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Imported Fire Ant Station

Whiteville Plant Methods Center

Science and Technology

Animal and Plant Health Inspection Service

U.S. Department of Agriculture

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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:
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January 1992

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FY 1991 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.

SECTION I

DEVELOPMENT OF QUARANTINE TREATMENTS FOR NURSERY POTTING MEDIA

PROJECT NO: FA02G037

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

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

MATERIALS AND METHODS:

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

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

RESULTS:

As indicated in Table 1, three candidates have demonstrated excellent residual activity; Ammo® 0.75G lasted 16 months, while Capture 0.3G and Force® 1.5G have each maintained excellent control for 36 months. Evaluations will continue until such time as residual efficacy falls below 100% for 2 consecutive periods.

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

CANDIDATE	Percent Mortality to Alate IFA Queens at Indicated Months Post-Incorporation 1/																				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(10)	(12)	(14)	(16)	(18)	(20)	(22)	(24)	(26)	(28)	(30)	(32)	(34)	(36)
Capture 0.3G	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	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Ammo 0.75G	100	100	100	100	100	100	100	100	100	100	100	100	35	100	100	100	100	100	100	100	80	100
Pounce 1.5G	100	100	100	100	95	45	35	0														
Dursban 2.5G	100	100	100	100	45	75	35	0														
Turcam 2.5G	100	100	15	20	0																	
Advantage 5G	45	100	20	40	0																	
Furadan 5G	25	35	0																			
Oftanol 5G	0	25	0																			
Check	5	10	5	5	10	5	5	5	5	5	0	5	0	5	5	5	0	0	0	0	0	0

1/ Test initiated December 14, 1988.

PROJECT NO: FA01G020

PROJECT TITLE: Evaluation of Candidate Potting Soil Toxicants, 1990.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Tim Lockley and Avel Ladner

INTRODUCTION:

Chlordane applied at a rate of 4 ounces of 5% dust per cubic yard of potting soil was used as a quarantine treatment for containerized nursery stock until cancellation of registration in December 1979. 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 most effective treatment thus far is chlorpyrifos (Collins et al. 1980). In January 1980, Dow Chemical Company obtained registration of a 5% chlorpyrifos granule which was marketed under the trade name FA-5. This product was applied at a rate of 0.5 lbs. FA-5 per cubic yard of potting media. Several cases of possible FA-5 related phytotoxicity to greenhouse grown succulent plants in Central Florida prompted the registrant to withdraw this product from the market in the fall of 1981. Registration of a second chlorpyrifos formulation (a 2.5% granule) for treatment of potting soil was obtained in July 1984 by Ford's Chemical and Service, Inc., Pasadena, Texas. At the current time this is the only registered product for this use pattern.

A limited number of candidate potting soil toxicants were evaluated in 1990 in an effort to expand the number of options available to growers who ship containerized plants outside the IFA regulated area. As in previous years, our efforts were impeded by the small number of suitable candidates.

METHODS AND MATERIALS:

Test procedures used to evaluate all candidate toxicants were as follows: granular or dust formulations of each product tested were blended into nursery potting soil, (Strong-Lite®, 382 pounds per cubic yard). A portable cement mixer (2 cu. ft. capacity) was used to blend the toxicants into the potting media, and was operated for one hour per batch to insure thorough blending. Treated media was then poured into one-gallon capacity plastic pots and weathered outdoors under natural conditions for one month prior to the first bioassay. Additional irrigation water was not added. 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 absorbed moisture from an underlying bed of damp peat moss. There were four replicates per treatment in each bioassay. Each pot (replicate) contained 20 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 to measure and compare residual activity with chlorpyrifos.

RESULTS:

Results are shown in Table 2, and indicate that no candidate provided sufficient residual activity to warrant additional trials.

Table 2. Residual Activity of Candidate Insecticides Incorporated Into Potting Media, 1990.[1/]

Candidate Formulation	Initial Concentration (PPM)	% Mortality at Indicated Months Post-Treatment (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Tempo .1% dust	12.5	30	35	10	80	20	50	25	--					
	25	80	70	35	95	55	80	60	--					
	50	85	75	20	90	35	85	100	100	100	40	80	35	20
	150	95	100	85	100	95	90	100	100	100	90	100	40	60
Suscon 10% chlorpyrifos - 0.6[2/]	200	100	100	100	100	100	75	100	0	5				
- 1.5[2/]	200	100	100	100	100	100	80	100	0	5				
- 2.0[2/]	200	100	100	100	40	0	20	10	--					
Suscon 10% carbosulfan - 1.0mm[2/]	200	5	10	10	10	0	5	--						
- 1.5mm[2/]	200	10	30	45	15	5	5	--						
Tralomenthrin - 0.025G	12.8	15	60	--	--	--	--							
0.05G	25.6	40	85	--	--	--	--							
Permethrin - 0.5G	25.0	0	5	--	--	--	--							
	100	15	10	--	--	--	--							
Diazinon - 5G	100	5	5	--	--	--	--							
Tempo - 2.5G	12.5	35	10	--	--	--	--							
	25.0	65	35	--	--	--	--							
	50.0	95	25	--	--	--	--							

1/ trial initiated 6/25/90.
2/ size of granule in millimeters (mm)

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@ 1.5G) has shown good potential in previous trials and was retested in this trial. Cypermethrin was previously tested as a 0.75G, but the Demon@ 50WP formulation was included in this trial because it had not been tested.

METHODS AND MATERIALS:

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

lamdacyhalothrin (Commodore® 10WP) at 100, 50, and 10 ppm
cypermethrin (Demon® 50WP) at 100, 50, and 10 ppm
telfluthrin (Force® 1.5G) at 100, 50 and 10 ppm
bifenthrin (Talstar® 10WP) at 50 ppm (standard)

RESULTS:

All treatments provided 100% mortality at 1 month post-treatment (Table 3).

Table 3. Activity of Candidate Potting Media Insecticides, 1991.[1/]

Insecticide	Dose Rate (PPM)	Average % Mortality to Alate IFA Queens at Post-Treatment Interval (Months) (1)
Commodore 10WP	10	100
	50	100
	100	100
Force 1.5G	10	100
	50	100
	100	100
Demon 40WP	10	100
	50	100
	100	100
Talstar 10WP	50	100
Check		10

1/ Trial initiated 10/7/91.

PROJECT NO: FA01G030

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

A totally different concept for application of a quarantine pesticide to potting media would be the use of a spray in lieu of incorporation, immersion, or drenching. Granular or dust formulations of candidate treatments do not lend themselves to a spray-on applicator. However, certain long-residual liquid treatments would appear to be compatible with a spray-on procedure. Talstar® 10WP, a synthetic pyrethroid, already labelled for use on ornamentals by FMC Corp., has provided over 20 months activity when incorporated into potting media at various rates. Empire® 20, a micro-encapsulated chlorpyrifos formulation by Dow Chemical, has provided up to 7 months residual following a drench application at 120 ppm in one preliminary study. These two formulations were evaluated for residual activity following a spray-on application to nursery potting media at 100 ppm.

METHODS AND MATERIALS:

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

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

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

RESULTS:

Results are listed in Table 4, and indicate that Talstar 10WP remained active through 17 months post-treatment. Empire was very erratic and was dropped from the trial after the 10 month bioassay.

Table 4. Effectiveness of Talstar 10WP and Empire ME Applied as a "Spray-On" Treatment for Potting Soil.

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

* dropped from trial due to lack of efficacy.

PROJECT NO: FA01G061

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

A totally different concept for application of a quarantine pesticide to potting media would be the use of a spray in lieu of incorporation, immersion, or drenching. Granular or dust formulations of candidate treatments do not lend themselves to a spray-on applicator. However, certain long-residual liquid treatments would appear to be compatible with a spray-on procedure. Talstar 10WP, a synthetic pyrethroid, already labelled for use on ornamentals by FMC Corp., has provided 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 17 months following treatment was obtained (see Report FA01G030). An additional study using much lower rates of application was initiated on 4/24/91.

METHODS AND MATERIALS

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

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

RESULTS:

Preliminary results are shown in Table 5 and indicate Talstar 10WP, applied at rates of 10, 25, and 50 ppm, show good residual 1 to 7 months after treatment. Evaluations will continue until cessation of activity.

Table 5. Evaluation of a "Spray-on" Procedure for Treatment of Potting Media with Talstar 10WP.

Rate of Appl. (PPM)	% Mortality of Alate Queens at Indicated Months PT 1/						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
5	100	100	60	60	100	90	60
10	100	95	100	100	100	100	100
25	100	100	100	100	100	100	100
50	100	100	100	100	100	100	100
Dursban 4E (65 PPM)	25	20	0	10	15	35	5
Check	10	20	5	10	0	10	0

1/ Standard bioassay procedure described in Appendix II.

PROJECT NO: FA01G090

PROJECT TITLE: Evaluation of Bifenthrin 0.2G and Telfluthrin 1.5G Incorporated at Varying Rates in a Standard Potting Media.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

Chlordane [5% dust] applied at a rate of 4 oz./cu. yd. of potting media was used as a quarantine treatment for containerized nursery stock until its cancellation in late 1979. An on-going program of evaluation of insecticides as pre-plant incorporated treatments for nursery potting soil has been conducted since 1974. To date, the most effective treatment is chlorpyrifos [Collins et al. 1980]. Recent re-evaluations of the efficacy of chlorpyrifos have led to new, tighter restrictions on its use as a quarantine material. Chlorpyrifos, however, remains the only chemical given a wide registration for this use pattern.

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

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 [Stronglite, 382 lbs/cu.yd.] at rates of 12.5, 25.0, 50.0, 75.0 and 100.0 ppm. A portable cement mixer, used to blend the toxicants into the media, was operated for 1 hour to insure a thorough blending. Treated media was placed into 75 standard one-gallon capacity plastic pots [per treatment] and weathered out doors under natural conditions. Supplemental irrigation was added as deemed necessary to simulate nursery practices.

Bioassays were conducted in the laboratory by confining alate IFA queens to treated media in 2″ x 2" plastic pots equipped with Labstone® bottoms.

Labstone absorbed moisture from an underlying bed of damp peatmoss. Four replicates per treatment were bioassayed. Each replicate contained 20 cc. treated soil and 5 alate queens. Mortality was assessed after 7 days continuous confinement to the treated media. Treatments were evaluated monthly for efficacy beginning one month post-treatment.

RESULTS:

Bifenthrin displayed excellent results at all rates. Telfluthrin, at rates of 50 ppm and higher was also effective through 21 months (Table 6). At rates of 12.5 and 25 ppm, telfluthrin remained actice for 15-17 months.

Table 6. Evaluation of Bifenthrin 0.2G and Tefluthrin 1.5G Against Alate IFA Queens Incorporated at 5 Rates to a Standard Potting Media.

CANDIDATE	RATE [PPM]	Percent Mortality to Alate IFA Queens 1/ at Indicated Months Post-Incorporation							
		(1)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Bifenthrin	12.5	100	100	100	100	100	80	95	100
	25.0	100	100	100	100	100	95	100	100
	50.0	100	100	100	100	100	100	100	100
	75.0	100	100	100	100	100	100	100	100
	100.0	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
	75.0	100	100	100	100	100	100	100	100
	100.0	100	100	100	100	100	100	100	100
Check		0	0	0	5	5	0	0	0

1/ Trials initiated 3/7/90.

PROJECT NO: FA01G130

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Anne-Marie Callcott

INTRODUCTION:

Talstar® 10WP (bifenthrin) has shown extremely long residual activity in various trials conducted by the IFA Station. Dose rates ranging from 100 ppm to 25 ppm have lasted for up to 12 months following incorporation of the pesticide into potting media. Most recent trials using topical applications at 100 ppm have provided 9 months residual activity against alate IFA queens. The need for more information on performance of befenthrin in various types of media and influence of application procedure on efficacy prompted the present study.

METHODS AND MATERIALS:

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

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

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

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

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

RESULTS:

Results appear in Table 7. Topical application provided slightly reduced efficacy in the IFA laboratory media at 3 and 8 months, and the Baccto media at 8 months. This is as expected since these two substrates have the highest bulk densities and therefore, the lowest initial theoretical dose rates of Talstar 10WP. By 15 months PT, all incorporated treatments, except the Baccto, were still effective. The topical applications in the two media with the lowest bulk densities were still effective 15 months post-treatment, but those with higher bulk densities (Baccto and IFA mix) produced inconsistent results after 7 months post-treatment. These results again demonstrated the absolute necessity of applying IFA treatments on a weight-to-weight basis rather than weight-to-volume, thereby obtaining a standardized dose rate.

Table 7. Residual Activity of Talstar 10WP Following Topical Application or Incorporation into Various Potting Media.

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

PROJECT NO: FA01G150

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

METHODS AND MATERIALS:

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

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

RESULTS:

At 15 months post-treatment, all irrigation treatments are providing 100% control of IFA alate queens while receiving in excess of 339 inches of rainfall and irrigation(ca. 5.1 inches of water per week) [Table 8].

Thus, excessive rainfall or irrigation has not affected the efficacy of Talstar 10WP in Strong-Lite potting media.

Table 8. Influence of Irrigation on Residual Activity of Talstar 10WP Incorporated into Strong-Lite Potting Media.

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

Irrigation Schedule (inches/wk)	% Mortality and Amount 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	+74.89	100	+88.81	100	+104.16	100	+114.76	100	+120.41	100	+135.46
2	100	+106.89	100	+123.81	100	+143.16	100	+155.76	100	+165.41	100	+185.46
4	100	+161.89	100	+186.81	100	+214.16	100 3/	+249.76	100	+257.41	100	+287.46
Check	20	+57.89	20	+66.81	0	+78.16	0	+83.76	10	+88.41	25	+100.46

Table 8. (Cont.)

Irrigation Schedule (inches/wk)	% Mortality and Amount Water at Indicated Months Post Treatment: 13 Months		14 Months		15 Months		16 Months		17 Months		18 Months	
	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)	% Mort	Cumul. H_2O (inches)
1	100	+140.21	100	+145.73	100	+152.38						
2	100	+194.21	100	+204.73	100	+215.38						
4	100	+304.21	100	+320.73	100	+339.38						
Check	10	+104.21	30	+111.23	5	+118.88						

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

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

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

PROJECT NO: FA01G140

PROJECT TITLE: "Off-Station" Talstar® Cooperator Study: Topical Application to Potting Media.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott, R. Mitchell (FMC Corp. - Jackson, MS), J. Stephenson (Mobile, AL), B. Sparks (Tifton, GA) R. Mizell (Monticello, FL)

INTRODUCTION:

Bifenthrin is a synthetic pyrethroid which has shown promise for control of IFA in nursery stock when either a 10WP (Talstar®) or 0.2G formulation is incorporated into potting media. Another method of application is an "over-the-top" or topical application directly to the surface of the media in lieu of incorporation. This study investigates the residual activity of Talstar 10WP when applied topically at various rates and aged in several geographical locations.

MATERIALS AND METHODS:

Cooperators were located in Jackson, MS; Mobile, AL; Tifton, GA and Monticello, FL. A 100 g. sample of soil to be used at each location was sent to A&L Agricultural Laboratories of Memphis (411 N. Third St., Memphis TN 38105-2723) for bulk density determination. Bulk densities were as follows:

Location	Dry Weight Bulk Density (lbs./cu. ft.)	% Moisture
Jackson, MS	14.1	55.6
Mobile, AL	15.8	55.2
Tifton, GA	44.4	19.2
Monticello, FL	44.4	19.2

One-gallon pots were filled at each location and treated topically by each respective cooperator with Talstar 10WP. Rates used were 5, 10, 25, 50, and 75 ppm (based on bulk density). Pots were irrigated immediately after application with 1.5 inches of water, then maintained under normal environmental conditions, receiving a minimum of 2 inches of water per week through rainfall or irrigation.

At monthly intervals, two pots from each treatment group were composited and sent to the IFA Station (Gulfport, MS), where each treatment was subjected to standard laboratory bioassay using IFA alate queens (Appendix II). At the Jackson, Mississippi study site, bioassays were conducted by Dr. R. Mitchell.

<u>RESULTS</u>:

Results appear in Table 9, and generally indicate that rates of 25 ppm or greater provided 10 months of excellent control. This trial has been terminated, but augments and confirms other studies regarding topical applications of Talstar 10WP for treatment of containerized nursery plants.

Table 9. Residual Activity of Talstar 10WP Applied Topically at Various Rates and Aged in Various Geographical Locations, June 1990.

Treatment Location/ Cooperator	Initial Theoretical Dose (ppm)	% Mortality to Alate IFA Queens at Indicated Months Post-Treatment 1/ (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Jackson, MS	5	100	100	85	100	85	100	90	90	90	85
R. Mitchell	10	100	100	100	55	100	100	90	100	100	100
FMC Corp.	25	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100
	75	100	100	100	100	100	100	100	100	100	100
	Check	5	5	15	15	5	5	0	5	5	0
Tifton, GA	5	100	45	100	100	100	100	100	100	3/	3/
B. Sparks	10	100	100	100	100	100	100	100	100		
Ga. Ext. Ser.	25	100	100	100	100	100	100	100	100		
	50	100	100	100	100	100	100	100	100		
	75	100	100	100	100	100	100	100	100		
	Check	0	25	5	10	45	35	20	0		
Monticello, FL	5	100	100	100	100	85	100	100	3/	3/	3/
R. Mizell	10	85	85	100	100	100	100	100			
Agric. Res. &	25	100	100	100	100	100	100	100			
Educ. Center	50	100	100	100	100	100	100	100			
	75	100	100	100	100	100	100	100			
	Check	0	25	50 2/	0	45 2/	5	5			
Mobile, AL	5	80	100	95	100	90	50	100	100	100	45
J. Stephenson	10	80	90	100	80	70	100	100	100	100	100
Auburn Univ.	25	100	100	60	100	100	95	100	100	100	95
Hort. Sta.	50	100	100	75	100	100	100	100	100	100	100
	75	100	100	100	100	100	100	100	100	100	100
	Check	25	15	0	15	5	0	10	45 2/	20	25

1/ Standard laboratory bioassay using IFA alate queens
2/ High check mortality unexplained
3/ No soil samples submitted for bioassay

PROJECT NO: FA01G180

PROJECT TITLE: Phytotoxicity of Talstar® 10WP Surface Applied and Preplant Incorporated to Selected Cultivars of Succulent and Woody Ornamental Plants.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Tim Lockley, A.J. Laiche [MAFES, Poplarville, MS] and Lee McAnally.

INTRODUCTION:

Among the many toxicants evaluated at the Gulfport IFA Station, one of the most promising is bifenthrin [Talstar 10WP]. Data suggests exceptional residual activity for this pyrethroid at a number of different rates. Although a significant amount of data has been gathered concerning the effect of bifenthrin on IFA, no data exists as to its potential phytotoxic effect on nursery stock. As part of our continuing evaluation of bifenthrin, tests were undertaken at the Mississippi Agricultural and Forestry Experiment Station (MAFES) at Poplarville to determine if bifenthrin poses any potential hazard to containerized plants.

MATERIALS AND METHODS:

TRIAL I:

On 23 January 1991, 15 selected cultivars of succulent and woody ornamental plants were treated with two rates of Talstar 10W surface applied as a dry powder "over-the-top". Applications were made at rates of 100 ppm [1X] and 300 ppm [3X]. Seven replicates per cultivar/treatment were made. Sufficient amounts of water [500 cc] were then applied to saturate each container.

Plants were sacrificed 90 days post-treatment. Fresh shoot weights were measured and root systems were visually compared for each replicate/cultivar.

TRIAL II:

Ten selected cultivars were transplanted from liners into standard industry 2-gallon pots containing media into which Talstar 10WP had been incorporated at 100 ppm [1X] and 300 ppm [3X] on 16 August 1991.

Plants were sacrificed 181 days after planting.

RESULTS:

TRIAL I:

No significant differences were noted for either fresh shoot weights or among root systems. *Impatiens* and Rosemary showed some enhanced growth at the 1X and 3X treatment rates respectively [Table 10].

TRIAL II:

No phytotoxic effects were noted among the cultivars tested. Some enhanced growth was noted [Table 11].

Table 10. Relative Phytotoxicity of Bifenthrin [Talstar 10WP] Surface Applied as a Powder to Various Succulent and Woody Ornamental Containerized Plants.

CULTIVAR	SHOOT FRESH WEIGHT [g] 1/		
	CHECK	1X	3X
SUCCULENTS			
Begonia semperflorens 'whiskey'	425.1a	425.7a	418.1a
Hibiscus varigatus	114.2a	103.9a	103.8a
Impatiens 'New Guinea'	225.5a	255.6b	237.7ab
Rosemary	74.0a	67.1a	82.9b
Pothos	158.1a	156.0a	160.8a
WOODY ORNAMENTALS			
Azalea 'Carror'	90.0a	90.4a	87.6a
Azalea 'eriocarpum'	119.1a	119.3a	114.7a
Azalea 'Formosa'	116.9a	117.5a	109.6a
Azalea 'sunglow'	94.4a	95.9a	98.8a
Ilex 'Avery Island'	57.7a	51.1a	61.4a
Ilex compacta	50.7a	47.5a	47.8a
Ilex fosteri	29.4a	28.9a	30.2a
Ilex latifolia	59.5a	48.8a	55.1a
Ilex vomitoria 'Stallings'	58.4a	57.7a	67.0a
Prunus carolinianum	62.1a	61.9a	59.3a

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

Table 11. Relative Phytotoxicity of Bifenthrin [Talstar 10WP] Preplant Incorporated Into Media to Various Succulent and Woody Ornamental Containerized Plants.

CULTIVAR	SHOOT FRESH WEIGHT [g] 1/ CHECK	1X	3X
SUCCULENTS			
Pothos	187.1a	182.0a	196.3a
Sheffelera	179.9a	167.6a	180.0a
Vinca minor	274.5a	252.2a	253.9a
Portulaca oleraceae	386.8a	489.9b	518.1b
WOODY ORNAMENTALS			
Azalea 'eriocarpum'	68.3a	84.4b	72.0a
Azalea 'Formosa	58.7a	79.9b	61.1a
Ilex compacta	32.2a	29.6a	29.6a
Magnolia michellia	67.1a	75.9b	74.7b
Juniperus 'Shore Juniper'	13.2a	18.4b	15.6ab

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

PROJECT NO: FA01G181

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

MATERIALS AND METHODS:

Four selected cultivars (Gardenia August Beauty, Holly Ilex savannah, Holly Ilex latifolia and Azalea Formosa) were placed in two gallon capacity pots containing Dodd's potting media [371 lbs/cu. yd.] and incorporated with Talstar® 10WP at 50 ppm [4.7 g/1.5 cu.ft.] on 3 May 1991. Fifty replicates were established for each cultivar. One hundred two-gallon capacity pots were set up containing the same media without plants. Monthly bioassays to determine efficacy were made and GLC analyses of media was collected from each cultivar and the control to determine if any of the test plants had any effect [positive or negative] on the efficacy (residual activity) of bifenthrin.

RESULTS:

Preliminary results to date are shown In Tables 12 and 13. Based on these very limited observations, there appears to be no difference in treated media with or without the presence of any of the 4 cultivars evaluated.

Table 12. Degradation of Bifenthrin as Affected by Actively Growing Nursery Stock.

CULTIVAR	Relative Degradation of Talstar 10WP (ppm) [1/] at Indicated Months Post-Treatment (0)	(2)	(3)	(4)	(5)	(6)
Azalea [Formosa]	50.0 [2/]	79.5	135.4	-	75.32	55.98
Gardenia [Aug. Beauty]	50.0 [2/]	72.0	135.8	-	91.80	36.16
Ilex savannah	50.0 [2/]	72.6	163.5	-	52.01	28.24
Ilex latifolia	50.0 [2/]	46.6	201.8	-	81.33	55.34
Control (No plants)	50.0 [2/]	108.7	95.8	-	52.01	51.55

1/ GLC analyses conducted by USDA, APHIS, NMRAL, Gulfport, MS.
2/ initial theoretical concentration of bifenthrin based on dose rate administered.

Table 13. Efficacy of Bifenthrin Against IFA Alate Queens as Affected by Selected Cultivars.

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

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 30 cu. ft. cement mixers. Dursban® 10G and Lorsban® 15G were mixed at a standard rate (11.2 g AI/cu. yd.). Suscon® 10CR 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 a custom media 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 14). Dursban 10G at the standard rate, Suscon 10CR at 25 and 50 ppm remained active for only 2 months. By month 4, Suscon 10CR (100 ppm) and Lorsban 15G had begun to deteriorate. Both bifenthrin formulations (Talstar 10WP and Capture 0.2G) continue to show 100% efficacy for 23 months.

In Trial II, as of this report, all treatments were indicating 100% efficacy (Table 15).

Table 14. Degradation of Candidate Insecticides in a Commercial Nursery Environment, Trial I.

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

Table 15. 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)
Force 1.5G	Greenleaf	25	100	100	100	100
	Greenleaf	50	100	100	100	100
Check	Greenleaf		15	0	0	0
Dursban 2.5G	IFA mix	per label 1/	100	100	100	100
Check	IFA mix		20	10	5	0

1/ 1.0 lb. 2.5G per yd^3 of media.

PROJECT NO: FA01G100

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

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

In recent years, interceptions of IFA infested nursery stock has increased significantly. Many of these infestations were found to be in certified containers. Complaints of product failure became common and regulatory officials began to question the effectiveness of granular chlorpyrifos treatments. Tests were initiated in November 1989 at there widely separated geographic locations to confirm the phenomena of enhanced degradation.

MATERIALS AND METHODS:

TRIAL I:

In October 1989, three chlorpyrifos formulations [Dursban 10G, Lorsban 15G and Suscon® 10CR], Triumph@ 1G and Capture@ 0.2G were all incorporated into a standard potting media [Strong-Lite®] as described in Appendix III. The incorporated media was blended at a rate of 100 ppm, divided into three equal parts per replicate, bagged and transported to three separate experimental sites in Gulfport, MS; Miami, FL; and

Whiteville, NC. The media was aged outdoors in standard trade gallon containers. In addition to natural rainfall, supplementary irrigation was added as was deemed necessary at each site. Samples were collected from each site at monthly intervals by Florida Dept. of Agriculture personnel and shipped to this laboratory for bioassays (Appendix II). This trial was designed to last for 18 months.

TRIAL II:

In September 1991, a trial was undertaken to evaluate bifenthrin [Talstar® 10WP] and tefluthrin [Force® 1.5G] at multiple rates in south Florida. Both pyrethroids were incorporated into the standard Gulfport Labmix [1:1:1; pine bark, sand, peatmoss] on 25 September at rates of 10, 25 and 50 ppm. Dursban was incorporated at the standard rate (1.0 lb./yd^3) on the same date into the same media. All toxicants/rates were bagged and transported to the IFAS Experiment Station at Homestead, Florida, where they were transferred to standard industry gallon containers and weathered under normal horticultural practices. As in the first trial, Florida Dept. of Agriculture personnel collected samples at monthly intervals and shipped them to this laboratory for bioassays.

RESULTS

TRIAL I:

All of the organophosphorous compounds [Dursban 10G, Lorsban 15G, Suscon 10CR and Triumph 1G] degraded more rapidly at the Miami site than at either the MS or NC sites. Bifenthrin 0.2G remained 100% active throughout the trial (18 months) at all sites. Results are documented in Table 16.

TRIAL II:

Only very preliminary data were available when this report was prepared. As shown in Table 17, all treatments were 100% effective at 1 and 2 months post-treatment.

Table 16. Relative Degradation of Selected Insecticides at Different Geographic Locations.

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

Table 17. Relative Toxicity of Various Toxicants/Rates to IFA Alate Queens aged in Homestead, FL.

CANDIDATE	Dose (PPM)	Percent Mortality of Alate IFA Queens at Indicated Months Post-Treatment (1)	(2)
Talstar 10WP	10	100	100
	25	100	100
	50	100	100
Force 1.5G	10	100	100
	25	100	100
	50	100	100
Dursban	1.0 lb./ $yd.^3$	100	100
Check		0	0

PROJECT NO: FA01G060

PROJECT TITLE: Residual Activity of Pyrethroid Insecticides in Potting Media at Low Rates of Application.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

Three synthetic pyrethroids,(cypermethrin 0.75G, bifenthrin 0.2G, and telfluthrin 1.5G) have produced up to 24 months residual activity at dose rates of approximately 85 ppm in other studies (See FA02G037). A study was initiated to study their effectiveness at lower rates i.e., 2.5 - 10 ppm.

METHODS AND MATERIALS:

Each compound was blended into two 1.5 cu. ft. batches of Strong-Lite® potting media at three rates; 2.5 ppm, 5 ppm, and 10 ppm using portable electric cement mixers. Each treatment was blended for one hour and then placed in 36 6"x 6" plastic nursery containers. The containers were then placed outdoors to weather naturally and simulate commercial nursery environmental conditions (Appendix III). Irrigation water was added to rainfall as necessary to maintain a minimum of 1" water per week. The amount of formulated product added to each batch of 1.5 cu. ft. was as follows:

Formulated Product	2.5 ppm	5 ppm	10 ppm
cypermethrin 0.75G	3.2 gm	6.4 gm	12.8 gm
telfluthrin 1.5G	1.6 gm	3.2 gm	6.4 gm
bifenthrin 0.2G	12.04 gm	24.1 gm	48.2 gm

At monthly intervals, three pots from each replicate were composited and a 80-100 cc subsample was bioassayed using standard laboratory procedures with field collected alate queens as described in Appendix II.

RESULTS:

Results are summarized in Table 18. With the exception of Force 1.5G and bifenthrin 0.2G at 10 ppm, the results are extremely variable. A possible explanation for this is uneven blending caused by the small volume of material required to achieve these low dosage rates.

Table 18. Activity of Selected Pyrethroid Insecticides at Low Rates of Application.

Insecticide	Dose Rate (PPM)	Average % Mortality to Alate IFA Queens at Indicated Months Post-treatment (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
bifenthrin 0.2G	2.5	10	35	100	60	70	30	95	95	100	100	40	15
	5.0	10	70	100	20	100	85	100	100	100	100	100	95
	10.0	40	60	100	100	100	100	100	100	100	95	100	100
telfluthrin 1.5G	2.5	20	55	65	55	10	0	15	55	65	1/	---	---
	5.0	85	100	100	15	95	0	20	15	80	55	30	1/
	10.0	100	100	100	100	100	100	100	100	100	100	100	100
cypermethrin 0.75G	2.5	5	35	90	5	15	0	60	70	5	1/	---	---
	5.0	10	15	60	5	15	15	90	70	100	30	55	1/
	10.0	25	40	95	45	10	5	95	100	100	100	40	1/
Check	0	5	5	5	0	0	5	10	5	20	5	15	15

1/ dropped from trial due to loss of efficacy.

PROJECT NO: FA01G260

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

TYPE REPORT: Interim

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

INTRODUCTION:

Several formulations of bifenthrin have shown excellent potential for long term control of IFA in nursery stock. Formulations currently under study include Capture® 0.2G applied as a granular incorporated treatment, Talstar 2E as a drench or pour-on, Talstar 10WP as an "over-the-top" or topical treatment, Talstar 10WP as an incorporated treatment and Talstar 10WP as a "spray-on" during potting media preparation.

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

Talstar % Conc.	g. AI/tablet	Theoretical dose rate/container 1/
0.5	.006	12 ppm
1.0	.012	24 ppm
2.0	.024	48 ppm
5.0	.060	120 ppm

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

METHODS AND MATERIALS:

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

Test I- Artificially infested pot study:

Plastic nursery pots (6″x6″) were filled with potting media and allowed to acclimate under simulated nursery conditions for 5 days prior to onset of the trials. Approximately 0.5″ irrigation water was applied daily during the acclimation period. Fragmented IFA colonies (50cc of workers, brood and reproductive forms; queen status unknown), were separated from the nest tumulus by flooding. One fragmented colony was then added to each pot to simulate an actual infestation. Infested pots were placed in ″moats″ to prevent ants from escaping. Each concentration was tested on 5 different infested pots or replicates. Each treatment was applied by placing 1 tablet in the center of each infested pot and then adding 1/2″ irrigation water through an overhead sprinkler irrigation system. Approximately 1/2″ of water was added daily for about 1 week or until 100% colony mortality was achieved. Mortality was assessed daily by observation of treated colonies. Colonies were rated as ″dead″ when 20 or fewer worker ants remained active.

Test II - Residual activity against alate IFA queens:

Plastic pots (6″x6″) were filled with 500 grams (dry weight basis) potting media. Each concentration of Talstar tablet was applied to a total of 72 pots (3 reps/month x 24 months = 72 pots/treatment). Tablets were placed on the center surface of each pot and immediately irrigated with 1/2″ of water. At monthly intervals, soil from 3 pots/ concentration was collected and bioassayed with alate queens according to standard laboratory protocol described in Appendix II.

RESULTS:

Test I - Artificially Infested Pot Study:

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

Test II - Residual Activity Against Alate IFA Queens:

Results are summarized in Table 19. All treatments remained 100% effective through 7 months, remained at or above 90% through 9 months. Results were beginning to become erratic beyond 10 months; however, samples will continue to be taken until activity drops below 50% two months consecutively or until scheduled termination at 18 months post-treatment.

Table 19. Residual Activity of Bifenthrin Tablets in Potting Media.

Tablet Concentration (% Bifenthrin)	Initial Theoretical Dose Rate (PPM)	% Mortality to Alate Queens Confined to Treated Media at Months Post-treatment											
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
0.5	12	100	100	100	100	100	100	100	90	100	30	20	100
1.0	24	100	100	100	100	100	100	100	100	100	100	80	100
2.0	48	100	100	100	100	100	100	100	95	100	70	80	100
5.0	120	100	100	100	100	100	100	100	100	100	100	80	100
Check	--	5	15	5	10	0	0	5	0	5	15	10	5

PROJECT NO: FA01G021

PROJECT TITLE: Influence of Formulation on Dispersal of Bifenthrin in Nursery Potting Media.

TYPE REPORT: Final

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

INTRODUCTION:

Quarantine treatments to prevent IFA infestation in nursery stock include drenches, topicals, spray-on, and preplant incorporation of granular and dust pesticide formulations. However, incorporation is the preferred use pattern according to a 1990 survey of growers by the American Nurserymen's Association(Regelbrugge, personal communication). This preference is based on several factors including labor costs, worker exposure, and management practices.

Bifenthrin, a synthetic pyrethroid insecticide/miticide produced by FMC Corporation(Philadelphia, PA) has shown tremendous potential for IFA quarantine treatment in a variety of trials (Lockley 1991, Insec. Acar. Test; Collins, 1990 IFA Station Annual Report). Talstar® 10WP (a bifenthrin formulation) has provided well over 1 year residual activity when incorporated into nursery potting media at various rates, as has an unregistered granular formulation (0.2G).

Thorough and complete incorporation of any insecticide into the potting media is necessary to avoid "hot spots" or portions of the media which are undertreated. Due to physical limitations, a totally homogenous mix can never be achieved; however, a highly uniform distribution of pesticide in the media is imperative. Although good results have been achieved with Talstar 10WP incorporated into potting media, it is generally assumed that a granular formulation would be preferred due to the theoretically more uniform mix afforded by the granule. A trial to compare homogeneity of distribution of four bifenthrin formulations was initiated in March 1991.

METHODS AND MATERIALS:

Strong-Lite® potting media (Strong-Lite Products, Pine Bluff, AR) was treated with each of the following bifenthrin formulations:

1. 10WP incorporated into the media with a cement mixer;
2. 0.2G incorporated into the media with a cement mixer;
3. 2EC applied as high volume water based drench (1/5 volume of container to be treated);
4. Technical bifenthrin in solution with acetone.

All treatments were applied at a rate of 100 ppm based on dry weight bulk density of the potting media. Standard laboratory operating procedures were used to determine bulk density, and to apply the pesticides. The cement mixer was operated for one hour to insure thorough blending of the pesticide into the media. The drench treatment was applied as a water based solution (400 mls finished solution per 500 grams of media, dry wt. basis). The technical bifenthrin was applied in sufficient volume of acetone to totally saturate 2500 grams of media. Following treatment, the acetone was evaporated under ambient greenhouse conditions for 48 hours. At that time, the media was divided into 5 groups (replicates) of 500 grams each. Each replicate was placed in a soil sample bag, separate Form 602 prepared and submitted to USDA, APHIS, NMRAL for gas chromatography (GC) analysis on 3/27/91. All other treatments were also divided into five replicates of 500 grams of treated media each. Following GLC analyses, a coefficient of variation (CV) for the analyses for each treatment was computed. Low CV's indicate homogeneity of application, whereas treatments with high CV's are evidence for unequal or uneven distribution of pesticide in the media.

RESULTS:

Concentrations of technical bifenthrin ranged from 89.5 ppm (replicate 1) to 134.1 ppm (replicate 4) as shown in Table 20. The mean of all five replicates was 116.2 ppm with a 16.37% coefficient of variation (CV). Although these analyses are somewhat higher than the expected 100 ppm (theoretical concentration), the relatively low CV indicates homogeneity of application. This was as expected since the technical formulation was applied in solution with acetone to provide a totally saturated mixture of media, solvent, and pesticide.

All other results were quite variable with large variations between replicates of the same formulation. The mean concentration for all 5 replicates of both the granular and 10WP formulations (as indicated by GLC analyses) were approximately 300% higher than the expected 100 ppm dose rate.

We had assumed that greater variation between replicates would occur in the 10WP and 0.2G formulations than in the EC or technical. The order of expected variation was:

Technical ≤ 2EC < Granular < 10WP

The results of this study confirm that expectation. However, we are unable to explain why the average concentration for 5 replicates (samples) of the 10WP and 0.2G would be 3X the theoretical expected dose rate.

Table 20. Bifenthrin Concentration in Nursery Potting Media Immediately Following Application of Various Formulations at a Theoretical Dose Rate of 100 ppm.

Bifenthrin Formulation	Bifenthrin concentration 1/ based on GC analysis (ppm) Rep. 1	Rep. 2	Rep. 3	Rep. 4	Rep. 5	Mean	SD	CV(%)
Technical	89.5	105.8	118.1	134.1	133.6	116.2	19.03	16.37
2EC	125	90	78.5	75	132.1	100.1	26.66	26.63
0.2G	168.6	425	290	233.5	225.8	293.6	92.17	31.39
10WP	98.3	569	250	207	181.5	301.9	180.31	59.73

1/ All formulations applied at a theoretical concentration of 100 ppm based on dry weight bulk density of the potting media (380 lb/cu. yd.).

PROJECT NO: FA01G031

PROJECT TITLE: Leachability of Bifenthrin 0.2G Through a Column of Potting Media.

TYPE REPORT: Final

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

INI

Talstar® 10WP and tablet formulations have been shown to leach through a packed column of potting media to a depth of 18-24 inches following surface applications at a rate of 50 ppm or higher (Lockley, unpublished). Topical applications for containerized nursery stock would offer additional options for certification. Therefore, this procedure has been investigated a number of times recently by the IFA Station. Since no information on leachability of a granular bifenthrin formulation was available, the study described herein was initiated on March 29, 1991.

METHODS AND MATERIALS:

A 8″ diameter PVC pipe (7.75 in. ID) was sectioned into 3' lengths. A fiberglass screen bottom was glued in place, and 1″ diameter holes were drilled every 6 inches along one side of each column. After closing the holes with duct tape, the soil columns were loosely packed with Strong-Liteb potting media (Strong-lite Products, Pine Bluff, AR). Each column was packed with approximately 1 cubic foot of potting media. Columns were then moistened by the addition of 1 gallon water/column. After 24 hours the following treatments were applied to three different (replicate) columns:

1. Bifenthrin 0.2G at 10 ppm;
2. Bifenthrin 0.2G at 25 ppm;
3. Bifenthrin 0.2G at 50 ppm;
4. Bifenthirn 10 WP at 25 ppm (standard).

All treatments were applied by evenly sprinkling on to the surface of each soil column. Immediately after treatment, 2″ of irrigation water

(1545 cc) were applied to each column.

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

RESULTS:

Soil columns were packed and moistened on 3/28/91. Immediately prior to insecticide application on 3/29/91, soil moisture at the 3″ depth was determined to be 25% with a pH of ca. 7. As shown in Table 21, bifenthrin 0.2G was very immobile and did not leach beyond the surface at any rate of application. As in previous trials, the Talstar 10WP formulation did leach approximately 12″, providing 100% and 87% mortality at the 6″ and 12″ level respectively.

Table 21. Leachability of Bifenthrin 0.2G in Strong-Lite Potting Media.

Treatment		% Mortality to Alate Queens Confined to Media at Indicated Depth (inches) 1/				
		(6)	(12)	(18)	(24)	(30)
Bifenthrin 0.2G	50 ppm	47	13	47	13	0
Bifenthrin 0.2G	25 ppm	47	20	27	7	20
Bifenthrin 0.2G	10 ppm	27	40	33	0	13
Bifenthrin 10 WP	25 ppm	100	87	47	7	33
Untreated Check	--	33				

PROJECT NO: FA01G109

PROJECT TITLE: Evaluation of Chlorpyrifos Formulations in Potting Media.

LEADER/PARTICIPANT(s): Avel Ladner

TYPE REPORT: Final

INTRODUCTION:

Ford's **Dursban® 2.5G** applied as a pre-plant incorporated treatment is approved for certification of nursery potting soil under the IFA Quarantine. However, there are many other chlorpyrifos formulations made by various chemical companies. Other effective formulations, if labelled for quarantine use, would provide an alternative IFA treatment for nursery growers. A study was initiated to test residual activity of several different formulations of chlorpyrifos in nursery potting media.

METHODS AND MATERIALS:

TEST I - 3/22/89:

The chlorpyrifos formulations used were Ford's 2.5G (standard), Ford's 1% dust, Dow's 20% Empire@ liquid and Dow's SOX WDG. All the formulations were mixed into **Strong-Lite®** potting media (Strong-Lite Products Corp. Pine Bluff, AR), and the two Ford formulations were also mixed into **Baccto®** potting media (Michigan Peat Co., Houston, TX).

Each formulation was mixed with the soil using a 2.0 cu. ft. electric cement mixer and operated for a minimum of 1 hour. Granular formulations were added to each soil type at a rate of 11.3 g. **AI/cu.** yd. The Empire formulation was prepared by mixing 3 **ml.** Empire with 1 pint water and spraying this solution directly onto the soil as it tumbled in the mixer using a Sure Shot Sprayer Model A pressurized to 100 lbs. PSI.

During the mixing procedure, small random soil samples from each treatment were taken and submitted to **NMRAL** for GLC analysis of initial chlorpyrifos present.

Treated soil was placed in trade gallon pots and placed outside for exposure to natural environmental conditions. Each treatment was bioassayed monthly using a composite of two pots from each group (Appendix II).

TEST II - November 3, 1989

Procedures described above were used to evaluate the following chlorpyrifos formulations: 10G, Empire, Suscon 10CR, 2EC, WDG 50%, 1% dust, XRD 429, Lorsban® 15G, Dursban 50WP and 2.5G.

However, rather than using a weight to volume dose rate as in Test I, (11.3 g. AI/ cu. yd of media), all treatments were applied at an application rate of 100 ppm based on dry weight bulk density of the potting media.

RESULTS:

TEST I:

As shown in Table 22, the initial concentration of chlorpyrifos as determined by GLC analysis varied greatly, primarily due to differences in the bulk densities of these potting medias. All formulations degraded rapidly as shown in Table 23. All formulations were active through 2 months post-treatment, but only the 1% dust remained active at 3 months. These results are consistent with numerous other studies conducted in 1989.

TEST II:

Results are shown in Table 24, confirming results of Trial I and others. Empire 20%, applied as a drench, has generally shown good control for 13 months.

Table 22. Initial Concentration of Chlorpyrifos as Determined by GLC Analyses Following Application of Various Formulations to Strong-Lite and Baccto Potting Media at 11.3 g. AI/cu. yd.

Formulation	Rate of App. (gms. AI/ cubic yd.)	Amt. of formulation/ 1.5 cu. ft.	Media Type	Chlorpyrifos (PPM) 1/
Ford's 1% dust	11.3	63.06 gms.	Strong-Lite	446.50
Ford's 1% dust	11.3	63.06 gms.	Baccto	81.79
Ford's 2.5G	11.3	25.2 gms.	Strong-Lite	93.67
Ford's 2.5G	11.3	25.2 gms.	Baccto	68.21
Dow Empire 20%	11.3	3 mls.	Strong-Lite	81.84
Dow WDG 50%	11.3	1.26 gms.	Strong-Lite	124.24
Check	--	--	Strong-Lite	0.01
Check	--	--	Baccto	0.01

1/ GLC analyses conducted by USDA, APHIS, NMRAL.

Table 23. Residual Activity of Various Formulations of Chlorpyrifos 1/ in Two Types of Potting Media 11.3 g. AI/cu. yd. of Media.

Treatment	Media	% Mortality (Months Post-Treatment) 2/ (1)	(2)	(3)	(4)	(5)
Ford's 1% Dust	Strong-Lite	100	100	100	0	70
Ford's 1% Dust	Baccto	100	100	100	10	60
Ford's 2.5G	Strong-Lite	100	100	45	10	10
Ford's 2.5G	Baccto	100	100	5	5	5
Dow Empire 20%	Strong-Lite	100	100	5	5	5
Dow 50% WDG	Strong-Lite	100	100	5	10	15
Check	Strong-Lite	10	5	0	0	10
Check	Baccto	0	10	0	15	25

1/ Trial initiated March, 1989.

2/ Standard laboratory bioassay using field collected alate queens; 4 replicate/treatment with 5 queens/replicate.

Table 24. Residual Activity of Various Chlorpyrifos Formulations at Application Rates of 100 ppm in Strong-Lite Potting Media. 1/

Formulation	Formulator	% Mortality at Indicated Months Post-Treatment 2/ (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Empire 20% 3/	Dow	100	100	100	100	100	100	100	85	100	100	100	80	100	10
10 G	Ford's	100	100	10	15	--									
Suscon 10 CR	Incitec Int.	100	100	25	5	--									
2 EC 3/	Dow	100	45	0	0	--									
WDG 50%	Dow	100	20	10	0	--									
1% Dust	Ford's	100	20	5	0	--									
XRD 429	Dow	100	5	15	5	--									
Lorsban 15G	Dow	100	5	0	0	--									
50 WP	Dow	100	0	0	0	--									
2.5G	Ford's	70	5	5	5	--									
Check	--	5	20	5	5	0	5	5	20	0	5	20	15	5	10

1/ Trial initiated November 3, 1989.
2/ Standard laboratory bioassay using field collected queens; 4 replicates/ treatment with 5 queens/replicate.
3/ Applied as drench rather than incorporated (8 oz. 2E/100 gal. water).

PROJECT NO: FA01G200

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

Original efficacy trials with granular incorporated 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 commercial potting media showed a great variability to the results of earlier trials. In no case was more than 3-4 months residual activity experienced.

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

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

METHODS AND MATERIALS:

Four and one-half cu. ft. each of sand, peat moss, and pine bark were mixed individually with granular chlorpyrifos (Lorsban 15G) at a rate of 11.34g AI/cu. yd. A mixture of equal parts of the above components was also mixed following the same procedure. Each of the four mixtures was mixed in a portable cement mixer for one hour in increments of 1.5 cu.ft. each. The mixtures were then placed into 6" plastic nursery pots and placed outdoors to weather naturally. Artificial irrigation was added to maintain an average 1-2 inches of water per week.

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

RESULTS:

Results are summarized in Tables 25 and 26. Table 26 indicates results of GC analysis and Table 25 indicates efficacy results. At 7 months post-treatment, Lorsban 15G in sand has shown decreased efficacy. Sand has also shown the lowest amounts of chlorpyrifos present by GC analysis. All other treatments remain at 100% efficacy through 15 months.

Table 25. Residual Activity of Lorsban 15G in Various Potting Media Components.

Component	Percent Mortality at Indicated Months Post-Treatment														
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Sand	100	100	100	100	100	100	100	30	25	75	75	10	0	0	1/
Peat Moss	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Pine Bark	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Mixture (1:1:1)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

1/ Dropped from trial due to decreased efficacy.

Table 26. Residue of Lorsban 15G Detected in Various Potting Media Components by Gas Chromatography.[1/]

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

1/ GLC analyses performed by USDA, APHIS, NMRAL.

PROJECT NO: FA01G011

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

TYPE REPORT: Interim

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

INTRODUCTION:

Trials conducted in the late 1970's indicated that granular chlorpyrifos **(Lorsban® 10G)** incorporated into a potting media comprised of equal parts by volume of sand, milled pine bark, and sphagnum peat provided a minimum of 24 months residual activity (Collins et al. 1979). In 1989, chlorpyrifos degradation in a number of different types of potting mixes was evaluated, and found to average 2-3 months (**Lockley** and Collins 1989). However, relatively long residual activity of granular chlorpyrifos can occur under certain conditions; 1990 studies with the potting mix used in the original studies (**1:1:1**: sand, pine bark and sphagnum) again provided at least a 12 month residual **(FA01G190).** Other studies in 1990 indicated that the component of the potting mix which is apparently responsible for the extended activity is peat **(FA01G200).** Research focusing on the relationship between peat and residual activity of chlorpyrifos is underway. The present study was initiated in another effort to determine if soil microorganisms are responsible for the rapid degradation of chlorpyrifos in nursery potting media.

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

Benelate (benomyl as a **50F** formulation) is a broad spectrum fungicide with activity against a variety of soil fungi including Botrytis, Fusarium, Rhizzoctonia, Sclerotina, Anthracnose, Penicillium, and others.

Agri-strp (Streptomycin sulfate, 21.2%) is an agricultural bacteriacide used for control of certain bacterial plant diseases including fire blight of apples and pears, blue mold of tobacco, and bacterial wilt of chrysanthemums. Rates of 50-200 ppm are commonly employed.

METHODS AND MATERIALS:

Treatments evaluated in the current study included:

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

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

Ten (10) cu. ft. of Strong-Lite media was fumigated under 4ml. polyethylene sheeting with 1.0 lb. of methyl bromide on March 1, 1991. Temperature was ca. 75°F, and tarping remained in place for 72 hours after the gas was introduced. Granular chlorpyrifos was incorporated into potting media March 4-6, 1991 at the labelled rate of 1.0 lb./cu. yd., providing an initial dose rate of 65 ppm. Granular chlorpyrifos was also incorporated into the IFA lab potting mix at 65 ppm based on dry weight bulk density of the media. Thorough incorporation of insecticides, and bacteriacide, was accomplished by tumbling 1.5 cu. ft. batches of each respective treatment in a 2.0 cu. ft. cement mixer for one hour.

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

RESULTS:

As shown in Table 27, the combination of a fungicide and a bacteriacide, regardless of the quality of the media (fumigated vs. non-fumigated), did not extend the activity of granular chlorpyrifos. We, therefore, conclude that microbial degradation is not a factgor in the dissipation of chlorpyrifos from nursery potting media. The two controls (IFA media + Dursban and Strong-Lite media + Talstar) have provided 9 months of residual and will continue to be bioassayed.

Table 27. Residual Activity of Chlorpyrifos Incorporated into Potting Media Treated with Various Combinations of Fungicides and Bacteriacides.

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

* Dropped from trial due to decreased efficacy

PROJECT NO: FA01G131

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

METHODS AND MATERIALS:

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

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

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

RESULTS:

Results for the soil bioassays are shown in Table 28, and the results of the leachate bioassays are in Table 29. Dursban in Strong-Lite began losing efficacy by 2 months PT (Table 28), while the IFA media showed good residual through the 4 month evaluation. The leachate from the IFA media was 98% effective at 24 hours PT, indicating some leachability (possibly "fines" that were physically washed through the pot) of chlorpyrifos in that media immediately after incorporation (Table 29). From 1 month PT on, neither leachate was toxic to IFA queens (ca. 30% mortality or less). Therefore, differences in the residual activity of granular chlorpyrifos in Strong-Lite vs. the IFA lab media is not due to removal of chlorpyrifos in the leachate of the Strong-Lite media.

Table 28. Residual Activity of Dursban 2.5G in Potting Media.

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

1/ Mean based on three replicates

Table 29. Activity of Leachate from Potting Media Treated with Dursban 2.5G.

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

1/ Mean based on three replicates

PROJECT NUMBER: FA01G041

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

TYPE REPORT: Interim

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

INTRODUCTION:

Rapid degradation of granular chlorpyrifos in most nursery potting media has been well documented by this laboratory (see 1989, 1990 Annual Reports). However, the original trials using granular chlorpyrifos incorporated into a laboratory potting mix (1:1:1 sand:peat moss:pine bark) provided over 24 months activity. These results were duplicated in 1990 (see 1990 Annual Report, FA01G190), and 12 months residual activity against both fragmented colonies and alate queens was achieved. In another study reported in the 1990 Annual Report (FA01G069), Lorsban® 15G incorporated into sphagnum peat moss provided over 12 months of activity. The enhanced degradation of chlorpyrifos in most types of media remains unexplained.

This study examines the effects of various amounts of sphagnum peat on the efficacy of Dursban® 2.5G in Strong-Lite potting media.

METHODS AND MATERIALS:

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

Treatment combinations evaluated were as follows:

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

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

RESULTS:

Dursban in the Strong-Lite only mix and the 9:1 Strong-Lite peat mix was effective for two months (Table 30), and in the 3:1 media was effective for 4 months. The peat only treatments provided up to 8 months residual, while the 1:1 media has shown up to 9 months of residual.

Table 30. Residual Activity of Dursban 2.5G Incorporated Into Various Volume to Volume Combinations of Strong-Lite Potting Media and Sphagnum Peat.

Media Mix	% Mortality to Alate IFA Queens at Indicated Months Post-Treatment 1/								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Strong-Lite without Peat	100	100	55	30	5	2/			
9:1 Strong-Lite:Peat	100	100	35	45	10	2/			
3:1 Strong-Lite:Peat	100	100	100	100	45	95	45	100	10
1:1 Strong-Lite:Peat	100	100	100	100	100	100	100	100	100
Peat check	100	100	100	100	100	100	100	100	65
Strong-Lite check	30	10	25	30	5	5	5	5	0

1/ standard laboratory alate queen bioassay procedure

2/ dropped due to decreased efficacy

PROJECT NO: FA01G101

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

TYPE REPORT: Interim

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

INTRODUCTION:

Loss of chlordane for use as an IFA quarantine treatment for nursery stock led to the registration of granular chlorpyrifos for this use. Data to support the registration was generated at the APHIS Imported Fire Ant Station by Collins et al. (1980). All trials were conducted on site using a "typical" nursery potting media comprised of a 1:1:1 pine bark: sand: sphagnum peat. When chlorpyrifos was incorporated into this mix at a rate of 11.2 gm. AI insecticide per cubic year 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 microoganisms, especially Rhizoctonia (Tahvonen 1982). This hypothesis was subsequently disproven by studies involving sterilization of media and addition of antibiotics (Collins & Callcott 1992). The current study investigates the addition of various quantities of sphagnum peat to commercial nursery media as a means of enhancement of the residual activity of granular chlorpyrifos.

METHODS AND MATERIALS:

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

1. By using the labelled rated of Dursban 2.5G (1 lb/cu yd), a variable dose rate would be 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 as 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.

Soil 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 7.0 lb. 0-18-0 14 oz. 0-0-60	 3.0 lb. iron sulfate 20 lb. dolomite 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 (preliminary results only):

Results at 5 months post treatment (PT) are shown in Table 31. Greenleaf media treated with chlorpyrifos lost efficacy by three months PT. Greenleaf media combined with sphagnum peat moss at various rates and treated with chlorpyrifos was still active at 5 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 32 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 never showed 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 33). However, granular chlorpyrifos incorporated into sphagnum peat moss has provided up to 15 months of residual activity (McAnally & Collins 1992).

Media Properties

Physical characteristics of each media and peat combination are shown in Tables 33, 34, and 35. The enchanced 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 31. Residual Activity of Dursban 2.5G Incorporated into Various Nursery Potting Media and Media/Peat Combinations.

Media	Treatment	% Mortality to Alate Queens at Indicated Months Post-Treatment				
		(1)	(2)	(3)	(4)	(5)
Greenleaf	Dursban	100	100	35	35	0
5:1	Dursban	100	100	100	100	100
3:1	Dursban	100	100	100	100	100
1:1	Dursban	100	100	100	100	100
Greenleaf	Talstar	100	100	100	100	100
Greenleaf	Check	10	30	10	15	20
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
Flowerwood	Check	65	35	60	20	15
Windmill	Dursban	70	85	10	30	40
5:1	Dursban	65	50	0	55	30
3:1	Dursban	95	100	20	25	45
1:1	Dursban	60	50	40	20	5
Windmill	Talstar	100	100	100	100	100
Windmill	Check	20	40	10	20	5
IFA mix	Dursban	100	100	100	100	100
IFA mix	Talstar	100	100	100	100	100
IFA mix	Check	20	0	15	10	10
Peat	Check	20	10	20	0	10

Table 32. 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	theoretical	GC result	theoretical	GC result	theoretical	GC result
Greenleaf	0	bdl*	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	--	--	--	--

* bdl = below detectable limits (0.01 ppm)

Table 33. Characterization of Various Nursery Media and Peat Mixes.

Media	Organic Matter(%) 1/	Cation Exchange Capacity (milli-equiv./100 g. soil) 2/	pH 2/	Bulk Density 3/ (lbs./cu.yd)
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

1/ Determination by NMRAL
2/ Determination by Agronomy Dept., Mississippi State Univ.
3/ Determination by IFA Station

Table 34. 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

Table 35. Bulk Densities of Various Nursery Soils.

Media	Bulk Density 1/ (lb/cu yd) (1)	(2)	(3)	Mean	CV 2/ (%)
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 3/	1351.44	--	--	1351.44	3.19
Peat	220.26	262.51	256.32	246.36	8.09

1/ each trial used a different soil sample; 3 replicates per trial

2/ CV = coefficient of variation: computed using raw data (9 replicates)

3/ only one trial run since bulk density was within the range of other tests

PROJECT NO: FA01G010

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

TYPE REPORT: Interim

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

INTRODUCTION:

Long residual insecticides blended into nursery potting media prior to planting is a highly favored method of preventing IFA infestation of containerized nursery stock. Chlorinated hydrocarbon insecticides provided up to 3 years activity when mixed into nursery media. However, all uses of these products were cancelled 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 telfluthrin have shown up to 24 months residual activity in several previously completed trials. An extremely long residual (minimum of 18-24 months) is needed for a successful preplant incorporated treatment for potting media. Talstar® 10WP, a formulation of bifenthrin with EPA registration for use on ornamental plants, has shown excellent potential for use as an IFA quarantine treatment in numerous other trials. A system to extend the normal residual activity of either Talstar or Dursban® might prove to be a very successful treatment.

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

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

METHODS AND MATERIALS:

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

Copolymer	$\bar{x}$ 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 10 WP. Treated media was placed in 6″x6″ plastic pots and subjected to simulated nursery conditions, i.e., weather variables and irrigation. A minimum of 2″ water/week was applied either through natural rainfall or supplemental irrigation. The following treatments were evaluated:

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

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

RESULTS:

The test results to date are shown in Table 36. The addition of copolymers did not extend the residual of Dursban 2EC, and all treatments with Talstar 10WP remained effective through the 22 month post-treatment evaluation. The trials will be continued until all activity ceases.

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

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

* Dropped from test

PROJECT NO: FA01G071

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

METHODS AND MATERIALS:

TEST I:

Twelve (12) formulations varying in particle size, % active ingredient, thickness of polymer layer, etc. were received on 4/26/91. All formulations plus a standard (Ford's Chemical 2.5G Dursban) were blended into Strong-Lite® media at a theoretical initial concentration of 65 ppm (labelled rate for Dursban 2.5G) April 29-30, 1991. A 2.0 cu. ft. electric cement mixer was loaded with 1.5 cu. ft. of Strong-Lite and each formulation was mixed for 30 minutes to insure thorough incorporation. Treated media was then used to fill 36 six-inch plastic nursery pots per formulation. Pots were maintained outdoors under simulated nursery conditions and received a minimum of 1" of water per week either through natural rainfall or supplemental irrigation.

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

TEST II:

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

RESULTS:

TEST I:

Results of the first trial are shown in Table 37, and indicate that this polymer technology did not extend the residual activity of chlorpyrifos.

TEST II:

At 2 months post-treatment, all formulations (at much higher rates of application) have provided 100% control (Table 38).

Table 37. Evaluation of Polyon Polymer Formulations of Dursban (Test I).

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

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

Table 38. Evaluation of Polyon Polymer Formulations of Dursban (Test II).

Formulation Code	% Mortality to Alate Queens at Indicated Months Post-Treatment 1/ (1)	(2)
I R1-91	100	100
I-91	100	100
I R3-91	100	100
II-91	100	100
II R1-91	100	100
II R3-91	100	100
2.5G	100	100
Check	10	15

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

PROJECT NO: FA01G210

PROJECT TITLE: Residual Activity of Incitec Int. Suscon® 10G (chlorpyrifos) Incorporated into Potting Media and Aged at Whiteville, NC.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott and Rebecca Norris [Whiteville, NC]

INTRODUCTION:

Suscon 10G is a control release formulation of chlorpyrifos produced by Incitec International(Brisbane, Australia). A study was initiated in Gulfport, MS in 1989 (FA01G139, this report), to evaluate the residual activity of this product against IFA. To determine whether geographical location(and thus varying environmental conditions) has an effect on Suscon, another study was initiated in Whiteville, NC.

MATERIALS AND METHODS:

Suscon chlorpyrifos 10G was shipped to Whiteville, NC where it was incorporated into a locally available commercial potting media at rates of 20, 40, 60, 80 and 100 ppm. The treated media was placed in 6" standard nursery pots and subjected to normal horticultural practices. At monthly intervals, three pots from each treatment group were cornposited and sent to Gulfport, MS where the soil was bioassayed with alate queens(Appendix II).

RESULTS:

Results are shown in Table 39. Rates of 60 ppm and higher showed effective residual activity through 9 months post-treatment. The 100 ppm rate was effective through 16 months. These results are generally better than those obtained in other studies with Suscon in potting media.

Table 39. Residual Activity of Suscon 10G Incorporated into Whiteville, NC Potting Media.

Rate of Application	% Mortality to Alate IFA Queens 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 ppm	20	60	80	55	100	35	45	25	0	15	30	20	25	1/	-	-	-	-	-
40 ppm	90	100	100	100	100	80	100	100	100	75	80	90	65	1/	-	-	-	-	-
60 ppm	100	100	100	100	100	100	100	100	100	45	100	100	100	100	100	60	10	55	45
80 ppm	100	100	-100	100	100	100	100	100	90	100	55	40	90	100	75	35	45	90	20
100 ppm	100	100	100	100	100	100	100	100	100	100	100	100	80	100	100	100	30	85	25
Check	0	10	0	5	0	0	10	5	5	5	5	10	20	5	25	10	70*	20	10

1/ dropped due to decreased control
* high check mortality unexplained

PROJECT NO: FA01G091

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

TYPE REPORT: Interim

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

INTRODUCTION:

Force 1.5G (telfluthrin) is a synthetic pyrethroid which has shown good potential as an IFA toxicant when incorporated into potting media. Force 1.5G incorporated into potting media at rates of 50 ppm and subjected to normal horticultural practices, has shown residual activity up to 21 months (FA01G090). This study was initiated to determine what effect varying amounts of irrigation may have on the residual activity of telfluthrin.

METHODS AND MATERIALS:

Force 1.5G was incorporated into the MAFES standard potting media (Appendix V) using a 2 cu. ft. cement mixer at a rate of 50 ppm. Treated soil was placed in trade gallon nursery pots and divided into 3 groups. Each group of treated pots received a different amount of irrigation (in addition to natural rainfall). 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:

Very preliminary results appear in Table 40. At 1 month post-treatment, all irrigation regiments provided 100% efficacy against alate queens while receiving up to 17.55 inches of rainfall and irrigation (ca. 4.4 inches of water per week).

Table 40. Influence of Irrigation on Residual Activity of Force 1.5G Incorporated into MAFES Potting Media.

Irrigation Schedule (inches/wk)	% Mortality and Amount Water at Indicated Months Post-Treatment	
	1 Month	
	% Mort	Cumul. H_2O (inches)
1	100	5.55
2	100	9.55
4	100	17.55
Check 1/	0	5.00

1/ Check received ca. 1 to 1.5 inches of irrigation per week in addition to minimal rainfall or only rainfall when totaling 1″ or more per week.

PROJECT NO: FA01G250

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Avel Ladner

INTRODUCTION:

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

METHODS AND MATERIALS:

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

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

RESULTS:

At 17 months post-treatment, all dose rates remained 100% effective (Table 41). Some reduced efficacy appeared in the two lower rates by 18 and 19 months post-treatment. These and other data confirm the deleterious effects of irrigation on residual activity of Triumph in potting media.

Table 41. Residual Activity of Triumph 1G Incorporated into Baccto Potting Media at Various Rates.

Rate of Application (g AI/cu. yd. media)	% Mortality to Alate Queens at Indicated Months Post-Treatment																		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
11.2	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	85	100
22.4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	85
44.8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Check	0	0	15	0	0	20	0	5	0	0	0	5	20	10	15	0	10	10	0

PROJECT NO: FA01G220

PROJECT TITLE: Residual Activity of Triumph® 1G Incorporated into Potting Media and Aged at Various Locations.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott, Ngoan Ngo [Ciba-Geigy, Greenville, MS], Brad Minton [Ciba-Geigy, Corpus Christi, TX], and Stan Diffie [Coastal Plains Experiment Station, Tifton, GA]

INTRODUCTION:

Triumph 1G incorporated into potting media was initially thought to be effective up to 18 months. These original trials were conducted at one site (Gulfport, MS), and received no irrigation (only rainfall). Subsequent studies employing weekly irrigation in addition to rainfall, resulted in substantially lower residual activity. This study was initiated to investigate the effects of geographical location and irrigation on Triumph 1G.

MATERIALS AND METHODS:

Triumph 1G was incorporated into Strong-Lite® potting media in Gulfport, MS at a rate of 22.6 g AI/cu yd. Treated media and check (untreated) media were shipped to three locations for aging: Greenville, MS; Tifton, GA; and Corpus Christi, TX.

At one month intervals, a cooperator at each location sent a composite sample (three pots) from the treated and untreated media to Gulfport, MS where the soil was bioassayed using IFA alate queens (Appendix II).

RESULTS:

Triumph aged in Greenville, MS was 100% effective up to 6 months post-treatment, in Corpus Christi, TX up to 3 months and in Tifton, GA no control was ever evident (Table 42). Irrigation, in addition to rainfall, was added at the Tifton, GA site only. These results confirm other studies in which irrigation greatly decreases the activity of Triumph when incorporated into nursery potting media.

Table 42. Residual Activity of Triumph 1G Incorporated into Potting Media and Aged at Various Geographical Locations.

Location	Treatment	Percent Mortality to Alate IFA Queens and Cumulative Amount Water at Indicated Months Post Treatment													
		1 Month		2 Months		3 Months		4 Months		5 Months		6 Months		7 Months	
		% Mort	Amt. H_2O (inches)	% Mort	Amt. H_2O (inches)	% Mort	Amt. H_2O (inches)	% Mort	Amt. H_2O (inches)	% Mort	Amt. H_2O (inches)	% Mort	Amt. H_2O (inches)	% Mort	Amt. H_2O (inches)
Greenville	Triumph	100	0.0	100	0.30	100	0.70	100	2.45	100	6.46	100	ND	60	ND
MS	Check	10		5		0		15		10		10		10	
Tifton	Triumph	-		15	6.40	5	13.20	30	21.60	25	29.10	0	ND	5	ND
GA	Check	-		5		0		70*		15		5		10	
Corpus Christi	Triumph	100	0.87	100	2.63	100	3.18	10	5.53	65	7.33	5	ND	5	ND
TX	Check	10		10		0		10		5		0		10	

* - high check mortality unexplained

ND - no data

** site dropped due to decreased efficacy

Table 42. (Cont'd)

Location	Treatment	% Mortality at Indicated Months PT (8)	(9)	(10)	(11)
Greenville MS	Triumph	100	5	0	30
	Check	15	0	0	10
Tifton GA	Triumph	**			
	Check				
Corpus Christi TX	Triumph	**			
	Check				

* - high check mortality unexplained
ND - no data
** - site dropped due to decreased efficacy

PROJECT NO: FA01G151

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

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

METHODS AND MATERIALS:

Eight different media were utilized in this study. Each media was placed in 18, 6"x 6" black plastic nursery containers. Each container was then drenched with Dursban 2E at the labelled rate for IFA quarantine treatment. Drench solution was applied to each container at 1/5 volume of that container. Containers were then placed outdoors to weather naturally. Water was added as necessary to maintain a minimum of 1-2" irrigation per week. At monthly intervals 3 pots per treatment were cornposited and a 200 cc subsample subjected to standard alate queen bioassay(Appendix 11). Media used are as follows:

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

RESULTS:

Results are summarized in Table 43. Although highly effective for at least 3 months in most media, Dursban in Strong-Lite media failed after 1 month and is showing decline in the Greenleaf media at 3 months. Testing will continue until efficacy drops below 50% for at least two months consecutively or scheduled termination at 6 months post-treatment.

Table 43. Activity of Dursban Drench (labelled rate of application) in Various Media.

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

PROJECT NO: FA01G080

PROJECT TITLE: Residual Activity of Drench Candidates, 1990.

TYPE REPORT: Final

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

INTRODUCTION:

In 1989, several trials were conducted with several candidate pesticides to determine their residual activity when applied to nursery potting media as a drench. Several of these compounds were still 100% effective when the test terminated at 180 days (FA01G070). An expanded test was initiated on June 16, 1990, to determine their residual activity beyond 180 days as well as test several new compounds.

METHODS AND MATERIALS:

Thirty-six 6"x6" nursery containers were filled with Strong-Lite® potting media for each treatment. 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 natural conditions. Water was added in addition to natural rainfall as needed to maintain a minimum of 1" irrigation per week. At monthly intervals, 2 pots from each treatment were composited and an 200 cc subsample was subjected to standard laboratory bioassay using field collected alate queens (Appendix II). Treatment rates and theoretical dose rates for each treatment are shown as follows:

Pesticide & Formulation	Rate of Application (fl. oz./100 gal. water)	Rate of Application (ml./ gal. water)	Theoretical Dose Rate (ppm)
cypermethrin 2.5EC	5.4	1.6	100
	10.8	3.2	200
Talstar® 2EC	6.7	2.0	100
	13.6	4.0	200
Danitol® 2.4EC	5.4	1.6	100
	10.9	3.2	200
Empire® 1.7EC	8.2	2.4	100
	16.4	4.8	200
Karate® 1EC	13.6	4.0	100
	27.2	8.0	200
Pounce® 3.2EC	4.1	1.2	100
	8.2	2.4	200
Talstar® 10WP	470 gms.	4.7 gms.	100
	950 gms.	9.5 gms.	200
Tempo® 2EC	6.7	2.0	100
	13.6	4.0	200
Tempo® 1ME	13.6	4.0	100
	27.2	8.0	200
Torpedo® 2EC	6.7	2.0	100
	13.6	4.0	200

RESULTS:

Results are summarized in Table 44. Capture, Karate, Talstar, and Tempo all maintained 100% efficacy at 100 ppm through 12 months post-treatment and were, therefore, included in a further test in 1991 to determine their residual activity at lower rates (FA01G111, this report).

Table 44. Drench Trials, 1990.

Pesticide	Rate (PPM)	% Mortality to Alate IFA Queens at Indicated Months Post-Treatment (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Talstar 2EC	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
Karate 1EC	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	100	100
	200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar 10WP	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
Tempo 2EC	100	100	100	100	100	100	100	100	100	100	100	100	100	90	100	45	25	1/	--
	200	100	100	100	100	100	100	100	100	100	100	95	100	100	90	80	75	100	95
Danitol 2.4EC	100	100	95	100	100	100	100	100	100	100	50	85	0	65	1/	--	--	--	--
	200	100	100	100	100	100	100	100	100	100	100	100	90	85	70	10	20	1/	--
cypermethrin 2.5EC	100	100	100	85	100	100	100	90	100	100	25	55	45	1/	--	--	--	--	--
	200	100	100	100	100	100	95	100	100	100	100	85	80	100	90	50	30	1/	--
Empire 1.7EC	100	100	100	100	80	65	35	35	5	1/	--	--	--	--	--	--	--	--	--
	200	100	100	100	10	100	100	60	75	30	100	85	100	80	100	100	100	25	25
Pounce 3.2EC	100	100	25	70	10	65	1/	--	--	--	--	--	--	--	--	--	--	--	--
	200	100	100	100	45	90	100	100	95	90	65	40	30	1/	--	--	--	--	--
Torpedo 2EC	100	20	80	25	10	5	1/	--	--	--	--	--	--	--	--	--	--	--	--
	200	95	95	100	20	100	95	100	100	100	70	45	5	1/	--	--	--	--	--
Tempo 1ME	100	20	40	20	25	0	1/	--	--	--	--	--	--	--	--	--	--	--	--
	200	15	25	75	45	55	1/	--	--	--	--	--	--	--	--	--	--	--	--
Check		5	5	5	0	5	5	0	5	0	5	0	0	5	5	10	10	5	5

1/ terminated due to lack of control

PROJECT NO: FA01G111

PROJECT TITLE: Residual Activity of Drench Treatments, 1991.

TYPE REPORT: Interim

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

JCT

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

METHODS AND MATERIALS:

Thirty-six 6"x 6" plastic nursery pots were filled with potting media from Flowerwood Nursery, Mobile, AL. Drench solution was applied at a rate of 400 ml per container. Containers were then placed outdoors to weather naturally. Irrigation water was added as needed to maintain a minimum of 1" water/week. At monthly intervals, 3 pots from each treatment were composited and subjected to alate queen bioassay (Appendix II). Treatment rates were as follows:

Capture® 2EC	25 ppm 50 ppm
Tempo® 2EC	25 ppm 50 ppm
Karate® 1EC	25 ppm 50 ppm
Talstar® 10WP	10 ppm 25 ppm 50 ppm

RESULTS:

Results are summarized in Table 45. At 4 months post-treatment, Tempo 2EC has shown some variability; however, it has not dropped below 85% mortality. All other treatments have thus far provided 100% mortality. Bioassays will continue until mortality drops below 50% twice consecutively, or until scheduled termination of this study at 12 months post-treatment.

Table 45. Activity of Selected Drench Candidates at 25 and 50 ppm.

Insecticide	Dose Rate (PPM)	Average % Mortality to Alate IFA Queens at Post-Treatment Interval (Months) (1)	(2)	(3)	(4)
Talstar 10WP	10	100	100	100	100
	25	100	100	100	100
	50	100	100	100	100
Capture 2EC	25	100	100	100	100
	50	100	100	100	100
Karate 1EC	25	100	100	100	100
	50	100	100	100	100
Tempo 2EC	25	90	95	95	100
	50	100	85	85	100
Check		10	10	5	5

PROJECT NO: FA01G051

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Anne-Marie Callcott

INTRODUCTION:

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

METHODS AND MATERIALS:

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

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

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

RESULTS:

As indicated in Table 46, a drench rate of 1 ppm was not effective against IFA alate queens. The 5 and 10 ppm rates showed some inconsistency, but fairly good results through 9 months PT. The 25 ppm rate has shown 100% efficacy through the 9 month post-treatment bioassay.

Table 46. Residual Activity of Low Rates of Talstar 10WP Applied as a Drench.

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

* dropped due to decreased efficacy

PROJECT NO: FA01G240

PROJECT TITLE: Empire® Drench Study.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Avel Ladner

INTRODUCTION:

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

METHODS AND MATERIALS:

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

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

RESULTS:

The highest rate of application (90 ml/gal water) has shown excellent control 20 months post-treatment (Table 47). The 60 mls/gal. rate has varied somewhat, but fairly good control is evident through 20 months. Rates of 15-30 mls/gal. water have generally provided good control 8 to 9 months post-treatment. Lower rates have been variable.

Table 47. Residual Activity of Empire Applied at Various Rates as a Drench.

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

* dropped from trial due to loss of efficacy

PROJECT NO: FA01G191

PROJECT TITLE: Efficacy of Bifenthrin Applied as a Drench to Nursery Stock in Large Containers.

TYPE REPORT: Interim

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

INTRODUCTION:

Because of the restrictions applied to the use of chlorpyrifos in IFA quarantine, alternative toxicants are constantly being evaluated. Even before the certification period for chlorpyrifos was reduced, it was known that the treatment of large containers posed a perplexing problem. Chlorpyrifos, in its granular formulation, previously held a two year certification for efficacy against IFA. Nursery stock grown in large containers often go well beyond two years before being shipped or repotted. A retreatment with granular chlorpyrifos posed a problem because of its lack of ability to penetrate the media to any significant depth. Drenches could succeed in penetrating through a column of media but the certification period was short and, if the plant had been originally field grown and the root ball was soil as opposed to media, often the chlorpyrifos drench failed to penetrate the ball allowing IFA colonies to survive. Because of these problems, a trial was conducted to determine the feasability of using bifenthrin [Talstar® 10WP] as a drench.

MATERIALS AND METHODS:

On 9 July 1991, ten containers [45 gal. cap.] located at Green Forest Nursery near Perkinston, Stone Co., MS, were drenched with a solution sufficient to saturate the entire container [9 gal.] such that 25 ppm of bifenthrin remained in the media. Five of the containers contained liner grown wax myrtles. Five containers held field grown wax myrtles. Containers were subjected to normal horticultural practices. A 1" diameter core sample was taken from the top center, top edge, center edge and bottom edge of each of the treated containers. Cores from each strata were composited with each other from the field grown and liner grown cultivars. Core samples were collected every month and bioassayed in the laboratory (Appendix II).

RESULTS:

Results are shown in Table 48 and indicate that Talstar 10WP applied as a large volume drench is effective for IFA control in large container grown nursery stock.

Table 48. Efficacy of Bifenthrin Applied as a Drench to Large Containerized Nursery Stock (25 ppm).

Core Sample	Initially Grown	Percent Mortality to Alate IFA Queens at Indicated Months Posttreatment (1)	(2)	(3)	(4)	(5)
Edge Top	Liner	100	100	100	100	100
Edge Center	Liner	100	100	100	100	100
Edge Bottom	Liner	100	100	100	100	100
Top Center	Liner	100	100	100	100	100
Edge Top	Field Grown	100	100	100	100	100
Edge Center	Field Grown	100	100	100	100	100
Edge Bottom	Field Grown	100	100	100	100	100
Top Center	Field Grown	100	100	100	100	100
Check		0	0	0	0	0

SECTION II

DEVELOPMENT OF QUARANTINE TREATMENTS FOR GRASS SOD

PROJECT NO: FA01G081

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

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

METHODS AND MATERIALS:

Test plots were located in a non-production field of common St. Augustine grass **(Stenotaphrum secumdatum)** near Wadsworth, TX. Plots were 210' x 210' (1 acre), with 6 replicates per treatment arranged in a completely random design. RIFA populations were assessed prior to and 4, 8, 12, and 20 weeks following application according to the procedure described by Lofgren and Williams (1982). Both population indices and colony mortality were computed for each rating interval. The RIFA population prior to treatment averaged 94 nests per acre. Analysis of variance and Duncan's new multiple range test (Duncan 1955) were used to determine statistical differences in treatment means at the $P<0.05$ level for each post-treatment rating interval.

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

RESULTS:

Although statistical analyses of the data have not yet been performed, pretreatment population indices were drastically reduced (92 to 98%) by all treatments 4 weeks after application (Table 49). By 20 weeks after application, decreased efficacy was noted in both the Dursban 10G and Talstar 10WP plots. However, Suscon 10CR remained highly effective (99.6% reduction in pretreatment population indices).

Table 49. RIFA Population Suppression in Commercial Grass Sod with Residual Insecticides.

Treatment		Pretreatment Population 1/		Control at Indicated Posttreatment Interval (Weeks) 1/							
				% Colony Mortality				% Change in Pretreat Pop. Index			
Insecticide & Formulation	Rate/Acre (Lbs. AI)	$\bar{x}$ colonies/ subplot	$\bar{x}$ pop. index	(4)	(8)	(12)	(20)	(4)	(8)	(12)	(20)
Suscon 10CR	5.9	24	402	88	90	98	99	-98	-93	-99	-99.6
Dursban 10G	5.3	31	537	90	86	94	74	-96	-87	-92	-77
Talstar 10WP	0.25	21	367	79	95	86	78	-92	-95	-87	-83
Untreated Ck.	--	20	356	27	44	49	51	-27	-26	-45	-56

1/ $\bar{x}$ based on six replicates/treatment.

PROJECT NO: FA01G270

PROJECT TITLE: Evaluation of Suscon® 10G for RIFA Control in Commercial Turf Grass.

TYPE REPORT: Interim

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

INTRODUCTION:

Suscon 10G, a controlled release formulation of chlorpyrifos produced by Incitec International (Brisbane, Australia), has provided multi-year activity against soil pests in Australia, New Guinea, and Indonesia. Two trials to evaluate Suscon 10G for fire ant control in grass sod were initiated in 1990.

METHODS AND MATERIALS:

Trial I - June 5, 1990

Nine half-acre test plots were established in a commercial planting of centipede grass at the Pearl River Sod Farm, Wiggins, MS. IFA population counts were made prior to insecticide application according to the population index system described by Lofgren and Williams (1982).

All treatments were applied on June 5, 1990, with a Herd GT-77 granular applicator (Herd Seeder Co., Logansport, IN). The applicator was mounted on a farm tractor, which was operated at 4 mph. A 20' swath was obtained. Suscon 10G (Batch No. 025041, 1.0 mm particle size) was applied to three replicated one-acre plots at a rate of 4.4 lb. AI/acre. Lorsban® 15G (Dow Chemical, Midland, MI) was applied to three replicated one-acre plots at 5.0 lb. AI/acre. Three plots served as an untreated check. All plots were evaluated at 6, 12, 18, 24, 38 and 48 weeks after treatment. The study was discontinued after the 48 week post-treatment evaluation because the owner treated the entire property with Dursban® 2.5G in order to achieve certification prior to sale.

Trial II - September 20, 1990

Six half-acre plots were established on a polo playing field at the Bill Hough Farm near Gulfport, MS on September 20, 1990. The field was kept closely mowed throughout the study, closely simulating agronomic practices in commercial grass turf. Procedures described above were used to apply Suscon 10CR (Batch No. 025014, 1.0 mm particle size) to 3 plots at a rate of 5.0 lb. AI/acre. Three plots served as an untreated check. Plots were evaluated at 6, 12, 27, 34, and 56 weeks after treatment.

RESULTS:

Trial I

Results are shown in Table 50 and indicate excellent control with Suscon 10CR up to 48 weeks after application. Good control was initially achieved with Lorsban 15G, but reinfestation was evident 18 weeks after treatment.

Trial II

Results of the second Suscon trial appear in Table 51, and indicate that the rate of control was somewhat slower than observed in the first trial, possibly indicative of a seasonal effect. Overall, good control was achieved from 3 to 12 months after application.

Table 50. Evaluation of Suscon 10 CR for IFA Control in Commercial Turf. Pearl River Sod Farm, Wiggins, MS. June 1990.

Treatment	Pretreatment Population: $\bar{X}$ colonies/ plot	Pretreatment Population: $\bar{X}$ pop. index	Results at Indicated Post-treatment Interval (Weeks) 1/ — $\bar{X}$ % Colony Mortality (6)	(12)	(18)	(24)	(38)	(48)	$\bar{X}$ % change in Pretreat Pop. Index (6)	(12)	(18)	(24)	(38)	(48)
Suscon 10 CR (4.4 lb/A)	13	150	100	95	100	98	97	100	-100	-95	-100	-98	-97	-100
Lorsban 15G (5.0 lb./A)	5.7	73.3	100	100	57	57	23	54	-100	-100	-65	-57	-24	-91
Untreated Check	8.3	117	10	21	8	0	0	10	-3	+10	+35	+57	+108	-11

1/ Mean based on 3 replicates; 1/4 acre subplots rated according to procedure described by Lofgren and Williams (1982).

Table 51. Evaluation of Suscon 10CR for IFA Control in Commercial Turf. Hough Polo Field, Gulfport, MS. September 1990.

Treatment	Pretreat Population		Results at Indicated Post-treatment Interval (Weeks)[1/]											
			$\bar{X}$ % Colony Mortality						$\bar{X}$ % Change in Pretreat Pop. Index					
	$\bar{X}$ Colonies/ plot	$\bar{X}$ Pop. Index	(6)	(12)	(27)	(34)	(45)	(56)	(6)	(12)	(27)	(34)	(45)	(56)
Suscon 10CR (5.0 lb/A)	6.2	101.7	59	72	100	100	100	74	-94	-95	-100	-100	-100	-83
Untreated Check	10.0	145.0	0	0	0	0	0	0	+50	+100	+104	+47	+46	+93

1/ Mean based on 3 replicates; 1/4 acre subplots rated according to procedure described by Lofgren and Williams (1982).

PROJECT NO: FA01G170

PROJECT TITLE: Evaluation of Candidate Synthetic Pyrethroid Insecticides in Commercial Sod, 1990.

TYPE REPORT: Final

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

INTRODUCTION:

Tests undertaken in 1989 indicated significant residual activity.of two synthetic pyrethroids(Capture@ 0.2G and 1EC and Karate@ 1EC) in commercial grass sod. Plots were disrupted by harvest before the evaluations could be completed. Because of this, additional trials were undertaken in 1990 to determine the maximum length of time these candidates could remain effective and the minimum rate of application needed to meet quarantine requirements of 4 to 10 weeks activity.

MATERIALS AND METHODS:

Applications of granular insecticides were made on 8/29/90 to plots measuring 50'x 20' at the Pearl River Sod Farm near Wiggins, Stone County, MS. Applications of liquid formulations were made on 8/30/90.

A tractor mounted boom system was used for the liquid application. The boom sprayer consisted of TeeJet 1/4 BSS3 nozzels spaced 24 inches apart and operated at 25 psi. Rate of output was ca. 30.9 gallons finished spray/acre. Materials were applied at rates ranging from 0.125 to 6.0 lbs. AI/acre.

RESULTS:

Results through 8 months post-application show 100% efficacy for Capture 0.2G at 1.0 and 0.5 lb. rates. A single liquid formulation of Capture 2EC [1.0 lb. AI/acre] maintained 100% efficacy. By the 9th month of the trial, all rates had failed. Dursban® 10G and Lorsban® 15G failed at month 6 (Table 52).

Table 52. Efficacy of Candidate Pesticides Applied at Varying Rates/Formulations to Commercial Grass Sod, 1990.

Candidate	Rate (lb AI/ acre)	Percent Mortality to IFA Alate Queens at Indicated months post-application[1/] (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Capture 0.2G	1.00	100	100	100	100	100	100	100	100	50
	0.50	100	100	100	100	100	100	100	100	40
	0.25	100	100	100	100	60	100	100	90	25
	0.125	100	100	100	100	80	80	-	-	-
Capture 2EC	1.00	100	100	100	100	100	100	100	100	50
	0.50	100	100	100	100	90	100	100	95	35
	0.25	100	85	100	100	60	75	65	-	-
	0.125	100	65	35	-	-	-	-	-	-
Lorsban 15G	6.00	100	100	100	100	100	30	20	-	-
Dursban 10G	6.00	100	100	100	100	100	80	80	-	-
Karate 1EC	0.50	100	100	100	100	95	100	100	15	10
	0.25	100	100	100	100	65	100	85	35	15
	0.125	100	10	65	-	-	-	-	-	-
Check		0	5	5	0	5	0	0	5	0

1/ Standard laboratory bioassay described in Appendix II.

SECTION III

POPULATION SUPPRESSION TRIALS

PROJECT NO: FA02G021

PROJECT TITLE: Logic® Formulation Trials, 1991.

TYPE REPORT: Final

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

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 commercial Logic formulation contains 1% AI in a soybean oil/defatted corn bait. At the request of the registrant (Ciba-Geigy Chemical Co.), several experimental formulations of Logic were evaluated in two separate trials in 1991.

METHODS AND MATERIALS:

TEST I - 6/6/91

Test plots were located in non-grazed permanent pasture in Harrison County, MS. A totally monogynous RIFA population averaging 70 colonies per acre infested the property. All treatments were made with a shop-built granular applicator mounted on a farm tractor (Collins 1987). The equipment was operated at 4 mph on a 15' swath. Rate of application was 1.25 lbs. bait per acre for all formulations. Treatments were applied on June 6, 1991. Soil was very moist, and the soil temperature (1" depth) was 82 degrees F. Air temperature was 74 degrees F under cloudy, overcast skies. Plots were one-acre in size and arranged in a completely randomized block design with 5 replicates per treatment. The population index method (Harlan et al. 1981) as modified by Lofgren and Williams (1982), as well as colony mortality was used to rate all plots at 6, 12, 18, and 24 weeks after treatment. Analysis of variance and

Duncan's new multiple range test (Duncan 1955) were used to determine statistical differences in treatment means at the $P<0.05$ level for each posttreatment rating interval.

TEST II- 7/29/91:

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, all treatments were applied to a single plot (i.e., non-replicated). Skies were sunny and clear with an air temperature of 91.8 degrees F. Soil temperature at 1" depth was 88.2 degrees F. Desired rate of application was 1.0 lb. bait/acre (except for the 0.1% formulation which was also applied at 10.0 lbs./acre). Some misapplication occurred due to oily, sticky material and equipment problems. Actual rates of application were as follows:

Treatment	Rate/Acre (lbs. bait)
Logic 1%	2.5
Logic 0.1%	1.2 and 10.0
Logic WPM	1.0
Untreated Check	

RESULTS:

TEST I:

As indicated in Table 53, 84 to 89% reduction in the pretreatment population indices were obtained 6 weeks after application. Differences in treatment means were not statistically different. By 12 weeks posttreatment, control ranged from 99.4% with the 0.25% formulation to 97.8% with the 0.75%, but differences were not significant. This trend continued throughout the trial until it was terminated 24 weeks after treatment. These results indicate that the amount of AI in Logic can be reduced without compromising efficacy.

<u>TEST II</u>:

The WPM formulation was very dry, flowable, and uniform and would have definite application advantages. However, it was less efficacious than other treatments evaluated in this trial (Table 54).

Table 53. IFA Control with LOGIC Formulations, 1991 (Test I).

Logic Formulation (% AI)	Mean % Reduction + SEM in Pretreatment PI at Indicated Weeks PT 1/ 2/			
	(6)	(12)	(18)	(24)
1.0%	84.4 ± 3.7a	98.6 ± 1.0a	81.6 ± 12.1a	81.6 ± 10.0a
0.75%	89.8 ± 1.0a	97.8 ± 0.7a	94.2 ± 2.1a	84.4 ± 7.3a
0.50%	89.2 ± 0.9a	98.0 ± 0.3a	95.2 ± 1.7a	96.6 ± 1.6a
0.25%	89.0 ± 2.4a	99.4 ± 0.4a	97.2 ± 1.9a	90.4 ± 3.4a
Check	28.4 ± 15.2b	58.4 ± 2.5b	13.8 ± 12.1b	25.2 ± 10.6b

1/ Population index based on scale described by Lofgren & Williams (1982).

2/ Means within columns followed by the same letter are not statistically different (P 0.5) according to DNMRT.

Table 54. IFA Control with LOGIC Formulations, 1991 (Test II).

Logic Formulation (% AI)	% Reduction in Pretreatment PI at Indicated Wks. PT		
	(6)	(12)	(18)
1.0% (standard)	94.7	98.7	85.3
0.1% (1.25#/A)	92.8	89.6	80.0
0.1% (10#/A)	86.7	93.3	80.0
WPM	92.9	64.7	72.9
Check	0.0	0.0	0.0

PROJECT NO: FA02G020

PROJECT TITLE: Evaluation of Neem Seed Extract for RIFA Control.

TYPE REPORT: Interim

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

INTRODUCTION:

Neem, Azadirachta indica (Meliaceae) is widely grown in tropical Asia and Africa. The leaves, fruits, and seed kernels of neem trees contain two triterpenoids, azadirachtin and salannin, and other active principals that possess repellent, anti-feedant and growth disruptive properties against various insect species (Karel 1989). Control of the birch leafminer with neem seed extract (NSE) was statistically equivalent to Metasystox-R in some studies (Larew and Knodel 1987, 1986b). NSE has also decreased oviposition in the greenhouse whitefly (Larew and Knodel 1986a). Anti-feeding effects have been reported for Japanese beetles (Ladd et al., 1978), Fall armyworm (Raffa 1987), Colorado potato beetle (Zeehnder and Warthen 1988) and Ootheca bennigseni (Coleoptera: Chrysomelidae) (Karel 1989).

Effects of NSE on the imported fire ant have not been investigated; its potential for use both as a bait toxicant, and contact drench was determined in the study described herein.

METHODS AND MATERIALS:

1. Bait treatments:

A. Laboratory bait acceptance tests:
Acceptability of various concentrations of azadirachtin in soybean oil and/or sucrose solutions was determined by standard laboratory bioassay procedures described in Appendix II.

B. Field trials:
Field trials were initiated as indicated by laboratory bait acceptance tests. Acceptable bait formulations were applied

broadcast on one-acre plots.

2. Determination of JH or other growth disruptive properties:
Effects of azadirachtin baits on growth and development of treated colonies were observed in the laboratory. Queen-right IFA colonies were established in the laboratory and fed azadirachtin baits. Brood production in treated colonies was compared to untreated colonies.

3. Drench treatments:
A. Laboratory tests:
IFA colonies, collected from the field and placed in 3-gallon plastic pans, were drenched using various concentrations of aqueous solutions of NSE to observe effects of NSE on immature ants as well as adult workers.

B. Field trials:
In addition to lab tests, a field trial with the most efficacious concentration was initiated. Efficacy of NSE drenches was determined by applying 1 gallon of NSE solution (100 ppm) to all IFA nests in a non-replicated 1 acre field plot.

RESULTS:

1. Bait treatments:
A. Laboratory bait acceptance tests:
Preliminary trials show that repellency occurs at higher concentrations. However, the Soy 3 and Soy 4 formulations containing 0.001% - 0.0001% azadirachtin were acceptable to IFA when offered as a bait formulated on pregelled defatted corn grits. Soy 4 containing 1, 4 and 40 ppm azadirachtin were also tested, and all were acceptable (Table 55).

B. Field trials:
Azadirachtin bait at 0.0003% AI was applied broadcast on a one acre plot. At three weeks PT, no significant reduction in population was detected. The 15 week PT count showed an 80% population reduction in

the check plot and a 50% decrease in the treated plot. These plots were dropped due to adverse weather conditions (drought).

Azadirachtin bait, 40 ppm in Soy 4, was applied to a one acre plot at a rate of 1.0 lb/acre. No significant decrease in population had been observed by 18 weeks PT.

A third field trial was initiated using .004% AI in Soy 3 bait and applied to a one acre plot at 10 lb/acre. At 6 weeks PT, no decrease in population was observed. Additional evaluations are scheduled for this trial.

2. <u>Determination of JH or other growth disruptive properties:</u>
Trials will be initiated in the spring when weather conditions are conducive to collection of queen-right IFA colonies.

3. <u>Drench Treatments</u>:
A. Laboratory tests:
Field collected colonies were drenched with a 1 liter solution of azadirachtin drench. Rates of 50 and 100 ppm were used with three replicates per treatment, along with check colonies drenched with 1 liter of water. These drenches produced slower activity and higher mortality than the checks, but did not provide 100% control.

A second trial was initiated in February 1991 using only the 100 ppm rate. Nine colonies were treated with 1 liter of azadirachtin solution, and nine were treated with 1 liter of water. At weekly intervals, three colonies of each were destructively sampled and compared. All azadirachtin treated colonies were much less active than the checks and did not actively forage for food. At 1 week PT, the azadirachtin colonies showed 50-90% mortality and no brood present, and by 3 weeks PT the remaining treated colonies were moribund.

B. Field trials:
All the mounds in a 1/4-acre plot were drenched with a 100 ppm, solution of azadirachtin. One day PT, most mounds had relocated and

contained "bone piles". The 15 week PT count showed an 80% population reduction in the check plot and a 95% decrease in the treated plot. These plots were dropped due to adverse weather conditions (drought).

SUMMARY:

Activity of NSE on IFA lab colonies was evident when 1 liter of NSE solution was applied at 100 ppm. Results with field tests with drench applications were negated by drought conditions. Baits prepared with NSE in soybean oil are repellent at concentrations greater than 0.01%. Field tests with NSE baits are inconclusive at this time. The most recent study (0.004% AI in Soy 3 applied at a bulk rate of 10 lbs. bait per acre) remains in a very preliminary stage with only data for 1 evaluation (6 weeks PT) available. Efforts to develop NSE baits will continue in 1992.

Table 55. Bait Acceptance Ratios of Various Formulations of Azadirachtin.

Formulation		Trial I (10/30/90) Mean Acceptance Ratio 1/	Trial I (10/30/90) SD 2/	Trial II (11/6/90) Mean Acceptance Ratio	Trial II (11/6/90) SD	Trial III (12/20/90) Mean Acceptance Ratio	Trial III (12/20/90) SD	Trial IV (7/7/91) Mean Acceptance Ratio	Trial IV (7/7/91) SD
Lot # 17	1.0%	0.15	0.08						
	0.1%	0.05	0.03						
	0.01%	0.33	0.07	1.32	0.78				
SOY 2	1.0%	0.02	0.03						
	0.1%	0.04	0.07						
	0.01%	0.83	0.44	0.78	0.29				
SOY 3	1.0%	0.02	0.02						
	0.1%	0.10	0.12						
	0.01%					0.57	0.34		
	0.001%					1.65	0.66		
	0.0001%					3.47	5.39		
SOY 4	0.1%					0.006	0.008		
	0.01%					0.49	0.30		
	0.001%					1.17	0.30		
	0.0001%					1.30	0.37		
	1 ppm							1.048	0.11
	4 ppm							0.92	0.11
	40 ppm							0.78	0.26

1/ Acceptance ratio - grams candidate bait removed/grams standard bait removed.
Mean acceptance ratio - average acceptance of 5 colonies tested.

2/ SD - standard deviation

PROJECT NO: FA02G041

PROJECT TITLE: Evaluation of Bollweevil Bait Sticks for RIFA Control.

TYPE REPORT: Final

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

INTRODUCTION:

Bollweevil bait sticks containing grandlure and cyfluthrin were obtained from Gerald McKibben, USDA, ARS Bollweevil Laboratory, Starkville, MS on 8/6/91. Field observation by various people had indicated the potential of this technology for IFA control. Both laboratory and field trials were conducted to determine effect of the bait sticks on IFA.

METHODS AND MATERIALS:

Lab tests: Fragmented IFA colonies were field collected by shovelling nest tumulus along with workers, immatures, and alates into 3 gallon plastic pails on 8/14/91. Queen status of all colonies was unknown; each colony contained an estimated 10,000 to 40,000 workers. Colonies were allowed to acclimate and re-establish nest structure in the laboratory until 8/16/91 at which time the blunt end of 1 bait stick was inserted approximately 6 inches into the center of each of five colonies. Five other colonies served as untreated controls. Observations were made over a one week period following introduction of the bait sticks.

Field tests: A field test was initiated in Stone County, MS on 9/19/91. Test plots were located in a mowed bahia grass (*Paspalum notatum*) field with a monogynous IFA population averaging approximately 59 active IFA nests per acre. Two unreplicated test plots and an untreated check were established. A team of 5 trained observers closely searched each plot by walking abreast at 8-10 foot intervals. All active nests in each plot were "treated" by first inserting the sharp end of a bait stick approximately 6-8 inches into the apex of each active mound. The stick was then removed and the blunt end reinserted to the same depth, thereby maximizing the exposed surface of the bait stick. Plots were crisscrossed in opposite directions to insure that all nests in each plot received a bait stick. A total of 111 sticks were placed in the two test plots. An untreated plot was counted but not treated in any manner. Prior to placement of the sticks, all IFA nests in a 1/4-acre circular subplot located in the center of each test plot were enumerated and rated on the population index scale described by Lofgren and Williams (1982). Four days after inserting the sticks into the nests, observations indicated that virtually all ant nests had been abandoned and relocated a short distance away from the original nest. All sticks in one of the two test plots were relocated into the "new" nests. Plots were evaluated at 3 and 6 weeks post-treatment.

RESULTS:

Lab tests: Within 5 minutes of insertion, toxic effects of the cyfluthrin were observed in many ants on the surface of the nest. Some ants which climbed the sticks in response to the disburbance died without returning to the surface. This rapid rate of kill has been observed with other synthetic pyrethroids, most notably bifenthrin, in nursery potting media. After 4 hours exposure numerous dead or pesticide affected workers were observed on the surface. Since the number of dead or moribund ants was much greater than the number that directly contacted the bait stick, fumigant activity was assumed. By the third day of exposure, several hundred dead IFA were observed on the surface of each treated nest. Additional exposure was achieved when agitated ants climbed up the sticks in response to routine watering, which was done every 3-5 days. One week after insertion of the bait sticks 4 of 5 treated colonies were rated as "dead" (less than 20 live worker ants), with only minimal activity in the fifth colony.

Field tests: Results are shown in Table 56 and indicate that control was not obtained by inserting bait sticks into IFA nests. Insertion of the bait stick almost invariable caused the colony to relocate the nest to a new site within 0.5 to 8 feet from the original nest site. Reinsertion of bait sticks into the new nest site also failed to kill the colony. Colony relocation following insecticidal treatment of IFA nest with any pesticide is a well documented phenomenon (Hays et al. 1982, Franke 1983, Williams and Lofgren 1983). It is for this reason that results or observations with individual mound treatments are often obscured by colony movement and relocation. Therefore, the most reliable results are obtained from trials which are designed, as was the current trial, to compensate for colony relocation.

Table 56. Evaluation of Bollweevil Bait Sticks for Control of IFA.

Treatment	Pretreat Population		% change in Pretreat Pop. at Indicated Wks. Post-treatment	
	No. Colonies	Pop. Index	(3)	(6)
stick left in original nest	13	200	-12.5	-10
stick removed and reinserted in "new" nests after 4 days	14	200	+12.5	+40
Untreated Check	17	250	-16.8	+12

SECTION IV

MISCELLANEOUS PROJECTS

PROJECT NO: FA01G048

PROJECT TITLE: Insecticide Coatings and Paint Additives for Residual Control of Foraging RIFA Workers on Painted Surfaces.

TYPE REPORT: Final

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

INTRODUCTION:

The presence of foraging workers on interstate shipment of general cargo has sparked controversy for several years. Even though IFA workers are sterile and cannot cause an infestation in and of themselves, current regulations disallow entry into non-quarantine areas if "*Solenopsis* species in any stage of development..." is detected. The records are replete with such occurrences on non-hazardous cargo. Entry of these cargoes can be made only after a thorough and expensive fumigation is accomplished. Current cost of such a procedure is ca. $1,000.00.

Our first study was begun in September 1988 to test the relative efficacy and residual activity of three commercial products against IFA workers: DL-A11 Brand Paint Insecticide (paint additive), CPF Insecticide (paint additive), and Super IQ/CIA Insecticide Coating. The potential use of chlorpyrifos impregnated paints or coatings could minimize the problem associated with foraging IFA workers which occasionally enter non-hazardous cargoes on tractor-trailers. They may also have some utility in the control of IFA in outdoor or subterranean electrical circuitry. The Texas Department of Agriculture experienced a significant number of documented incidences in which IFA infestations have caused failure of diversified electrical systems.

MATERIALS AND METHODS:

TEST 1:

A one-half inch, exterior grade, pine plywood board was sectioned into 1'x1' test boards and given a coating of primer (Exterior Latex) on September 27, 1988. Three boards (replicates) were then painted with each of the following treatments:

1. CPF Insecticide (61.5% chlorpyrifos by volume) mixed 18.9 ml with 1 gallon of paint. Manufactured by Environ-Chem, Inc., P.O. Box 1086, Walla Walla, WA 99362. AI = 0.25%.

2. Di-All Brand Paint Insecticide (11.2% chlorpyrifos by volume) mixed 3 fl. oz. per gallon of paint. Manufactured by Di-All Chemical Co., P.O. Box 14347, Orlando, FL 32857. AI = 0.31%.

3. Super IQ/CIA Insecticide Coating (pre-mixed). Manufactured by Farmland Industries, Inc., P.O. Box 7395, Kansas City, MO 64116-0005.

CPF and Di-All were incorporated into a latex enamel patio and decking paint (Artisan Classic Brand manufactured for West Building Materials Centers, Atlanta, GA 30309).

Untreated paint was applied to three boards as a painted check and three boards were left unpainted as a control. The boards were aged under conditions designed to simulate the interior environment of a tractor-trailer.

TEST 2

A second trial was begun in August 1989 to determine the effects wear would have on the efficacy of Super IQ/CIA Insecticide Coating. Three 4′ x 4′ exterior plywood boards were painted with two coatings of Super IQ/CIA and allowed to dry thoroughly before being exposed to foot traffic. Board 1 was placed at the main entrance of the Imported Fire Ant Laboratory and received a significant amount of foot traffic. Board 2 was placed at the rear entrance to the IFA Lab and received relatively light to moderate foot traffic. Board 3 was placed atop a fifty-five gallon drum and received no traffic. All three boards were subjected to normal climatic conditions.

Bioassays for Tests 1 and 2 were made at monthly intervals. Bioassays were conducted by confining 100 CO_2 anesthetized major workers to each test board with inverted petri dishes. Observations for mortality were made at hourly intervals.

RESULTS:

The results for Test 1 were completed in 1989 for Di-All and CPF treatments. Results of Super IQ/CIA Insecticide Coating were completed in 1991. All results are summarized in Tables 57 and 58. Evaluations indicate excellent long-term residual activity with Super IQ/CIA.

Table 57. Relative Toxicity of Insecticide Coatings to Major Workers of the Imported Fire Ant.

	% Mortality to Major Imported Fire Ant Workers at Indicated Months Post-Treatment													
Candidate	(1) ///	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20) ///	(30)	(31)	(32)	(33)
Super IQ	100	100	100	100	100	100	100	100	100	100	100	80	67	48
CPF	100	15	10	---										
Di-All	100	3	1	---										
Unpainted Ck	0	0	0	0	0	0	0	0	0	0	0			
Painted Ck	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 58. Effects of Various Wear Patterns on the Overall Efficacy of Super IQ CIA Insecticide Coating Against Imported Fire Ant Workers.

Board Traffic	Months Post Application	Percent Mortality of IFA Major Workers After Indicated Time [Hours] of Exposure 1/								
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Heavy	1	0	63	100						
Moderate		5	87	100						
None		0	49	100						
Heavy	2	25	70	100						
Moderate		33	83	100						
None		42	80	100						
Heavy	3	19	63	100						
Moderate		21	70	100						
None		20	66	100						
Heavy	6	0	40	100						
Moderate		10	75	100						
None		60	90	100						
Heavy	9	15	65	90	100					
Moderate		45	73	100						
None		35	95	100						
Heavy	12	56	85	100						
Moderate		70	100							
None		44	87	100						
Heavy	15	21	77	100						
Moderate		30	79	100						
None*										
Heavy	17	6	16	95	100					
Moderate		7	8	90	100					
Heavy	18	8	24	100						
Moderate		9	23	100						
Heavy	21	12	20	90	100					
Moderate		9	19	73	95	100				
Heavy	24	6	11	67	79	100				
Moderate		3	9	53	71	89	100			
Heavy	25	6	9	18	21	39	67	70	81	100
Moderate		4	13	32	37	42	56	68	73	80
Heavy	26	3	12	17	24	44	73	73	88	95
Moderate		0	2	17	24	38	48	56	68	70
Heavy	27	0	1	9	18	27	45	48	61	69
Moderate		0	0	6	9	19	42	46	57	61
Heavy	28	0	0	10	21	35	50	50	50	53
Moderate		0	2	7	23	29	48	51	51	55

1/ average based upon 100 IFA major workers per replicate.
* test board inadvertently destroyed.

PROJECT NO: FA01G141

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

METHODS AND MATERIALS:

Test boards of 3/8" unpainted, exterior plywood were sectioned into 1'x 1' pieces and treated with each candidate insecticide. All products were applied at the labelled rate for "ant control" to the point of runoff. Sprays were applied using 1 quart, hand pump mister bottles adjusted to give a coarse spray pattern. Three boards (replicates) per candidate were treated. The boards were aged outdoors under a pick-up camper shell to simulate the interior of a tractor-trailer. Bioassays were conducted 24 hours, 7 days, 4 weeks, 8 weeks, 12 weeks etc., or until activity ceased.

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

RESULTS:

Results are summarized in Table 59. At one month post-treatment all sprays were providing 100% mortality within 2-3 hours exposure. Testing will continue until 8 hours or more exposure are required to produce 100% mortality.

Table 59. Activity of Selected Insecticides Applied as a Spray-on Surface Treatment.

Insecticide	Replicate	Hours Required to Produce 100% Mortality at Indicated Post-treatment Intervals (24hrs)	(7days)	(1month)
Ficam®	1	1	1	1
	2	1	1	1
	3	1	1	1
Diazinon®	1	1	1	2
	2	2	2	2
	3	2	2	2
Dursban®	1	2	2	1
	2	2	2	1
	3	1	1	1
Malathion®	1	1	1	1
	2	2	2	1
	3	2	1	1
Tempo®	1	1	3	2
	2	2	3	2
	3	1	2	2
Check (% mort. at longest exp.)	1	0	0	0
	2	5	5	1/
	3	5	0	0

1/ Ants escaped from test chamber

PROJECT NO: FA01G121

PROJECT TITLE: Evaluation of Commercial Ant Bait Stations for IFA Control in Tractor-trailers.

TYPE REPORT: Final

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

INTRODUCTION:

Fire ants are notorious hitchhikers and often enter tractor-trailers as extraneous foraging workers on a variety of cargo. Occasionally, entire reproducing colonies establish nests in the walls of trailers, particularly non-maintained units that are infrequently used. The potential for using commercial ant bait stations for IFA control in tractor-trailers was investigated.

METHODS AND MATERIALS:

Field colonies, with brood,(queen status unknown), were collected in plastic pails and returned to the lab on August 5, 1991. Colonies were allowed to acclimate for approximately 7 days receiving moisture as needed, but no food prior to testing.

Five commercially available roach and/or ant baits were purchased locally from various retail stores. The baits were as follows:

Name/Manufacturer	Active Ingredient(AI)	% AI
Black Flag Ant Control System/ Boyle-Midway Household Products, Inc. New York, NY 10017	chlorpyrifos	0.500
Raid Ant Controller/ S.C. Johnson & Son, Inc. Racine, WI 53403	chlorpyrifos	0.030
Raid Ant Controller/ S.C. Johnson & Son, Inc. Racine, WI 53403	bendiocarb	0.03125
Raid Max Bait/ S.C. Johnson & Son, Inc. Racine, WI 53403	sulfonamide	0.500
Combat Roach Control System/ American Cyanimid Co. Wayne, NJ 07470	hydramethlynon	1.65

In this study, the bait was presented to the IFA colonies in two ways:

(1) The bait station was placed in a petri dish accessible to the colony (1 replicate per bait treatment).

(2) The bait was removed from the bait station and placed in a petri dish accessible to the colony (3 replicates per bait treatment), along with another petri dish containing an equal weight of untreated standard IFA bait (70:30 wt:wt mix of pregelled corn grits and peanut oil).

Bait Station Colonies

The number of ants entering the bait station during a one minute interval was determined at 1, 2, 3, 4, 6, and 24 hours after bait placement.

Bait Acceptance Study

Colonies which received both a candidate and a standard bait were handled as a typical bait acceptance study (Appendix IV), and acceptance ratios for each candidate bait were determined. Acceptance ratios of 0.75 or higher is usually considered acceptable to most IFA researchers (Lofgren et al. 1961).

Long Term Effects:
The colonies were observed weekly for any obvious effects of the various bait treatments. Biweekly, one colony from each bait treatment was destructively sampled to better determine the effects of the treatments. These were compared to controls of Amdro® (hydramethlynon) treated colonies and untreated colonies.

RESULTS:

These laboratory results were based on whole colonies that were stressed for food. Extraneous (straggler) workers isolated from their nest, and introduced into trucks on cargo would be disoriented and unlikely to respond to the same stimuli as foraging workers that leave the nest in deliberate search for food. Therefore, these results may not be a good predictor of actual results in real conditions.

Bait Station Colonies

The Raid with chlorpyrifos and Raid Max with sulfonamide were the most active stations with an average of 945 ants and 900 ants per hour, respectively, entering the stations during the first 4 hours. However, chlorpyrifos is a fast acting toxicant, and large numbers of dead workers rapidly accumulated near the bait stations.

Bait Acceptance Study

The bait acceptance study showed only the Raid Max (sulfonamide) to be attractive to the IFA with an acceptance ratio of 0.85 (Table 60).

Long Term Effects

At 2 weeks PT, one Amdro treated colony showed 80-90% mortality, and a sulfonamide treated colony showed sluggish responses to stimuli, large "bone piles" and 30-40% mortality. All others were active with small "bone piles" (evidence of natural attrition). At 4 weeks PT, only the Raid Max (sulfonamide) showed any significant mortality (approx. 50% worker mortality). At 6 weeks PT, mortality in the sulfonamide colony had increased to approximately 80%; in the Amdro control colony to 100%. All others were comparable to the untreated check colony. By 8 weeks PT, an Amdro treated colony showed 100% mortality, a Raid chlorpyrifos and a sulfonamide colony each showed ca. 60% mortality and a Combat hydramethylnon colony had 100% mortality. All other and the check showed no significant mortality.

In summary, the food attractant/toxicant used in most commercial ant bait stations are repellent to IFA. These stations are not intended for use against IFA, but instead, are formulated for roach and house-infesting ant control. However, Raid Max bait containing sulfonamide was attractive to IFA (acceptance ratio of 0.85) as shown in Table 60. Furthermore, this product was toxic to IFA colonies in the laboratory and might be of some value in controlling IFA colonies infesting tractor-trailer trucks.

Table 60. IFA Feeding Acceptance of Some Common Ant Bait Stations.

Product/ Active Ingredient	$\bar{X}$ Acceptance Ratio 1/
Raid Max/sulfonamide	0.85
Raid/chlorpyrifos	0.45
Combat/hydramethylnon	0.11
Raid/bendiocarb	0.025
Black Flag/chlorpyrifos	0.00

1/ Mean based on 3 captive IFA colonies following a 24 hr. exposure period.

PROJECT NO: FA05G011

PROJECT TITLE: Effect of RIFA Predation on a Population of the Least Tern - an Endangered Species.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

Birds nesting on an open beach are faced with many hazards that endanger their nesting success. These threats are commonly associated with avian and mammalian predators, human intrusion and tidal washouts. However, harassment by ants must also be considered as a factor that can influence the reproductive success of ground-nesting birds. Littlefield (1987) suggested that ant harassment was the probable cause of death of a Sand Hill Crane (Grus canadensis tabida) chick at Malheur National Wildlife Refuge in Oregon, as well as the cause of nest abandonment. Jackson and Jackson (1985) reported the abandonment of a Killdeer (Charadrius vociferus) nest in east-central Mississippi due to ant infestation at the pipping stage. Red imported fire ant (Solenopsis invicta) predation on six avian species has been documented. As early as 1938, fire ants were reported killing quail (Bobwhite, Colinus virginianus) [Travis 1938, 1943]. Ridelhuber (1982) found evidence of RIFA predation on the chicks and pipped eggs of the Wood Duck (Aix sponsa) and the Roseate Spoonbill (Ajaja ajaja). Other avian species predated include the Barn Swallow (Hirundo rustica [Kroll et al. 1973]), the Mississippi Kite (Ictinia mississippiensis) [Parker 1977] and the Black-bellied Whistling Duck (Dendrocygna autumnalis) [Delnicki and Bolen 1977].

Ant harassment and potential ant predation was found in a colony of Least Terns (Sterna antillarum) nesting along a large expanse of beach in Gulfport, Harrison County, Mississippi. During the 1988 nesting season, numerous chicks, ranging in developmental stages from hatchlings to fledglings, were observed with ants and/or ant stings on their bodies. These ants, though not positively identified at the time, were most likely RIFA. A subsequent survey showed only colonies of this ant species in the immediate area of the nesting grounds. RIFA workers were typically found clinging to the feet of the chicks or to the areas around the eyes. A total of 22 chicks were found with ants on their bodies. Some chicks had as few as one ant on their body while others were completely covered with ants. Sixteen of these chicks were less than 10 days old and nine were less than one week of age. Younger, less mobile chicks would seem to be most susceptible to attack by RIFA workers. Twenty-six chicks were found with ant induced stings; these wounds usually resulted in swelling of the feet and the area around the eyes. A few chicks had holes through the webs between their toes. In one instance, a chick's foot was so badly damaged by RIFA stings that it was deformed and appeared permanently crippled. Additionally, seven nests were found abandoned (with eggs). Five dead pipped eggs and 18 dead chicks infested with RIFA workers were located. Although nest abandonment and chick mortality were not directly observed, these data suggest the probable culprits were foraging RIFA workers. Previous studies by other researchers have shown similar patterns of predation (Kroll et al. 1973, Parker 1977, Ridlehuber 1982, Stoddardis 1932, Travis 1938).

MATERIALS AND METHODS:

A single application of Amdro® fire ant bait was made to a 9.45 acre nesting site on 25 September 1990 at a rate of 1.5 lbs/acre.
Population density surveys of RIFA were carried out prior to treatment within both the treated and untreated check areas. Subsequent surveys were made monthly to determine the efficacy of the treatment.
During the bird nesting season, surveys were conducted on both the RIFA populations and the fledgling population. Fledglings were examined for signs of ant predation and mortality factors for dead birds were determined.

RESULTS:

Beginning the first week of May 1991, visual surveys were conducted at both the treated and the untreated site. Counts were made of active nesting sites, numbers of eggs, pipped eggs and fledglings, and mortality. Because of unusually heavy rainfall that spring, Least Terns delayed their egg laying ca. 4-5 weeks beyond the normal time frame.

Although nests were excavated beginning in early April, no eggs were observed until the first week in May. Eggs layed during this early period were heavily predated by Fish Crows. By week 4 in late May, egg numbers had declined precipitously (Fig. 1). Beginning in June (week 5), egg numbers began to increase once again (this also coincided with a substantial increase in growth of beach grasses and forbes perhaps supplying camouflage for the nests). The first fledglings began to appear in week 5 as well. No fledgling mortality was noted until week 7. Comparative mortalities between the treated and untreated sites showed a consistent pattern (Fig. 2). The highest mortality at the treated site occurred in week 9. Two strong storms passed over the area during this time period. Mortality at the untreated site during week 9 was only slightly higher than the previous two weeks. The storms may have restricted the ability of RIFA workers to effectively forage. Only 2.5% of the fledglings killed during the 9th week were killed by RIFA. Mortality levels began to drop at week 12 at the untreated site. At the treated site, mortality levels began dropping around week 10.

The single most significant factor involved in the mortality of Least Tern eggs and fledglings are Fish Crows. Mobbing is the normal defensive response of Least Terns to intruders, scavengers and predators. Least Terns will harass an intruder and, through shear numbers, drive the invader from the area. At both study sites, there were far too few adults to successfully defend the nesting areas. During one survey, a Fish Crow was observed entering the nesting area and devouring an egg while being molested by only two adult Least Terns. While conducting a survey two weeks later, a Fish Crow's cache of 19 broken eggs was found along the sea wall.

Next in significance was the intrusion of man. Even though the areas are clearly marked as Least Tern nesting sites, numerous incursions were made by people throughout the nesting season. On one occasion, 18 separate sets of footprints were observed passing within 10 feet of a 4' x 8' warning sign and into the nesting grounds. During the study, five nests were found trampled upon destroying 8 eggs and two fledglings. Nests that are disturbed often enough are abandoned by the parent birds. Young birds forced from their nests by intruders are often attacked by adult

Least Terns.

Fire ants ranked third as a causative factor in Least Tern mortality. As can be seen in Figure 2, RIFA made a significant impact upon those young birds that managed to survive the crow and human intrusion.

FIG. 1 COMPARATIVE NUMBER OF EGGS/ACRE

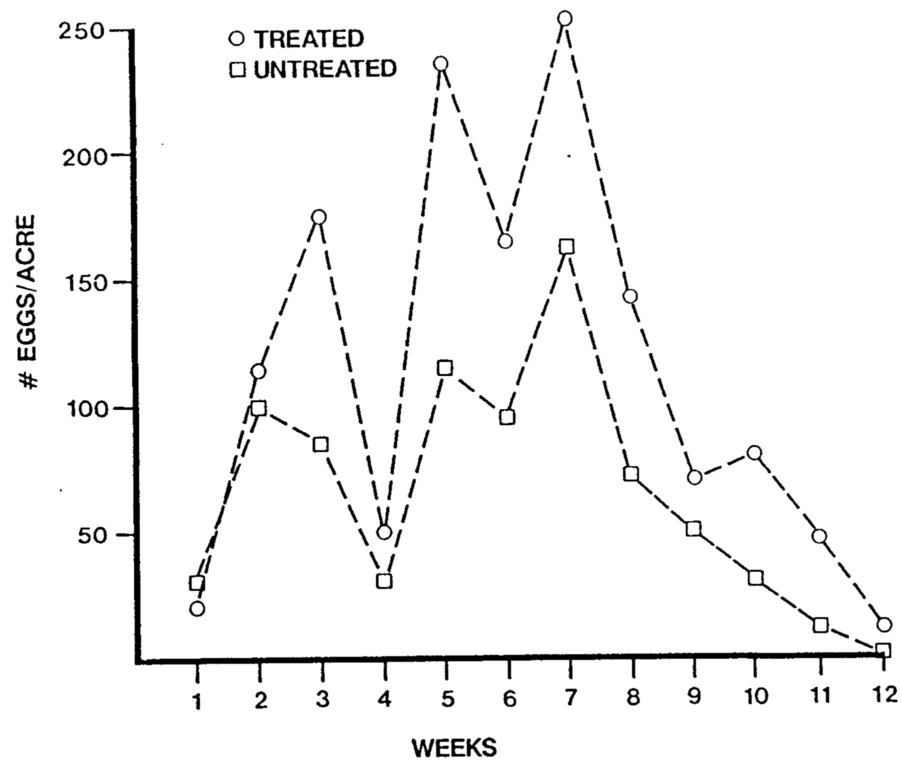
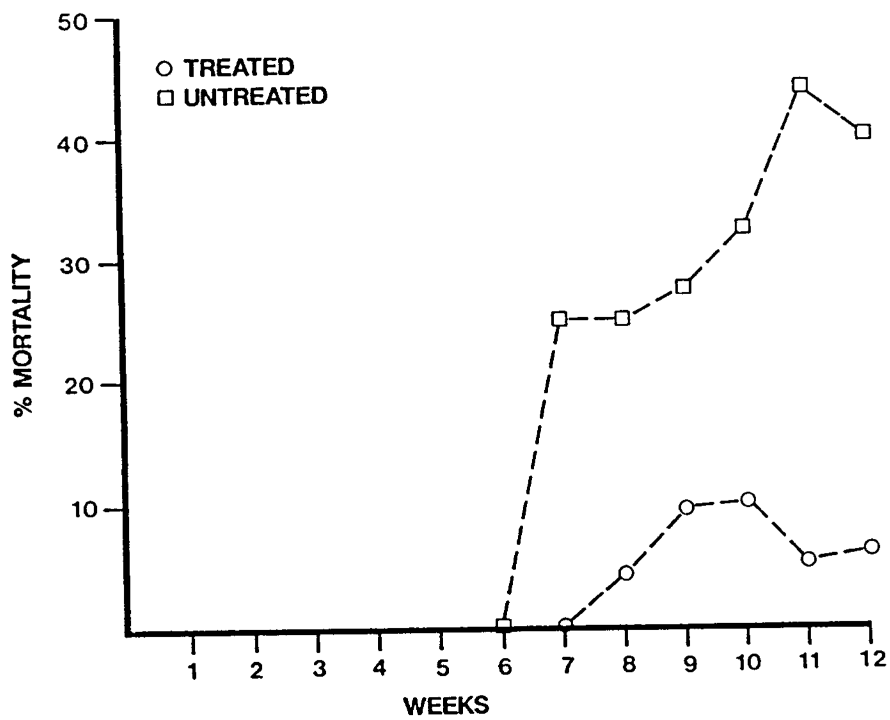


FIG. 2 COMPARATIVE MORTALITY OF 1-3 DAY OLD LEAST TERNS



PROJECT NO: FA05G021

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Tim Lockley

INTRODUCTION:

As part of a larger study addressing the potential impact of the red imported fire ant (RIFA) on wildlife production in Texas rangelands, five 500 acre plots were treated with Amdro® in the southeastern part of the state on 4/15/91 with a subsequent applications made 6 months later on 10/15/1. This study is being conducted under the auspices of Texas Tech University (TTU) [lead agency]. TTU is tasked with quantifying the effect of RIFA on annual production of selected vertebrate game, non-game and endangered species. The Texas Department of Agriculture is conducting population sampling of RIFA. USDA-APHIS-S&T-NMRAL is conducting chemical analysis of selected species for the presence of Amdro.

MATERIALS AND METHODS:

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

In order to determine if treatment with Amdro has any effect (positive or negative) on non-target invertebrates, collections of various arthropods were made within the treated areas. Comparative collections outside 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) 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 flowering community were made. UV light traps were placed within 100 m of the area(s) collected by sweep net. The traps were set up and collected during the 30 minutes prior to true dark and 30 minutes prior to true light respectively. Collections were made beginning 3-2 days pretreatment.

Subsequent samples were taken at 24 and 72 hours post-treatment. Further samples were taken at 6, 12 and 24 weeks post-treatment following the first Amdro application. 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.

Residue analysis of non-target arthropods for the presence of Amdro was be accomplished by NMRAL. A twenty gram aliquot of orthopterans (primarily tettigoniidae) per treatment period was taken from the samples collected within 24 hours of treatment, frozen and transported to NMRAL for subsequent analysis.

RESULTS:

No significant difference in mean biomass of arthropods collected pretreatment by UV light trap was observed (Table 61). However, by 6 weeks post-treatment, 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 post-treatment), while still indicating significant differences in biomass, had dropped to a level only 50% greater than the untreated mean. Although an increase to greater than 100%, was shown at 24 weeks post-treatment, numbers of arthropods collected were insufficient to validate the difference in biomass. Overall mean biomass collected tended to follow the population index of RIFA (Table 62).

There was no significant increase in species diversity among the selected arthropods collected by either UV light trap (Table 63) or sweep net (Table 64). By 6 weeks post-application, the treated sites averaged 69 representatives of 10 selected species. The untreated sites averaged only 4 species with 38 representatives. By week 12, number of species was equal for both the treated sites and the controls at 31. However, the treated sites yielded 221 specimens while the control sites held only 106. From the samples collected at week 24, the treated site gave 17 separate species and the control gave 12. Both yielded 24 total specimens. The results to date were anticipated. Twenty-four weeks after a bait application is not sufficient time for recovery. By the end of the study (spring 1993), we expect to see changes in both species diversity and species richness.

Table 61. Total Arthropod Biomass Collected by UV Light Trap in Treated and Untreated Plots.

Collection Month	Total Biomass (grams)	
	Treated	Untreated
IV (Pretreat)	167	248
VI	2405	960
VII	487	323
X	43	21

Table 62. Average Mean RIFA Population Indices for Plots Treated with Amdro and Untreated Check Plots.

Collection Month	Mean Population Index	
	Treated	Untreated
IV (Pretreat)	455	297
VI	84	176
VII	126	126
X	306	290

Table 63. Average Number of Selected Arthropods Collected by UV Light Trap in Treated (T) and Untreated (U) Plots.

	Collection Month					
	VI		VII		X	
Arthropod	T	U	T	U	T	U
SCARABAEIDAE						
Anomala flavipennis			1	12	1	1
Canthon imitator	1		1			
C. vigilans				1		
Cyclocephala linida				1		
Eucanthus lazarus	1	1				
Eutheola h. rugiceps	1					
Omorgus punctatus			1			
Onthophagus gazella	67				1	1
Phyllophaga sp.	1	2				
Ph. submicida	2					
Ph. crinita	3	3				
Ph. torta	1					
Ph. tusa			1	1		
Ph. ephilida				1		
Pelidnota punctata	1					

Table 63. (Cont'd)

Arthropod	Collection Month VI T	VI U	VII T	VII U	X T	X U
CARABIDAE						
Acupalpus sp.		1				
Agonum sp.	1	1		1		
A. decorum	3	3	1	1		
A. punctiformes	1	2			1	
Amara sp.	1					
Amblygnatha iripennis		2		1		1
Anatrichus minuta		1				
Anisodactylus sp.					1	1
A. opaculus		20				
A. ovularis	3				1	3
Apenes sinuata		1	1			
Ardistomis viridis			1			
Asplidoglossa subangulata	1	3	1	4	2	3
Brachinus sp.	1	1				
B. adustipennis	1	1	1		1	
Calosoma sayi			1			
Calleida decora		1				
Chlaenius pennsylvanicus	1		1			1
Clivina sp. A	21	18	1	1	2	1
Clivina sp. B	1			1	1	
Colliuris pennsylvanica		1				
Harpalus caliginosus	1	1				
H. pennsylvanicus	1	1				
Lebia sp.	1	1		2		
L. ornata	1	1				
L. pulchella	56	23	2	7		
L. viridipennis				1		
L. viridis	1	15	1	1		
L. vittata	5	24	2	3		
Loxandrus sp.	24	21	1	3	2	5
Pterostychus chalcites	11	13	1	2		
Scarites subterraneus		3	1	1		
Selenophorus palliatus		1				
Stenocrepis cuprea	1					
S. quatrodecimstriata	1					
Stenophus dissimilis	2	1	1	1	5	3
Stenomorphus californicus	6	25	13	12		3
Tetragonoderus fasciatus	1					
Thalpius sp.	1					
Zuphium americanum	7	3	2	2	1	
Carabid sp. A	1		1	1	1	
Carabid sp. B	1				1	
Carabid sp. C	1					

Table 63. (Cont'd)

	Collection Month					
	VI		VII		X	
Arthropod	T	U	T	U	T	U
ORTHOPTERA						
TETTIGONIIDAE						
Amblycorypha r. parvipennis	3	1		1		
Arethaea g. papago	2	1	1	1		
Neoconocephalus fasciatus	60	14	167	14		
Orchelium vulgare	80	18	1	1	1	
ACRIDIDAE						
Encotolophus subgracilis	1		1			
Hesperottetix sp.	1					
Melanoplus sp.	5	1		1		
Orphulella sp.			1			
O. speciosa	1	1	1		1	
Syrbula admiribilis			1			
Trimerotropis maritima				1		
GRYLLIDAE						
Gryllus sp.			1	1		
Nemobius sp.	16	34	10	27	1	1

Table 64. Mean Number of Selected Arthropods Collected by Sweep Net From Treated (T) and Untreated (U) Plots.

	Collection Month					
	VI		VII		X	
Arthropod	T	U	T	U	T	U
ORTHOPTERA						
Amblycorypha rotundifolia	2					
Arethaea gracilipes	1		9	1		
Hesperotettix sp.					1	1
H. viridis						1
Melanoplus sp.	20	7	8	2	5	2
Myogrillus verticalis	3					
Nemobius sp.					1	1
Neoconocephalus fasciatus	5		31	9	1	1
Orchelium sp.	15	18				
O. vulgare					15	11
Orphulella speciosa					1	1
Oecanthus celernictus	7	3	16	3		
Pediodectes haldemani	14	10	1			
Scudderia sp	1					
S. furcata	1					

PROJECT NO: FA01G179

PROJECT TITLE: Red Imported Fire Ant Damage to Blueberries in South Mississippi.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Tim Lockley, Barbara J. Smith*, Homer Collins
Avel Ladner, Lee McAnally, Anne-Marie Callcott
[*USDA-ARS, Small Fruits Research Lab,
Poplarville, MS]

INTRODUCTION:

The earliest documentation of damage to field crops by imported fire ants, *Solenopsis invicta* Buren and *S. richteri* Forel, was made in the spring of 1935 when damage to a corn crop was noted near Fairhope, Alabama (Eden and Arant 1949). Red imported fire ants (RIFA), *S. invicta*, are widespread throughout the southeastern United States. Adams (1986) listed numerous agricultural crops seriously affected by imported fire ants (e.g., citrus, soybeans, eggplant, okra). Many commercial rabbiteye blueberry (*Vaccinium ashei* Reade) fields in the southeastern U.S. are severely infested with this pest (personal observation, Barbara J. Smith) and RIFA mounds are often present at the base of many of the plants. Most blueberry fields are irrigated using drip irrigation systems. Blueberries have extensive but very shallow root systems and soil excavated for RIFA mounds results in the exposure of roots to the surface environment. Plants in infested areas appear to be much weaker and more chlorotic that the non-infested plants (personal observation, Tim Lockley); however, no information regarding RIFA damage to blueberries appears in the literature. In addition to any damage to the blueberry plant that may occur, RIFA also present a hazard to workers and pickers in the field. This hazard is of particular concern to growers who market their blueberries through a "pick-your-own" business. The objective of this study was to determine the relative damage to commercially grown blueberries by RIFA in Mississippi.

MATERIALS AND METHODS:

The trial was conducted on an 8 ha RIFA infested blueberry farm located in Covington County, MS (latitude 31.4 N). Rabbiteye blueberry plants had been established in 1983 and 1984 on a Ruston fine sandy loam soil with a pH of

6.1-6.4. Peat moss was incorporated into each planting hole prior to planting. Plants were maintained following recommended fertilizer and cultural procedures (Spiers et al. 1985). Plants were irrigated via a drip irrigation system with an emitter located at the base of each plant. Water was applied to each plant on an as-needed basis (ca. 8 liters/day during the growing season). Prior to the initiation of this study, a survey was made to determine the severity of the RIFA infestation in the field using the population index method (Harlan et al. 1981) as modified by Lofgren and Williams (1982) (Table 65).

The study site was divided into two replications based on age of the plants. Two treatments (infested and non-infested plants) were applied. Each plot consisted of one row of 75 to 100 Tifblue variety plants. Logic® fire ant bait (1% fenoxycarb) was applied at a rate of 1.68 kg/ha equivalent to a strip within each treatment plot 11 m wide by ca. 180 m long on 10/15/89 and 10/23/90. A treated strip was centered on rows 10 and 100. A population index survey conducted on 10/10/89 confirmed that RIFA had been significantly reduced in the treated area (Table 65). These rows became the non-infested treatment for this study and two untreated rows (40 and 70) were used as the infested treatment. A buffer zone of 90 m was established between the infested and non-infested rows.

On 11/13/89, every fifth plant in the 4 treatment rows was measured for height and width. A volume was also calculated for each bush. There were no significant differences between treatments at the initiation of the study in plant height, width or volume (Table 66). On 5/22/90 and again on 6/15/91, the height and width of the same plants was measured and a volume calculated. The change in plant size was calculated by subtracting the plant size at the beginning of the study from the plant size at the termination of the trial. All berries on six plants from the infested and six plants from the non-infested treatments were harvested and total yield and berry size was determined. A population index survey of RIFA infestation was also made at that time.

RESULTS:

There were significant differences in the change in plant height, width and volume between the infested and non-infested treatments in 1990. Non-infested plants had a significantly greater increase in each size parameter than did the infested plants (Table 66). Infested plants were slightly shorter at the end of the study than they were at the start of the study. This was probably due to the bending of the top branches caused by the weight of the berries. No significant differences in yield or average berry size was noted between the infested and non-infested plants harvested in 1990. However, many of the flowers on the plants in the test field were killed by two late freezes in the spring of that year. Average yield of the 12 bushes sampled was only 952 g/bush. Berry size was small because most of the berries were green at the time they were collected. There was a significantly greater increase in plant volume for the non-infested plants when compared to the infested plants within these 12 plants. The application of Logic® effectively eliminated RIFA from the treated area of the field. Non-infested plants within the treated rows showed significantly larger increases in plant height, width, and volume when compared to the plants in the infested rows. This difference was apparent within 10 months of application.

Following the 1990 treatment, the population index for the treated rows remained at 0 (Table 65). On 6/15/91, 20 plants from both treatments and the untreated checks were measured and an average yield determined per treatment. There were no significant overall differences in plant volume however yield results showed a significantly higher number in that volume. However, yield results showed a significantly higher number in the treated rows (2037 g/bush) than in the untreated checks (1695 g/bush) [Table 67].

We feel that the data presented here indicate that red imported fire ants cause injury to blueberry plants which can result in potential yield loss. Only diazinon, as a drench, is currently registered for use against RIFA in blueberry fields. Individual mound drenches require large volumes of water and are labor intensive. The broadcast application of Logic would seem to be both a logistically and ecologically sound method of control of RIFA in blueberries.

Table 65. Relative Populations of the Red Imported Fire Ant in Logic (fenoxycarb) Treated and Untreated Rows of Rabbiteye Blueberries [1990].

			RIFA Population Index Days Post-application			
Row	Age	Treatment	(0)	(30)	(120)	(300)
10	Old	Treated	415	24	10	3
40	Old	Untreated	352	245	450	130
70	Young	Untreated	225	240	290	110
100	Young	Treated	330	52	3	0

Table 66. Relative Comparisons of Plant Size Among Untreated (n=40) and Treated (n=35) Rabbiteye Blueberry Bushes [1990].

	DAY 0			DAY 300			RELATIVE CHANGE		
				HT	WD	VOL	HT	WD	VOL*
RIFA	(cm)	(cm)	(cm^3)	(cm)	(cm)	(cm^3)	(cm)	(cm)	(cm^3)
Treated	175.2	133.8	1334.0	181.2	161.2	2047.0	6.0	27.4	713.0
Untreated	175.9	128.9	1289.0	166.4	149.9	1707.0	-9.5	20.9	418.0
Pr > F	0.93	0.48	0.79	0.13	0.20	0.19	0.04	0.12	0.03

* volume calculated by formula (height x width x width)/2500.

Table 67. Effect of IFA Infestation on Growth and Yield of 'Tifblue' Rabbiteye Blueberry Plants [1991].

Plant Size		Treated	Untreated	Co Var 1/	ANOVA
Yield [g]		1711	2018	.25	.21
Berry Size [g]		0.48	0.46	.13	.14
Volume [start]	cm3	1484	1512	-	.84
Volume [end]	cm3	2042	2037	.98	.98
Div. Vol.	cm3	558	526	.85	.88
Yld/Vol.	[g/cm3]	.83	1.0	.06	.04

1/ Co Variance calculated using volume at beginning of study as an error term.

PROJECT NO: FA04G019

PROJECT TITLE: Systematic Survey of the Three Coastal Counties of Mississippi for Incidences of Polygynous Colonies of the Red Imported Fire Ant, *Solenopsis invicta* Buren.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Timothy Lockley

INTRODUCTION:

Mature colonies of *Solenopsis invicta* Buren have, until relatively recently, been considered monogynous (Lofgren et al. 1975). Tschinkel and Howard (1978) concluded from their study of colony founding and queen replacement that colonies often have more than one mated queen, but are, never-the-less, functionally monogynous (i.e. only one of the queens will lay eggs).

The red imported fire ant (RIFA) entered the United States at the port of Mobile, Alabama ca. 1940 (Lofgren et al. 1975). By 1957, they had entered the state of Texas. Reports of polygyny (multiple queens) started to appear in the early 70's at two widely separate locations--Mississippi (Glancey et al. 1973) and Texas (Hung et al. 1974). These studies found that multiple queens were gravid and that, when separated, produced brood. From these observations, they concluded that these colonies were functionally polygynous. Since their first discovery, polygynous colonies have been reported from Arkansas (Banks and Collins, unpublished data), Georgia and Louisiana (Fletcher 1983) and Florida (Lofgren and Williams 1984).

The polygyne phenomena is not just limited to *S. invicta*. Several other ant species have been observed to have multiple queens (Wilson 1971). Green (1952) observed large numbers of dealate queens (+ 25) in colonies of the black imported fire ant, *Solenopsis richteri* Forel. Fertility, however, was not determined. Polygyny has also been reported from native American fire ants, *Solenopsis geminata* (Banks et al. 1973) and *Solenopsis xyloni* (Summerlin 1976). Glancey et al. (1989) reported the occurrence of polygyny among populations of the *S. invicta* X *S. richteri* hybrid.

The mechanisms behind the independent occurrences of polygyny among RIFA colonies is unknown, but the frequency of this form seems to be increasing (Glancey et al. 1987). However, a recent survey of the Mississippi site where polygynous mounds were first reported showed a significant decline in polygyny. Of the mounds examined in and around the site, only ca. 50% were polygynous.

OBJECTIVE:

A number of questions concerning polygyny in _S_. _invicta_ remain to be answered. Among these are (1) how are polygynous colonies geographically distributed locally in relation to monogynous colonies, and (2) are polygyne colonies permanent or are they merely a temporary aberration? To help answer these questions, a systematic survey was conducted in 1989, 1990 & 1991 to determine the current extent of polygyny in the three coastal counties of Mississippi.

MATERIALS AND METHODS:

The survey was conducted using Mississippi State Highway Commission (MSHC) maps of the three Mississippi coastal counties of Hancock, Harrison, and Jackson. The survey was made at the juncture of all non-urban paved roads within the boundaries of all three counties. The area immediately adjacent to these junctures (6 meters from the road and 50 meters along its lengths) was surveyed. A maximum of ten mounds per site were excavated and examined at length for the presence of RIFA dealate queens. Tschinkel and Howard (1978) described the phenomena of functional monogyny in colonies of _S_. _invicta_. Because of this phenomena, when more than one dealate was observed within an excavated colony, replicate samples of the dealates were collected, placed in 80% ethanol and returned to the Imported Fire Ant Station at Gulfport, MS for dissection under magnification to determine the gravidity of each specimen. Examined sites were each given a code based upon the map coordinates indicated on the MSHC maps.

RESULTS AND DISCUSSION:

Of the three counties surveyed, Jackson County had the least number of paved roads followed closely by Hancock County. Harrison County contained ca. 2.5 times the total number of roads as the two adjacent counties. In Jackson County, a total of 23 sites were examined. In 1989, eighteen of these sites proved to be monogynous. Four of the remaining sites contained both multiple and single queen mounds. Only one site was completely polygynous. Ten of the monogynous sites contained colonies in which multiple, sterile, dealate queens were found. In 1990, the multiple queen site had reverted to a mixed population. No discernable change was noted in the habitat. Approximately 2.0 km to the east, a site that had been mixed the previous year had become completely polygynous. One site remained mixed (Hwy 57/I-10) and two sites had changed from mixed to single queen. In 1991, the polygynous site found in 1990 remained multiple-queen. The one mixed site had reverted to single-queen and no new mixed or polygynous sites were located.

Hancock County contained 30 sites. In 1989, a single site located near Point Clear was completely polygynous. Three sites were mixed. In 1990, the multiple queen site remained unchanged. However, two of the mixed sites had reverted to single queen sites. Four of the monogynous sites were found to be functionally monogynous. There was no discernable change among the sites in 1991.

Harrison County contained 126 sampling sites. In 1989, 1 site was completely polygynous. Eleven of the sites were mixed and 115 were totally monogynous. Thirteen of the monogynous sites contained unfertilized dealates. In 1990, the polygyne site remained unchanged. Of the 11 mixed sites examined in 1989, only two remained. The other nine had reverted to monogyny. One new site was found to be mixed. In 1991, the polygyne site remained unchanged. The two mixed sites examined in 1990 also remained. One new mixed site was documented (the site had been noted as mixed in 1989).

<u>CONCLUSION</u>:

Mississippi can lay claim to the dubious distinction of having been the state from which the first polygynous RIFA were reported. The site, located near Hurley, Jackson County, Mississippi was known among fire ant workers as "Queen City". Eighteen years later, the same site is ca. 50% monogynous. At the same time, in states like Florida and, most notably, Texas, multiple queen colonies are on the advance with no sign of decline. A survey carried out by the Texas Department of Agriculture in 1988 found 79 of 122 Texas counties infested with multiple queen colonies. In each of the three counties surveyed in Mississippi, only a single site in each proved to be totally polygynous. Are the polygyne colonies on the decline in southeast Mississippi? Are their numbers static? Are they growing? Data from these surveys would seem to indicate that polygyny, at least along the Mississippi Gulf Coast, is not significantly expanding and that it may even be declining somewhat. Future, annual surveys at these same sites over the next few years may help us in answering these questions.

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APPENDIX I

A. PUBLICATIONS:

Callcott, A.M., H.L. Collins. (IN REVIEW). Reinfestation of colonies of the red imported fire ant, Solenopsis invicta Buren (Hymenoptera:Formicidae) following a broadcast application of fenoxycarb bait.

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B. PRESENTATIONS:

Callcott, A.M. 3/91. "Bifenthrin: A Promising New Imported Fire Ant Quarantine Treatment for Containerized Nursery Plants". 1991 Imported Fire Ant Research Conference. Stone Mountain, GA.

Callcott, A.M. 4/91. "Research Update on IFA Treatments". Florida Nurserymen's Assoc. Workshop. Palmetto, FL.

Collins, H.L. 2/91. "Research Update on IFA Treatments". Florida Nurserymen's Assoc. Workshop. Homestead, FL.

Collins, H.L. 3/91. "Seasonal Effectiveness of AMDRO and LOGIC for Red Imported Fire Ant Control". 1991 Imported Fire Ant Research Conference. Stone Mountain, GA.

Collins, H.L. 4/91. Bifenthrin: A Promising New Imported Fire Ant Quarantine Treatment for Containerized Nursery Plants". Southern Plant Board Meeting. San Antonio, TX.

Collins, H.L. 9/91. "Tactics for Mitigating Interceptions of IFA on Non-regulated Articles". National Plant Board Council Meeting. Gainesville, FL.

Lockley, T.C. 1/91. "New Fire Ant Regulations". Joint Louisiana Assoc. of Nurserymen and Mississippi Nurserymen's Assoc. Baton Rouge, LA.

Lockley, T.C. 6/91. "Fire Ants: Research Activities and New Regulations". Alabama Nurserymen's Association. Birmingham, AL.

Lockley, T.C. 11/91. "The Imported Fire Ant: Current Research Activities". International Plant Propagators Society Meeting. Ocean City, MD.

Lockley, T.C. 11/91. "Current Status of Imported Fire Ants in North America". Mississippi Entomological Association Annual Meeting. Mississippi State University, Starkville, MS.

Lockley, T.C. 12/91. "Imported Fire Ants as a Significant Factor in the Mortality of the Least Tern, an Endangered Species". Entomological Society of America National Conference. Reno, NV.

APPENDIX II

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

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

Collection of test insects: Field collected alate imported fire ant 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 than 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 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 200-300 queens per hour. It is generally advisable to place collected queens in a 500 cc beaker of 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 replicated. Five alate queens are then introduced into each replicate.

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

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

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

1. Availability of queens; supply is primarily influenced by season. More time will be spent collecting queens in winter or during extreme droughts.

2. Number of treatments to be evaluated; e.g., if only a single treatment and an untreated check are to be evaluated, only 40 queens/month are needed. Conversely, a test involving 4 insecticides at 3 rates of application (12 treatments + untreated check) will require 260 queens monthly for the duration of the test.

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

APPENDIX III

PROTOCOL FOR EVALUATION OF GRANULAR SOIL INSECTICIDES FOR QUARANTINE TREATMENT OF NURSERY POTTING SOIL

1. General: In order to comply with IFA quarantine regulations, shipment of potted nursery plants cannot be approved by PPQ or State Inspectors unless the soil in which the plants are growing has been treated with an approved pesticide or other procedure. Chlordane dust (4 ounces of 5%/cu. yd. of soil) served this purpose until its use was cancelled by EPA on March 6, 1978. Five percent granular chlorpyrifos was adopted for program use in December 1979 and discontinued in 1981. In 1984, chlorpyrifos in either a 2.5% granular or a 10% granular formulation, was added to the treatment program. A premixed granular insecticide treatment is favored by most growers due to the ease of application and relative cost compared to other procedures such as liquid drenches, fumigation, bare-rooting, etc.

2. Requirement of the pesticide: Candidate pesticides must meet certain rigid requirements in order to be considered an effective treatment:

   A. The candidate must be toxic to the IFA (100% kill of alate queens in laboratory bioassays).

   B. The candidate must demonstrated a minimum of 12 to 18 months residual acitvity (so that growers will not be forced to apply additional treatments until repotting with fresh soil becomes necessary due to plant root development).

   C. The candidate must not cause phytotoxicity to the numerous species and types of plants which are grown in the treated media.

   D. Low mammalian toxicity (dermal) due to worker exposure.

   E. Economical to use.

3. Preparation of potting soil - toxicant mixture:

   A. The standard IFA potting media (adopted September 1991), consisting of a 3:1:1 mixture of milled pine bark:sphagnum peat moss:sand, is prepared by mixing 1.5 cu. ft. batches in a portable cement mixer.

   Specialized or commercially available potting media can be substituted for the above as necessary.

   B. Candidate toxicants are blended into the potting soil at an initial rate of 100 ppm based on dry weight bulk density of the media, i.e. if bulk density = 480 lb/cu. yd., then 1 mixer load weighs 26.7 lbs.

$$\frac{480 \text{ lbs}}{27 \text{ cu. ft.}} = \frac{X \text{ lbs.}}{1.5 \text{ cu. ft.}}$$

$$X = 26.7 \text{ lbs.}$$

So that
$$\frac{100}{1{,}000{,}000} = \frac{X \text{ g. AI}}{26.7(454)}$$

$$X = 1.21 \text{ g. AI/mixer load}$$

The actual amount of each candidate toxicant needed to treat a 1.5 cu. ft. batch of media is computed as follows:

$$C\ (X) = 1.21$$

Where C = % AI of the candidate
and X = g. of candidate needed for 1.5 cu. ft. of media

e.g. given a 15% granular candidate:

$$.15\ (X) = 1.21$$
$$X = 8.07 \text{ g. of a 15G candidate/1.5 cu. ft. media}$$

C. After the candidate toxicant is added to the potting media, the cement mixer is operated for about 1/2 hour in order to insure thorough blending of the toxicant with the potting media.

D. After the mixing process is complete, the treated media is poured into 1 gallon plastic nursery pots and weathered outdoors under simulated nursery conditions (1″ to 2″ irrigation weekly) until the first bioassay is conducted 30 days after treatment.

4. <u>Bioassay</u>: See Protocol for Bioassay

5. <u>Dose rate</u>: Depending upon results obtained with the initial concentration of 100 ppm, additional tests with various dose rates may be indicated.

APPENDIX IV

PROTOCOL FOR CONDUCTING BAIT ACCEPTANCE STUDIES

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

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

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

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

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

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

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

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

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

APPENDIX V

PROTOCOL FOR PREPARATION OF NURSERY POTTING MEDIA

General:

Strong-Lite® potting mix was adopted as the "standard" media in 1988 in an effort to maintain uniformity among the numerous trials comparing rates of dissipation of candidate toxicants. Numerous trials have been conducted with that mix; however, effective September 1, 1991, the standard mix was changed to the media used by Dr. A.J. Laiche, Mississippi Agricultural Forestry Experiment Station (MAFES), Poplarville, MS. This change was prompted for several reasons:

1. Cost of Strong-Lite mix increased from $6.50 per 3 cu. ft. to $12.95 per 3 cu. ft. ($116.55 per cu. yd)

2. The Strong-Lite mix is actually a bedding mix, rather than a growing medium typically used to grow woody ornamentals to marketable size. Therefore, the MAFES mix will be more representative of the mixes used in the industry.

Preparation of Media:

The MAFES mix is blended as follows (A. J. Laiche, personal communication):

3 parts milled pine bark
1 part sand
1 part sphagnum peat
(i.e., 3:1:1 by volume)

amendments are as follows: (cu. yd. basis)
4# dolomite
1# 25/10/0 complete fertilizer
1# superphosphate (0/20/0)
1# micromix

complete fertilizer added according to crop, i.e., 1/2 tsp. Stay-Green per 6" every 4-6 wks. for short-term crops.

Components of the MAFES mix will be purchased in bulk and blended on-site as needed. Cost of the MAFES media will be approximately $16.56 per cu. yd. For routine pesticide screening trials, amendments will not be added.