	100	100	95	10	15	5	10[1]										
Lorsban 15G	STD	100	100	100	5	0	0	0[1]										
Triumph 1G	150	100	85	65	10	0	0	10[1]										
Check		5	0	0	0	0	5	0		0	30	10	10	15	0	0		5

[1] Dropped due to loss of efficacy

Table 3. Degradation of Candidate Insecticides in a Commercial Nursery Environment, Trial II.

CANDIDATE	MEDIA	RATE (ppm)	% Mortality to Alate IFA Queens at Indicated Months Post-Treatment													
			(1)	(2)	(3)	(4)///	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
Force 1.5G	Greenleaf	25	100	100	100	100	100	100	100	55	45	90	95	55	10	5
	Greenleaf	50	100	100	100	100	100	100	100	100	100	100	85	100	20	90
Check	Greenleaf	--	15	0	0	0	0	10	10	0	5	5	0	5	15	5
Dursban 2.5G	IFA mix	per label[1]	100	100	100	100	100	85	100	100	100	100	100	100	60	100
Check	IFA mix	--	20	10	5	0	0	5	0	10	0	0	0	20	20	30

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

PROJECT NO: FA01G161

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

MATERIALS AND METHODS:

Test procedures used to evaluate all candidate toxicants were as follows: granular or dust formulations of each product tested were blended into nursery potting soil (MAFES mix, 900 pounds per cubic yard)[1]. A portable cement mixer (2 cu ft capacity) was used to blend the toxicants into the potting media, and was operated for 15 minutes per batch to insure thorough blending. Treated media was then poured into one-gallon capacity plastic pots and weathered outdoors under simulated nursery conditions for one month prior to the first bioassay. A pulsating overhead irrigation system supplied ca. 1-1½" water per week. Bioassays were conducted in the laboratory by confining alate queens to treated soil placed in 2" x 2" plastic flower pots equipped with a Labstone® bottom. The labstone absorbs mixture from an underlying bed of damp peat moss. There were four replicates per treatment in each bioassay. Each

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

pot (replicate) contained 50 cc of treated soil and five alate queens. Queen mortality was assessed after seven days of continuous confinement to the treated soil. Treatments which were effective at the first bioassay interval were aged and retested periodically.

Treatments tested were as follows:

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

RESULTS:

Through 25 months posttreatment all treatments maintained 100% mortality at the 50 and 100 ppm rate except Demon 40WP. At the 10 ppm rate, Commodore and Force have maintained good control (>85%). Demon at 10 ppm dropped below 100% after 9 months, while the 50 and 100 ppm rates became erratic after 17 and 19 months respectively (Table 4).

Table 4. Activity of Candidate Potting Media Insecticides, 1991.

Insecticide	Dose Rate (PPM)	% Mortality to Alate Queens at Indicated Post-Treatment Interval (Months)																				
		(1)	(2)	(4)	(6)	(8)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
Commodore 10WP	10	100	100	100	100	100	100	85	100	100	100	100	100	100	85	100	100	100	100	100	90	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Force 1.5G	10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Demon 40WP	10	100	100	100	100	100	85	45	55	60	85	70	35	100	15	25	0	5	55	30	35	25
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	85	90	100	100	100	85	40	50
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	100	100	100	85	100
Talstar 10WP	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	--	10	10	0	15	0	15	5	10	10	0	5	5	0	5	5	15	10	10	10	15	0

PROJECT NO: FA01G182

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

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott

INTRODUCTION:

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

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, 900 lbs/cu yd). A portable cement mixer (2 cu ft capacity) was used to blend the toxicants into the potting media, and was operated for 15 minutes per batch to insure thorough blending. Treated media was then placed into 3-qt. plastic nursery pots and weathered outdoors under simulated nursery conditions. 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).

Test I:

Pennington* Gro Tec Inc.® (Madison, GA) has developed a 0.15% granular fluvalinate under the name of Mavrik*. On 7/13/92, Mavrik was incorporated into MAFES mix at rates of 12.5, 25, 50 and 100 ppm on 7/13/92. Standards included Force* 1.56 and bifenthrin 0.26 incorporated at a rate of 25 ppm.

Test II:

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

RESULTS:

Test I:

The 100 ppm rate has consistently provided >85% mortality for 9 months (Table 5). Efficacy at the lower rates was also consistent over time, but decreased as the dose rate decreased.

Test II:

Rates of 150 ppm and higher were 100% effective for 6 mths post treatment (PT) (Table 6). By 7 mths PT, all rates had dropped to or below 80% efficacy. High rates of Mavrik (150 ppm or higher) may be considered for use as a short term treatment, but it's short residual excludes it from candidacy for long term incorporated quarantine use.

Table 5. Residual Activity of Granular Mavrik Insecticide Incorporated into Nursery Potting Media at Various Rates - Test I.

Insecticide	Rate of Applic (ppm)	% Mortality to Alate Queens at Indicated Months PT											
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mavrik 0.15G	12.5	0	30	25	30	75	35	90	50	50	20	30	30
	25.0	45	55	80	80	100	20	85	65	50	50	20	25
	50.0	80	70	90	95	100	20	75	95	90	65	60	40
	100.0	90	85	85	100	100	90	90	85	100	75	60	25
Force 1.5G	25.0	100	100	100	100	100	100	100	100	100	100	100	100
Talstar 0.2G	25.0	100	100	100	100	100	100	100	100	100	100	100	100
Check	--	10	15	5	10	15	5	5	0	45	20	10	15

Table 6. Residual Activity of Granular Mavrik Insecticide Incorporated into Nursery Potting Media at Various Rates - Test II.

Insecticide	Rate of Applic (ppm)	% Mortality to Alate Queens at Indicated Months PT										
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Mavrik 0.15G	100	80	90	100	95	100	100	80	80	30	30	35
	150	100	100	100	100	100	100	75	75	50	10	50
	200	100	100	100	100	100	100	65	80	30	15	25
	300	100	100	100	100	100	100	75	85	30	35	65
Force 1.5G	25.0	100	100	100	100	100	100	100	100	100	100	100
Talstar 0.2G	25.0	100	100	100	100	100	100	100	100	100	100	100
Check	--	0	5	10	0	5	25	30	5	15	0	10

PROJECT NO: FA01G123

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

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally and Randy Cuevas

INTRODUCTION:

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

MATERIALS AND METHODS:

Test procedures used to evaluate all candidate toxicants were as follows: granular formulations of each product tested were blended into nursery potting media (MAFES Mix, 750 lbs/cu yd). A portable cement mixer (2 cu ft capacity) was used to blend the toxicants into the potting media, and was operated for 15 minutes per batch to insure thorough blending. Treated media was then placed into 3-qt. plastic nursery pots and weathered outdoors under simulated nursery conditions. A pulsating overhead irrigation system supplied ca 1-1½ water per week. At monthly intervals, three pots from each treatment group were composited and subjected to standard alate queen laboratory bioassay (Appendix II).

Fipronil (pyrazole insecticide) is a new product from Rhone Poulenc which has shown promise when used as a soil termiticide. This chemical is formulated as a 1.5% granular 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 7. Commodore showed erratic results initially, but at four months post-treatment all compounds exhibited 100% mortality at all rates except fipronil at 5 ppm which showed 95%. Bioassays will continue until activity of all treatments ceases.

Table 7. Evaluation of Candidate Potting Media Toxicants, 1993.

Chemical	Dose Rate (ppm)	% Mortality to Alate Queens at Indicated Months Posttreatment (1)	(2)	(3)	(4)
Bifenthrin 0.2G	10	100	100	100	100
on peanut hulls	15	100	100	100	100
	25	100	100	100	100
Commodore 1G	10	55	90	90	100
on sand	15	95	55	95	100
	25	100	90	100	100
Force 1.5G	10	100	100	100	100
	15	100	100	100	100
	25	100	100	100	100
Fipronil 1.5G	5	100	100	100	95
	10	100	100	100	100
	25	100	100	100	100
	100	100	100	100	100
	300	100	100	100	100
Check	-	15	10	15	5

PROJECT NO.: FA016153

PROJECT TITLE: Evaluation of Merit® 2.56 Insecticide for RIFA Control in Nursery Potting Media

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Timothy C. Lockley & Lee McAnally

INTRODUCTION:

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

MATERIALS AND METHODS:

Merit 2.56 was incorporated into MAFES potting media at a rate of 25 ppm on 30 October 1993. The treated media was placed in standard gallon containers, and nine selected cultivars of woody ornamental plants [12 each] were transplanted into the treated media. Twelve pots containing treated media were left as controls. The media were subjected to normal climatic conditions and a pulsating overhead irrigation system supplied ca 1-1½" water per week. Alate queen bioassays were performed at thirty days post-treatment (Appendix II).

RESULTS AND DISCUSSION:

At 30 days post treatment, samples of media were collected from each cultivar/container and composited by cultivar. Bioassays showed negligible mortality among all the cultivars as well as the control media. It was assumed that the initial ppm rate of 25 was insufficient and, on 7 December 1993, sufficient quantities of 2.56 NTN were added 'over-the-top' to each container to raise the dose rate to ca. 200 ppm. Bioassays of the increased rate will be made at monthly intervals until contraindicated.

PROJECT NO: FA01G022

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

TYPE REPORT: Interim

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

INTRODUCTION:

Each year the IFA laboratory investigates candidate potting media toxicants for use in certification of nursery stock to be shipped outside the IFA quarantine area. Those that show promise in preliminary trials under simulated nursery conditions are targeted for more strenuous testing under actual nursery conditions. In 1992, two insecticides were selected for additional testing: tefluthrin, a 1.56 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 25t months of residual at rates of 10, 50 and 100 ppm (FA01G161 - ongoing trial).

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 0.26 (Talstar®), tefluthrin 1.56 (Force@) and lambda-cyhalothrin 1.56 (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:

Preliminary results are shown in Table 8. At one month posttreatment (PT), all chemicals and rates were 100% effective in the nursery media, except the 25 ppm rate of Commodore 1.5G in Windmill (90% effective). By 3 months PT, all chlorpyrifos rates, except Windmill 100 ppm, showed significant reduction in efficacy. All other chemicals show excellent residual through 15 months.

The pots at Green Forest Nursery were accidently destroyed by workers at the nursery before the 18 month test. At 18 mths PT, the Force 25 ppm rate showed reduced efficacy at both remaining nurseries, while both Commodore rates were also less effective at Windmill Nursery.

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

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

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

PROJECT NO: FA01G172

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

MATERIALS AND METHODS:

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

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

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

RESULTS:

As indicated in Table 9, all chemicals and rates, except Scimitar at 10 ppm and suSCon have provided 15 month of residual activity under actual nursery conditions. The suSCon treated media began to show erratic results 7 mths after treatment. The trial will continue until activity of all treatments ceases.

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

INSECTICIDE	DOSE RATE (ppm)	% ALATE FEMALE MORTALITY AT INDICATED MONTHS POSTTREATMENT															
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Scimitar 10WP	10	100	100	100	100	100	100	100	100	100	95	100	100	100	90	80	
	25	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	
Force 1.5G	10	100	100	100	100	100	100	100	100	90	100	100	100	100	100	100	
	25	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	
Talstar 0.2G	25	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]	

[1] We assume that treated media was inadvertently labelled as check media somewhere in the handling process.

PROJECT NO: **FA01G033**

PROJECT TITLE: **Prepl**ant Incorporation Treatments for Short Term Certification of Containerized Nursery Stock

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott, Avel Ladner, Randy Cuevas, Sherman Clem (TX Dept. of Agric), Homer Collins and Nursery Cooperators

INTRODUCTION:

Nursery stock is quite varied in regards to the manner in which it is grown, the size of the container, growing cycle, type of media in which it is grown, etc. Growers of containerized nursery stock have repeatedly indicated a preference for treatments which are incorporated into the media prior to planting the "liner". In general, most crops are grown from 12 to 24 months. Therefore, more efforts have been directed towards the development of long residual treatments such as **Talstar® T&O** Granular, and **Force®** 1.56, both of which are applied at **25ppm,** and provide up to 24 months residual activity.

However, some horticultural crops do not require a long term, highly residual treatment due to the relatively short growing cycle. Rose culture is a good example of this type of nursery stock. Rose cuttings are rooted or grafted in greenhouses, then grown to maturity in the field. While dormant (i.e., in winter), they are dug, pruned, and replanted into 1 to 2 gallon containers which are shipped from the nursery prior to budding in spring. The interval between field digging and shipping is about 2-3 months. An insecticide that could be incorporated into the potting media and provide 4 to 6 months residual would be ideal. Such requirements should minimize cost of the relatively long term treatments because lower dose rates or less expensive insecticides may be suitable for this use. A series of trials were initiated in the spring of 1993 to identify suitable candidate insecticides.

MATERIALS AND METHODS:

Rose growers in different parts of the IFA quarantine area were be asked to participate in this trial. One trial was initiated April 13, 1993 at Ran Pro Farms, Inc. in Tyler TX, and another April 19 at South Forrest Rose Nursery, Inc. in Brooklyn MS. A third trial was set up at the IFA lab in Gulfport, MS on April 20. These nurseries were asked to provide space for 350 1-gallon pots and to allow us to purchase 2 cu yd of their media. The media was the same type of media their roses are planted in prior to shipping. The following insecticides and rates were incorporated on site into each nursery's media: Force® 1.5 Ornamental, Commodore® 10WP, Talstar® 0.2G T&O, Demon®40WP, and a granular cypermethrin (0.75%) all at rates of 10, 20 and 30 ppm; Dursban® 0.5G at 50 and 100 ppm; and a granular fluvalinate (Mavrik 0.15G) at 150 ppm. All trials were aged in houses and subjected to normal irrigation practices to simulate conditions prior to shipping. The South Forrest Rose Nursery trial was not subjected to normal irrigation practices, and therefore media was moistened before bioassays were performed. At monthly intervals, three pots from each treatment were collected, composited, and transported to the IFA lab in Gulfport, MS for standard laboratory bioassay.

RESULTS:

Force, Talstar and Dursban were 100% effective for 6 mths in all nursery media (Tables 10, 11, 12). Commodore showed excellent control in Ran Pro Nursery media and MAFES media, but was erratic in South Forrest Rose Nursery media. Demon, cypermethrin and Mavrik were erratic and generally ineffective for the 6 mth trial.

Short term certification treatments for specialty nursery stock is greatly needed. This trial indicates that Force and Talstar at an initial dose rate of 10 ppm, and Dursban at an initial dose rate of 50 ppm, would be excellent for this use pattern.

Table 10. Residual Activity of Various Insecticides Incorporated into Ran Pro Farms Potting Media and Aged at the Nursery, Tyler, TX.

Insecticide/ Formulation	Dose Rate (ppm)	% Mortality to Alate Queens at Indicated Months PT					
		(1)	(2)	(3)	(4)	(5)	(6)
Force 1.5G Ornamental	10	100	100	100	100	100	100
	20	100	100	100	100	100	100
	30	100	100	100	100	100	100
Commodore 10WP	10	100	100	100	100	100	100
	20	100	100	100	100	100	100
	30	100	100	100	100	100	100
Talstar 0.2G T&O	10	100	100	100	100	100	100
	20	100	100	100	100	100	100
	30	100	100	100	100	100	100
Demon 40WP	10	80	100	95	30	5	45
	20	100	100	100	70	15	60
	30	100	100	100	100	30	45
cypermethrin 0.75G	10	100	100	80	95	35	75
	20	100	100	100	100	70	100
	30	100	100	100	100	100	100
Dursban 0.5G	50	100	100	100	100	100	100
	100	100	100	100	100	100	100
Mavrik 0.15G	150	100	100	35	30	15	20
Check	-	10	60	55	15	20	15

Table 11. Residual Activity of Various Insecticides Incorporated into South Forrest Rose Nursery Potting Media and Aged at the Nursery, Brooklyn, MS[1].

Insecticide/ Formulation	Dose Rate (ppm)	% Mortality to Alate Queens at Indicated Months PT					
		(1)	(2)	(3)	(4)	(5)	(6)
Force 1.5G Ornamental	10	100	100	100	100	100	100
	20	100	100	100	100	100	100
	30	100	100	100	100	100	100
Commodore 10WP	10	100	100	45	100	15	80
	20	100	100	100	100	60	100
	30	100	100	100	100	100	100
Talstar 0.2G T&O	10	100	100	100	100	100	95
	20	100	100	100	100	100	100
	30	100	100	100	100	100	100
Demon 40WP	10	100	100	35	0	30	15
	20	100	100	10	15	20	10
	30	100	100	15	20	5	15
cypermethrin 0.75G	10	100	100	20	10	10	20
	20	100	100	5	0	5	20
	30	100	100	30	10	15	40
Dursban 0.5G	50	100	100	100	100	100	100
	100	100	100	100	100	100	100
Mavrik 0.15G	150	100	100	15	20	15	15
Check	-	0	20	15	0	0	5

[1] This trial was not subjected to normal irrigation.

Table 12. Residual Activity of Various Insecticides Incorporated into MAFES Mix and Aged at the IFA Laboratory, Gulfport, MS.

Insecticide/ Formulation	Dose Rate (ppm)	% Mortality to Alate Queens at Indicated Months PT					
		(1)	(2)	(3)	(4)	(5)	(6)
Force 1.5G Ornamental	10	100	100	100	100	100	100
	20	100	100	100	100	100	100
	30	100	100	100	100	100	100
Commodore 10WP	10	100	90	100	100	100	100
	20	100	100	100	100	100	100
	30	100	100	100	100	100	100
Talstar 0.2G T&O	10	100	100	100	100	100	100
	20	100	100	100	100	100	100
	30	100	100	100	100	100	100
Demon 40WP	10	40	25	65	45	40	5
	20	80	75	90	35	35	80
	30	100	70	100	80	80	75
cypermethrin 0.75G	10	100	65	90	65	65	80
	20	60	50	100	80	80	35
	30	100	45	100	100	100	90
Dursban 0.5G	50	100	100	100	100	100	100
	100	100	100	100	100	100	100
Mavrik 0.15G	150	100	25	85	95	85	90
Check	-	5	0	10	15	10	5

PROJECT NO: FA01G010

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

TYPE REPORT: Final

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

INTRODUCTION:

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

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

Terra-sorb copolymers are capable of absorbing 300-400 times their weight in water. The copolymer particles could possibly serve as a reservoir for the pesticide/water system. Normal degradation processes might or might not be impacted since pesticide molecules could theoretically reside within the copolymer particles during retention periods (i.e., wet phase). As the media dries through evaporation between rainfall or irrigation, the water/pesticide system might be slowly released back into the media from the copolymer particle. The reverse cycle may occur during the wet phase.

MATERIALS AND METHODS:

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

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

A portable cement mixer was used to blend 1.5 cu ft batches of the media/insecticides/copolymer mixture. Each batch received 1.5 cu ft media, 50.4 grams copolymer, and 9.6 grams Talstar 10WP. Treated media was placed in 6"x6" plastic pots and subjected to simulated nursery conditions, i.e., weather variables and irrigation. A pulsating overhead irrigation system supplied ca 1-1½" water per week. The following treatments were evaluated:

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

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

RESULTS:

Test results are shown in Table 13. The addition of copolymers did not extend the residual of Dursban 2EC, and all treatments with Talstar 10WP, including Talstar with no copolymer added, remained effective through the 33 month post-treatment evaluation. Therefore, the addition of a copolymer did not extend the residual activity of either Dursban or Talstar.

Table 13. Evaluation of Acrylamide Copolymers for Extended Residual Activity of Pesticides in Potting Media.

Formulation	Dose Rate (PPM)	% Mortality of Alate Queens at Indicated Post-Treatment (Months)															
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(10)	(12)	(14)	(16)	(20)	(22)	(24)	(26)	(28)
Talstar 10WP	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar + AG	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar + GB	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar + HB	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Dursban 2EC	100	100	25	10	20	0	5	*									
Dursban 2EC+AG	100	100	100	10	25	10	5	*									
Check	0	10	0	15	15	5	5	5	5	0	5	25	10	15	5	10	25

Table 13. Cont.

Formulation	Dose Rate (PPM)	% Mortality of Alate Queens at Indicated Post-Treatment (Months)						
		(30)	(31)	(32)	(33)	(34)	(35)	(36)
Talstar 10WP	100	90	100	100	90	95	80	75
Talstar + AG	100	100	100	100	100	90	85	80
Talstar + GB	100	100	100	100	95	95	90	80
Talstar + HB	100	100	100	100	100	95	85	85
Dursban 2EC	100							
Dursban 2EC+AG	100							
Check	0	0	5	10	10	5	10	15

PROJECT NO: FA01G090

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

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

Chlordane (5% dust) applied at a rate of 4 oz/cu yd of potting media was used as a quarantine treatment for containerized nursery stock until its cancellation in late 1979. Granular chlorpyrifos was registered in 1980, but was found to perform erratically and eventually replaced with other treatments. An on-going program of evaluation of insecticides as pre-plant incorporated treatments for nursery potting soil has been conducted since 1974. Until recently, the most effective treatment was chlorpyrifos (Collins et al. 1980). A 0.2G formulation of bifenthrin (Talstar® T&O Granular) was registered in June 1992, and Force®1.5G received registration in June 1993. Several states have also issued SLN labels for Talstar 10WP.

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

MATERIALS AND METHODS:

On March 7, 1990, granular formulations of bifenthrin (Capture®0.2G) and tefluthrin (Force®1.5G) were mechanically incorporated into a commercial nursery potting media [Strong-Lite®, 382 1bs/cu yd] at rates of 12.5, 25.0, 50.0, 75.0 and 100.0 ppm. A portable cement mixer, used to blend the toxicants into the media, was operated for 1 hour to insure a thorough blending. Treated media was placed into 75 standard one-gallon capacity plastic pots (per treatment) and weathered outdoors under natural conditions. A pulsating overhead irrigation system supplied ca 1-1½" water per week.

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

RESULTS:

At 12.5 ppm, bifenthrin remained 100% effective through 26 months PT, but was erratic thereafter (Table 14). Bifenthrin at the rate of 25 ppm displayed excellent results through 35 months PT. At rates of 50, 75 and 100 ppm, bifenthrin continued to effect 100% mortality through 45 months. At rates of 12.5 and 25 ppm, tefluthrin remained active for 15-17 months. Tefluthrin at the 50 and 75 ppm rates were effective for 23 and 26 months respectively, while the 100 ppm rate was effective for 32 months.

Table 14. Evaluation of Bifenthrin 0.2G and Tefluthrin 1.5G Against Alate IFA Queens Incorporated at Five Rates to a Standard Potting Media.

		% Mortality to Alate IFA Queens at Indicated Months Post-Incorporation*																								
CANDIDATE	RATE [PPM]	(1)\\\	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(23)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(45)
Bifenthrin	12.5	100	100	100	100	100	80	95	100	90	100	100	60	85	100	75	--	---								
	25.0	100	100	100	100	100	95	100	100	100	100	100	90	100	100	75	100	100	100	100	100	95	75	25	---	---
	50.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	100
	75.0	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
	100.0	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
Tefluthrin	12.5	100	100	45	30	---	---	---	---																	
	25.0	100	100	100	100	15	20	---	---																	
	50.0	100	100	100	100	80	100	100	100	100	40	15	---													
	75.0	100	100	100	100	100	100	100	100	100	100	25	40	---												
	100.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	70	90	95	90	60	50	---	---	
Check		0	0	0	5	5	0	0	0	0	0	0	5	0	0	5	0	10	0	5	5	5	0	0	10	5

* Trials initiated 3/7/90.

PROJECT NO. FA01G053

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

TYPE REPORT: Interim

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

INTRODUCTION:

Historically, insecticidal treatments for nursery potting media were administered on a weight to volume basis, i.e. 1 lb of Dursban® 2.56 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 Force® 1.5G are applied at a rate of 25ppm, 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. Undoubtably, 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 as much as 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 and tefluthrin 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. 1-1½" per week) plus rainfall. Two pots from each treatment were removed at monthly intervals and bioassayed against alate IFA queens.

RESULTS:

Nine mths after treatment, all media, regardless of sand content or chemical applied, provided ≥90% control of IFA alate females (Table 15). Even sand alone has shown excellent control of IFA for 9 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. After 10 mths of aging, Force incorporated into 1:1 and 2:1 media (initial dose rate of 5.6 and 7.6 ppm respectively) has shown decreased efficacy. All other rates remained 100% effective.

Table 15. Effect of Sand Content of Potting Media on Efficacy of Bifenthrin and Tefluthrin.

Chemical	Media Ratio Bark:Sand	% Alate Queen Mortality at Indicated Months Post Treatment										
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Talstar	0:1	100	100	100	100	100	100	100	100	100	100	
	1:1	100	100	100	100	100	100	100	100	100	100	
	2:1	100	100	100	100	100	100	100	100	100	100	
	3:1	100	100	100	100	100	100	100	100	100	100	
	6:1	100	100	100	100	100	100	100	100	100	100	
	8:1	100	100	100	100	100	100	100	100	100	100	
	1:0	100	100	100	100	100	100	100	100	100	100	
Force	0:1	100	100	100	100	100	100	100	100	100	100	
	1:1	100	100	100	100	100	100	100	100	90	65	
	2:1	100	100	100	100	100	100	100	100	100	85	
	3:1	100	100	100	100	100	100	100	100	95	100	
	6:1	100	100	100	100	100	100	100	100	100	100	
	8:1	100	100	100	100	100	100	100	100	100	100	
	1:0	100	100	100	100	100	100	100	100	100	100	
Check	Bark	0	0	20	0	10	30	0	30	35	0	
	Sand	5	5	15	10	5	10	0	10	20	0	

PROJECT NO: FA01G023

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

TYPE REPORT: Interim

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

INTRODUCTION:

Talstar® T&O 0.26 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
- Tifton GA - Mel Garber
- McCorkle Nursery, Dearing GA - Mark Johnson
- Lonestar Nursery, San Antonio TX - Dr. Bart Drees

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

A sample of 'the media from each nursery site was submitted through the IFA

Station to the USDA, APHIS, National Monitoring and Residue Analysis Laboratory (NMRAL, Gulfport, MS) for bulk density determination prior to the initiation of the trial. Bulk density of the media is necessary to determine the quantity of product needed to acquire desired dose rates.

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

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

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

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

RESULTS:

The plants growing in the treated media at Imperial Nursery were "potted up" (i.e. moved into a larger container) in Nov. 1993, and therefore the original treated media was lost. However, no phytotoxicity was evident at any rate prior to "potting up". Results to date show excellent control at all rates in all media types, except Lonestar Nursery media, 11-12 months posttreatment (PT) (Table 16). The media at Lonestar Nursery showed reduced efficacy at 11 mths PT, and has been erratic since that time.

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 16. 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	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		
	Check	5	10	5	0	50	85	5	10	20	10	0		
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 16. Cont.

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

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

[2] Did not receive a one month sample from Wight Nursery

PROJECT NO: FA01G181

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

TYPE REPORT: Final

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

INTRODUCTION:

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

MATERIALS AND METHODS:

On 3 May, 1991, four selected cultivars (Gardenia 'August Beauty', Holly *Ilex savannah*, Holly *Ilex latifolia* and Azalea 'Formosa') were placed in two-gallon capacity pots containing Dodd® potting media [371 lbs/cu yd] incorporated with Talstar® 10WP at 50 ppm [4.7 g/1.5 cu ft]. Fifty replicates were established for each cultivar. One hundred two-gallon capacity pots were set up containing the same media without plants. All pots were placed in simulated nursery conditions, and a pulsating overhead irrigation system supplied ca 1-1½" water per week. On a monthly basis, two plants from each cultivar were sacrificed and the media collected and composited. Media was also collected from the check pots with no plants. A portion of the collected media was used in standard alate queen bioassays (Appendix II) and the remainder was submitted to USDA, National Monitoring and Residue Analysis Laboratory (NMRAL), Gulfport, MS for residue analysis. The bioassays were conducted to determine if any of the test plants had any effect [positive or negative] on the efficacy [residual activity] of bifenthrin. Results of the gas chromatographic (GC) analysis of media samples by NMRAL determined the relative degradation of bifenthrin over time.

RESULTS:

Results of the laboratory bioassays are shown in Table 17. Based on these observations, there appears to be no difference in treated media with or without the presence of any of the 4 cultivars evaluated. Results of GC analysis showed extremely erratic fluctuations in ppm from month to month (Table 18).

Table 17. Efficacy of Bifenthrin Against IFA Alate Queens as Affected by Selected Cultivars Grown in Treated Potting media.

PLANT CULTIVAR	Comparative Percent Mortality of IFA Queens at Indicated Months Post-Incorporation								
	(0)	(2)	(3)	(4)	(5)	(6)	(7)	///(18)	(23)
Azalea [Formosa]	100	100	100	100	100	100	100	100	100
Gardenia [Aug. Beauty]	100	100	100	100	100	100	100	100	100
Ilex savannah	100	100	100	100	100	100	100	100	100
Ilex latifolia	100	100	100	100	100	100	100	100	100
Control (No plants)	100	100	100	100	100	100	100	100	100
Untreated check	0	0	0	0	0	0	0	0	5

Table 18. Degradation of Bifenthrin as Affected by Actively Growing Nursery Stock.

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

Table --. Cont.

	(19)	(20)	(21)	(22)	(23)
Azalea [Formosa]	17.1	19.0	16.5	13.6	21.1
Gardenia [Aug. Beauty]	12.3	8.4	16.5	12.5	9.4
Ilex savannah	7.7	12.0	16.6	10.0	5.7
Ilex latifolia	27.2	5.6	7.1	9.5	5.2
Control (No Plants)	51.0	8.3	9.4	21.4	7.6

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

PROJECT NO: FA01G091

PROJECT TITLE: Effect of Irrigation on Residual Activity of Force@ 1.56 Incorporated into Nursery Potting Media.

TYPE REPORT: Final

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

INTRODUCTION:

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

MATERIALS AND METHODS:

Force 1.56 was incorporated into the MAFES standard potting media[2] using a 2 cu ft cement mixer at a rate of 50 ppm. Treated media was placed in trade gallon nursery pots and divided into 3 groups. Each group of treated pots received a different amount of irrigation (in addition to natural rainfall). Irrigation rates were 1 inch, 2 inches, and 4 inches per week.

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

RESULTS:

Results appear in Table 19. At 24 month post-treatment (PT), all irrigation regiments provided 100% efficacy against alate queens while receiving in excess of 572.37 inches of rainfall and irrigation (ca. 5.4 inches of water

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

per week). The highest rate of irrigation did produce reduced efficacy at 23 mths PT, but 100% efficacy was regained at 24 mths PT. Thus, excessive watering, through rainfall or irrigation does not affect the efficacy of tefluthrin, when applied at a rate of 50 ppm, up to 24 months after treatment.

Table 19. Influence of Irrigation on Residual Activity of Force® 1.5G Incorporated into MAFES Potting Media.

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

Table 19. Cont.

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

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

Table 19. Cont.

Irrigation Schedule (inches/wk)	13 Months % Mort	13 Months Cumul H_2O (inches)	14 Months % Mort	14 Months Cumul H_2O (inches)	15 Months % Mort	15 Months Cumul H_2O (inches)	16 Months % Mort	16 Months Cumul H_2O (inches)	17 Months % Mort	17 Months Cumul H_2O (inches)	18 Months % Mort	18 Months Cumul H_2O (inches)
1	100	+131.47	100	+141.07	100	+156.02	100	+161.57	100	+171.67	100	+183.12
2	100	+188.47	100	+202.07	100	+224.02	100	+231.57	100	+245.67	100	+262.12
4	100	+303.47	100	+325.07	100	+350.02	100	+369.57	100	+391.67	100	+418.12
Check	5	+129.92	0	+139.02	5	+150.97	5	+157.02	5	+165.62	15	+175.57

Percent Mortality and Amount of Water at Indicated Months Post-Treatment

Table 19. Cont.

Irrigation Schedule (inches/wk)	19 Months % Mort	19 Months Cumul H_2O (inches)	20 Months % Mort	20 Months Cumul H_2O (inches)	21 Months % Mort	21 Months Cumul H_2O (inches)	22 Months % Mort	22 Months Cumul H_2O (inches)	23 Months % Mort	23 Months Cumul H_2O (inches)	24 Months % Mort	24 Months Cumul H_2O (inches)
1	100	+190.92	100	+199.92	100	+217.77	100	+228.97	100	+236.52	100	+250.37
2	100	+273.92	100	+286.92	100	+309.77	100	+327.97	100	+339.52	100	+358.37
4	100	+437.92	100	+459.92	100	+492.77	100	+519.97	20	+543.52	100	+572.37
Check	0	+184.12	5	+194.47	0	+211.32	5	+224.52	20	+231.07	15	+244.42

Percent Mortality and Amount of Water at Indicated Months Post-Treatment

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

PROJECT NO: FA01G111

PROJECT TITLE: Residual Activity of Drench Treatments, 1991.

TYPE REPORT: Final

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

INTRODUCTION:

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

MATERIALS AND METHODS:

Fifty-four 6"x 6" plastic nursery pots were filled with potting media from Flowerwood Nursery, Mobile, AL. Drench solution was applied at a rate of 400 ml per container. Containers were then placed outdoors to weather naturally. A pulsating overhead irrigation system supplied ca 1-1½" water per week. At monthly intervals, 3 pots from each treatment were composited and subjected to alate queen bioassay (Appendix II). Capture® 2EC, Tempo® 2EC, and Karate® 1EC were applied at 25 and 50 ppm. Talstar® 10WP was applied at 10, 25, and 50 ppm.

RESULTS:

Results are summarized in Table 20. Both bifenthrin compounds (Talstar 10WP and Capture 2EC) have maintained 100% mortality through 18 months. Karate 1EC at 25 ppm maintained 100% through 11 months, while the 50 ppm rate maintained 100% mortality through 16 months. Tempo 2EC was extremely variable with neither rate reaching 100% until 4 months posttreatment, nor maintaining it beyond 11 months.

Table 20. Activity of Selected Drench Candidates at 25 and 50 ppm.

Insecticide	Dose Rate (PPM)	Average % Mortality to Alate IFA Queens at Indicated Months Posttreatment (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Talstar 10WP	10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Capture 2EC	25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Karate 1EC	25	100	100	100	100	100	100	100	100	100	100	100	85	60	80	35	25	95	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	10	100	100	100	100	100
Tempo 2EC	25	90	95	95	100	70	100	95	100	100	100	100	75	100	65	40	10	25	50
	50	100	85	85	100	100	100	100	100	100	100	100	90	100	20	5	5	25	15
Check		10	10	5	5	0	0	5	5	0	5	15	0	0	0	5	10	0	10

PROJECT NO: FA01G202

PROJECT TITLE: Residual Activity of Drench Candidates, 1992.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTJON:

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

MATERIALS AND METHODS:

Fifty-four 6"x6" nursery containers for each treatment were filled with standard laboratory potting media (MAFES mix). Drench solution was applied to each container at a rate of 400 mls drench solution per container. All containers were then placed outdoors to weather under simulated nursery conditions. A pulsating overhead irrigation system supplied ca 1-1½" water per week. At monthly intervals, 3 pots from each treatment were composited and an 80-100 cc subsample was subjected to standard laboratory bioassay using field collected alate queens (Appendix II). Application rates and theoretical dose rates for each treatment are shown as follows:

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

RESULTS:

Results are summarized in Table 21. At 15 months posttreatment both rates of Talstar are maintaining 100% efficacy with the exception of the 50 ppm rate at 3 months post-treatment. Commodore at the 100 ppm rate has also maintained 100% efficacy while the 50 ppm rate has dropped below 100% on three occasions (4, 13 & 15 months). Both rates of Demon began to show erratic results at 7 months post-treatment. Testing will continue until the scheduled termination of this test at 18 months post-treatment.

Table 21. Effectiveness of Drench Candidates, 1992.

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

PROJECT NO: FA01G103

PROJECT TITLE: Residual Activity of Drench Treatments, 1993.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

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

MATERIALS AND METHODS:

Fifty-four 6"x6" nursery containers for each treatment were filled with standard laboratory potting media. Drench solutions were applied to each container at a rate of 400 mls per container. All containers were then placed outdoors to weather under simulated nursery conditions. A pulsating overhead irrigation system supplied ca 1-1½" water per week. At monthly intervals, 3 pots from each treatment were composited and an 80-100 cc subsample was subjected to standard laboratory bioassay using field collected alate queens (Appendix II). All treatments listed below were treated on April 23, 1993 with the exception of Optem PT® 600 which was set up on October 23, 1993. Treatment rates and theoretical dose rates for each treatment are shown as follows:

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

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

RESULTS:

Results are summarized in Table 22. The 50 ppm rate for Bengal and the two Fury formulations have provided 95% or better mortality through 6 months. The 25 ppm rate for these three formulations has given somewhat erratic results while the 10 ppm appears to be too low to provide sufficient residual activity. Prevail does not appear to be effective at these rates but may provide control at higher rates. Optem PT® at one month post-treatment has shown very poor results.

Table 22. Residual Activity of Candidate Drench Treatments.

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

PROJECT NO: FA01G212

PROJECT TITLE: Relative Phytotoxicity of Tefluthrin [Force® 1.5G] to Selected Foliage and Woody Ornamental Plants, 1992.

TYPE REPORT: Final

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

INTRODUCTION:

Force 1.5G 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 Force in June 1993. We studied potential phytotoxic effects of Force 1.5G in this and other studies (FA01G163).

MATERIALS AND METHODS:

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

TRIAL I:

Seven varieties of plants [4 foliage & 3 woody ornamental] were selected for evaluation of possible effects of granular tefluthrin on plant growth and phytotoxicity when incorporated into potting media. Plants were selected on the basis of availability, local popularity among commercial growers and/or a previous history of phytotoxic response.

The experimental media consisted of a mixture of pine bark, peat moss and sharp sand [3:1:1] with a dry bulk density of 741 lbs/cu yd. This media was mixed at MAFES using components on site. Tefluthrin was incorporated on 1 September 1992 at rates of 1X [50 ppm] and 3X [150 ppm].

On 1 March 1993 [181 days post-incorporation], all plants were sacrificed. Evaluations were made using three criteria; total top biomass in grams, top biomass rating scale, and root rating scale.

Top Rating Scale

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

Comparative Root Rating Scale

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

Root ratings were made based upon comparisons of each plot.

TRIAL II:
Twelve selected cultivars were transplanted from liners into pots containing media into which Force 1.5G was incorporated at 50 ppm [1X] and 150 ppm [3X] on 2 September 1992. Seven replicates/cultivar treatments were established in a randomized complete block design. Shoots and roots were observed for possible phytotoxicity. Plants were sacrificed 177 days after planting and fresh shoot weights were measured.

RESULTS:

TRIAL I:
No significant differences were noted for either fresh shoot weights of root systems among all seven cultivars (Table 23).

TRIAL II:

No indications of phytotoxic effects were observed among the 12 cultivars evaluated (Table 24).

Table 23. Relative Phytotoxic Response of Seven Selected Varieties of Foliage and Woody Ornamental Plants of Media Incorporated Granular Tefluthrin.

CULTIVAR	SHOOT FRESH WEIGHT [g][1]			ROOTS		
	CK	1X	3X	CK	1X	3X
WOODY ORNAMENTALS						
Ilex meserveae 'Blue Girl'	55.9a	59.7a	53.1a	3.1a	3.2a	3.2a
Ilex 'Ole Spring'	28.7a	27.9a	28.3a	2.9a	3.3a	3.4a
Juniperus conferta 'Emerald Sea'	44.6a	45.9a	44.6a	2.9a	2.9a	3.0a
Rhaphiolepis indica 'Elizabeth'	62.0a	55.6a	54.3a	3.0a	3.0a	3.1a
FOLIAGE PLANTS						
Antirrhinum majus 'Tahiti Yellow'	188.6a	160.0a	143.6a	3.0a	3.0a	3.0a
Petunia x *hybrida*	805.0a	771.4a	847.0a	3.1a	3.2a	3.3a
Syngonium podophyllum 'Butterfly'	277.6a	307.9a	272.0a	3.2a	3.4a	3.3a

[1] Means within cultivars followed by the same letter are not significantly different using Duncan's multiple range test (P=0.05).

Table 24. Relative Phytotoxic of Tefluthrin [Force 1.5G] Preplant Incorporated into Media to Various Woody Ornamental Containerized Plants.

CULTIVAR	SHOOT FRESH WEIGHT [g][1]			ROOTS		
	CK	1X	3X	CK	1X	3X
Abelia grandiflora cv 'Edward Goucher'	36.9a	38.9a	44.0a	3.0a	3.0a	3.2a
Barberis thurnbergii 'Aurea'	4.0a	4.6a	3.7a	3.0a	3.5a	2.9a
Cotoneaster dammeri	46.0a	40.9a	56.8a	3.0a	3.0a	3.6a
X Cupressocyparis lelandii	62.9a	69.1a	71.4a	2.9a	3.1a	3.4a
Euonymus japonicus 'Golden'	38.9a	36.0a	38.3a	3.0a	3.0a	3.1a
Ilex cornuta 'Carissa'	16.3a	14.6a	15.1a	2.9a	3.1a	3.0a
Ilex crenata 'Helleri'	36.9a	33.7a	37.1a	3.1a	3.0a	3.3a
Juniperus chinensis 'Green Sergent'	16.3a	14.6a	21.1a	3.2a	3.0a	3.5a
Myrica cerifera	73.0a	62.6a	74.9a	3.0a	3.1a	3.2a
Rhaphiolepis indica 'Enchantress'	34.9a	29.4a	35.7a	3.1a	3.0a	3.2a
Rhododendron 'Pink Gumbo'	27.4a	25.4a	25.1a	3.0a	3.0a	3.1a
Rhododendron 'Rene Michelle'	27.4a	24.0a	25.1a	3.1a	3.2a	3.3a

[1] Means within cultivars followed by the same letter are not significantly different using Duncan's multiple range test (P=0.05).

PROJECT NO: FA01G163

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

TYPE REPORT: Interim

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

INTRODUCTION:

Force 1.56 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 Force in June 1993. We studied potential phytotoxic effects of Force 1.56 in this and other studies (FA01G212).

MATERIALS AND METHODS:

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

TRIAL I:
Fourteen varieties of plants [6 foliage & 8 woody ornamental] were selected for evaluation of possible effects of granular tefluthrin on plant growth and phytotoxicity when incorporated into potting media. Plants were selected on the basis of availability, local popularity among commercial growers and/or a previous history of phytotoxic response.

The experimental media consisted of a mixture of pine bark, peat moss and sharp sand [3:1:1] with a dry bulk density of 741 lbs/cu.yd. This media was mixed at MAFES using components on site. Tefluthrin was incorporated on 18 August 1993 at rates of 1X [50 ppm] and 3X [150 ppm].

On 6 December 1993 [110 days post-incorporation], all foliage 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 Force 1.5G was incorporated at 50 ppm (1X) and 150 ppm (3X) on 13 September, 1993. Seven replicates/cultivar treatment were established in a randomized complete block design. Shoots and roots were observed for possible phytotoxicity. Plants are to be sacrificed ca. 365 days after planting when fresh shoot weights and root measurements will be taken.

RESULTS AND DISCUSSION:

TRIAL I:

No significant differences were noted for either fresh shoot weights of root systems among all six foliage cultivars (Table 25). All woody ornamental cultivars will be sacrificed ca. 365 days post-treatment.

Table 25. Relative Phytotoxic Response of Sixteen Selected Varieties of Foliage and Woody Ornamental Plants of Media Incorporated Granular Tefluthrin.

CULTIVAR	SHOOT FRESH WEIGHT [g]			ROOTS		
	CK	1X	3X	CK	1X	3X
FOLIAGE PLANTS						
Chrysanthemum morifolium 'Megan'	226.1a	208.2a	237.0a	3.8a	3.8a	3.8a
Chrysanthemum morifolium 'Sandy'	171.5a	178.3a	191.0a	3.8a	3.7a	3.8a
Hibiscus 'Single Red'	135.4a	109.3a	121.6a	3.8a	3.7a	3.7a
Petroselinum crispum	147.4a	140.6a	159.5a	3.7a	3.8a	3.8a
Plumbago auriculata	84.1a	67.9a	86.7a	3.8a	3.7a	3.9a
Trachelospermum asiaticum	24.9a	24.6a	26.7a	3.9a	3.9a	3.6a
WOODY ORNAMENTALS						
Betula nigra						
Cyrilla racemiflora						
Ilex crenata 'Compacta'						
Ilex cornuta 'Anicet Delcambre'						
Ligustrum sinense 'Variegated'						
Myrica cerifera						
Rhododendron 'Hinodegiri'						
Quercus virginiana						

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

PROJECT NO: FA01G083

PROJECT TITLE: Phytotoxicity of Tefluthrin (Force® 1.56) to Selected Woody Ornamental Plants

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

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

MATERIALS AND METHODS:

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

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

Cleyera japonica	Japanese Cleyera
Ilex vomitoria nana	Dwarf Yaupon Holly

Media consisted of pine bark, peat moss and river sand (3:1:1) with a dry weight bulk density of 750 lbs/cu. yd. The following amendments were also added (per cu yd): 4 lb dolomite, 1 lb fertilizer (25-10-0), 1 lb superphosphate (0-20-0) and 1 lb micromix. Media was blended and treated with Force 1.5G on June 28-29, 1993. Plants were transplanted on June 30, 1993. Plants were then subjected to normal nursery "growing on" practices for one year. A pulsating overhead irrigation system supplied ca 1-1½" water per week. At one year post-treatment all plants will be sacrificed. Evaluations will be made using three criteria; total top biomass in grams, top biomass rating scale and root rating scale.

<u>Top Rating Scale</u>

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

<u>Comparative Root Rating Scale</u>

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

Root ratings are made based upon comparisons of each plot.

<u>RESULTS</u>:

An interim visual evaluation was made on December 17, 1993 (approximately six months post-treatment). No noticeable differences between the 1X, 3X and untreated blocks of each variety were observed. Final evaluation as noted above will be conducted on or about June 30, 1994.

PROJECT NO: FA01G032

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

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Anne-Marie Callcott

INTRODUCTION:

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

MATERIALS AND METHODS:

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

RESULTS:

Media under a standard irrigation program regardless of treatment rate has maintained excellent activity against IFA alate females for 22 mths (Table 26). Media treated with 400 ppm of suSCon and subjected to excessive irrigation has shown erratic activity since the 10 mth posttreatment (PT) bioassay. The two lower rates receiving excessive irrigation became erratic around 15 mth PT. Thus, excessive irrigation does appear to accelerate the time release action of the suSCon carrier particle.

Table 26. Residual Activity of suSCon Green when Subjected to Various Amounts of Irrigation.

Amount H_2O per week (inches)	Dose Rate (ppm)	% Mortality at Indicated Months Post Treatment																							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1-1.5 (normal)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
	200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
	400	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
	Check	0	30	20	25	10	20	5	20	10	0	15	5	5	15	10	5	15	20	5	5	15	0		
4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	100	100	65	75	25	50	0		
	200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	90	100	85	100	40	55		
	400	100	100	100	100	100	100	100	100	100	50	85	85	100	50	90	80	100	50	100	50	80	15		
	Check	0	5	5	25	25	5	0	30	5	5	0	0	0	10	30	10	30	20	10	15	5	10		

PROJECT NO: FA01G013

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

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

suSCon Green lOCR is a controlled release formulation of chlorpyrifos produced by Incitec Ltd. (Brisbane, Australia). Several tests were conducted to determine residual activity when applied as a preplant incorporate. These first trials were conducted at the IFA lab in Gulfport, MS and were not successful (FA01G139, FA01G020, FA01G100). However one trial (FA01G210) conducted at Whiteville, NC provided 16 months residual activity when incorporated at 100ppm. Another trial (FA01G032) has provided 22 months residual activity at 100, 200, and 400ppm under standard irrigation (1.0-1.5 inches/wk) and 10-15 months activity under excessive irrigation (4.0 inches/wk).

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

MATERIALS AND METHODS:

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

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

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

<u>RESULTS</u>:

Results are summarized in Table 27. suSCon mixed in the MAFES potting media maintained 100% mortality at 200 and 400 ppm through 13 months. The Green Forest mixture maintained 100% through 7 months at both rates with the exception of a drop to 75% at 4 months at the 400 ppm rate. The Grace Sierra mixture provided 100% mortality for only 3 months at both rates. These results are consistent with previous trials utilizing other chlorpyrifos formulations in various media, i.e. media type affects residual activity of chlorpyrifos regardless of formulation.

Table 27. Efficacy of suSCon Green 10CR in Various Media Types.

Media Type	Dose Rate (ppm)	% Mortality to Alate Queens at Indicated Months Posttreatment												
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Grace Sierra	200	100	100	100	85	75	30	25	45	40	15	5	*	
	400	100	100	100	50	85	55	50	60	25	45	25	*	
	Check	0	0	5	10	0	0	0	15	10	15	0		
Green Forest	200	100	100	100	100	100	100	100	65	25	20	15	*	
	400	100	100	100	75	100	100	100	85	75	20	20	*	
	Check	0	0	5	10	0	5	10	5	15	10	5		
MAFES	200	100	100	100	100	100	100	100	100	100	100	100	100	100
	400	100	100	100	100	100	100	100	100	100	100	100	100	100
	Check	35	5	10	5	5	0	0	10	5	5	10	5	10

* dropped due to decreased efficacy

PROJECT NO: FA01G101

PROJECT TITLE: Influence of Sphagnum Peat on Residual Activity of Chlorpyrifos in Nursery Potting Media

TYPE REPORT: Final

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

INTRODUCTION:

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

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

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

MATERIALS AND METHODS:

Four types of potting media were used in this study; three were obtained from commercial nurseries and one was the original IFA laboratory mix. Dursban® 2.5G (Ford's Chemical and Specialty Co., Pasadena, TX) was incorporated into each media at a rate of 18.4 ppm using a cement mixer for 1 hour. This rate was chosen for the following reasons:

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

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

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

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

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

Media Components and Properties

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

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

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

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

Particle Size

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

RESULTS:

Laboratory Bioassay:

Bioassay results are shown in Table 28. Greenleaf media treated with chlorpyrifos lost efficacy by 3 months posttreatment (PT). The Greenleaf media showed good residual activity in all but the Dursban only treatment at 5 months PT but by 6 months PT reduced residual activity was seen in all treatments. The 1:1 treatment regained 100% control at 8 and 9 months PT, before a decline again at 10 months PT.

Flowerwood media alone or combined with sphagnum peat and treated with chlorpyrifos provided good control for 1 month, but all media combinations showed reduced efficacy by 4 months PT. The high mortality in the one and three month Flowerwood checks may be as result of contamination of the media when mixed at the nursery. (Table 29 shows 0.61-1.58 ppm of chlorpyrifos present in the pretreat Flowerwood soil samples).

Chlorpyrifos incorporated into Windmill nursery media or media/peat combinations provided no activity against alate queens. The percent organic matter of this media was much greater than that of the other media types, excluding sphagnum peat moss (Table 30). However, granular chlorpyrifos incorporated into sphagnum peat moss has provided 24 months of residual activity in other trials (McAnally & Collins 1992).

All media treated with Talstar showed excellent control for 24 months at which time the test was terminated.

Media Properties

Physical characteristics of each media and peat combination are shown in Tables 30, 31, and 32. The enhanced residual activity of granular chlorpyrifos in the IFA lab media (1:1:1 sand, peat, pine bark) cannot be explained solely on the basis of variation in certain physical characteristics (bulk density, pH, % organic matter, cation exchange capacity, etc.). The addition of various ratios of peat to 3 different commercial media did appear to somewhat extend the residual activity of chlorpyrifos in 2 out of 3 media tested. As in numerous other trials, this study confirms that the enhancement of residual activity of chlorpyrifos occurs when used in one specific type of potting media. Thus far, all efforts to explain this phenomenon have not been successful.

Table 28. Residual Activity of Dursban 2.5G Incorporated into Various Nursery Potting Media and Media/Peat Combinations.

Media	Treatment	% Alate Queen Mortality at Indicated Months Post-Treatment																							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Greenleaf	Dursban	100	100	35	35	0	10	30	0	25	*														
5:1	Dursban	100	100	100	100	100	40	100	5	0	*														
3:1	Dursban	100	100	100	100	100	0	25	5	5	*														
1:1	Dursban	100	100	100	100	100	50	50	100	100	40	90	5	25	10	*									
Greenleaf	Talstar	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Greenleaf	Check	10	30	10	15	20	10	0	0	10	5	75	10	5	0	15	30	10	10	0	5	10	30	15	10
Flowerwood	Dursban	100	100	100	60	0	*																		
5:1	Dursban	100	20	10	15	5	*																		
3:1	Dursban	100	100	15	20	10	*																		
1:1	Dursban	100	100	100	80	85	*																		
Flowerwood	Talstar	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Flowerwood	Check	65	35	60	20	15	5	0	15	15	0	15	0	30	20	10	25	15	15	5	0	15	5	0	5
Windmill	Dursban	70	85	10	30	40	*																		
5:1	Dursban	65	50	0	55	30	*																		
3:1	Dursban	95	100	20	25	45	*																		
1:1	Dursban	60	50	40	20	5	*																		
Windmill	Talstar	100	100	100	100	100	100	100	100	95	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Windmill	Check	20	40	10	20	5	0	10	5	5	5	60	15	10	20	25	5	10	10	5	0	10	15	5	10
IFA mix	Dursban	100	100	100	100	100	100	100	100	100	95	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IFA mix	Talstar	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IFA mix	Check	20	0	15	10	10	5	0	50	0	5	15	0	5	5	10	10	5	5	0	5	5	15	0	15
Peat	Check	20	10	20	0	10	5	5	0	10	10	10	0	5	15	0	0	0	5	5	0	0	10	0	5

* dropped due to decrease efficacy

Table 29. Amounts of Dursban and/or Talstar present in untreated and treated media as determined by GC analysis. All analysis conducted by NMRAL and reported in parts per million (ppm).

	Untreated Media		Treated Media			
			Dursban		Talstar	
Media	theore-tical	GC result	theore-tical	GC result	theore-tical	GC result
Greenleaf	0	bdl[1]	18.4	14.41	50.0	40.46
5:1	0	bdl	18.4	28.53	--	--
3:1	0	0.01	18.4	37.50	--	--
1:1	0	bdl	18.4	37.30	--	--
Flowerwood	0	0.69	18.4	39.42	50.0	64.08
5:1	0	0.61	18.4	62.30	--	--
3:1	0	0.70	18.4	52.22	--	--
1:1	0	1.58	18.4	34.85	--	--
Windmill	0	0.30	18.4	34.55	50.0	19.01
5:1	0	0.22	18.4	138.80	--	--
3:1	0	0.20	18.4	186.67	--	--
1:1	0	0.12	18.4	128.40	--	--
IFA mix	0	0.03	18.4	43.25	50.0	44.75
Peat	0	0.29	--	--	--	--

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

Table 30. Characterization of Various Nursery Media and Peat Mixes.

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

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

Table 31. Bulk Densities of Various Nursery Soils.

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

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

Table 32. Particle Size of Various Nursery Media and Peat Mixes.

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

[1] percentage by weight

PROJECT NO: FA01G052

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

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

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

In December 1989, a trial was set up to duplicate the original trials (see FA01G190). Equal parts sand, sphagnum peat, and milled pine bark were blended and Ford's Dursban® 2.56 and Dow's Lorsban® 15G were incorporated into two separate batches at a rate of 11.34 g AI/cu yd. Both treatments were subjected to a fragmented colony bioassay monthly. By 12 months post-treatment both mixes were still providing 100% mortality.

An additional trial was begun in August, 1990, using each component of the mix separately to determine if one or more of the components contributed to the enhanced residual activity of chlorpyrifos. Peat moss and pine bark both maintained good control through 24 months. In all of the above trials 'green' or uncomposted pine bark was used.

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

MATERIALS AND METHODS:

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

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

Particle size

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

Bioassay

Each media was treated with granular chlorpyrifos (Lorsban 15G) at a rate of 65 ppm (labelled rate for Dursban 2.5G). A portable cement mixer was used to blend each media type with the appropriate quantity of chlorpyrifos. Each batch (1.5 cu ft media + chemical) was blended for 15 minutes. Treated media were then placed in 6"x6" plastic nursery containers and placed outdoors to weather naturally. A pulsating overhead irrigation system supplied ca 1-1½" water per week. At monthly intervals, three pots from each treatment were composited and an 80-100 cc sub-sample subjected to standard laboratory alate queen bioassay (Appendix II).

RESULTS:

Particle Size

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

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

Bioassays

At 3 months post-treatment, the chlorpyrifos incorporated in the composted bark began to decline (Table 33). All other treatments remain at 100% efficacy through 15 months. After 15 months the mixed media containing composted pine bark also began to decline. Results through 18 months are an indication that the composting process of the bark may influence the residual properties of chlorpyrifos. These results may indicate that the presence of certain compounds (such as terpines) which eventually "weather" out of pine bark may somehow enhance residual activity of chlorpyrifos.

Table 33. Influence of Pine Bark Age on Residual Activity of Granular Chlorpyrifos.

Treatment	% Mortality at Indicated Months Post-Treatment																	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Green Bark Mix (1:1:1 peat:bark:sand)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Composted Bark Mix (1:1:1 peat:bark:sand)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	35	0	15
Green Bark	100	100	100	100	100	100	100	100	100	100	90	100	100	100	100	100	90	100
Composted Bark	100	100	100	35	10	5	5	10	5	5	0	5	10	5	15	10	10	0
Check	5	0	5	10	10	0	10	10	10	10	0	15	0	5	0	5	5	0

PROJECT NO: FA01G122

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

PROJECT TYPE: Interim

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

INTRODUCTION:

In the late 1970's, experiments with chlorpyrifos at the IFA Station indicated significant residua1 activity (t2 years) and subsequent periods of certification were based on these data. Experiments conducted in the late 80's and early 90's showed a significant reduction in residual activity in various potting media. When the earlier experiments were repeated using a media prepared on site (1:1:1, sand, peat, pine bark), the earlier results were repeatable. These results led to speculation that either sphagnum peat moss or pine bark was enhancing the residual of chlorpyrifos. This trial was begun to determine the potential of pine bark as a carrier to enhance residual activity of chlorpyrifos.

MATERIALS AND METHODS:

Green "new" pine bark was ground in a laboratory grinder (Model 4E, Quaker City Mill, Philadelphia, PA; Westinghouse 1/3 h.p. AC motor) and sifted through a Hubbard wire screen sieve (mesh size 6 squares/linear inch) to remove any large particles and to acquire a uniform size (2 - 4 mm). Chlorpyrifos was added to the milled bark by mixing 250 ml of analytical grade acetone and 25.0 g of technical chlorpyrifos (Dow Chemical Co., Midland, MI). This solution was mixed with 1,000 g of ground pine bark in a 2 cu ft cement mixer for 15 minutes. The formulated pine bark was then spread at a depth of 1-15 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 Résidue 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 formulated at 25 ppm in media (3:1:1 pinebark; peatmoss; sand) mixed at the Gulfport IFA Station. Media was placed in standard trade gallon pots and subjected to normal horticultural practices. At monthly intervals, two pots were collected from each replicate, composited and subjected to a bioassay (Appendix II).

RESULTS:

At 30 days post-treatment, all replicates at all sites caused 100% mortality to alate queens (Table 34). 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 continue to cause 100% mortality at 16 months.

Table 34. Relative Efficacy of Three Chlorpyrifos and Two Synthetic Pyrethroid Formulations in Selected Media to IFA Alate Queens.

Test Site	Treatment: Formulation	Treatment: Rate (ppm)	% Mortality to Alate IFA Queens at Indicated Months Posttreatment (1)	(2)	(3)	(4)	///	(16)
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		5

* Trial destroyed by Hurricane Andrew

PROJECT NO: FA01G142

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

TYPE REPORT: Final

LEADER/PARTICIPANTS: Homer Collins and Anne-Marie Callcott

INTRODUCTION:

In our continuing efforts to determine the cause of the apparent enhanced residual activity of chlorpyrifos in a 1:1:1 mixture of sphagnum peat, pine bark and sand, we began to investigate the potential role of pine bark. Studies using pine bark as a carrier for chlorpyrifos, and "new" (green) vs. "old" pine bark as a media component have been initiated and reported elsewhere. In this study, we wanted to determine if solvent extractable compounds in the pine bark were involved in the enhancement of residual activity of chlorpyrifos.

METHODS AND MATERIALS:

Alcohol and acetone are solvents commonly used for the extraction of 2-pinene, pine oil and pine tar (The Merck Index 1989). Green, freshly ground pine bark (*Pinus palustris*), was obtained from Southern Bark Company, Wiggins, MS, on June 11, 1992 and solvent extracted as follows: 1 cu ft of bark was placed in a 12 gallon open container with 6 gallons of isopropyl alcohol and acetone (50:50 by volume), and manually agitated for 30 minutes. The solvent was then decanted, and excess solvent allowed to drain over a sieve for ca. 15 minutes. A second extraction was then performed with fresh solvent solution described above. The bark-solvent mixture was again manually agitated for 30 minutes prior to decanting and allowing to drain overnight. The bark was then spread in a thin layer (ca. 1"), and allowed to air dry for two days prior to use.

Extracted pine bark was mixed with sphagnum peat and coarse river sand in a 1:1:1 ratio (vol:vol) to prepare a potting media. This media was then treated with Dursban® 2.56 (Ford's Chemical and Specialty Co., Pasadena, TX) at a rate equivalent to 1.0 lb formulated Dursban per yd^3 of potting media by tumbling the media and insecticide in an electric cement mixer. Treated media was then placed in trade 1-gallon plastic pots and subjected to simulated nursery environmental conditions.

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

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

RESULTS:

At 12 months posttreatment (PT), both media types are provided 100% control of IFA (Table 35). Thus, solvent extractable compounds such as 2-pinene, pine oil and pine tar, apparently are not involved in the enhancement of chlorpyrifos efficacy. However, other unknown compounds may leach out or degrade during composting. These unknowns may be reacting with chlorpyrifos or somehow preventing the normal routes of degradation for chlorpyrifos.

Table 35. Residual Activity of Chlorpyrifos Incorporated into 1:1:1 IFA Media Using Solvent Extracted Bark or Plain Bark as a Media Component.

Bark Treatment	% Mortality at Indicated Months PT											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Extracted	100	100	100	100	100	100	100	100	100	100	100	100
Plain	100	100	100	100	100	100	100	100	100	100	100	100
Check	0	15	5	0	20	20	0	10	10	10	30	35

PROJECT NO: FA01G073

PROJECT TITLE: Comparison of Convection Oven vs. Microwave Oven for Drying Nursery Media for Determination of Bulk Density

TYPE REPORT: Final

LEADER/PARTICIPANTS: Lee McAnally and Anne-Marie Callcott

INTRODUCTION:

The current IFA laboratory protocol for determining the bulk density of nursery potting requires a minimum of 4 hours of drying time in a convection oven at 250°F (longer for supersaturated soils). This trial was initiated to determine whether a microwave oven could be used to dry media in a much shorter time without ashing the sample.

MATERIALS AND METHODS:

Five media types, representing both potting media and bedding mixes, were tested:

Green pine bark - Southern Bark, Wiggins, MA

Green Forest media (composted pine bark) - Perkinston, MS

MAFES mix - 3:1:1 green pine bark:sphagnum peat moss:sand

Grace-Sierra® bedding mix
Grace Sierra Horticultural Products Co.
1001 Yosemite Dr., Milpitas, CA 95035

Baccto® bedding mix
Michigan Peat Co.
P.O. Box 980129, Houston, TX' 77098

One-half cu ft of each media type was dried for 24 hours at 250°F in a convection oven to insure thorough drying and a theoretical 0% moisture. One-hundred gms of dry media were then placed in a 9" aluminum pie pan and 100 gms of water mixed in to acquire approximately 50% moisture by weight. The MAFES mix and Green Forest media could not readily absorb 50% moisture, therefore 50 gms of water was added to acquire ca. 33% moisture. One set of wet media (5 replicates/media type) was then dried in a 121°C oven (VWR Scientific gravity convection oven, Model 1370GD, 120 volt, 1600 watt). After 1, 2, 3, 4, 6, 8 and 24 hrs, each replicate (rep) was weighed and the % moisture lost determined. Another set was dried in a 1560 watt microwave using 50% power (Roper Corp, Kankakee, Ill., Model 2959000, 120 volt, manu. 1978). In preliminary trials, high heat in this microwave burned the media before it was dry. At 10 minute intervals, each rep was weighed and the % weight lost determined. Media was stirred at each weighing interval to facilitate drying.

RESULTS:

Achieving a truly dry media without "burning" or "ashing" the organic matter in the media is a difficult task. We use the term "burn" to indicate that a burnt or burning odor and/or smoke was emitted from the media. Using the microwave, only the Baccto media did not burn, and required a minimum of 50-60 mins to remove all the moisture, 48.9% and 50.2% weight loss respectively (Fig 1). However, this trial was not continued past the theoretical dry weight to determine if overdrying would induce burning. The remaining media types had 1 or more reps which burned before totally drying. In the MAFES mix trial (initially 33% moisture), the rep which began burning at 40 mins was eliminated from the trial and the remaining four reps averaged for the 50 and 60 min counts, 33.1% and 33.5% weight loss respectively (Fig 2). One rep of the Grace Sierra media (initially 50% moisture) began to burn at the 50 min count (Fig 3). This trial was terminated at this time with 50.2% weight loss. Four reps in the green pine bark trial (initially 50%) began burning at 30 mins (Fig 4). We continued heating the fifth rep until it too burned at the 50 min count with 49.7% weight loss. Four reps burned in the Green Forest media trial (composted pine bark - initially 33% moisture); one at 20 mins, two at 30 mins and one at 40 mins (Fig 5). The fifth rep achieved 33.3% weight loss at 50 mins.

In the media which burned, all except the Grace Sierra media contain pine bark. It appeared that the smaller, fine pieces of bark were burning first. Many nurserymen use pine bark as one of the components of their potting mixes. Thus, as indicated here, using a microwave to dry media for bulk density determination is not suggested since it will probably burn a portion of the media.

In the gravity convection oven, only the Baccto media apparently burned (Fig 1). We stipulate "apparently" because, although no burning or odor was evident, after 24 hrs in the oven 64.1% weight loss occurred. Initially only 50% moisture was added to the media, therefore this additional weight loss must have been from the media components through ashing. All other media types achieved total moisture loss (50% or 33% weight loss) within 3-6 hrs and maintained this loss through 24 hrs (Fig 2-5). Therefore, these media did not burn even with overdrying.

In conclusion, we do not recommend the use of a microwave to dry any potting media for bulk density determination. The use of a convection oven at 250°F for a minimum of 6 hrs is recommended. However, all media should be checked on an hourly basis, stirred to facilitate drying and closely watched for any signs of burning.

Figure 1. Drying Time for Baccto Potting Media
Convection Oven vs. Microwave Oven

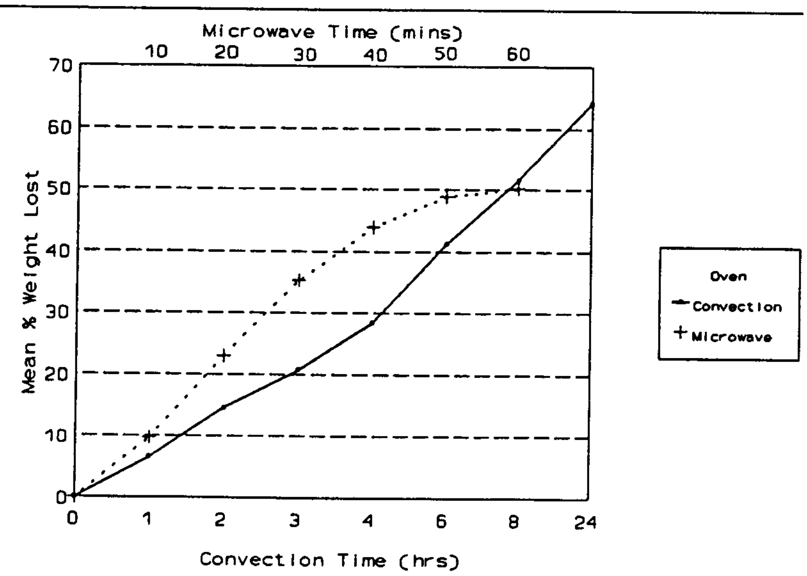
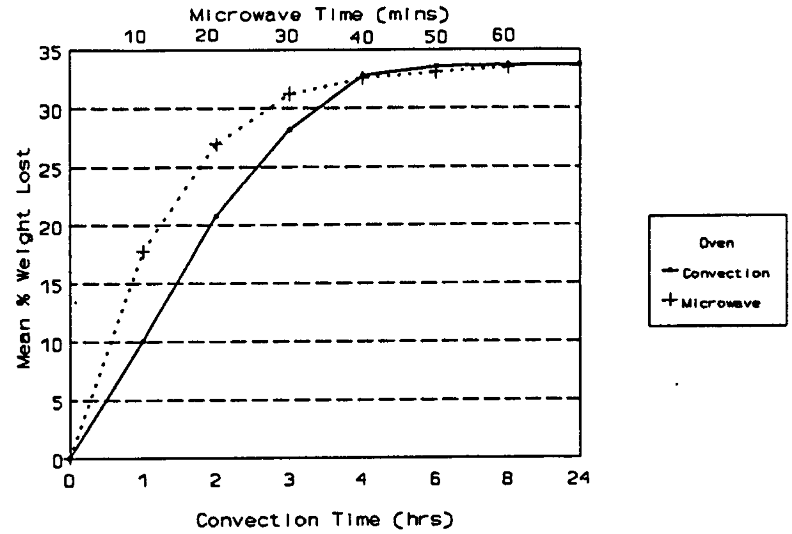
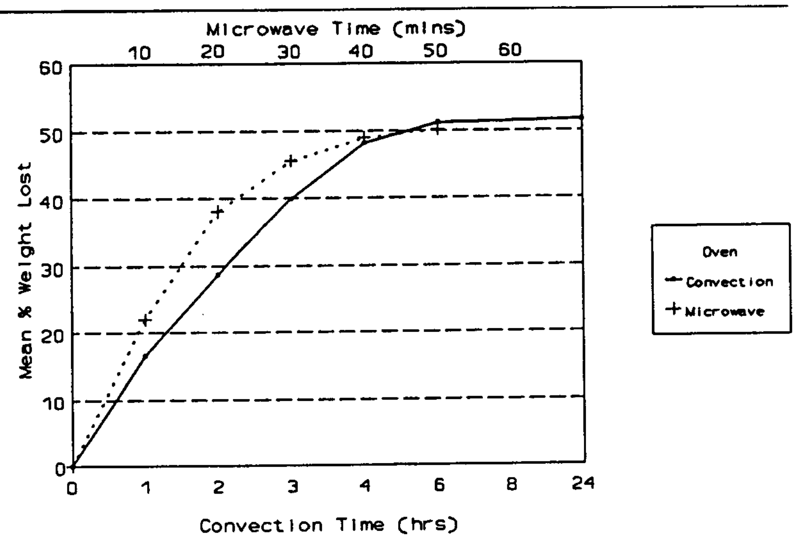


Figure 2. Drying Time for MAFES Mix
Convection Oven vs. Microwave Oven



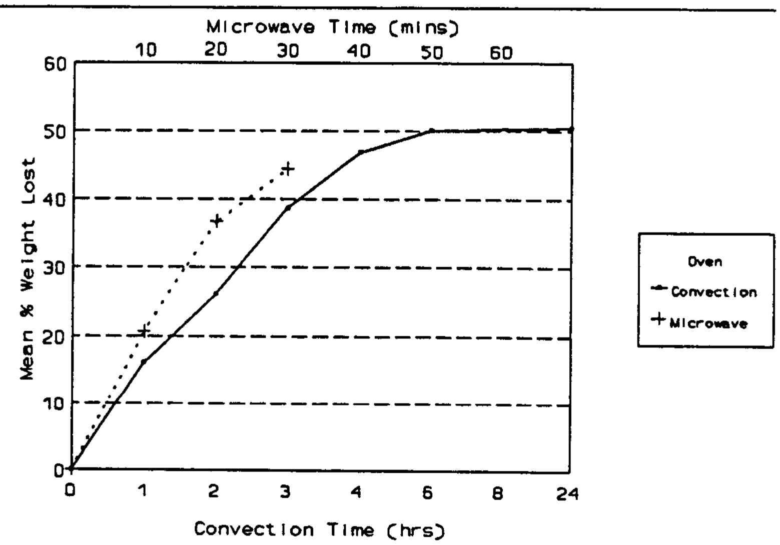
One replicate began burning in the microwave at 40 mins and was deleted from the trial

Figure 3. Drying Time for Grace Sierra Media
Convection Oven vs. Microwave Oven



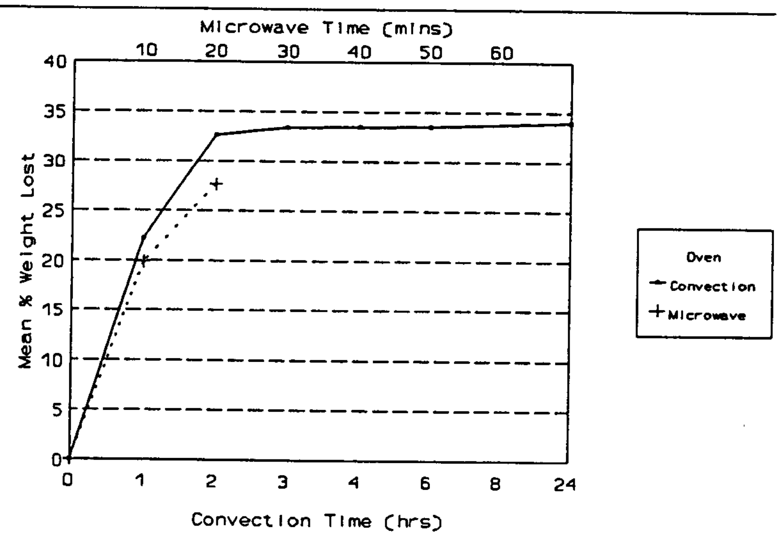
One replicate began burning in the microwave at 50 mins

Figure 4. Drying Time for Green Pine Bark
Convection Oven vs. Microwave Oven



Four replicates began burning in the microwave at 30 mins and the 5th rep. burned at 50 mins

Figure 5. Drying Time for Green Forest Media
Convection Oven vs. Microwave Oven



One replicate burned in the microwave at 20 mins, two at 30 mins and 1 at 40 mins

PROJECT NO: FA01G143

PROJECT TITLE: Comparison of Methods of Bulk Density Determination and Effect of Moisture Content on Bulk Density of Nursery Potting Media

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott

INTRODUCTION:

In the past, imported fire ant (IFA) quarantine treatments involving the incorporation of granular insecticides into potting media were applied on a weight to volume basis, i.e. 1 lb material/cu yd media. Current IFA quarantine treatments are applied on a weight to weight basis. In 1991, when the recommendation for this weight to weight application was made, the IFA Station developed a standardized protocol for determining bulk density of nursery potting media (Appendix IV). When the Talstar® treatment was approved for IFA quarantine use in June 1992, this protocol was slightly modified and adopted by the USDA, APHIS, National Monitoring and Residue Analysis Laboratory (NMRAL). Nursery media was sent to NMRAL by nurseries, bulk density determined and the results returned to the nursery who then used the information to determine the amount of Talstar needed per cu yd of their potting media. The accuracy of this method was questioned in June 1993 by attendees at an IFA Quarantine Treatment meeting called by the Florida Dept. of Agric. It was stated that a method from the ASTM Standards Book might be the more appropriate method to use.

In August-September 1993, NMRAL conducted trials to determine any significant differences between their original bulk density determination method and the modified "Standard Test Method for Screening Apparent Specific Gravity and Bulk Density of Waste" - 1993 Annual Book of ASTM Standards - Section 11 - ASTM D5057-90 (Group B materials). NMRAL also compared the use of different weighing vessels when utilizing the ASTM method. All their trials were conducted using media which had been dried prior to testing. Their results indicated that there was no significant difference between testing method or weighing vessel.

in all but one case, the ASTM method did result in a numerically higher bulk density.

<u>Effect of moisture content on ASTM protocol</u>

The effect of laboratory-induced moisture content on the ASTM method was varied. There was no significant difference in bulk density of media from Windmill Nursery regardless of moisture content (Table 37). Varying differences in bulk density were detected in the MAFES and Greenleaf Nursery media, and only in the Flowerwood Nursery media were clear-cut differences due to moisture content evident.

Nursery media dried in the laboratory and then moistened by adding specific quantities of water does not accurately portray naturally saturated media. The pine bark and other media components, when moistened in the lab, do not immediately and thoroughly absorb the water. Media subjected to nightly irrigation (field saturation) was able to absorb 33.3% to 64.1% moisture by weight (Table 38). Using the original IFA method, dry weight bulk density was significantly lower than the bulk density of fully saturated media collected directly from the field (Table 38). Using the ASTM method, moisture had no significant effect on the bulk density of MAFES or Greenleaf media, but did significantly effect Flowerwood and Windmill media.

From these results, we conclude that the method used to determine bulk density is not as important as the condition of the media, i.e. moisture content. To maintain consistent results, we recommend that, whichever method is chosen to be used by all laboratories providing bulk density determinations to the nursery industry, that method should stipulate that media be dried to a theoretical 0% moisture before weighing.

Table 36. Comparison of Methods to Determine Bulk Density of Nursery Potting Media: Original IFA Method vs. ASTM D5057-90, Group B Materials.

Media	Bulk Density Determination Method	Percent Moisture	Mean Bulk Density[1] (lb/cu yd) ± SD
MAFES	IFA dry wt. protocol	0	836.55 ± 53.26a
	ASTM protocol	0	888.47 ± 119.87a

Media	Bulk Density Determination Method	Percent Moisture	Mean Bulk Density[1] (lb/cu yd) ± SD
Flowerwood 19:3	IFA dry wt. protocol	0	641.07 ± 90.46a
	ASTM protocol	0	702.58 ± 8.04a

Media	Bulk Density Determination Method	Percent Moisture	Mean Bulk Density[1] (lb/cu yd) ± SD
Greenleaf 5:2:1	IFA dry wt. protocol	0	843.87 ± 31.18a
	ASTM protocol	0	811.53 ± 190.52a

Media	Bulk Density Determination Method	Percent Moisture	Mean Bulk Density[1] (lb/cu yd) ± SD
Windmill	IFA dry wt. protocol	0	442.22 ± 8.67a
	ASTM protocol	0	467.25 ± 19.72a

[1] Mean of 3 replicates. Means within a column followed by the same letter are not significantly different according to *t*-test (SAS Institute 1988).

Table 37. Comparison of Mean Bulk Density of Potting Media at Various Moisture Levels Computed using ASTM D5057-90, Bulk Density - Group B materials (weights in g, weighing bottle = 1 pt)

Media	Percent Moisture	Bulk Density Determination Method	Mean Bulk Density[1] (lb/cu yd) ± SD
MAFES	0	ASTM protocol	888.47 ± 119.87ab
	5	ASTM protocol	803.00 ± 22.38ab
	10	ASTM protocol	783.91 ± 36.27a
	20	ASTM protocol	787.36 ± 19.20a
	30	ASTM protocol	779.90 ± 2.90a
	40	ASTM protocol	947.92 ± 18.88b

Media	Percent Moisture	Bulk Density Determination Method	Mean Bulk Density[1] (lb/cu yd) ± SD
Flowerwood 19:3	0	ASTM protocol	702.58 ± 8.04a
	5	ASTM protocol	708.26 ± 30.02a
	10	ASTM protocol	615.83 ± 6.70b
	20	ASTM protocol	733.11 ± 23.07a
	30	ASTM protocol	766.20 ± 35.73a
	40	ASTM protocol	849.16 ± 39.99c

[1] Mean of 3 replicates. Means within a column followed by the same letter are not significantly different according to Tukey's Studentized Range (HSD) Test (SAS Institute 1988).

Table 37. Cont.

Media	Percent Moisture	Bulk Density Determination Method	Mean Bulk Density[1] (lb/cu yd) ± SD
Greenleaf 5:2:1	0	ASTM protocol	811.53 ± 190.52ab
	5	ASTM protocol	660.05 ± 78.55a
	10	ASTM protocol	664.69 ± 103.16a
	20	ASTM protocol	838.45 ± 32.24ab
	30	ASTM protocol	872.76 ± 19.50ab
	35[2]	ASTM protocol	956.71 ± 38.82b

Media	Percent Moisture	Bulk Density Determination Method	Mean Bulk Density[1] (lb/cu yd) ± SD
Windmill	0	ASTM protocol	467.25 ± 19.72a
	5	ASTM protocol	481.48 ± 9.24a
	10	ASTM protocol	468.25 ± 9.77a
	20	ASTM protocol	504.05 ± 12.20a
	30	ASTM protocol	477.92 ± 11.11a
	40	ASTM protocol	495.77 ± 17.70a

1 Mean of 3 replicates. Means within a column followed by the same letter are not significantly different according to Tukey's Studentized Range (HSD) Test (SAS Institute 1988).

2 40% moisture was oversaturated, therefore 35% was used in this media

Table 38. Effect of Moisture Content Produced by Field Saturation on Bulk Density of Media as Determined by the Original IFA Method and the ASTM Method.

Media	Percent Moisture	Method: Original IFA — Mean Bulk Density[1] (lb/cu yd) ± SD	Method: ASTM D5057-90 — Mean Bulk Density[1] (lb/cu yd) ± SD
MAFES	0	708.11 ± 17.56a	797.09 ± 29.03a
	45.8	998.23 ± 87.85b	891.16 ± 67.73a

Media	Percent Moisture	Method: Original IFA — Mean Bulk Density[1] (lb/cu yd) ± SD	Method: ASTM D5057-90 — Mean Bulk Density[1] (lb/cu yd) ± SD
Flowerwood 19:3	0	657.41 ± 16.12a	703.72 ± 29.25a
	44.5	890.63 ± 18.82b	872.79 ± 8.15b

Media	Percent Moisture	Method: Original IFA — Mean Bulk Density[1] (lb/cu yd) ± SD	Method: ASTM D5057-90 — Mean Bulk Density[1] (lb/cu yd) ± SD
Greenleaf 5:2:1	0	611.22 ± 24.91a	693.11 ± 51.41a
	33.3	775.71 ± 47.11b	747.28 ± 16.46a

Media	Percent Moisture	Method: Original IFA — Mean Bulk Density[1] (lb/cu yd) ± SD	Method: ASTM D5057-90 — Mean Bulk Density[1] (lb/cu yd) ± SD
Windmill	0	428.70 ± 5.94a	424.59 ± 13.32a
	64.1	811.76 ± 17.01b	803.49 ± 20.34b

[1] Mean of 3 replicates. Means within a column followed by the same letter are not significantly different according to *t*-test (SAS Institute 1988).

PROJECT NO: FA01G082

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

TYPE REPORT: Final

LEADER/PARTICIPANTS: Avel Ladner and Homer Collins

INTRODUCTION:

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

MATERIALS AND METHODS:

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

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

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

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

<u>RESULTS</u>:

Results are shown in Table 39. Tempo 2EC coated pots successfully prevented colony establishment for 1 week after application when pots were immersed in solutions containing either 1.0 or 2.0 oz 2E/gal water. After weathering for 1 month, treated pots had little or no effect on invading colonies.

Pots treated with Capture 2EC at 2 oz/gal water successfully prevented colony establishment for 3 months. The only Dursban 2EC rate which prevented colony establishment was the highest rate (2 oz/gal water), and only at the 24 hr posttreatment interval.

These results are considered to be extremely encouraging because this procedure represents a totally new concept for certification of containerized pots. Observations indicate that foraging workers (scouts) encounter the toxicant around the drain holes and sides of the pots. Due to the extremely rapid knockdown of pyrethroids, these ants die before a pheromone trail to the rest of the colony can be established. It seems doubtful that sufficient long residual activity can ever be achieved through surface applications of EC or other formulations. However, the use of insecticide impregnated pots (or water permeable pot inserts) may offer a more economical and environmentally acceptable treatment than the presently used drenches or incorporation of pesticides into the potting media. This area of investigation will be continued in 1993 (see reports FA01G093 and FA01G173).

Table 39. Effectiveness of Insecticide Coated Plastic Nursery Pots in Preventing IFA Colony Establishment.

Insecticide	Treatment Rate (oz/gal H_2O)	Number of IFA Workers Successfully Invading Pots at Indicated Post-treatment Intervals[1] (24 Hrs)	(1 Wk)	(1 Mo)	(2 Mo)	(3 Mo)	(5 Mo)
TEMPO 2EC	0.5	175	500	>300	>500	[2]	
	1.0	0	0	>150	>200	[2]	
	2.0	0	0	>200	>200	[2]	
CAPTURE 2EC	0.5	>1,000	4	10	6	0	>100
	1.0	>1,000	0	30	100	250	>500
	2.0	7	0	0	5	0	>500
DURSBAN 2EC	0.5	>300	>400	>800	>500	[2]	
	1.0	>200	>400	>800	>500	[2]	
	2.0	0	>200	>500	>500	[2]	
Untreated Cks	(pooled results)	>500	>500	>500	>500	>500	>500

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

PROJECT NO: **FA01G093**

PROJECT TITLE: Evaluation of Toxic Pot Inserts to Prevent IFA Infestation of Containerized Nursery Stock

TYPE REPORT: Final

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

INTRODUCTION

Certification of containerized nursery stock has always been achieved by insecticidal treatment of the potting media in which the plants are grown. Granular formulations incorporated into the media, liquid drenches, and topical applications have been employed. We have hypothesized that IFA infestation of nursery containers (particularly trade 1-gallon plastic pots) always occurs by entry through the drain holes in the bottom and sides of pots. Use of a water permeable toxic barrier might preclude entry of fire ant colonies, and not interfere with drainage. A study comparing the effectiveness of various toxic barriers or "pot inserts" was initiated in the spring of 1993.

MATERIALS AND METHODS:

Pot inserts were fabricated from several different types of fabric, which were then impregnated with technical grade bifenthrin at a rate of 100 mg **AI/1000** cm^2. Fabrics tested were chosen due to their propensity to resist rotting for the 24 month test period. The following fabrics were tested:

Burlap - Burlap fabric treated with copper napthalate (to prevent deterioration). Used as a balling fabric for B&B nursery stock.

DeWitt Weed Barrier - A 100% woven polypropylene fabric with a blend of polyester and polypropylene fiber. Used as a week control landscape fabric.

Geojute® - A woven jute fabric engineered for erosion control and soil stabilization. Advertised to decompose in two years or less.

Rope - 100% cotton rope, ⅝" diameter

All fabrics were purchased from a large nursery supplier (Hummert Nursery Supply Co., St. Louis, MO), except the rope which was purchased locally.

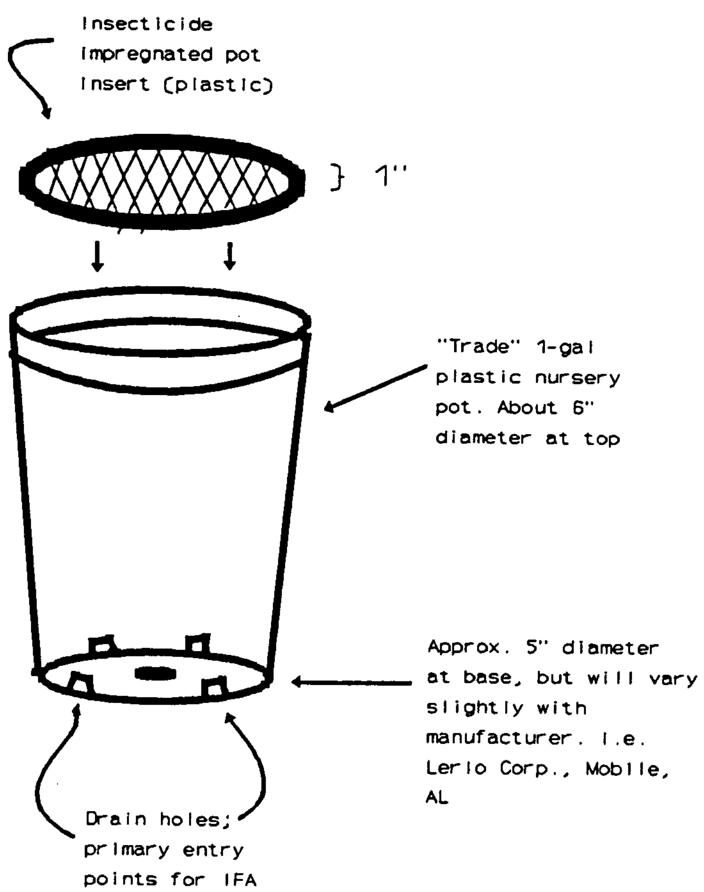
Treatment Procedures — Pot inserts were fashioned from each type of fabric by cutting a 7-inch diameter circle from the bolts (Figure -). The rope was cut into 14" lengths. Each insert was then impregnated with technical bifenthrin (FMC Corp. Philadelphia, PA) mixed in acetone using the procedure described by Schreck et al. (1978, 1980). Rate of insecticide application was 100 mg AI/1000 cm^2 of material. Treated inserts were placed in the bottom of trade 1-gallon plastic nursery pots and filled with potting media (MAFES mix). Since the diameter of the circular inserts was greater than the diameter of the pot bottom, the inserts overlapped and covered the drain holes in the sides of the pot as well as the bottom. Each length of rope was looped end to end to make a circle which fit snugly into the bottom of a pot covering the side drain holes only. A total of 48 pots per material type were lined with inserts and filled with media. Media filled pots were then placed in a simulated can yard where they were subjected to standard agronomic practices including irrigation through an overhead pulsating irrigation system.

Bioassay Procedures — At monthly intervals, two pots from each treatment group were randomly selected for bioassay against live IFA colonies. Bioassays were conducted by placing the two pots from each fabric type at each end of a 2′ x 8′ test arena. A freshly collected field colony and nest tumulus was evenly spread over the bottom of the test arena. Sides of the test arena were talced to prevent ants from escaping. A row of 200-watt light bulbs placed 12" above the test arena and 30" apart rapidly desiccated the soil and nest tumulus which stimulated the colony to seek refuge in the more moist containers of potting media. Colonies were allowed 72 hours to complete the move from the desiccated nest tumulus into the pots. Afterwards, each pot was removed from the test arena and the potting media in each pot closely searched for the presence of live ants. Total number of ants present was then estimated. Treatments which allowed more than 10 workers to become established in one or more pots were considered ineffective.

RESULTS AND DISCUSSION:

One month posttreatment (PT), only the bifenthrin-treated Dewitt Weed Barrier was effective in preventing infestation of the nursery pots. The other three barrier treatments allowed the colonies to move in: the majority of the colony and brood in one pot and the remaining workers in the other pot. At two months PT, one of the Weed Barrier pots had ca 25 workers under the pot but none in the pot, and by 3 months PT, the bifenthrin treated Weed Barrier was ineffective against IFA infestation. At this point in time, the study was terminated.

Figure 6. Fire Ant Inserts for Nursery Containers.



PROJECT NUMBER: FA01G173

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

TYPE REPORT: Interim

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

INTRODUCTION:

Traditionally, long residual insecticides have been incorporated into nursery potting media to prevent infestation of imported fire ants in containerized nursery stock. Currently, bifenthrin (Tal star@) and tefluthrin (Force®) are registered for this use pattern. Bifenthrin is incorporated at rates from 10 to 25 ppm for varying terms of certification (6 months to indefinite). Force is labelled for application at 25 ppm, but is awaiting APHIS approval prior to use.

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

MATERIALS AND METHODS:

Nursery pot liners were formed at Batelle Pacific Northwest Laboratories, Richland, WA in September 1993. Reemay® spunbonded poly ester (2470) and Typar® spunbonded polypropylene style 34016 were glued for liners for 6-inch containers. The liners were then painted with chlorpyrifos or cyfluthrin. Both insecticides were dissolved in methyl isobutyl ketone (26 grams AI/85 mls MIK). Two thirds of each solution was absorbed by the 2470 fabric; the remaining third was taken up by the 34016 fabric.

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

RESULTS AND DISCUSSION:

Three separate bioassays have been accomplished. To date, no successful occupations of any container containing a treated liner has been accomplished by RIFA. In those tests where RIFA were given a choice between treated and untreated containers, only the untreated containers held RIFA at the end of the test. In those tests in which RIFA were given choices among treated containers, no successful occupations have occurred. Some unsuccessful attempts have been made to occupy those containers with liners treated with chlorpyrifos. Those ants attempting to enter the cyfluthrin treated pots died with 10 - 15 minutes after exposure. When given only the option of occupying a cyfluthrin treated container or the death of the colony due to desiccation, the RIFA colony will move en masse to the point within the arena furthest from the container.

These initial results show a strong potential for these types of barriers as a quarantine weapon against RIFA. Additional studies will be conducted in 1994.

PROJECT NO: FA016113

PROJECT TITLE: Efficacy of an Injection Treatment for Balled and Burlapped Nursery Stock

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott, Homer Collins, Jim Eisler (TN Dept. of Agric), and Randy Cuevas

INTRODUCTION:

Tennessee has approved a root injection procedure with Dursban®EC and Talstar®WP under SLN labelling for certification of balled and burlapped (B&B) nursery stock under the Japanese Beetle quarantine program. This technique was investigated for effectiveness as an IFA quarantine certification procedure.

MATERIALS AND METHODS:

Balled and burlapped plants were selected from several places in three counties in TN to represent different soil types. Various species of plants were selected to depict different root types. Ball size was approximately 14". On March 11, 1993, all plants were treated by injection using Talstar®10WP (16 oz/100 gal H_2O) or Dursban®4E (8 oz/100 gal H_2O). Balls were injected using 20 or 30 pounds of pressure, and 2 or 3 injections per ball were performed (Table 40).

These plants were then transported to the IFA lab in Gulfport, MS on March 22. The balls were irrigated on March 30 to insure that the soil would hold together during core removal. Soil cores were removed from each ball using a I-inch diameter soil corer. Four horizontal cores, from the outside to the center of the ball, were taken from each ball (Fig 7). Each core was divided into four sections (ca. 1-1½") and the corresponding sections composited (Fig 8). Each sample was then subjected to standard IFA alate queen bioassay (only three replicates per sample due to small amount of soil available). Vertical cores were also taken; four vertical cores from the top of the ball to the center (Fig 9). Each core was divided into three sections (ca. 1") and handled as stated above. Because of the large number of samples involved, bioassays were initiated over a two-week period.

RESULTS:

Of those balls treated with Talstar, only soil from the oaks and the apples provided 100% control of IFA at all injection rates tested (Table 41). The rest showed some reduced efficacy in several sections of the horizontal samples, and the *Althea* (30# - 3X) also showed little control in the outermost vertical sample. The Dursban treated soil also showed reduced control in some sections of the horizontal samples. The majority of the balls appeared to be injected from the top and off to one side, which would be the most feasible method in the field. However, this method appears to distribute most of the chemical to the vertical portion of the ball and less to the outermost horizontal sections. With some modification, this technique may be an effective alternative treatment for the IFA quarantine.

Table 40. Injection Treatment Schedule.

County of Origin	Plant Species	Chemical	Rate	Pounds Pressure	Number Inject.
Warren	Burning Bush	Talstar	16 oz/100 gal	20	2
					3
				30	2
					3
Warren	Pagoda Dogwood	Talstar	16 oz/100 gal	20	2
					3
				30	2
					3
Warren	*Althea*	Talstar	16 oz/100 gal	30	2
					3
Warren	Oak	Talstar	16 oz/100 gal	20	2
					3
				30	2
					3
Dekalb	Holly	Talstar	16 oz/100 gal	20	2
					3
				30	2
					3
Franklin	Apple	Talstar	16 oz/100 gal	20	3
				30	3
Franklin	Mock Orange	Dursban	8 oz/100 gal	20	3
				30	3
Franklin	*Eleagnus*	Dursban	8 oz/100 gal	20	3
				30	3
Franklin	Silver Bell	Dursban	8 oz/100 gal	20	3
				30	3

Figure 7. Horizontal core cut.

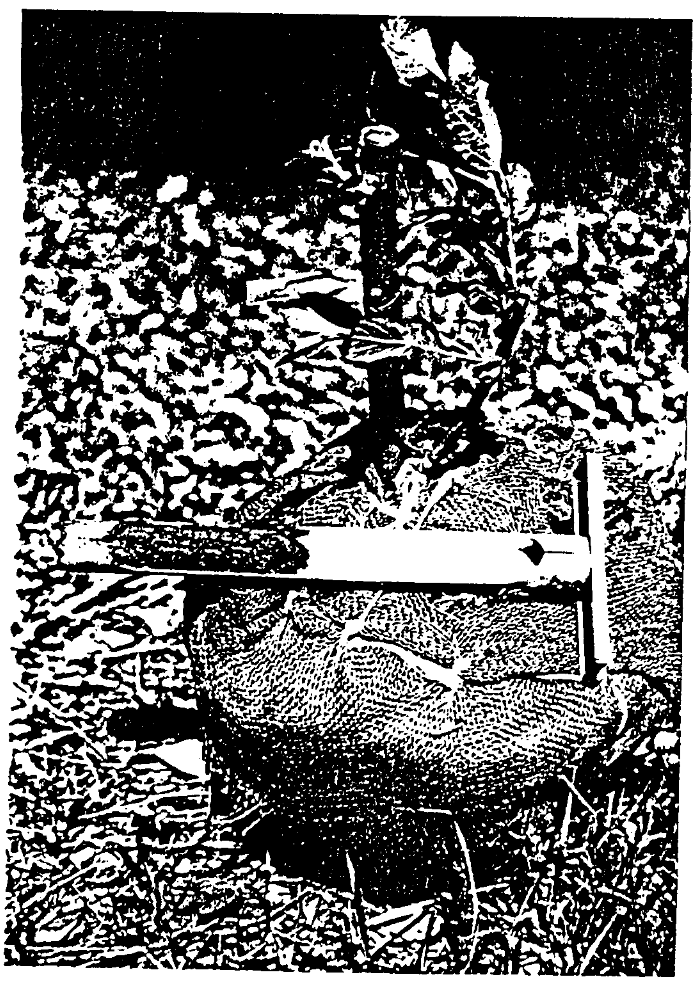


Figure 8. Media core.

Figure 9. Vertical core cut.

Table 41. Activity of Insecticides Injected into B&B Nursery Stock.

INSECTICIDE	SPECIES	INJECTION RATE (lbs. pres - no. injections)	SECTION[1]	PERCENT MORTALITY
Talstar	Burning Bush	20# - 2X	Hori 1	33.3
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		20# - 3X	Hori 1	93.3
			Hori 2	66.7
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 2X	Hori 1	100
			Hori 2	60
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
Talstar	Pagado Dogwood	20# - 2X	Hori 1	60
			Hori 2	53.3
			Hori 3	60
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100

Table 41. Cont.

INSECTICIDE	SPECIES	INJECTION RATE (lbs. pres - no. injections)	SECTION[1]	PERCENT MORTALITY
	Pagoda Dogwood	20# - 3X	Hori 1	93.3
			Hori 2	100
			Hori 3	40
			Hori 4	53.3
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 2X	Hori 1	60
			Hori 2	26.7
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	93.3
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
Talstar	*Althea*	30# - 2X	Hori 1	20
			Hori 2	13.3
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	6.7
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	13.3
			Vert 2	100
			Vert 3	100

Table 41. Cont.

INSECTICIDE	SPECIES	INJECTION RATE (lbs. pres - no. injections)	SECTION[1]	PERCENT MORTALITY
Talstar	Oak	20# - 2X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		20# - 3X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 2X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
Talstar	Holly	20# - 2X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100

Table 41. Cont.

INSECTICIDE	SPECIES	INJECTION RATE (lbs. pres - no. injections)	SECTION[1]	PERCENT MORTALITY
	Holly	20# - 3X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 2X	Hori 1	46.6
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	20
			Hori 2	73.3
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
Talstar	Apple	20# - 3X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100

Table 41. Cont.

INSECTICIDE	SPECIES	INJECTION RATE (lbs. pres - no. injections)	SECTION[1]	PERCENT MORTALITY
Dursban	Mock Orange	20# - 3X	Hori 1	100
			Hori 2	100
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	100
			Hori 2	93.3
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
Dursban	*Eleagnus*	20# - 3X	Hori 1	66.7
			Hori 2	20
			Hori 3	100
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	53.3
			Hori 2	73.3
			Hori 3	80
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100

Table 41. Cont.

INSECTICIDE	SPECIES	INJECTION RATE (lbs. pres - no. injections)	SECTION[1]	PERCENT MORTALITY
Dursban	Silver Bell	20# - 3X	Hori 1	73.3
			Hori 2	33.3
			Hori 3	6.7
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
		30# - 3X	Hori 1	6.7
			Hori 2	0
			Hori 3	13.3
			Hori 4	100
			Vert 1	100
			Vert 2	100
			Vert 3	100
Check				15.6[2]

[1] Sections listed as horizontal (hori) or vertical (vert) indicating the direction of the core. 1 = outermost 1-1½" core section; 3 or 4 = innermost 1-1½" section (middle of the ball). Check media was topsoil collected at Gulfport MS.

[2] Check mortality is an average of 6 check trials.

PROJECT NO.: FA04G013

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

A relatively recent development in root pruning has been chemical barriers (Burdett & Martin 1982). A timed-release formulation of trifuralin (dinitroanaline herbicide) placed on a geotextile fabric has been developed to protect streets, sewers and sidewalks from tree root damage (Typar®, BioBarrier™, Reemay Inc., P.O. Box 511, Old Hickory, TN 37138). BioBarrier is currently under trial as a method of root pruning for field-grown ornamental plants. By lining the planting hole with BioBarrier, it is believed that a grower could promote fibrous root development without mechanical pruning.

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

MATERIALS AND METHODS:

Rooted 3-gallon containers of crepe myrtles (10), flowering dogwoods (8), live oaks (12), NASA hollies (10), Burford hollys (10), azaleas (8), and Leyland cypress (10) were transplanted on 17 March 1993. Half of the plants were placed in planting holes with BioBarrier and half placed in untreated holes. The holes were excavated by shovel to a depth ca. 0.5 m. The planting holes were ca. 25% greater in circumference than the root ball. In the treated holes, BioBarrier was placed along and attached to the outer wall with 6p galvanized nails. The plant was placed in the center of the hole and the excavated soil was used to refill the hole.

After 12 months, IFA colonies from the surrounding field will be excavated and population indices determined. One of each of these colonies will then be placed within the BioBarrier circle surrounding one of the treated plants. Each of the untreated cultivars also will receive one indexed colony of IFA placed within the dripline of the plant. The colonies will be examined at 24 hr and one week after placement for presence of brood and to determine the colony's population index.

RESULTS & DISCUSSION:

On 30 September 1993, a survey of all plantings was undertaken to determine if any 'volunteer' colonies of RIFA had established themselves within the barrier circles. None of the Biobarrier treated plants were found with RIFA colonies. Among the untreated checks, two crepe myrtles, one flowering dogwood, one NASA holly and three azaleas were found with active colonies of RIFA. Two other azaleas had abandoned mounds at the base of the plants.

SECTION II

DEVELOPMENT OF QUARANTINE TREATMENTS FOR GRASS SOD

PROJECT NO: FA01G102

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

TYPE REPORT: Final

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

INTRODUCTION:

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

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

MATERIALS AND METHODS:

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

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

RESULTS:

As show in Table 42, the 3 lb. AI/acre rate provided excellent control up to 30 weeks posttreatment. One hundred percent control was achieved at the 5 lb rate, while a 20.3% increase in the untreated check plots was recorded at 30 weeks. Excellent control was maintained by the 5 lb rate through 37 weeks, but decreased efficacy noted at 42 weeks resulted in the trial being terminated. Prior to the 30 weeks count, the nurseryman harvested a portion of the test site. This included 1 plot (replicate) each from the check, and the 1.0 and 5.0 lb AI/acre treatments. The loss of these plots resulted in insufficient replicates for statistical analyses to be performed.

Table 42. Efficacy of Various Rates of Suscon Green Applied to Commercial Grass Sod.

Treatment (lb AI/acre)	% Change in Population Index at Indicated Weeks Post Treatment[1]						
	(6)	(12)	(18)	(24)	(30)	(37)	(42)
1.0[2]	-87.9a	-85.2ab	-73.0a	-43.7a	-74.3	-71.8	-40.5
3.0	-98.4a	-93.0ab	-89.1a	-96.9a	-89.4	-84.6	-79.9
5.0[2]	-99.8a	-100.0a	-97.3a	-100.0a	-100.0	-99.2	-88.4
Check[2]	-18.7b	+6.2b	+47.4b	+51.5b	+20.3	+60.4	+64.3

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

[2] Prior to 30 week count 1 plot (replicate) from each of the indicated groups was dropped due to harvesting. Therefore, no statistics were performed from this count on.

PROJECT NO: FA01G063

PROJECT TITLE: Grass Sod Trials, 1993

TYPE REPORT: Final

LEADER/PARTICIPANTS: Homer Collins, Avel Ladner, Anne-Marie Callcott, Randy Cuevas, Lee McAnally, Tim Lockley, and Tavo Garza [Texas Dept. Agric]

INTRODUCTION:

Grass sod is certified for movement outside the IFA regulated area by use of chlorpyrifos (PPQ Treatment Manual M301.81). Currently, the only registered formulations of chlorpyrifos are Pageant® DF and Dursban® 50WP (DowElanco, Indianapolis, IN). Both products are labelled for use at a rate of 8.0 lb AI/acre. Biology of the ant, management practices, and the uncertainty of markets require the use of residual contact pesticides for certification of sod. Baits alone are not acceptable for certification of sod because newly mated queens, which do not forage for food, could be transported on or slightly below the sod surface. Conventional short term pesticides do not provide the residual activity needed to kill ant colonies; hence, the only approved treatment procedure involves high rates of chlorpyrifos. Sod farmers are encouraged, but not required, to use fire ant baits in conjunction with the specific quarantine treatment.

A controlled release formulation of chlorpyrifos produced in Australia by Incitec International (Brisbane), has provided 100% control for up to 8 months when applied at a rate of 5 lb AI/acre (FA01G102). The Incitec formulation (suSCon® Green) contains 10% chlorpyrifos in a plastic matrix and is sized as a 1.0mm particle. Talstar® T&O Granular (FMC Corporation, Philadelphia, PA) contains 0.2% bifenthrin, and has shown promise in previous trials (FA01G081). Empire® (DowElanco) is a microencapsulated formulation of chlorpyrifos labelled for residual control of ants, bees, beetles, cockroaches, crickets, etc. As mentioned above, Pageant 50DF is labelled for IFA control in turf. Efficacy of these insecticides will be determined in the present study. In addition, the release rate of chlorpyrifos from the suSCon granules will be determined.

MATERIALS AND METHODS:

Cooperators include Texas Department of Agriculture, FMC Corporation, DowElanco, and Incitec Ltd. and the sod farms listed above.

Efficacy of insecticides:
Candidate treatments tested included the following:

Insecticide & Formulation	Rate (lb AI/acre)	Registrant
Talstar .2G	.25 & .50	FMC Corp.
Pageant 50DF	3.0 & 6.0	DowElanco
Empire 20	1.7 & 3.4	"
suSCon Green	4.0	Incitec Ltd

All treatments were applied at three different test sites as follows: Murff Turf Farms, Crosby, TX; Pearl River Valley Turf, Wiggins, MS; and Woerner Turf, Elberta, AL. All treatments were applied to 1-acre test plots (3 replicates/treatment) at each site using either a Herd GT-77 granular applicator or a shop built boom sprayer attached to a Suzuki ATV. The double boom sprayer assembly was comprised of 5 TSS-4 spray tips spaced 36" apart and overlapped by 5 TSS-3 spray tips. Operation of both pumps and both booms at 20 PSI and 4 mph provided a total output of 32 gal/acre. The suSCon (code # G01014) granules were darker in color and smaller in size (ca. 0.8 mm) than formulations evaluated in previous trials.

IFA populations in each test plot were assessed prior to and at 6 week intervals after treatment until reinfestation occurred. Population assessments were based on the system devised by Harlan et al. (1981), and modified by Lofgren and Williams (1982). Analysis of variance and Tukey's studentized range (HSD) test were used to determine statistical differences in treatment means at the $P<0.05$ level for each post-treatment rating interval (SAS Institute 1988).

Release rate of chlorpyrifos:
The release rate of chlorpyrifos from the suSCon granules was determined for the Wiggins MS site. A 1-m^2 sample of thatch was removed from one of the suSCon treated plots 24 hours after treatment, and at 6 week intervals thereafter (concurrent with population assessments). The theoretical application rate of the suSCon was 4.5 g/m^2. The thatch was removed by using a sharpened hoe and flat square-nosed shovel, then was placed in a large plastic bag and transported to the lab. The suSCon granules were then separated from the thatch sample by the following technique.

The thatch sample was hand crumbled under a waterjet and the material allowed to pass through a four-tiered sieve system. Screen sizes were 6.4 mm, 3.2 mm, 1.6 mm and 0.4 mm (top to bottom); actual aperture size for each screen was a fraction smaller. Most of the suSCon granules were retained by the 0.4 mm screen, but some were present in the 1.6 mm screen. Material from both of the screens was placed in a K_2CO_3 solution (specific gravity 1.12) and the material which floated to the top was skimmed off. This procedure allowed the sand to be separated from the lighter material which included the suSCon granules. The "skimmed" material was dried overnight under incandescent lights and then subjected to additional sieving. The granules were then removed from the remaining material by an airflow system. A Vidal Sassoon Cold Shot™ 1500 hand held hair dryer equipped with a rheostat 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 10). 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. The rheostat was set to blow the lighter material out of the cylinder and retain the heavier suSCon granules. Any remaining foreign material was removed by hand. The retrieved granules were then sent to Incitec Ltd. for analysis.

RESULTS:

Efficacy of insecticides:
Due to the excellent control and residual activity afforded by several of the treatments, counts continued through the winter months. During this time, adverse weather conditions precluded routine counts, and therefore assessments were not always made at 6 week intervals.

Test plots at Murff Turf Farms in Crosby TX were treated on May 26 under extremely wet conditions. The soil was at field capacity with standing water in some places. On one plot (Talstar 0.25 lb AI/acre), ca ½ of the chemical was applied in a medium rain. More than 18" of rain fell before the 1st posttreatment count interval. Very little rain fell before the 2nd and 3rd posttreatment counts. All treatments in the Murff Turf Farms trial gave excellent results through 18 wks posttreatment (PT), as shown in Table 43. However, the untreated checks also showed very high rates of mortality, especially at 18 wks PT and there was no significant difference between the treated and untreated plots. The high check mortality was probably due to the extremely hot and dry conditions which were prevalent between the 1st and 3rd PT count dates. During such extreme conditions, the ants generally move deep into the mound (or cracks in the heavy clay soil) to access relatively cooler and more humid areas. By 24 wks PT, the treated plots continued to show good control while populations on the check plots had made an excellent recovery. This suggests that the ants were on the plots previously, but were not detectable through ordinary survey methods. Excellent control was retained through 33 wks PT by suSCon and by the high rates of the other treatments.

Treatments at Pearl River Valley Turf in Wiggins MS were applied under very hot and dry conditions on June 3. The test site consisted of sandy soil with mostly crabgrass and broadleaf weeds, and little to no St. Augustine or Centipede grass. All treatments at Pearl River Valley Turf gave excellent control at 6 wks PT (Table 43). Again, high check mortality, probably due to the hot, dry weather conditions, was observed. These check plots recovered well in subsequent counts. By 12 wks PT, the lower Pageant and Talstar rates began losing efficacy. Prior to the 18 wk count, three plots were lost due to harvesting; two of the Pageant 50DF 6 lb AI/acre plots and one Talstar 0.2G 0.50 lb AI/acre plot. Excellent control was retained by the suSCon treatment through 33 wks PT, and good control retained by the higher rates of Empire and Talstar through the same period.

The Woerner Turf treatments near Foley AL were applied on July 7 under very hot conditions to sandy soil with St. Augustine grass. Rain fell intermittently during application: <0.5" the evening of 7/7 after all granules had been applied, and +1.0" from a downpour on 7/8 after the Empire application. Treatments at Woerner Turf also showed good results for 18 wks, except for the lower Talstar rate (Table 43). Check plots at this site tended to have less mortality than other sites, probably due to the regular irrigation these plots received. These plots were lost prior to the 24 week count due to harvesting by the owner.

Results of these trials suggest that suSCon Green, applied at 4 lb AI/acre, is consistently effective for use on grass sod and was very effective for up to 33 wks after application (disregarding the site that was lost due to harvesting), regardless of weather conditions or irrigation practices. Talstar 0.2G, applied at 0.50 lb AI/acre, also showed good residual activity for 18-24 wks, as did the higher rates of Pageant 50DF and Empire 20%. Thus, there are several products which show excellent promise for use on grass sod as IFA quarantine treatments.

Release rate of chlorpyrifos:

Results obtained from Incitec Ltd are shown in Table 44. According to Peter May (Market Development Manager - International, Incitec Ltd), the release trend is as expected from a broadcast surface application of suSCon granules. The rapid release between day 1 and 42 is probably due to the high temperatures and dry conditions during this time. At 18 weeks PT, analysis found 0.9% chlorpyrifos present in the retrieved granules, but 100% control was still being obtained in the field. Markin et al. (1973) determined that small incipient IFA colonies were growing and developing 1-2 months prior to visual detection in the field. Thus, the slight decrease in control at 24 weeks PT (96.4%) corresponds to the rate of decrease of chlorpyrifos present.

Figure 10. Assembly of airflow system using Vidal Sassoon Cold Shot 1500 hair dryer.

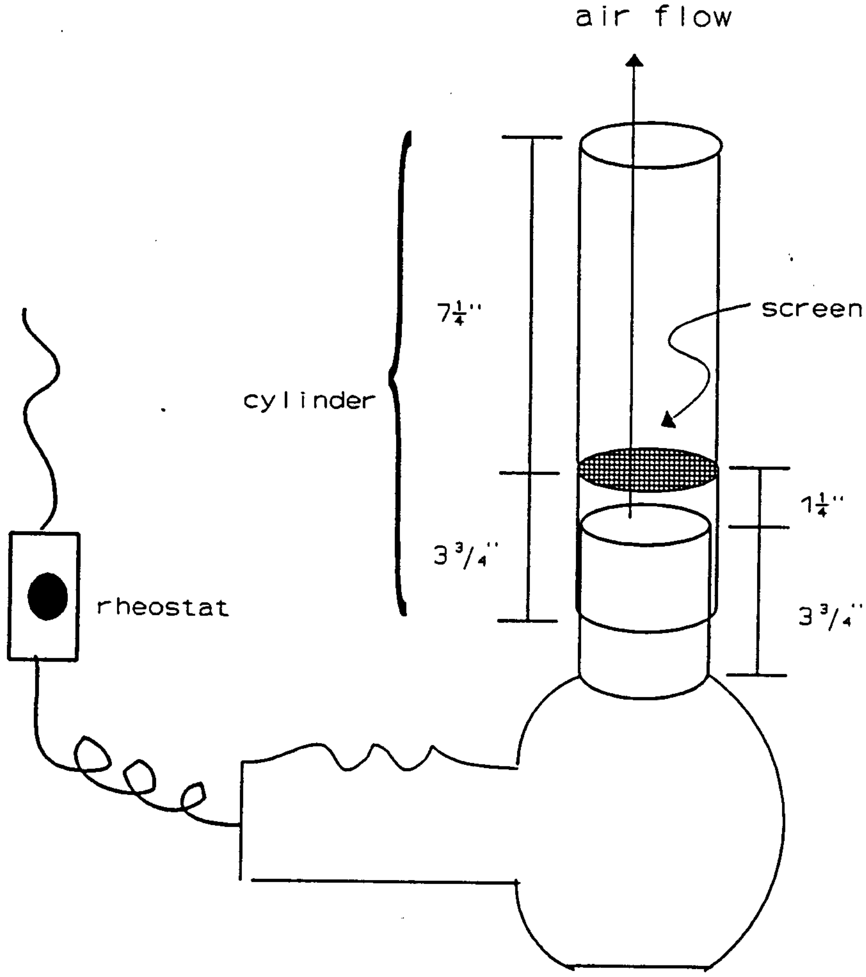


Table 43. Control of Imported Fire Ant Populations in Grass Sod Treated with Various Chemicals at Sites in Texas, Mississippi and Alabama.

Chemical	Rate (lb AI/ acre)	Mean % Change in Population Index at Indicated Weeks PT				
		(7)	(12)	(18)	(24)	(33)
		Murff Turf Farms, Crosby, Texas				
Empire 20%	1.7	-100.0a	-100.0a	-100.0a	-81.5a	-78.3a
	3.4	-98.5a	-100.0a	-100.0a	-93.8a	-96.4a
Pageant 50DF	3	-99.6a	-100.0a	-100.0a	-90.3a	-88.4a
	6	-100.0a	-100.0a	-100.0a	-97.4a	-100.0a
Talstar 0.2%	0.25	-100.0a	-100.0a	-99.5a	-92.1a	-88.7a
	0.50	-99.0a	-100.0a	-100.0a	-99.0a	-97.0a
suSCon Green	4	-100.0a	-100.0a	-100.0a	-95.2a	-98.9a
Check	-	-54.7b	-91.9b	-91.9a	-31.3b	-16.4b
		Pearl River Valley Turf, Wiggins, Mississippi				
Empire 20%	1.7	-100.0a	-82.0ab	-84.7ab	-26.6ab	-38.0ab
	3.4	-100.0a	-89.5ab	-97.4a	-80.27a	-82.1a
Pageant 50DF	3	-93.6a	-49.7bc	-28.9bc	-22.7ab	-5.3bc
	6	-100.0a	-90.2ab	-94.9[1]	-46.2[1]	-51.3[1]
Talstar 0.2%	0.25	-99.7a	-78.5ab	-66.6abc	-65.4a	-60.1ab
	0.50	-100.0a	-92.9ab	-93.9[2]	-86.6[2]	-83.6[2]
suSCon Green	4	-100.0a	-100.0a	-100.0a	-96.4a	-100.0a
Check	-	-74.0b	-22.5c	-16.5c	27.8b	52.0c
		Woerner Turf, Elberta, Alabama				
Empire 20%	1.7	-100.0a	-100.0a	-100.0a	-[3]	
	3.4	-100.0a	-100.0a	-100.0a	-	
Pageant 50DF	3	-100.0a	-100.0a	-94.7a	-	
	6	-100.0a	-100.0a	-100.0a	-	
Talstar 0.2%	0.25	-100.0a	-100.0a	-79.5ab	-	
	0.50	-100.0a	-100.0a	-100.0a	-	
suSCon Green	4	-100.0a	-100.0a	-100.0a	-	
Check	-	-42.9b	-38.9b	-18.8b	-	

For any given test site, means within a column followed by the same letter are not significantly different according to Tukey's studentized range (HSD) test (SAS Institute 1988).

[1] Two plots were lost due to harvest prior to the 3rd posttreatment count on 10/5/93 - not included in statistical analysis
[2] One plot was lost due to harvest prior to the 3rd posttreatment count on 10/5/93 - not included in statistical analysis
[3] Plots lost due to harvest

Table 44. Results of Analysis of suSCon Granules Retrieved from Grass Sod.

Days Posttreatment (weeks PT)	0	1	42(6)	84(12)	126(18)	168(24)
Sample Size (g)	-	2.2	2.5	3.3	1.1	1.2
Moisture Content (%)	0.7	4.6	2.1	17.3	9.5	8.8
Chlorpyrifos Content (%)	10.1	8.6	2.5	1.9	0.9	0.8

PROJECT NO: FA01G133

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

MATERIALS AND METHODS:

Application of all materials was made on 7 September 1993 at the Pearl River Sod Farm near Wiggins, Stone Co., MS. A trailer mounted boom system was used for liquid applications. The boom sprayer consisted of 5 TeeJet TSS4 nozzles spaced at intervals of 36 inches and overlapped by 5 TSS3 spray tips. Both pumps and both booms operated at 20 psi. Rate of output was ca. 32.0 gallons finished spray/acre. Applications of granular materials were made using a hand-held radial seed spreader. Materials were applied to plots measuring 15' x 100' at rates indicated in Table 45. Soil samples were collected by wheel-type core sampler. Approximately 300 soil cores (0.5" x 1.0") from each plot were collected at six-week intervals. Samples from each like-treated plot were cornposited and then bioassayed with alate RIFA queens (Appendix II).

RESULTS AND DISCUSSION:

Optem® PT 600, Bengal®, and Fipronil 1.56 demonstrated insufficient efficacy at 4 weeks post-treatment to continue their trials (Table 45). Commodore@ 1GR initially showed weak mortality rates but improved significantly when evaluated at week 10. Pageant 50DF, Bistar™ 1.75EC and Force® 1.5G have shown consistent efficacy through 10 weeks post-treatment. Trials will continue for these three candidates until such time as they show significant decreases in efficacy over two separate bioassay periods.

Table 45. Candidate Insecticides Applied at Varying Rates/Formulations to Commercially Grown Grass Sod.

Candidate	Rate lbs AI/ Acre	% Mortality to IFA Alate Queens at Indicated Weeks Posttreatment					
		[4]	[10]	[16]	[ ]	[ ]	[ ]
Pageant 50DF	8.000	100	100				
BiStar 1.75 EC	0.250	100	100				
	0.500	100	100				
Optem PT 600	0.250	10	60				
Bengal	0.160	0	75				
Force 1.5G	2.000	100	100				
Commodore 1GR	0.500	25	90				
Fipronil 1.5G	0.044*	0	30				
	0.088**	0	40				
Untreated Check		0	70				

* Equivalent to 50 g/ha (rate used in other insect control trials)
** Equivalent to 100 g/ha (rate used in other insect control trials)

SECTION III

POPULATION SUPPRESSION TRIALS

PROJECT NO: FA02G012

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

TYPE REPORT: Final

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

INTRODUCTION:

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

MATERIALS AND METHODS:

Treatment Procedure

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

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

Data Analysis

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

RESULTS:

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

Results indicate that the presence of dew during application does not negatively affect the efficacy of Award bait (Table 46).

Table 46. Effect of Dew on Efficacy of Award Fire Ant Bait.

Treatment	% Change in Population Index at Indicated Weeks PT[1]								
	(6)	(12)	(18)	(24)	(30)	(37)	(43)	(48)	(54)
Dew	-88.6a	-91.9a	-89.6a	-92.2a	-93.3a	-95.0a	-90.3a	-98.5a	-85.5a
No Dew	-86.4a	-84.9a	-75.5a	-91.3a	-88.3a	-91.4a	-61.5a	-88.1a	-43.9ab
Check	+5.6b	+31.5b	+21.6b	+24.2b	+50.2b	+47.4b	+88.6b	+22.2b	+14.8b

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

PROJECT NO: FA02G022

PROJECT TITLE: RIFA Control with Award[m] Blended into a Controlled Release Fertilizer Formulation.

TYPE REPORT: Final

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

INTRODUCTION:

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

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

MATERIALS AND METHODS:

Trial I:

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

Trial II- Shelf life study:

On 7/27/92, Award was blended into polyon granules at a rate of 1.5 lbs Award (Batch #RA11019) to 100 lbs fertilizer using an electric cement mixer. The mixed materials were resealed into original fertilizer bags and stored at ambient temperature and humidity. This material was applied to 4 one-acre plots at a rate of 101.5 lb/acre on May 7, 1993. Four one-acre plots were also treated with Award only at 1.5 lb/acre on the same date.

RESULTS:

Trial I:
Weather conditions during treatment were as follows: skies clear to partly cloudy. Air temperature was 80°F, and soil temperature (indirect sun, 1" depth) was 68°F. A light rain shower (estimated at < 0.1") occurred within 1 hour of application.

As shown in Table 47, there was no significant difference in population index reduction at 6 and 12 weeks PT for either treatment. Thus, fertilizer does not appear to enhance or degrade the efficacy of Award. This trial was terminated after the 18 week count because reinfestation had occurred.

Trial II:

After 10 months of storage, the fertilizer had no adverse affect on the efficacy of the bait; i.e. 18 weeks of excellent control was achieved with the Award/fertilizer mixture (Table 48). Reinfestation was noted 24 wks PT, and the trial terminated after the 30 wk count.

Table 47. Effect of Fertilizer on Efficacy of Award™ Fire Ant Bait. Trial I.

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

Table 48. Effect of Fertilizer on Efficacy of Award After Aging for 10 Months. Trial II.

Treatment	% Change in Population Index at Indicated Weeks PT[1]				
	(7)	(12)	(18)	(24)	(30)
Fert + Award	-94.8a	-98.2a	-95.6a	29.6a	-29.8a
Award only	-96.8a	-99.8a	-98.8a	-96.1a	-94.9a
Check	-32.1b	-40.4b	-33.9b	-37.3a	-62.3a

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

PROJECT NO: FA02G032

PROJECT TITLE: Fenoxycarb Formulation Trials, 1992 and 1993.

TYPE REPORT: Interim

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

INTRODUCTION:

Fenoxycarb exhibits classical IGR activity against a variety of insects including cockroaches, fleas, mosquitoes, etc. In preliminary studies with red imported fire ants (RIFA), Banks et al. (1983) found that it caused dramatic alterations in egg-laying and brood development and eventual death of most treated colonies. Other trials (Banks 1986, Banks et al. 1988) confirmed efficacy, and this product was registered for use on turf, non-agricultural land, nurseries, sod farms, and non-bearing citrus as Logic® in October 1985. The Award™ brand of Logic was introduced in 1991 for use on turf, nurseries, non-agricultural areas, etc. Commercial formulations of both Award and Logic contain 1% AI in a soybean oil/defatted corn bait. At the request of the registrant (Ciba-Geigy Chemical Co.), several experimental formulations of fenoxycarb were evaluated in two trials in 1992, and two additional trials in 1993.

MATERIALS AND METHODS:

Test I - 6/4/92:

Test plots were located in non-grazed permanent pasture in Harrison County, MS. A totally monogynous RIFA population averaging 74 colonies per acre infested the property, Treatments evaluated included a 1% AI formulation, a 0.5% formulation, and a standard commercial formulation of Amdro®. All treatments were made with a shop-built granular applicator mounted on a farm tractor (Collins 1988). The equipment was operated at 4 mph on a 10' swath. Rate of application was 1.25 lbs bait per acre for all formulations. Treatments were applied on June 4, 1992. Soil was very moist, and the soil temperature (1" depth) was 68°F. Air temperature was 78°F under partly cloudy skies. Plots were one-acre in size and arranged in a completely randomized block design with 4 replicates per treatment. The population index method (Harlan et al. 1981) as modified by Lofgren and Williams (1982), as well as colony mortality was used to rate all plots prior to and at 6 week intervals after treatment. Analysis of variance and Tukey's studentized range (HSD) test (SAS Institute 1988) were used to determine statistical differences in treatment means at the $P < 0.05$ level for each posttreatment rating (PT) interval.

Test II:

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

Test III:

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

Test IV:

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

RESULTS:

Test I:

Light rain (estimated at <0.1") occurred during application of the 1.0% formulation. All treatments provided excellent reduction in population indices through 12 weeks (Table 49). Reinfestation was apparent in all plots at the 18 week count and the trial was terminated.

Test II:

Results show no difference in efficacy of the various formulations used through 54 weeks (Table 50). The best control for all formulations was found 47 weeks PT, with reinfestation evident at 54 weeks PT. The slow rate of reinfestation in these plots is unexplained.

Test III:

Eighteen weeks of excellent control (>85%) was obtained with the two formulations in this trial (0.75% & 1%) for 18 weeks (Table 51). By 24 weeks PT, reinfestation was noted.

Test IV:

Interim results indicate that 18 weeks of excellent control has been obtained by formulation number FL931171 (Table 52).

Table 49. Efficacy of Various Award Formulations, 1992. Test I.

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

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

Table 50. Efficacy of Various Award Formulations, 1992. Test II.

Treatment	% Change in Population Index at Indicated Weeks PT								
	(6)	(12)	(18)	(25)	(30)	(38)	(42)	(47)	(54)
921414 (0.5%)	-86.1a	-86.1a	-83.2a	-83.1a	-80.5a	-89.0a	-84.4a	-96.7a	-82.0a
921424 (0.5%)	-89.2a	-88.9a	-93.2a	-89.8a	-89.4a	-95.0a	-95.9a	-98.7a	-83.4a
921425 (0.5%)	-81.6a	-81.0a	-80.3a	-70.3a	-78.5a	-85.7a	-75.8a	-91.9a	-85.6a
Check	+0.6a	+44.9b	+7.6b	+15.6b	-26.3b	+38.0b	+14.8b	+1.8b	-35.3b

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

Table 51. Efficacy of Various Fenoxycarb Formulations, 1993. Test III

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

Table 52. Efficacy of Various Fenoxycarb Formulations, 1993. Test IV

Treatment	% Change in Population Index at Indicated Weeks PT[1]			
	(6)	(12)	(18)	(24)
FL931171	-87.2a	-95.3a	-99.3a	
Award Standard	-84.4a	-96.4a	-97.9a	
Check	13.5b	3.9b	-49.3b	

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

PROJECT NUMBER: FA02G023

PROJECT TITLE: Laboratory Feeding Acceptance Tests with Three Rohm Hass Non-Steroidal Ecdysone Insect Growth Regulators

TYPE REPORT: Final

LEADER/PARTICIPANTS: Tim Lockley

INTRODUCTION:

Rohm & Hass Co. has developed novel non-steroidal ecdysone agonists that mimic the action of 20-hydrooxyecdysone that have shown very good selectivity to non-target organisms. The three analogues (RH 0345, RH 2485 & RH 5992) were tested for feeding acceptance as formulated baits on laboratory RIFA colonies.

MATERIALS AND METHODS:

Field collected colonies of red imported fire ants were given access to candidate baits and standard baits to determine acceptance. Five grams of candidate baits contained in a plastic petri dish were placed in each of 5 test colonies. Candidate baits were prepared by dissolving the IGR (0.5% AI) into soybean oil and mixing the oil with pregelled corn grits.

Simultaneously, five grams of freshly prepared standard bait (soybean oil and pregelled corn grits 30%:70% w/w) in an identical petri dish was placed ca. 10 cm from the candidate bait. Foraging workers were provided free access to each bait. After 24 hours, the petri dishes were removed and the bait weighed.

Acceptance of each candidate was computed as follows:

$$\frac{\text{No. Grams Candidate Consumed}}{\text{No. Grams Standard Consumed}} = \text{Acceptance Ratio}$$

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) reported on the evaluation of 222 different food materials and provided a list of those which gave an acceptance ratio of 0.75 or higher. By this convention, this figure has become the minimum ratio recognized as acceptable by most imported fire ant researchers.

RESULTS AND DISCUSSION:

At rates of 0.5% AI, none of the three candidates were acceptable to IFA when formulated on pregelled defatted corn grits (Table 53).

Table 53. Bait Acceptance of Three IGR's Formulated on Pregelled Defatted Corn Grits.

IGR	Acceptance Ratio
RH-0345	0.1
RH-2485	0.0
RH-5992	0.0

PROJECT NO: **FA02G013**

PROJECT TITLE: Spot Treatments of Red Imported Fire Ant (RIFA) Colonies: How Effective Are They?

TYPE REPORT: Final

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

INTRODUCTION:

Efforts to control imported fire ants through spot treatment or single mound application of insecticides date back to 1937 when the first organized control program in Baldwin County Alabama was initiated. In that program, 48% calcium cyanide dust was applied to each nest by digging into the mound with a shovel, sprinkling the dust, and covering it with soil (Eden and Arant 1949). Even today, a number of commonly used insecticides, including acephate, bendiocarb, carbaryl, chlorpyrifos, diazinon, malathion, and many others are registered and marketed as drenches, dusts, granules, and aerosols for spot treatment of fire ant nests. The literature is replete with reports of insecticide trials in which the authors used spot treatment or individual nest applications to evaluate the efficacy of candidate pesticides, formulations, or dose rates. Virtually all of the many trials conducted utilized various methods of marking treated mounds by tagging, flagging, and/or mapping. Many studies used very small plots with or without buffer zones or various size boundaries around treated nests. However, colony movement or nest relocation in response to insecticidal treatment is a well documented phenomenon (Hays et al. 1982, Franke 1983, Williams and Lofgren 1983, Collins et al. 1992). This induced movement due to the presence of an insecticide is usually over a relatively short distance (5 to 10'), but can be greater (personal observation). Colony movement or relocation in field trials based on marked colonies or small plots can skew results when mortality data is based solely on survival of marked or tagged mounds, or in trials in which relatively small plots are used. We report here the results of a field trial that utilized an experimental design which compensated for colony relocation following pesticide application to individual fire ant nests.

MATERIALS AND METHODS:

Test plots measuring 210′ x 210′ (one acre), were established in Harrison County, MS. on November 3, 1993 in an area infested with a monogynous RIFA population averaging 89.3 active nest per acre. An experienced team of 6 investigators closely searched each entire test plot and flagged each active RIFA nest immediately prior to pesticide application, thereby insuring that each nest in each test plot was treated.

Prior to treatment, circular subplots with a radius of 58.3′ (0.25 acre), were established in the center of each test plot (Figure 11). RIFA population estimates were made in each circular subplot prior to and 1, 2, 4, and 8 weeks after pesticide application, using the population indexing system described by Harlan et al. (1981) and modified by Lofgren and Williams (1982). The number of active RIFA colonies and population indices were calculated for each subplot and means of each treatment separated using ANOVA and Tukey's studentized range (HSD) test (SAS Institute, 1988).

Products tested included Dursban® 2EC, [chlorpyrifos], (Rigo Company, Buckner, KY), Orthene® 75S,[acephate], (Valent U.S.A. Corp., Walnut Creek, CA), Optem® PT-600 [cyfluthrin], (Whitmire Research Labs, St. Louis, MO), and Bengal® Fire Ant Killer Concentrate [(1R,3S)3((1'RS)(1',2',2'2'-tetrabromoethyl)-2,2-dimethylcyclopropanecarboxylic acid, (S)-alpha-cyano-3-phenoxybenzyl ester] (Bengal Chemical, Inc., Baton Rouge, LA). Dursban, Orthene, and Bengal Fire Ant Killer are registered for control of fire ants, and were applied according to label directions. Optem PT-600 is not registered for fire ant control, but was applied at a rate equivalent to the Dursban treatment. Application rates, formulations tested, and methods of application were as follows:

Insecticide & Formulation	Method of Application	Rate of Application	
		Amount	g AI/nest
Dursban 2EC	Drench	0.5 oz/gal H_2O/nest	3.54
Bengal Fire Ant Killer	Drench	0.2 oz/pt H_2O/nest	0.24
Orthene 75S	Sprinkled on dry	2 tsp/nest	0.54
Optem PT-600	Drench	2.0 oz/gal H_2O/nest	3.54

RESULTS:

Posttreatment population estimates were made at 1, 2, 4, and 8 weeks after pesticide application. Observations made 1 wk after treatment indicated that, with the exception of Orthene 75S, all treatments killed large numbers of worker ants, and all surviving colonies were much reduced in size relative to the pretreatment population. All mounds which received a drench treatment (as evidenced by disrupted nest tumulus due to the effects of the drenching operation), were vacant, indicating that the colony had either succumbed to the treatment or had relocated the nest. Numerous freshly formed nests, much smaller in size were usually observed within 5-8′ of the treated nest, indicating that colony relocation had indeed occurred.

As shown in Table 54, Dursban 2EC, Optem PT-600, and Bengal Fire Ant Killer significantly reduced the pretreatment population indices at 1, 2, and 4 weeks after application. Colony mortality, i.e. % kill, ranged from ca. 65 to 80% at 2 weeks posttreatment (PT) (Table 55). However, by 4 weeks PT colony mortality had declined to the 50% range. The decline in control at 4 weeks PT can not be explained by reinfestation by newly mated queens due to the biology of this insect (Markin et al. 1973, Callcott and Collins 1992), and was probably not due to invasion of the plot by untreated colonies from outside the plot due to the 76' buffer provided by the plot design. More likely, colonies which were severely disrupted and decimated by the pesticide application were able to regroup and reform more visible nests 4 to 6 weeks

PT. Control with Orthene 75S was not significantly different from the untreated check.

DISCUSSION:

Recent isolated infestations outside the generally infested area in Virginia, Tennessee, Arkansas, and other states have led to renewed efforts to eradicate fire ants from small areas to prevent further spread. These eradication efforts generally are conducted by the affected state plant regulatory agency. Drench treatments in combination with broadcast bait applications are commonly used in these programs, and success of the eradication effort is dependent upon judicious use of the most effective insecticides available. Results of this study should aid in the selection of the most appropriate products for small scale eradication efforts, or other fire ant control programs. These results also clearly demonstrate the need to use spot treatments in combination with broadcast bait applications to achieve maximum population suppression.

The experimental plot design used in this trial was extremely labor intensive, requiring ca. 100 person hours to lay out plots, conduct pre and posttreatment population estimates, and apply treatments. Additional time was required for data analysis and report preparation. However, the results obtained are far more valid than other studies employing less vigorous plot designs.

Figure 11. Experimental design of field plots.

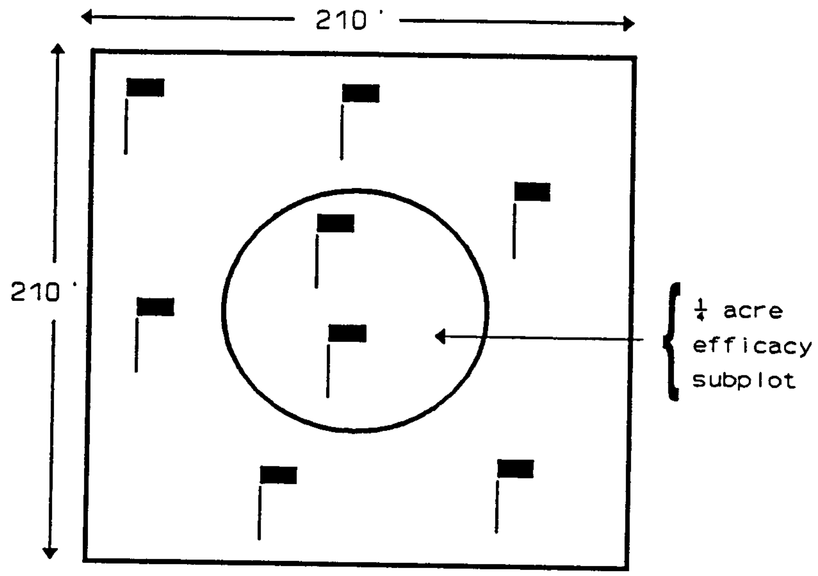


Table 54. Reduction in Pretreatment Population Index by Spot Treatments with Various Insecticides, Harrison County, MS. November, 1993.

Treatment	% Change in Pretreatment Population Index at Indicated Weeks Posttreat†			
	(1)	(2)	(4)	(8)
Dursban 2EC	-78.4a	-86.4a	-62.4ab	-83.4a
Optem PT-600	-73.5a	-81.5a	-54.6ab	-61.7ab
Bengal Fire Ant Killer	-57.3ab	-81.7a	-69.5a	-61.1ab
Orthene 75S	-27.9bc	-30.3b	-17.5b	-11.5b
Untreated Check	-25.2c	-39.2b	-16.2b	-11.8b

† Mean based on three replicates. Means within a column followed by the same letter are not significantly different according to Tukey's Studentized range (HSD) test, (SAS Institute, 1986).

Table 55. Colony Mortality Produced by Spot Treatments with Various Insecticides, Harrison County, MS. November, 1993.

Treatment	% Decrease in number of active RIFA colonies at indicated weeks posttreat†			
	(1)	(2)	(4)	(8)
Dursban 2EC	68.7a	79.4a	52.5a	80.4a
Optem PT-600	70.4a	78.7a	51.4a	57.2ab
Bengal Fire Ant Killer	42.9ab	64.4ab	53.0a	40.6bc
Orthene 75S	16.5b	23.9b	2.0b	11.1c
Untreated Check	21.2b	40.0ab	10.3b	10.0c

† Mean based on three replicates. Means within a column followed by the same letter are not significantly different according to Tukey's Studentized range (HSD) test, (SAS Institute, 1986).

SECTION IV

MISCELLANEOUS PROJECTS

PROJECT NO: FA05G021

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

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

As part of a larger study addressing the potential impact of the red imported fire ant (RIFA) on wildlife production in Texas rangelands, five 500-acre plots were treated with Amdro® in the southeastern part of the state on 4/15/91 with a subsequent application made 6 months later on 10/15/91. A third application was made in March 1992. This study was conducted under the auspices of Texas Tech University (TTU) [lead agency]. TTU was tasked with quantifying the effect of RIFA on annual production of selected vertebrate game, non-game and endangered species. Results of this study have been reported by Allen et al. (1992), Lutz et al. (1992), Thorvilson et al. (1992), Allen (1993), Allen et al. (1993), Phillips et al. (1993) and Thorvilson & Phillips (1993). The Texas Department of Agriculture conducted population sampling of RIFA. The USDA Imported Fire Ant Station conducted studies of non-target invertebrates (Lockley et al. 1992). The results of the IFA Station's study are also reported herein.

MATERIALS AND METHODS:

The USDA-APHIS-PPQ-Aircraft Operations supplied an airplane for aerial application of Amdro. American Cyanamid Chemical Company supplied the material for application.

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

Sampling was comprised of two methods; sweep netting and UV light traps. Sweep net samples were taken from dominant plant communities (in bloom, if available) to collect herb strata, diel-active arthropods. Because of the difficulty involved, no arboreal samples were taken. UV light traps (portable) were employed to collect nocturnally active insects. Sweep net samples were made using heavy, muslin bags (beating nets). Samples were taken by net immediately after collecting the UV samples (within 30 minutes to 1 hour after true light). One-hundred sweeps per plant community were made. UV light traps were placed within 100m of the area(s) collected by sweep net. The traps were set up and collected during the 30 minutes prior to true dark and 30 minutes prior to true light respectively. Collections were made beginning 3-2 days pretreatment.

Subsequent samples were taken at 24 and 72 hours posttreatment (PT). Further samples were taken in June, July and October 1991 following the first Amdro application. Additional samples were collected in March 1992, 5 months following the second application of Amdro (October 1991), and again in May, June, July and October 1992 following the third bait application (March 1992). Final samples were collected in June and August 1993 after resurgence of RIFA population. Three paired sites (Bill Welder Ranch, Pat Welder Ranch and McFaddin Ranch) were sampled. Three major groups were selected as non-target species groups or complexes. The carabidae were selected because they are surface dwelling predators and as such are in direct competition with RIFA. The scarabaeidae were selected because they represent a food source for RIFA. The acrididae and tettigoniidae represent a group that could be affected by the treatment regimen.

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

RESULTS:

No significant difference in mean biomass of arthropods collected pretreatment by UV light trap was observed (Figure 12). However, by 6 weeks PT (June 1991), the treated mean biomass had increased ca. 2.5 fold over the untreated mean. The July 1991 mean sample of the treated plots (12 weeks PT), while still indicating significant differences in biomass, had dropped to a level ca. 50% greater than the untreated mean. Although an increase to greater than 100% was shown at 24 weeks PT, numbers of arthropods collected were insufficient to validate the difference in biomass. Following the 2nd treatment in October 1991, samples were collected in March 1992. Although biomass was still greater in the treated plots, there was insufficient biomass to quantify. Following a 3rd bait application (March 1992) biomass increased rapidly. In the May 1992 collection, the samples from the treated sites showed a level ca. 30% greater than the untreated sites. By June 1992, the difference was >100%. This trend continued through July 1992, but dropped to ca. 60% by October 1992. By June 1993 (15 month PT), comparison of biomass levels showed no significant differences between treated and untreated at all sites. Overall mean biomass collected tended to follow the population index of RIFA (Figure 13).

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

Among the 3 groups selected, there were no significant differences between either the carabidae or the orthopterans when comparing treated versus untreated plots (Table 56). However, carabids and orthopterans were found to be somewhat more numerous in the untreated versus the treated sites.

Conversely, the scarabs showed both a significantly larger number of genera and species (Table 57) and a significantly greater population density in the treated plots when compared to the untreated sites.

Figure 12. Comparative Population Fluctuations of Arthropods Captured by UV Light Traps in Amdro-Treated and Untreated Sites

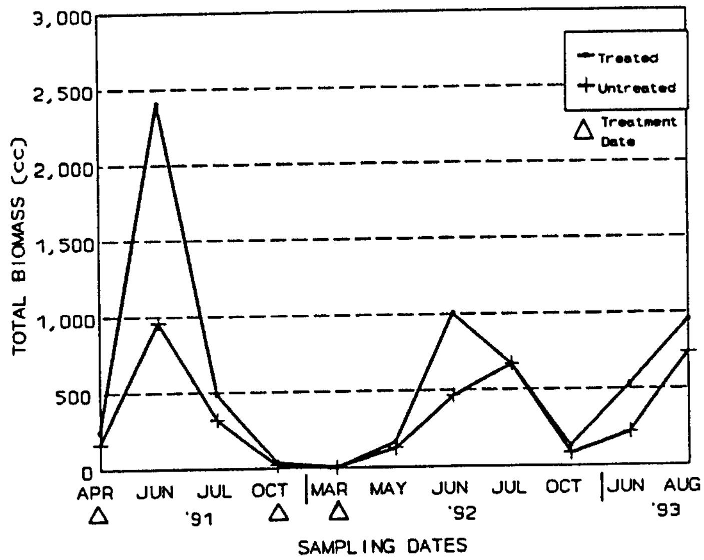


Figure 13. Comparative Population Fluctuations of Red Imported Fire Ants in Amdro-Treated and Untreated Sites

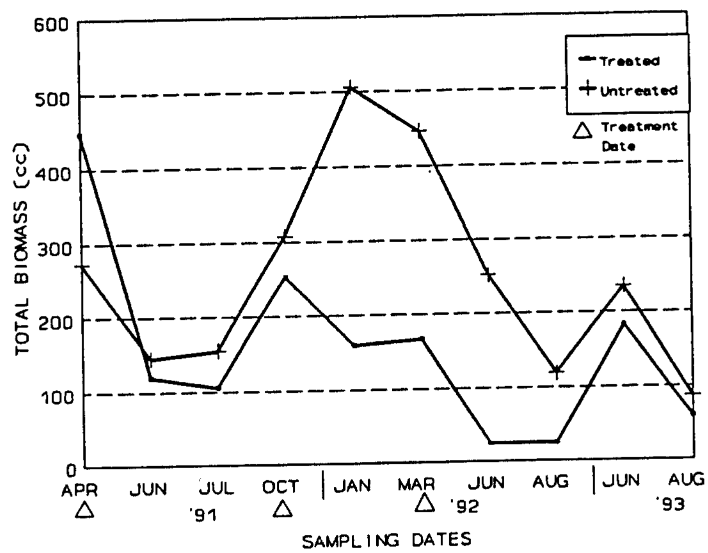


Table 56. Relative Species Diversity of Three Arthropod Groups in Plots Treated (Amdro) and Untreated Plots.

Group	Treatment	Number Collected	
		Genera	Species
Scarabaeidae	treated	15a	30a
	untreated	9b	19b
Carabidae	treated	25a	39a
	untreated	25a	42a
Orthoptera	treated	19a	23a
	untreated	17a	19a

Table 57. Relative Numbers of Arthropods from Three Selected Groups Collected from Sites Treated and Untreated with Amdro.

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

PROJECT NO: FA05G013

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

TYPE REPORT: Interim

LEADERS/PARTICIPANTS: Homer Collins[3], David F. Williams[4], David Oi[2], Tim Lockley[1], Randy Cuevas[1], R. G. Milam[5] and others

INTRODUCTION:

Red imported fire ants (RIFA), Solenopsis invicta; currently infest over 260,000,000 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.

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

Various ecological studies of this isolated population were initiated in 1993 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 will be conducted. Winter kill, seasonal life cycle, survivability of incipient colonies/newly mated queens under sub-optimal temperatures, and impact of RIFA on local myrmecofauna will be determined.

WINTER KILL: Winter kill (survival) of colonies in the Calhoun, TN infestation will be 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 will be re-evaluated ln late March or early April 1994. Maximum and minimum temperatures, humidity, rainfall, and soil temperatures (if possible) will be collected at both sites. Mean percent colony survival at each site will be compared with a *t*-test.

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 will be utilized to compare life cycle of RIFA in Calhoun, TN with Gulfport, MS. Briefly, those procedures will consist 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 will then be preserved in 2 liter glass containers filled with isopropyl alcohol. The preserved colonies will be thoroughly mixed using a magnetic stirrer, and while the solution is mixing, a 5 ml subsample will be remove by dipping a ¼ tsp spoon into the mixture 3-6 time. Each "spoonful" will be dumped into a calibrated beaker with a screen bottom. This will allow the alcohol to drain off and to accurately obtain a 5 ml ant subsample. The 5 ml subsample will then be placed on filter paper and the excess alcohol drawn off through a Buchner funnel. Finally, each subsample will be dried under a hood for 1 hr prior evaluation. Each life stage present will then be enumerated. From this data, the percentage of all life stages present at any given time will be determined.

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

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

<u>Bait transect</u>: Bait transects 250 meters in length (n=4), baited with both molasses and canned sausages will be placed in each area. Transects will be placed in similar habitats at both sites i.e. open fields, pine forests, etc. Each 250 meter transect will be comprised of 10 bait stations, with both types of bait placed in contact with the soil surface at each station. Baits will be placed in soft drink bottling caps (or other suitable receptacles) approximately 1 meter apart, and will be left in place for 1-2 hrs prior to

collecting all ants assembled on the baits. During collection each cap will be quickly retrieved with forceps and immediately placed into a collecting jar containing isopropyl alcohol. Transects will be operated monthly if weather conditions permit (minimum soil temperature of 50°F). Collections will be returned to the laboratory 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 will also be 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 25 pitfall traps located along a 500-1000 meter "trap line" will be located at each site. Each trap line will traverse similar habitats and efforts will be made to include as much habitat diversity as possible. "Permanent" type pitfalls will be utilized. During monthly collections they will be filled with a 1:1 mixture of ethylene glycol:isopropyl alcohol which will act as a killing agent/preservative. A few drops of liquid soap will be added to break the surface tension. The ants that are collected will be transferred to vials containing 70% isopropyl alcohol until identifications can be determined.

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

RESULTS:

A site visit was made Oct. 25-28, 1993 by all involved parties. Test plots for the winter kill study were established and initial population assessments made (the control site in MS was established and assessed Nov. 3, 1993). TN Dept. of Agric. personnel were instructed in techniques for collection of RIFA colonies and bait transect and pitfall traps.

PROJECT NO.: FA05G023

PROJECT TITLE: Comparative seed harvesting by the red imported fire ant, *Solenopsis invicta.*

TYPE REPORT: Interim

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. Within the past 15 years, Brown et al. (1979) showed that the abundance of the winter annual, *Filago californica*, was reduced by seed-harvesting ants and, in the presence of ants, plant diversity increases (Inouye et al. 1980). O'Dowd and Hay (1980) demonstrated that ant dispersal of *Datura discolor* seeds in deserts lowers post-dispersal seed predation by rodents. In mesic West Virginia forests, Heithaus (1981) has shown for several plant species that dispersal by ants lowers both pre- and post-dispersal seed predation by rodents. The importance of ants as seed dispersal agents in Australia has been documented by Berg (1975). The role of seed-eating ants on crop-weed interactions has considerable potential for several reasons:

1. Many weed seeds are small and therefore easily transported by ants;
2. The process of cultivation creates conditions suited for colonization by weed seeds from soil bank and from dispersal;
3. The clearing of fallow vegetation in preparation for planting eliminates or reduces some alternative foods. Thus, this reduction may force increased seed harvesting;
4. Agricultural weeds have a high percentage of species producing seeds with little or no chemical defenses. The impact of seed-eating ants could strongly affect the plant community by modifying it in favor of chemically protected species. This would, in general, favor dicots over grasses and influence density-dependent competitive interactions between dicots and annual grasses. This has considerable agricultural

significance since four of the ten most serious weeds (world-wide) are annual grasses (Holm et al. 1977).

Comparatively little is known about the ant-dispersed [myrmecochorous] plant species in the southeastern United States. Scattered reports indicate that myrmecochory may be common with some weed species and in some areas of the U.S. (Berg 1972, Nesom 1981). 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 1981), soybeans (Adams et al. 1983), eggplant (Adams 1983), okra (Smittle et al. 1983), cabbage, citrus, peanuts potatoes, sweet potatoes and watermelon (Lofgren 1986).

MATERIALS AND METHODS:

Seeds of selected plant species were placed on moistened filter paper in a grid pattern (5 x 5) in a 100mm petri dish (one species per dish). A control, consisting of ca. 2.0 g of Amdro fire ant bait was placed on unmoistened 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 of three separate trials on separate dates. At 24 h., dishes were returned to the IFA lab where the remaining seeds were sorted and examined under magnification for signs of feeding damage. Presence or absence of Amdro bait was used as an indicator of IFA presence in the dish.

RESULTS AND DISCUSSION:

Fifty-seven species in 48 genera belonging to 23 families of flower seeds were evaluated as potential food sources for the red imported fire ant. Among those plants grown commercially as food (Table 58), members of the Poaceae and oil seeds were significantly selected over all other seeds. Comparisons of commercially grown flowering plants (Table 59) showed Periwinkle, Forget-me-not, Cardinal Flower, California Poppy, Columbine and Foxglove to be highly selected over all other tested seeds. Some selectivity was noted for Lupin and Verbena. Among the common weeds of the southeastern United States, members of the Amaranthaceae, Asteraceae, Poaceae, and the Polygonaceae were significantly fed upon by RIFA (Table 60). Among the weedy grasses, Dallisgrass, Bermuda Grass and Johnson Grass were completely removed from the dishes. Broadleaf Signalgrass and Barnyard Grass showed indications of RIFA activity though not as great as in other grasses. When compared with closely-related commercial species, consistent selection was noted in all but the *Solanum* species in which Eastern Night Shade seeds were completely removed while seeds of the Irish Potatoe remained untouched. Earlier trials with various solanaceae (Bell Pepper, Bird Pepper, Tomatoe and Eggplant) had indicated a decidedly negative response by RIFA to seeds from this family. In all trials, Amdro bait was completely removed; indicating active foraging by RIFA workers.

Further evaluations of selected plants will continue with concentration being made on seedlings of previously tested plants and on seeds and seedlings of endangered and threatened native wildflowers from the RIFA infested areas of the U.S.

Table 58. Feeding Response of RIFA to Selected Cultivated Fruit, Grain and Vegetable Seeds.

SEED	COMMON NAME	PERCENT OF SEEDS REMOVED OR DESTROYED BY RIFA		
		TRIAL 1	TRIAL 2	TRIAL 3
Poaceae				
Triticum aestivum	Wheat	100.0a	100.0a	100.0a
Zea mays	Corn	100.0a	100.0a	100.0a
Amaryllidaceae				
Allium cepa	Onion	0.0b	0.0b	0.0b
Asteraceae				
Helianthus annus	Common Sunflower	100.0a	100.0a	100.0a
Brassicaceae				
Brassica juncea	India Mustard	2.0b	0.0b	3.0b
B. oleraceae var. *acephala*	Cabbage	0.0b	0.0b	0.0b
B. oleraceae var. *capitata*	Collards	0.0b	0.0b	0.0b
Cucurbitaceae				
Cucumis sativus	Gooseneck Squash	0.0b	0.0b	0.0b
Cucurbita moschata	Cucumber	0.0b	0.0b	0.0b
Fabaceae				
Glycine max	Soybean	100.0a	100.0a	100.0a
Phaseolus linensis	Lima Bean	0.0b	0.0b	0.0b
Ricinus communis	Castor Bean	0.0b	0.0b	0.0b
Vigna sinensis	Cowpea	0.0b	0.0b	0.0b
Solanaceae				
Capsicum frutescens var. *grossum*	Bell Pepper	0.0b	0.0b	0.0b
C. microcarpum	Bird Pepper	0.0b	0.0b	0.0b
Lycopersicon esculentum	Tomato	0.0b	0.0b	0.0b
Solanum melogena var. *esculentum*	Eggplant	0.0b	0.0b	0.0b

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

Table 59. Feeding Response of RIFA to Selected Commercial Flower Seeds.

SEED	COMMON NAME	PERCENT OF SEEDS REMOVED OR DESTROYED BY RIFA		
		TRIAL 1	TRIAL 2	TRIAL 3
Apocyanaceae				
Vinca minor	Periwinkle	100.0a	100.0a	100.0a
Asteraceae				
Calendula officinalis	Marigold	0.0b	0.0b	0.0b
Coreopsis grandiflora	Tickseed	0.0b	0.0b	0.0b
Gaillardia pulchella	Blanketflower	0.0b	0.0b	0.0b
Balsaminaceae				
Impatiens niamniamensis	Impatiens	0.0b	0.0b	0.0b
Boraginaceae				
Mysotis alpestris	Forget-me-not	99.0a	100.0a	100.0a
Brassicaceae				
Brassica fimbriata	Flowering Kale	0.0b	0.0b	0.0b
Campanulaceae				
Lobelia cardinalis	Cardinal Flower	100.0a	100.0a	100.0a
Cruciferae				
Lobularia maritima	Alyssum	0.0b	0.0b	0.0b
Fabaceae				
Lupinus sp.	Lupin	28.0c	32.0c	29.0c
Onagraceae				
Oenothera speciosa	Evening Primrose	0.0b	0.0b	0.0b
Papveraceae				
Eschscholzia californica	California Poppy	91.0a	100.0a	100.0a
Ranunculaceae				
Aquilegia vulgaris	Columbine	100.0a	100.0a	100.0a
Scrophulariaceae				
Digitalis grandiflora	Foxglove	100.0a	100.0a	100.0a
Verbenaceae				
Verbena x hybrida	Verbena	31.0c	26.0c	37.0c
Violaceae				
Viola x wittrockiana	Pansy	0.0b	0.0b	0.0b

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

Table 60. Comparative Response of RIFA to Seeds of Important Economic Weed and Their Commercially Grown Congenera.

SEED	COMMON NAME	PERCENT OF SEEDS REMOVED OR DESTROYED BY RIFA		
		TRIAL 1	TRIAL 2	TRIAL 3
Poaceae				
Brachiaria platyphylla	Broadleaf Signalgrass	64.0c	64.0c	59.6c
Echinochloa crusgalli	Barnyardgrass	32.0d	33.2d	30.0c
Cynodon dactylon	Bermuda Grass	99.2a	100.0a	99.2a
Paspalum dilatatum	Dallisgrass	100.0a	100.0a	100.0a
Sorghum halpense	Johnson Grass	100.0a	100.0a	100.0a
S. vulgare	Grain Sorghum	100.0a	100.0a	100.0a
Amaranthaceae				
Amaranthus retroflexus	Red Root Pigweed	99.2a	100.0a	99.2a
A. tricolor	Joseph's Coat	100.0a	100.0a	99.2a
Asteraceae				
Carduus arvensis	Canada Thistle	100.0a	100.0a	100.0a
Silybum marianum	St. Mary's Thistle	100.0a	100.0a	100.0a
Brassicaceae				
Brassica kaber var. *pinnativida*	Wild Mustard	1.2e	0.0e	0.0d
B. rapa	Turnip	0.0e	0.0e	0.0d
Chenopodiaceae				
Chenopodium album	Common Lambsquarters	5.2e	4.0e	2.0d
Beta vulgaris	Sugar Beet	0.0e	0.0e	0.0d
Convolvulaceae				
Ipomoea hederaceae var. *integrioscula*	Ivyleaf Morning Glory	10.0e	8.0e	0.0d
I. alba	Moon Flower	4.0e	0.0e	0.0d
Fabaceae				
Cassia tora	Sicklepod	1.2e	1.2e	0.0d
C. didymobotyra	Candalabra Plant	0.0e	0.0e	0.0d
Crotalaria spectabilis	Showy Crotalaria	0.0e	1.2e	0.0d
C. agatifolia	Canary-bird Bush	0.0e	0.0e	0.0d
Sesbania exaltata	Hemp Sesbania	0.0e	1.2e	0.0d
Malvaceae				
Abutilon theophrastii	Velvetleaf	0.0e	0.0e	0.0d
A. vitifolium	Album	0.0e	0.0e	0.0d
Sida spinosa	Prickly Sida	78.0b	83.2b	92.0a
S. malvaeflora	Checkerbloom	60.0b	79.2b	82.0b
Polygonaceae				
Polygonum aviculare	Pale Smartweed	100.0a	100.0a	100.0a
P. lapathifolium	Knotweed 'D. Lowndes'	100.0a	100.0a	100.0a
Rumex crispus	Curly Dock	100.0a	100.0a	100.0a
R. acetosa	Garden Sorrel	100.0a	100.0a	100.0a
Solanaceae				
Datura stramonium	Jimsonweed	0.0e	0.0e	0.0d
D. x *candida*	Angel's Trumpet	0.0e	0.0e	0.0d
Solanum ptycanthum	East. Black Nightshade	100.0a	100.0a	100.0a
S. tuberosum	Irish Potato	0.0e	0.0e	0.0d

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

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APPENDIX I

A. PUBLICATIONS:

Bryson, C.T. & T.C. Lockley. 1993. *Sacciolepis indica* (Poaceae) new to Mississippi. SIDA. 15: 555-556.

Collins, H.L. & A.M. Callcott. 1993. RIFA quarantine treatments in grass sod. Insecticide and Acaracide Tests. 18: 333.

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B. PRESENTATIONS:

Callcott, A.M. 6/93. "Past Accomplishments of the USDA, APHIS, PPQ, Imported Fire Ant Station, Gulfport, MS (1992-1993)". Imported Fire Ant Technical Work Group Meeting. Charleston, SC.

Callcott, A.M. 6/93. "Tefluthrin: A Promising New Imported Fire Ant Quarantine Insecticide for Containerized Nursery Stock". 1993 Imported Fire Ant Research Conference. Charleston, SC.

Callcott, A.M. 10/93. "Imported Fire Ant Certification Treatments and Application Equipment". LA Association of Nurserymen, Nursery Educational Seminar. Hammond, LA.

Collins, H.L. 1/93. "Status of Imported Fire Ant Quarantine". USDA, APHIS, PPQ, ARD/OIC Conference. Biloxi, MS.

Collins, H.L. 3/93. "Quarantine Program for *Solenopsis invicta*". Entomological Society of America, Southeastern Branch Meeting. Little Rock, AR.

Collins, H.L. 4/93. "Imported Fire Ant Control Update". Southern Plant Board Meeting. Gainesville, FL.

Collins, H.L. 4/93. "Historical Background of Imported Fire Ants - Entry into US/Tennessee". Public Meeting of Imported Fire Ant Status in Tennessee. Jackson, TN.

Collins, H.L. 6/93. "1992 Bait Trials". Imported Fire Ant Research Conference. Charleston, SC.

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Collins, H.L. 8/93. "Imported Fire Ant Quarantine Update". American Association of Nurserymen TAN-MISSLARK Convention and Trade Show. Dallas, TX.

Collins, H.L. 8/93. "Imported Fire Ant Control". Jackson County Fire Ant Control Program Meeting. Pascagoula, MS.

Collins, H.L. 8/93. "State of the Art Imported Fire Ant Control Technology". Public Meeting Called by Shelby County Tennessee Cooperative Extension Service. Memphis, TN.

Collins, H.L. 10/93. Testimony before the Mississippi Senate Agriculture Committee. Jackson, MS.

Lockley, T.C. 2/93. "Effects of Reduction of Red Imported Fire Ant Populations on the Diversity of the Arthropod Community". Mississippi Academy of Sciences Annual Meeting. Jackson, MS.

Lockley, T.C. 6/93. "The Effects of Red Imported Fire Ants on a Nesting Population of Least Terns: An Endangered Species". Imported Fire Ant Research Conference. Charleston, SC.

Lockley, T.C. 7/93. "Current Status of IFA Research". South Mississippi Cattlemen's Association. Poplarville, MS.

Lockley, T.C. 10/93. "Current Status of IFA Research". Mississippi Agricultural and Forestry Experiment Station Horticultural Field Day. Poplarville, MS.

Lockley, T.C. 10/93. "Current Status of IFA Research". Alabama Horticultural Research Station Field Day. Mobile, AL.

Lockley, T.C. 11/93. "Current Status of IFA Research". Armed Forces Pest Management Board. Rockville, MD.

Lockley, T.C. 12/93. "Food Preference of Imported Fire Ants Among Common Weed Seeds Versus Commercial Baits". Entomological Society of America Annual Meeting. Indianapolis, IN.

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

McAnally, L. 6/93. "Relative Phytotoxicity of Tefluthrin (Force 1.5G) to Selected Ornamentals". Imported Fire Ant Research Conference. Charleston, SC.

C. REQUESTED SITE VISITS

H.L. Collins made several trips this year at the request of various agencies to observe local imported fire ant infestations and explain available control treatments and technologies.

4/93 Tennessee - Requested by State through PPQ

5/93 Phoenix, AR - Requested by State through PPQ

9/93 Envira, Brazil - Humanitarian Aid Requested by the Mayor of Envira through the U.S. Embassy to OICD. (See Appendix III.)

D. REQUESTED TRAINING

3/93 At the request of Ciba-Geigy Corporation, the Imported Fire Ant Station conducted a training session for Ciba personnel and cooperators. This included a half-day classroom session followed by a half-day field session.

APPENDIX II - LABORATORY BIOASSAY PROCEDURE

PROTOCOL FOR BIOASSAY OF INSECTICIDE TREATED POTTIN_'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

Agricultural Research Service
Research Management Information System
Foreign Travel Information System
Trip Report

1. David F. Williams, Research Entomologist, Danel G. Haile, Agricultural Engineer, Medical & Veterinary Entomology Research Laboratory, P.O. Box 14565, Gainesville, Florida, and Homer C. Collins, Entomologist - USDA/APHIS, Imported Fire Ant Station, Gulfport, Mississippi.

2. Envira, Brazil September 6 - September 21, 1993.

3. The purpose of the trip was: 1) to provide humanitarian and technical assistance to Brazilian government officials concerning the fire ant problem in the town of Envira, Brazil located in the Amazon forest, **2)** to demonstrate methods for control of fire ants to the local officials and people in the town using bait technology (Logic), 3) to conduct research on the fire ant populations in this **area,** and 4) to consult with scientists from the Brazilian government research agencies EMBRAPA and EMATER about this fire ant problem.

4. Summary. The three U.S. government scientists arrived in Manaus, Brazil and were flown along with 2,000 lbs of Logic fire ant bait and 4 boxes containing equipment and supplies to Envira, Brazil in a Brazilian Air Force cargo plane. Upon arrival, we had a meeting with Brazilian government officials and scientists to coordinate the control plan. All the equipment was calibrated for the application of Logic. Some modifications had to be made to the tractor mounted spreader. The bait was applied by broadcast method to all accessible areas using a spreader mounted on a farm tractor and to inaccessible areas using hand-operated rotary spreaders. Throughout the process we demonstrated to the local city employees how to apply the bait by hand to treat individual fire ant mounds. In addition, a town meeting was held in which we described safety precautions to use when applying the bait, safety of the bait to people and animals, the action of the bait, the length of time to obtain control of the ants, the amount of control they can expect, and length of time it would take before the ants returned. The total amount of bait applied was approximately 500 lbs leaving 1,500 lbs to be used for a treatment in February, 1994 during the wet season. Another treatment should be applied during the summer 1994. The fire ant in Envira has been tentatively identified as <u>Solenopsis saevissima</u>; however, samples have been submitted to Drs. James Trager (USA), Dan Wojcik (USA), and Roberto Brandao (Brazil) for confirmation. Some possible factors that may have contributed to the fire ant problem in Envira include:

(a) Rapid growth and expansion of the town; the population was only 1,000 in 1980 versus 9,000-10,000 people in 1993. This resulted in an expansion of the city, construction of streets and homes, etc., all of which altered the native environment.

(b) Annual flooding of all low lying areas concentrates the fire ant population in areas frequented by people such as their homes, stores, schools, churches, cemetery, etc.

(c) The use of DDT on fire ant nests in conjunction with a malaria campaign was suspended about 3 years ago. The DDT may have been suppressing the fire ant population while in use.

(d) Garbage was not discarded in a sanitary manner until recently, but instead is dumped in back yards and other areas nearby creating a vast and easily accessible food supply for ants.

Although there are many problems in Envira (economic, black flies, mosquitoes, open sewers, etc.), the people here view the fire ant problem as a very significant one.

Finally, press coverage of the project was extensive. In the state of Amazonas, local TV stations from Manaus carried the story while REDE GLOBOL (equivalent to CNN), broadcast the story all over Brazil. In the U.S., newspaper articles appeared in the Washington Post, Houston Chronicle, and several other newspapers. In addition, National Public Radio (NPR) interviewed Dr. Williams and broadcast the story on its "Weekend Edition".

5. Travel Details. We left Gainesville, Florida on **Monday, September 6, 1993** and arrived in Manaus, Brazil on **Tuesday, September 7, 1993**. We met with the mayor of Envira, Luis Castro and discussed the logistics of the operation. Envira. On **Wednesday, September 8, 1993,** we met again with the mayor of Envira and went to the airport cargo area to locate the bait and equipment that was shipped from the U.S. We also obtained the necessary papers for clearance of Brazilian Customs. In the afternoon, we met with the Mayor and Federal Deputado Paudemey Avelino at the Deputado's office in Manaus. We discussed the problems that may be encountered in controlling fire ants in Envira, the logistics of transporting the bait and equipment to Envira, and numerous other questions about the bait, its safety, its effectiveness and longevity. We emphasized that the use of this bait would only be a temporary measure of relief and that the fire ants would eventually return within 9 months to a year after the bait application. Later in the afternoon, we were interviewed by 2 TV crews and 3 print journalists about the trip to Envira. On **Thursday, September 9, 1993,** we contacted Carl Hampton, Asst. Agric. Counselor at the U.S. Embassy in Brasilia and reviewed our plans. On **Friday, September 10, 1993,** we departed Manaus, Brazil for the town of Envira on a military transport plane. We were joined on the flight by the Deputado Paudemey Avelino, Mayor Luis Castro and his family, plus two television station teams, and 4 reporters. We landed in Envira at approximately 3:00pm and were surrounded by approximately 8,000 people (most of the residents of Envira were present). Later in the afternoon, we demonstrated bait application procedures for the press. The next morning, **Saturday, September 12, 1993,** we held a meeting with the mayor and his staff and two Brazilian scientists, one from EMBRAPA and one from EMATER, to coordinate the control plan. We then took a tour of the town and used a map of the city to mark the areas that should receive the first treatments. We saw several large

fire ant mounds each containing over 500,000 worker ants. We began equipment calibration and also had to make a modification of the spreader used on the tractor. We began applying the bait by broadcast using the tractor mounted spreader but were still not satisfied with the calibrations. We also observed that fire ant workers were readily foraging on the ground and were quickly picking up the bait particles and returning them to their colonies. On **Sunday, September 12, 1993,** we spent most of the day touring the town making observations on the location of fire ant nests, talking to residents about the problem, and collecting ant specimens from several locations. On **Monday, September 13, 1993,** we again met in the Mayor's office with his staff and the two Brazilian scientists and decided on 4 things to accomplish, (1) refine the calibration and then apply the bait along the streets in the town, (2) after completion of these treatments, use the tractor to treat some of the larger open areas, for example, several large areas around the church, schools, power plant, etc., (3) plan a town meeting with people in charge of each street or zone (street captains and district leaders) to explain to them that they needed to locate individual mounds of fire ants. Then, each resident would be supplied with the correct amount of bait to treat any individual mound that he or she had located near their homes, and (4) conduct a survey of the entire town for ant species that are present in Envira. This last information is important for us to determine if there are any other ant species present that might be able to compete with the fire ants. After the meeting, we continued calibration and modification of the equipment. On Monday night, a town meeting was held in which we described safety precautions to use when applying the bait, safety of the bait to people and animals, the action of the bait, the length of time to obtain control of the ants, the amount of control they can expect, and length of time before the ants return again. During the next two days **Tuesday, September 14, 1993 and Wednesday, September 15, 1993,** we completed the application of all the areas that could be treated using a tractor. On **Thursday, September 16, 1993,** we began treating those areas inaccessible by tractor by using 9 hand-operated rotary spreaders with individuals walking in a straight line with a 10ft distance between each person. We found 20-25 extremely large fire ant mounds located in the dry river bed that runs through the center of the town. These were some of the largest mounds ever seen by us and each mound easily contained over 1 million workers. We also demonstrated again to the local city employees how to apply the bait by hand to treat individual fire ant mounds. On this day, we also began collecting data on populations of fire ants in the town, conducted a survey on the ant species in the town by collecting ants at 36 sites throughout Envira, and tried to determine if the fire ant colonies in Envira had multiple queens. We noticed that at almost every survey site, the only ants that were collected were fire ants. On **Friday, September 17, 1993,** all of the bait treatments were completed in addition to the ant surveys of the town. The total amount of bait applied was approximately 500 lbs leaving 1,500 lbs to be used for a treatment in February, 1994 during the wet season, and another treatment during the summer 1994. We began preparing for our departure by securing and packing all of the ant collections to be returned to the U.S. for taxonomic identification. On **Saturday, September 18, 1993,** we departed Envira at 7:30am by chartered plane arriving in Eirunepe for our flight to Manaus. We arrived in Manaus at 8:30pm. We departed Manaus, Brazil at 1:00am, **Tuesday September 21, 1993** and arrived back in Gainesville, Florida around 12:30pm.

APPENDIX IV - PROTOCOL FOR DETERMINING DRY WEIGHT BULK DENSITY OF POTTING MEDIA

Introduction: Current quarantine treatments involving the incorporation of granular materials in potting media are measured on a weight to volume basis i.e. 1 pound/yd^3. Because potting media vary greatly in bulk density, this results in a wide range in actual amount of material when measured in parts per million. A recommendation has been made to apply incorporated insecticides on a weight-to-weight basis i.e., 1 pound/ X pounds potting media. In order for this recommendation to be utilized, a standardized method of determining bulk density was needed. The procedure utilized by the USDA, APHIS Imported Fire Ant Laboratory in Gulfport, Mississippi, is described herein.

Collection of soil: A minimum of three liters of media to be used should be collected and placed in a convection oven at 250°F for a minimum of 4 hours to insure thorough drying.

Bulk Density Determination: Once the media has been dried, 3 one-liter increments are measured out and weighed in grams. Measuring containers should be filled loosely (Do Not Pack). The weights of these three increments are then averaged. This value is then converted from grams/liter to pounds/cubic yard by multiplying grams/liter by 1.69 to obtain pounds/cubic yard i.e. 600gms/liter X 1.69 = 1014 lbs/yd^3.

Amendment:

(October 1991) The bulk density of 5 replicate samples is determined as indicated above and the mean of the 5 replicates calculated.

Revised: October 1991