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U.S. DEPARTMENT OF AGRICULTURE

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

SCIENCE AND TECHNOLOGY

WHITEVILLE PLANT METHODS CENTER

IMPORTED FIRE ANT STATION

3505 25th AVENUE
GULFPORT, MS 39501

1990 ANNUAL REPORT

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

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

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

Compiled and Edited by:

Homer L. Collins

March 1991

CONTENTS

FY 1990 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.

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 dust formulations of each product tested were blended into nursery potting soil, (Strong-Lite®, 382 lbs. per cubic yard) at an initial rate of 10 lbs. AI per three-inch acre (equivalent to 11.35 grams AI per cu. yd. of media). 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 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. With the exception of bifenthrin 0.3G (72.6 ppm), all toxicants were incorporated into potting media at 86.3 ppm.

RESULTS:

As indicated in Table 1, two candidates have demonstrated excellent residual activity. Bifenthrin 0.3G and Force 1.5G have each maintained 100% efficacy for 25 months post-incorporation. 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)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
Bifenthrin 0.3G	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Force 1.5G	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Cypermethrin 0.75G	100	100	100	100	100	100	100	100	100	100	100	100	100	95	35										
Pounce 1.5G	100	100	100	100	95	45	35	0	0																
Dursban 2.5G	100	100	100	100	45	75	35	0	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	0	0	0

1/ Test initiated December 14, 1988.

PROJECT NO: FA02G018

PROJECT TITLE: Population Dynamics of Imported Fire Ant Colonies.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott and Rebecca Norris

INTRODUCTION:

IFA colonies grow and develop following mating flights. Small incipient colonies are often comprised of less than 100 workers and the queen. Conversely, large mature colonies can contain over 250,000 workers plus reproductive and immature forms. Only a few studies have been undertaken to determine the time interval necessary for a colony to develop from a single queen to a mature, reproductive colony. Markin et al. (1973) showed the time interval to be a minimum of 2 1/2 years, and by 3 years, all colonies examined were fully matured. Lofgren et al. (1975) and Markin and Dillier (1971) estimated that mature colonies were at least 2 years old. Many factors can inhibit or enhance the growth of a colony; climatic conditions such as air and soil temperature, soil moisture, and humidity, and environmental conditions such as food and site availability (Green 1967, Rhoades and Davis 1967 and Lofgren et al. 1975).

A numerical colony classification system based on estimated worker ant population and status of worker brood (Lofgren and Williams, 1982) is routinely used by many researchers to evaluate the effects of insecticides upon IFA populations. In this system a newly formed colony (less than 100

workers, with worker brood present) is rated as a "5". A large mature colony (more than 50,000 workers and brood present) is given a numerical rating of 25. Studies to determine the time interval required for new colonies to attain the various rating levels have not been conducted. A study was initiated in the summer of 1988, to determine the time required for incipient colonies (i.e., class "5" colony) to develop to certain colony classes (10, 15, 20, and 25) on the population index scale described by Lofgren and Williams (1982).

METHODS AND MATERIALS:

Since geographical differences in the growth rate of RIFA colonies can be expected to occur, this study was conducted at two sites. The South Mississippi site represented the epicenter of the infestation while the Whiteville, North Carolina site represented the northern periphery of the infestation.

The pre-existing population in each 20 acre study site was eliminated (reduced to a theoretical population of "0") by applying Logic® bait at a rate of 1.5 lbs./acre on or about April 1, 1988. The bait was applied broadcast using the APHIS granular applicator mounted on a farm tractor. Population changes following application were monitored monthly in ten 1/4 acre permanently located subplots at each site. When the pre-existing population reached or approached 0, the present study began. At that time subplots were rated quarterly. As reinfestation occurred and incipient colonies grew and

developed into the various colony classes, the types and numbers of colonies present were recorded. From this data, the time required for colonies to grow and mature into the various colony classes was determined.

RESULTS:

South Mississippi Site I:

The South Mississippi site was located in Forest County, Mississippi approximately 40 miles north of Gulfport, Mississippi. However, the site was not ideal due to its small size (about 10 acres) and the number of trees in the area. The trees made even broadcast of the bait difficult. Some of the efficacy plots were located close to the edge of the treated area, resulting in a possible "edge effect" i.e., mature colonies outside the 10 acre treated area moving into the outer edges of an efficacy plot. This "edge effect" was very evident in Plot 1, thus this plot was removed from the study. A theoretical population of zero was reached at about 5 months (23 weeks) post-treatment. At this time, 5 of the plots had 100% colony mortality (Table 2), while the remaining 4 plots had 5 surviving colonies between them. Good control was still being observed 9 months post-treatment and reinfestation had not occurred. By 15 months, reinfestation was occurring. While the number of colonies and population index was still much lower than pretreat populations, all the colonies present were in class 10 and higher (Table 2 and 3).

This site was abandoned after the 15 month count for a number of reasons including rain (site too boggy to count for months), and especially lack of personnel available for counts when necessary. Another site was selected and a second Mississippi study initiated (see south MS Site II).

North Carolina Site:

A theoretical population of zero was reached at about 6 months (24 weeks) post-treatment. At this time, 5 of the plots had 100% mortality (Table 2), while the remaining 5 plots ranged from 90 to 95% mortality. At 16 months post treatment, reinfestation had begun. As in the Mississippi site, while the number of colonies and population index were still very low compared to pretreat populations, 94% of the colonies present at 16 months rated in class 5 and above (Table 3). At 29 months post treatment, the study at this site was concluded. Eight of the ten plots were close to or above pretreat population levels. Ninety percent of the colonies were rated as class 5 and above, and 89% of those were in classes 15, 20 and 25.

South Mississippi Site II:

A second trial was initiated in Saucier, Mississippi, (10 miles north of Gulfport, MS) on June 13, 1989, because we feel that the test site in Site I was relatively small. Because of the size of that site, little or no treated border was applied and migration of mature colonies into the test site biased the results ("edge effect").

A theoretical population of zero was reached at about 3 months post-treatment. At this time, population mortality in all plots was 97% or greater (Table 2). The population growth of IFA colonies at this site progressed as expected; single undetected mated queens to small undetected incipient colonies (<100 workers), and then through the visible colony classes to mature colonies (Table 3). Newly mated queens and small class 5 colonies are difficult to find in the field. Markin et al. (1973), following the growth of IFA colonies in the field from newly mated queens to mature colonies, found colonies aged 2 months had an average of 66 workers (class 5), and those aged 3 and 5 months averaged over 200 (class 10) and over 1000 workers (class 15) respectively. New nests developed into class 20 colonies after approximately 1 year and into class 25 colonies after 2 1/2 years.

From the Markin et al. (1973) findings, we assume small class 5 colonies were growing and developing 1-2 months prior to detection in the field. Incorporating this assumption into the data presented here, we find that classes 10 and 15 develop after approximately 3 months of growth, and classes 20 and 25 first appear after 12-15 months of development.

Table 2. (Cont'd).

Plot Number	Pretreat Population: Colonies/ Subplot	Pretreat Population: Pop. Index	Status of Population at Indicated Months Post-Treatment: % Colony Mortality (1)	(2)	(3)	(4)	(8)	(13)	(16)	% Change in Pre-Treatment Population Index (1)	(2)	(3)	(4)	(8)	(13)	(16)
SOUTH MISSISSIPPI SITE II																
1	13	235	61.5	53.8	84.6	69.2*	69.2	84.6	0	-92.8	-94.5	-97.9	-81.3*	-88.5	-87.2	+72.3
2	15	273	66.6	66.6	93.3	80.0	80.0	26.6	0	-94.5	-94.5	-98.9	-83.5	-89.4	-54.2	+11.7
3	14	290	50.0	50.0	100	85.7	92.8	50	0	-93.4	-93.1	-100	-95.5	-99.3	-70.7	+12.1
4	9	175	77.7	77.7	100	55.5	66.6	0	0	-97.1	-97.7	-100	-81.7	-92.0	- 5.7	+74.3
5	17	248	70.5	70.5	100	82.4	82.3	52.9	17.6	-94.3	-95.9	-100	-87.9	-87.1	-59.7	+2.8
6	14	250	78.5	64.3	71.4	92.8	78.6	35.7	0	-96.4	-95.2	-97.2	-98.8	-88.0	-52	+8.0
7	10	180	10.0	60.0	90.0	40.0	60.0	40	0	-84.4	-95.0	-98.9	-65.5	-82.2	-58.3	+33.3
8	13	245	46.1	46.1	92.3	92.3	100	46.2	0	-92.2	-92.2	-99.2	-99.2	-100	-67.3	+18.4
9	15	265	66.6	53.3	93.3	80.0	80.0	33.3	0	-94.3	-92.8	-99.2	-69.8	-97.3	-56.6	+17.0
10	18	330	55.5	22.2	83.3	50.0	77.7	33.3	0	-93.3	-88.8	-97.2	-73.9	-91.5	-57.5	+9.1

* possible "edge effect"

Table 3. Decline and Resurgance of IFA Colonies by Colony Class following a Broadcast Application of Logic Bait.

Colony Class	Pre-treat	% of Total Colonies in each Colony Class at Indicated Post-Treatment Interval (Months) (1)	(2)	(3)	(4)	(5)	(9)	(12)	(13)	(15)	(16)	(19)	(22)	(25)	(29)
SOUTH MISSISSIPPI SITE I															
1	1.9	-	1.9	9.8	0	0	0	0	-	0	-	-	-	-	-
2	0	-	12.7	39	0	40	16.7	0	-	0	-	-	-	-	-
3	0.6	-	30.4	41.5	22.2	20	0	3.7	-	0	-	-	-	-	-
4	0	-	38.2	2.4	0	0	0	0	-	0	-	-	-	-	-
5	0	-	15.7	0	11.1	0	0	3.7	-	0	-	-	-	-	-
5	0	-	0	0	0	0	0	3.7	-	0	-	-	-	-	-
10	7	-	0	2.4	44.4	20	0	14.3	-	37	-	-	-	-	-
15	26.1	-	1	2.4	11.1	0	33.3	46.4	-	38.9	-	-	-	-	-
20	37.6	-	0	2.4	11.1*	20*	33.3*	21.4	-	17.6	-	-	-	-	-
25	26.6	-	0	0	0	0	16.7	7.1	-	6.5	-	-	-	-	-
NORTH CAROLINA SITE															
1	1.6	8.2	2.3	12.5	24.3	0	0	-	10	-	0	0	1.4	0	0
2	7.2	14.6	12.2	29.2	18.9	0	0	-	20	-	3.1	4	5.5	0.7	3.5
3	5.7	27.6	35.5	26.7	29.8	0	0	-	0	-	2.1	8	11.0	1.3	1.4
4	6.7	18.5	34.3	15.8	13.5	0	25	-	0	-	1	9	4.8	3.4	1.4
5	15	20.9	9.9	2.5	2.7	0	0	-	0	-	1	4	10.3	1.3	3.5
5	8.3	0	0.6	1.7	2.7	33.3	0	-	0	-	13.4	12.5	1.4	2.0	1.4
10	19	4.4	2.3	6.6	5.4	66.7	75	-	50	-	47.4	18	20.7	27.5	8.3
15	23.2	2.9	1.2	4.2	2.7	0	0	-	20	-	30	33	31.7	35.0	27.0
20	10.3	2.9	1.7	0.8	0	0	0	-	0	-	2	8.5	6.9	20.1	34.7
25	3	0	0	0	0	0	0	-	0	-	0	3	6.2	8.7	18.8

* Possible "edge effect"

Table 3. (Cont'd).

Colony Class	Pre-Treat	% of Total Colonies in each Colony Class at Indicated Post-Treatment Interval (months) (1)	(2)	(3)	(4)	(8)	(13)	(16)
SOUTH MISSISSIPPI SITE II								
1	0	1.8	3.2	7.7	0	3.6	0	0
2	1.4	30.4	41.9	69.2	19.4	35.7	0	0
3	0	44.6	51.6	23.1	8.3	7.1	0	0
4	0	21.4	3.2	0	2.7	3.6	0	0
5	0	1.8	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
10	7.9	0	0	0	33.3	32.1	56.5	12.0
15	33.3	0	0	0	22.2	14.3	43.5	44.8
20	39.1	0	0	0	11.1*	3.6	0	39.3
25	18.1	0	0	0	2.7*	0	0	3.8

* possible "edge effect"

PROJECT NO: FA01G048

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

TYPE REPORT: Interim

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.

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. Our first study was begun in September 1988 to test the relative efficacy and residual activity of three commercial products against IFA workers: Di-A11 Brand Paint Insecticide (paint additive); CPF Insecticide (paint additive); and Super IQ Insecticide

Coating.

MATERIALS AND METHODS:

TEST 1:

A one-half inch, exterior grade, pine plywood board was sectioned into 1´x 1´ 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 (chlorpyrifos 11.2% 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 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 Insecticide Coating. Three 4′ x 4′ exterior plywood boards were painted with two coatings of Super IQ and allowed to dry thoroughly before being exposed to 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 test boards with inverted petri dishes. Observations for mortality were made at hourly intervals.

RESULTS:

The results for Test 1 were completed in 1989 for D-All and CPF treatments. (See 1989 Annual Report). Results of Super IQ Insecticide Coating are

still ongoing, and are summarized in Table 4. Evaluations to date indicate excellent long-term residual activity with Super IQ (at least 29 months). Both CPF and Di-All provided 9 months of residual activity. Results of Test 2 are not complete at this time. However, initial data would seem to indicate that heavy wear for up to 17 months (Table 5) does not lessen the efficacy of Super IQ Insecticide Coating.

Table 4. Relative Toxicity of Insecticide Coatings to Major Workers of the Imported Fire Ant.

	Percent Mortality to Major Imported Fire Ant Workers at Indicated Months Post-Application										
CANDIDATE	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	/ / / (29)
Super IQ	100	100	100	100	100	100	100	100	100	100	100
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

Table 5. Effects of Various Wear Patterns on the Efficacy of Super IQ Insecticide Coating Against Imported Fire Ant Workers.

Traffic Pattern 1/	Months Post-Application	Percent Mortality of IFA Workers Confined to Surfaces Board Treated with Super IQ Insecticide Coating for Indicated Exposure Time [Hours] 2/ [1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
H		0	63	100						
M	1	5	87	100						
N		0	49	10						
H		25	70	100						
M	2	33	83	100						
N		42	80	100						
H		19	63	100						
M	3	21	70	100						
N		20	66	100						
H		0	40	100						
M	6	10	75	100						
N		60	90	100						
H		15	65	90	100					
M	9	45	73	100						
N		35	95	100						
H		56	85	100						
M	12	70	100							
N		44	87	100						
H		21	77	100						
M	15	30	79	100						
N 3/										
H		6	16	95	100					
M	17	7	8	90	100					

1/ H= Heavy; M = Moderate; N = None.
2/ Average based upon 100 IFA major workers per replicate.
3/ Test board inadvertently destroyed.

PROJECT NO: FA01G039

PROJECT TITLE: Effects of Irrigation on Residual Activity of Granular Dursban® and Triumph®.

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

TYPE REPORT: Final

INTRODUCTION:

Triumph is a relatively new organophosphate from Ciba-Geigy, which in previous trials has shown good potential for IFA regulatory use. The granular formulation (Triumph 1G) would provide an alternative to using Dursban for certification of containerized plants. Dursban granules can be used for control of IFA in containerized or field grown nursery stock (M301.81). All previous studies on residual activity, with both Dursban and Triumph, have been conducted under natural rainfall conditions only. Under actual nursery conditions, irrigation is a constant occurrence.

Ford's Chemical Company currently holds the only granular Dursban registration for IFA quarantine certification of nursery stock. In recent months, the certification period of 24 months for incorporated Dursban has been questioned. Original residual activity studies were conducted using Dow's Dursban 10G (Collins et al. 1980). Studies were initiated to determine the effects of irrigation on the residual activity of granular Triumph and Dursban.

METHODS AND MATERIALS:

The chemicals used were Triumph 1G (Ciba-Geigy CGA-135223), Ford's Dursban 2.5G and Dow's Lorsban® 15G. Each of these formulations was incorporated into Strong-Lite® potting media, using a portable cement mixer, at a rate of 11.35 gms. AI/cu yd. media (Ford's 2.5G labelled rate for certification of containerized nursery stock).

Each treatment filled 288 6" standard plastic nursery pots, and was divided into 4 groups, each receiving a different amount of water per week through irrigation (in addition to rainfall). The source of the irrigation water was the Gulfport, MS municipal water department. Irrigation schedule was as follows:

1) 72 pots of each treatment receiving 1 inch water per week

2) 72 pots of each treatment receiving 2 inches water per week

3) 72 pots of each treatment receiving 4 inches water per week

4) 72 pots of each treatment receiving only natural rainfall (standard)

5) 72 untreated check pots receiving only natural rainfall

Monthly bioassays with IFA alate queens were performed using a composite sample of three pots from each treatment group (Appendix II).

RESULTS:

Irrigated treatments of two and four inches per week were inactivated after one month; one inch per week after two months; and the non-irrigated standard between three and six months (Table 6).

The second and third trials utilized Dursban 2.5G, Lorsban 15G and Triumph. All treatments receiving irrigation were ineffective by two months post-treatment (Table 7 and 8). Dursban 2.5G and Triumph non-irrigated standards had one to three months residual while the Lorsban 15G had one to six months residual.

CONCLUSION:

These trials indicate that irrigation, regardless of the amount, decreases the residual activity of Dursban 2.5G, Lorsban 15G and Triumph 1G. Additional studies with distilled water versus tap water have been initiated to determine if factors such as carbonate level, metal ions, chlorine content, etc., in the irrigation water enhances degradation of these pesticides.

Table 6. Influence of Irrigation on Residual Activity of Dursban 2.5G Incorporated into Nursery Potting Media - Trial I.

Irrigation Schedule (inches/wk)	1 Month		2 Months		3 Months		4 Months	
	% Mort.	Cumulative Amt. H_2O (inches)	% Mort.	Cumulative Amt. H_2O (inches)	% Mort.	Cumulative Amt. H_2O (inches)	% Mort.	Cumulative Amt. H_2O (inches)
1"	100	5.45	100	14.05	0	24.6	--	--
2"	100	9.45	70	23.05	0	37.6	--	--
4"	100	17.45	5	41.05	0	66.6	--	--
Standard	100	1.45	100	5.05	100	10.6	10	30.21

Table 7. Influence of Irrigation on Residual Activity of Various Granular Insecticides Blended into Strong-Lite Potting Media - Trial II.

Insecticide Treatment	Irrigation Schedule (inches/wk)	1 Month % Mort.	1 Month Cumulative Amt. H_2O (inches)	2 Months % Mort.	2 Months Cumulative Amt. H_2O (inches)	3 Months % Mort.	3 Months Cumulative Amt. H_2O (inches)	4 Months % Mort.	4 Months Cumulative Amt. H_2O (inches)	5 Months % Mort.	5 Months Cumulative Amt. H_2O (inches)	6 Months % Mort.	6 Months Cumulative Amt. H_2O (inches)
Dursban 2.5G	1	100	7.4	5	16.3	10	24.4	0	38.8	-	-	-	-
11.3g AI/cu. yd.	2	100	11.4	100	25.3	15	37.4	0	53.8	-	-	-	-
of media	4	100	19.4	0	43.3	15	67.4 *	5	94.8	-	-	-	-
	Rain only	100	3.4	100	7.3	100	11.4	75	22.8	25	28.1	10	37.35
Lorsban 15G	1	100	7.4	10	16.3	10	24.4	5	38.8	-	-	-	-
11.3g AI/cu. yd.	2	100	11.4	5	25.3	15	37.4	0	53.8	-	-	-	-
of media	4	100	19.4	0	43.3	5	67.4 *	5	94.8	-	-	-	-
	Rain only	100	3.4	100	7.3	100	11.4	100	22.8	100	28.1	0	37.35
Triumph 1G	1	100	7.4	15	16.3	15	24.4	0	38.8	-	-	-	-
11.3g AI/cu. yd.	2	100	11.4	0	25.3	5	37.4	0	53.8	-	-	-	-
of media	4	100	19.4	5	43.3	5	67.4 *	0	94.8	-	-	-	-
	Rain only	100	3.4	100	7.3	100	11.4	20	22.8	0	28.1	0	37.35
Check	1	0	7.4	15	16.3	5	24.4	0	38.8	-	-	-	-
(untreated)	2	15	11.4	5	25.3	0	37.4	0	53.8	-	-	-	-
	4	5	19.4	0	43.3	10	67.4 *	0	94.8	-	-	-	-
	Rain only	10	3.4	0	7.3	15	11.4	5	22.8	0	28.1	15	37.35

* Received an extra 4 inches on 10/24/89 due to an oversight.

Table 8. Influence of Irrigation on Residual Activity of Various Granular Insecticides Blended into Strong-Lite Potting Media - Trial III.

Insecticide Treatment	Irrigation Schedule (inches/wk)	1 Month % Mort.	1 Month Cumulative Amt. H_2O (inches)	2 Months % Mort.	2 Months Cumulative Amt. H_2O (inches)	3 Months % Mort.	3 Months Cumulative Amt. H_2O (inches)	4 Months % Mort.	4 Months Cumulative Amt. H_2O (inches)
Dursban 2.5G	1	100	15.05	0	29.05	0	40.75	0	40.75
11.35g AI/cu.	2	100	20.05	0	44.05**	10	53.75	10	53.75
3yd. of media	4	100	38.05*	100	56.05	5	79.75	5	79.75
	Rain only	100	10.05	80	20.05	0	27.75	0	27.75
Triumph 1G	1	20	15.05	0	29.05	0	40.75	0	40.75
11.35g AI/cu.	2	100	20.05	15	44.05**	5	53.75	5	53.75
yd. of media	4	100	38.05*	5	56.05	5	79.75	5	79.75
	Rain only	100	10.05	5	20.05	0	27.75	0	27.75
Lorsban 15G	1	100	15.05	0	29.05	0	40.75	0	40.75
11.35g AI/cu.	2	100	20.05	5	44.05**	0	53.75	0	53.75
yd. of media	4	100	38.05*	70	56.05	5	79.75	5	79.75
	Rain only	100	10.05	90	20.05	0	27.75	0	27.75
Check	1	0	15.05	5	29.05	0	40.75	0	40.75
(untreated)	2	10	20.05	0	44.05**	5	53.75	5	53.75
	4	0	38.05*	0	56.05	10	79.75	10	79.75
	Rain only	0	10.05	0	20.05	10	27.75	10	27.75

* Received an extra 8 inches on 1/17/90 due to an oversight.
** Received an extra 6 inches on 2/7/90 due to an oversight.

PROJECT NO: FA01G049

PROJECT TITLE: Evaluation of Mobay NIN 33893 for Control of IFA.

TYPE REPORT: Final

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

INTRODUCTION:

Mobay NIN 33893 FS (flowable solution) is an experimental compound under investigation for use against a variety of insect pests. The chemical composition and its mode of action are undisclosed at this time. However, Mobay feels the compound may be effective against imported fire ants (IFA) due to its activity against other social insects such as termites. Several studies were designed and implemented to test and evaluate the effects of NTN 33893 on IFA following various application techniques in both laboratory and field studies.

MATERIALS AND METHODS:

Laboratory Tests

Drench Studies:

IFA colonies were collected in the field, brought to the laboratory, and allowed to rebuild their nests in 12" x 15" x 6" plastic tubs for 3-5 days. NIN was prepared in solution with water at a variety of concentrations and applied to the colonies as a mound drench.

I. Test I - May 17, 1989

Five colonies were drenched using 7.81 ml NTN/liter water/mound (equivalent to 2X Dursban 2EC label rate for mound drench).

II. Test II - June 22, 1989

IFA colonies were drenched with 1 quart of the following treatments (3 replicates/treatment):

Dursban 2EC standard - 15cc/gal water
NTN - 15cc/gal water
NTN - 7.5cc/gal water
NTN - 3.7cc/gal water
NTN - 1.8cc/gal water
NTN - 0.9cc/gal water
Check - plain water

Bait Studies:

NTN was also prepared as a bait, using several different carriers and attractants such as peanut butter, honey and water, macerated mealworms (Tenebrio sp.), and 10% sucrose solutions.

I. Peanut butter bait

NTN was mixed with peanut butter to provide a 2% NTN bait. Ten grams of bait in a petri dish was offered to each of five field collected IFA colonies.

II. Honey and water bait

A 1.5% bait was prepared using equal parts honey and water. Ten grams of the bait solution was offered in petri dishes to each of three colonies.

III. Macerated mealworm bait

A macerated mealworm preparation (25 g. mealworms and 5 g. water blended for 3 minutes in a laboratory blender) was mixed with NTN to provide a 1% bait. Three colonies were given 10 g. of bait each in a petri dish.

IV. Sucrose bait

Colony test - A bait test using serial dilutions of NTN in a 10% sucrose solution was initiated. NTN rates of .0001%, .0005%, .001%, .01%, .05% and .1% were introduced to IFA colonies. Three colonies were treated with each dose rate. Colonies were fed the NTN/sucrose bait in micropipets, each colony receiving a maximum of 240 ul. of bait (Banks & Harlan 1982). Three untreated check colonies received 240 ul. each of 10% sucrose.

Brood test - A study was initiated to determine the effect of the compound on gravid queens and brood when introduced in a sucrose bait. Queen right colonies were place in Labstone® nests and a NTN sucrose bait (various dose rates in 10% sucrose) introduced to each colony using micropipets. Colonies were watered and fed (Tenebrio sp.) weekly.

Residual Contact Activity in Soil

Drench studies:

Residual contact activity of NTN FS was tested by drenching Strong-Lite® nursery potting media contained in 1 gallon pots with NTN drenches. Activity was determined by bioassay of treated media using alate queens. Application

0.6 ml/gal water. Pots were weathered under natural conditions, and irrigation added when needed to maintain 2 inches of water per week. A composite sample of two pots from each treatment was collected at 24 hours and then monthly, and bioassayed with alate queens, using slightly modified procedures described by Banks et al. (1964).

Granular incorporated studies:

A 0.5G formulation of NTN 33893 was incorporated into Strong-Lite® potting media at a rate of 11.35 g. AI/cu. yd. of media (Dursban 2.5G label rate) using a portable cement mixer. The treated media was placed in 1 gallon nursery pots and subjected to natural weather conditions. A composite sample of 2 pots of the treated soil was collected and bioassayed monthly.

Field Tests

Test I - August 2, 1989

A one-acre plot was established in Harrison County, Mississippi, and a 1/4 efficacy subplot marked in the center. IFA colonies in the subplot were counted and rated according to the procedure described by Lofgren and Williams (1982). All mounds in the plot were marked with engineering flags prior to treatment. Each mound was then drenched with 1 cc NTN FS/gal. water/mound (lowest effective rate from the lab drench studies). The plot was counted and observations made at 5 days, 14 days and 12 weeks after treatment.

Test II - June 19, 1990

A second field study using NTN as an individual mound drench was initiated in Harrison County on June 19, 1990. Three one-acre plots were established with 1/4 acre efficacy subplots marked in the center of each and prepared as above. Each plot received a different treatment:

Plot 1 - Acephate at 1 oz/5 gal H_2O with 1 gal solution/mound

Plot 2 - NTN at 3.7 cc/gal H_2O with 1 gal solution/mound

Plot 3 - untreated check

The plots were evaluated weekly and both population indices and nest mortality were recorded.

RESULTS:

Laboratory Tests

Drench Studies:

I. Test I - May 17, 1989

Approximately 95% mortality had occurred in each treated mound by two hours post-treatment, and survivors were moving very slowly. By 28 hours post-treatment, 100% mortality had occurred in all treated colonies.

II. Test II - June 22, 1989

Totally abnormal behavior was observed 6 - 24 hours after treatment and eventually, all rates provided 100% colony mortality in 2-14 days after application (Table 9).

Bait Studies:

I. Peanut butter bait

Up to 3 hours after bait introduction, all colonies were feeding well with some foragers around the food source showing symptoms of CNS poisoning. By 24 hours post-treatment, no colonies were feeding and very little bait was removed. Colonies were observed for 7 days at which time the test was terminated due to lack of mortality.

II. Honey and water bait

Ants actively fed for a few hours then stopped. Check colonies continued feeding for 24 hours. By 4 days post-treatment, ants in the treated colonies were "clustering" on the soil and moving very slowly when agitated, despite minimal bait ingestion. Colony mortality had not occurred by 7 days post-treatment and test was terminated.

III. Macerated mealworm bait

All colonies actively fed during the first hour. By 2 hours post-treatment,

feeding had ceased and foragers in the feeding dishes showed symptoms of CNS poisoning. Three days after treatment, some colonies were "clustering". At 7 days, all colonies were "clustering" on the soil surface, even after minimal bait ingestion. However, by 21 days, colonies had recovered and no significant mortality had occurred.

IV. Sucrose bait

Colony test - The lower rates were readily consumed, and caused some "clustering" on the soil and sluggish movements, but had little lasting effect on the colonies. The two highest rates were repellent to the foragers (avg. - 36% of the bait consumed), but did cause "clusters" for several days and reduced responsiveness to stimuli. The .001% bait was well received by the workers, with 95% of the bait removed within 24 hours of introduction. A concentration of .01% resulted in consumption of 60% of the available bait within 24 hours. In both of these trials, extreme reduction in response to stimuli and reduced movements were observed, but entire colony mortality was not achieved in the 21 day test period.

Brood test - Five weeks post-treatment, there seemed to be no observable difference between the treated and check colonies. All colonies had lost up to 50% of their original numbers, and whether repopulation was occurring was not certain. The colonies (treated and untreated) had eggs and larvae, but no pupae were observed at this time. At nine weeks post-treatment, one check colony had expired. The remaining check colonies and all treated colonies were normal. All these colonies contained eggs and larvae, and pupae were

the drench to be effective at rates as low as lcc/gal water. Field tests,using higher rates, thus far show a moderate decrease in pretreatment population indices, but acceptable mound control was not achieved.

Table 9. Observations on Laboratory Colonies Drenched with Various Rates of NTN.

Treatment	Visual Observations at Indicated Time Post-Treatment				
	6 hrs.	24 hrs.	2 days	9 days	14 days
Dursban 2EC-Standard 15 cc/gal. water	100% mortality	-------	------	------	------
NTN 15cc/gal water	ants alive but non-responsive to stimuli very slow movements	ants unresponsive or dead large groups "clustered" on soil with slight antennal movement	100% mortality	------	------
NTN 7.5cc/gal water	ants alive but non-responsive to stimuli very slow movements	ants unresponsive or dead ants "clustered" on soil with slight antennal movement	some recovery in activity	100% mortality	------
NTN 3.7cc/gal water	ants alive but non-responsive to stimuli very slow movements	ants unresponsive or dead ants "clustered" on soil with slight antennal movement	some recovery in activity	100% mortality	------
NTN 1.8cc/gal water	ants alive but non-responsive to stimuli very slow movements	ants unresponsive or dead ants "clustered" on soil with slight antennal movement	some recovery in activity	greatly reduced activity	100% mortality
NTN 0.9cc/gal water	ants alive but non-responsive to stimuli very slow movements	ants unresponsive or dead ants "clustered" on soil with slight antennal movement	100% mortality*	------	------
Check	normal activity	normal activity	normal activity	normal activity	normal activity

* possibly due to improper mixing - each dilution mixed separately, not in serial dilutions

Table 10. NTN Field Drench Test, Harrison Co., MS, August 2, 1989.

Treatment	Pretreat Population		Population Status at Indicated Days Post-Treatment					
	No. Colonies	Pop. Index	% Colony Mort. (5)	(14)	(82)	% Pop. Index Chg (5)	(14)	(82)
NTN FS 1 cc/gal water/nest	17	210	18	17.6	5.9	-44	-16.6	-10.9
Untreated Check	9	120	11	11.1	0	-13	-25	+12.5

Table 11. NTN Field Drench Test, Harrison Co., MS, June 19, 1990.

Plot	Treatment/ Application Rate	Pretreat Pop. No. Col.	Pretreat Pop. Pop. Index	Population Status at Indicated Weeks Post-Treatment: % Colony Mortality (1)	(2)	(3)	(4)	(6)	(8)	% Change in Population Index (1)	(2)	(3)	(4)	(6)	(8)
1	Orthene 75SP/ 0.2 oz/gal/mound	15	185	93.3	100	86.7	93.3	80	73.3	-94.6	-100	-97.3	-91.9	-75.7	-79.5
2	NTN 33893 240 FS/ 3.7 ml/gal/mound	15	215	13.3	0	13.3	66.6	46.6	66.6	-49.3	- 60	-80	-93.9	-77.2	-73.5
3	Untreated check	15	185	0	13.3	6.7	13.3	26.6	20	+13.5	- 13.5	-13.5	-13.5	-21.6	-16.2

PROJECT NO: FA01G069

PROJECT TITLE: Performance of Triumph® 1G in Various Types of Potting Media.

TYPE REPORT: Final

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

INTRODUCTION;

Several previous studies suggests that Triumph 1G may be an effective IFA quarantine treatment for potting media. Since potting media varies greatly in composition, pH, density, and numerous other factors which could affect residual activity, more information on the performance of Triumph 1G in various potting media was needed. One previous trial utilized Triumph 1G in Baccto potting media at a rate of 22.4 gms. AI/cu. yd. yielding a theoretical dose rate of 60 ppm. This rate provided at least 27 months residual activity under simulated non-irrigated nursery conditions. (Ladner and Collins 1988 Annual Report).

METHODS AND MATERIALS:

The objective of this study was to examine the residual activity of Triumph 1G and Lorsban® 15G mixed at a weight-to-weight dose rate to yield 60 ppm for Triumph and 40 ppm for Lorsban (based on recommendation of IFA Technical Work Group in a May 2, 1989 position paper). Each compound was also mixed at a weight-to-volume ratio of 11.3 gms. AI/cu. yd. for Lorsban and 22.4 gms. AI/cu. yd. for Triumph. One and a half (1.5) cubic feet of each potting media listed below was treated with Triumph 1G at each rate listed below and 1 1/2

cubic feet of each media was also treated with Lorsban 15G at each rate listed as follows:

Each mixture was thoroughly blended using portable cement mixers and then placed in 6" pots (18 pots/treatment). Three pots from each treatment were collected and composited at monthly intervals and bioassayed with alate queens using standard laboratory bioassay procedures in Appendix II. Pots were weathered outdoors under natural conditions. Irrigation water was added to simulate normal agronomic practices, i.e., a minimum of 2" of water/week, whether by rainfall or by irrigation.

Treatments evaluated were as follows:

	Triumph 1G Grams AI/cu. yd.		Lorsban 15G Grams AI/cu. yd.	
Potting Media	wt. to vol.	wt. to wt.	wt. to vol.	wt. to wt.
Stronglite	22.4	10.4	11.34	6.94
Baccto	22.4	22.3	11.34	14.85
Peat Moss	22.4	9.37	11.34	6.25
Sunshine	22.4	6.7	11.34	4.47

RESULTS:

As shown in Table 12, the initial 1 month post-treatment bioassay indicated 100% mortality for both compounds in all medias and rates with the exception of Triumph in the Sunshine potting media at the weight-to-weight (higher) rate (60% mortality). At the two month point, all four combinations in the peat

moss and the weight-to-weight combinations of both Lorsban and Triumph in Baccto were still at 100% mortality. All other combinations were at 60% or below. At three months post-treatment, all replicates except those in peat moss were discarded after failing to produce at least 50% mortality. All treatments in peat moss showed 100% control of IFA for 12 months. These very interesting results confirm the need for additional research into factors influencing residual activity of pesticides in potting media. The extremely long residual of both Triumph and Lorsban in peat moss, but not in other soils, may be due to either biotic or abiotic factors.

Table 12. Residual Activity of Triumph 1G and Lorsban 15G in Various Types of Potting Media.

Treatment		Average % Mortality to Alate Queens at Indicated Months Post-treatment											
Potting Media	Insecticide Rate (Gms AI/YD^3)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Baccto	Triumph 22.4	100	10	0	-								
	Triumph 22.3	100	100	5	5								
	Lorsban 11.34	100	10	30	-								
	Lorsban 14.8	100	100	10	5								
	Check	10	10	5	5								
Sunshine	Triumph 22.4	60	30	5	-								
	Triumph 6.76	100	15	5	-								
	Lorsban 11.34	100	20	10	-								
	Lorsban 4.47	100	15	5	-								
	Check	10	25	5	-								
Stronglite	Triumph 22.4	100	5	0	-								
	Triumph 10.4	100	15	15	-								
	Lorsban 11.34	100	60	15	-								
	Lorsban 6.94	100	10	10	-								
	Check	5	0	0	-								
Peat Moss	Triumph 22.4	100	100	100	100	100	100	100	100	100	100	100	100
	Triumph 9.37	100	100	100	100	100	100	100	100	100	100	100	100
	Lorsban 11.34	100	100	100	100	100	100	100	100	100	100	100	100
	Lorsban 6.25	100	100	100	100	100	100	100	95	100	100	100	100
	Check	5	0	0	0	0	5	15	5	0	5	0	5

PROJECT NO: FA01G079

PROJECT TITLE: Effect of Irrigation Water pH on the Rate of Degradation of Chlorpyrifos in Nursery Potting Media.

TYPE REPORT: Final

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

INTRODUCTION:

Dursban® 2.5G applied as a preplant incorporated treatment is approved for certification of nursery potting soil under the IFA quarantine. A certification period of 24 months was listed in USDA, APHIS, PPQ Treatment Manual M301.81 until August 1990. Previous degradation studies, conducted under local conditions in Gulfport, Mississippi, dealt with the effects of various amounts of irrigation water on residual activity (See Report FA01G039). Questions have also surfaced regarding effects of pH of the irrigation water on degradation rates. This study determined if irrigation water pH affects the rate of degradation of granular chlorpyrifos blended into potting media.

METHODS AND MATERIALS:

TEST I:

Ford's Dursban 2.5G was blended into Strong-Lite® potting media with a cement mixer for one hour at a rate of 11.3 grams AI/yd^3 soil (the labelled rate of application). The potting media was then placed into 4" square pots and maintained on greenhouse benches. The pots were divided into 3 groups of 75

pots each. One group was irrigated with plain tap water (Gulfport Municipal Water Dept., average pH of ca. 7.8) while each of the other two groups were irrigated with water at pH 9 and 11, respectively. The pH of the water was amended with a 50% solution of sodium hydroxide. All three groups received 1" of water each week. At monthly intervals, 3 pots from each treatment were composited and a 80-100 cc subsample was used for the bioassay. Standard laboratory alate queen bioassay procedures were used (Appendix II).

TEST II:

A second study was initiated when efficacy in the original study declined after 3 months. Three treatment groups consisting of three sub-groups each were used. One treatment group was treated with Dursban 2.5G, One treatment group was treated with Lorsban® 15G, and the third group was an untreated check. One sub-group in each treatment received tapwater and the other two sub-groups in each treatment received water at a pH of 9 and a pH of 11 respectively. The same methodology and rates AI, as used in the first study, were used in the second study.

RESULTS:

Results of the first study are summarized in Table 13. After two months the tap water treatment had dropped to 45% mortality. After three months, all three groups had dropped well below 50% mortality and the study was terminated.

As a result of this failure, a second study was begun. Results are summarized in Table 14. At three months two Dursban treatments (tap water and pH 11) and one Lorsban treatment (pH 11) remained at 100%. The Dursban tap water and Lorsban pH 11 remained effective after 6 months. The Dursban pH 11 dropped out after 3 months. The Lorsban tap water treatment fell to 35% and 75% in months 2 and 3 respectively. At months 4 and 5 it returned to 100%, but dropped back to 15% at month 6.

Table 13. Influence of pH of Irrigation Water on Residual Activity of Dursban 2.5G in Nursery Potting Media.

Irrigation water	Average % Mortality to Alate Queens at Days Post-Treatment 1/ (1)	(30)	(60)	(90)
Tap	100	100	45	30
pH 9	100	100	100	15
pH 11	100	100	100	20
Untreated Check	5	20	5	5

1/ Standard laboratory bioassay using field collected alate queens.

Table 14. Influence of pH of Irrigation Water on Residual Activity of Dursban 2.5G and Lorsban 15G in Nursery Potting Media.

Insecticide Treatment	Average Mortality to Alate IFA Queens at Months Post-Treatment 1/										
	(24 Hrs.)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dursban											
Tap	100	100	100	100	100	100	100	85	100	15	5
pH 9	100	100	0	40	5	25	40	--	--	--	--
pH 11	100	100	100	100	10	0	10	--	--	--	--
Lorsban											
Tap	100	100	35	75	100	100	15	0	5	30	0
pH 9	100	100	5	5	0	0	15	--	--	--	--
pH 11	100	100	100	100	100	100	100	15	75	100	25
Untreated											
Tap	0	10	0	0	5	0	5	0	0	15	5
pH 9	0	15	0	5	10	5	10	--	--	--	--
pH 11	25	10	10	0	0	15	20	0	0	0	5

1/ Standard laboratory bioassay using field collected alate queens.

PROJECT NO: FA01G099

PROJECT TITLE: Effect of Multiple Applications of Logic[B] [fenoxycarb] for Population Suppression of Polygynous Imported Fire Ant in Commercial Grass Sod.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Homer Collins, Tim Lockley, Avel Ladner, Lee McAnally, Mark Trostle, and Octavio Garza [Texas Department of Agriculture]

INTRODUCTION:

Logic has been shown to be an effective toxicant for use as a bait to control imported Eire ants. As with any other IFA bait, Logic provides no protection against reinfestation of treated areas by newly mated reproductive forms. Biannual or quarterly applications could play a vital role in control of the movement of IFA by reducing the population on commercial sod farms. A study to compare the effects of annual, biannual, and quarterly applications of Logic on polygyne populations of IFA infesting grass sod farms in South Texas was initiated on August 29, 1989.

Theoretically, polygyne infestations of IFA present an even greater quarantine problem than monogyne populations. New infestations outside of the quarantined area have been traced to shipments of grass sod and recent experiments(Lockley, unpublished) have shown that reproductive IFA queens can be removed from polygynous colonies during normal harvesting operations.

METHODS AND MATERIALS:

The study site was located in commercial turf near Bay City, Texas. All bait applications were made by Texas Department of Agriculture personnel using a HERD® GT-77A bait applicator mounted on a John Deer AMT-600 and operated on a 24' swath at approximately 10 mph. Treatment regimens consisting of the following sequence were made to 1-acre test plots (5 replicates/sequence):

1. Fall only (late August 1989).
2. Fall/spring (late August 1989 and February 1990).
3. Spring only (February 1990).
4. Fall/spring/fall (late August 1989 and February 1990 plus October 1990).
5. Spring/fall (February 1990 and October 1990).
6. Spring/fall/spring (February 1990 and October 1990 plus February 1991).

Ratings of all test plots will be conducted at semi-monthly intervals throughout the study period.

RESULTS:

Preliminary results appear in Table 15, and tentatively indicate that multiple applications were not superior to a single fall only application of Logic bait.

Table 15. Impact of Multiple Applications of Logic on Population Suppression in Commercial Grass Sod.

Treatment Sequence	Date(s) of Application	Average Pretreat Pop Index 1/	% Change in Pretreat Pop. Index at Indicated Post-treat Intervals (Months) 1/										
			(1)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(11)	(14)	(15)
Fall only	8/29/89	276	-91	-88	-88	-86	-84	-86	--	-98	-96	-28	+16
Fall/Spring	8/29/89 - 2/27/90	170	-86	-85	-86	-81	-79	-80	--	-99	-100	-24	+88
Fall/Spring/ Fall	8/29 - 2/27- 10/23/90	215	-90	-87	-87	-86	-79	-90	--	-99.6	-100	-44	-87
Spring only	2/27/90	353	-78	--	-91	-99	--	--	-34	-11	--	--	--
Spring/Fall	2/27/90 -10/23/90	363	-80	--	-94	-93	--	--	-83	-93	--	--	--
Spring/Fall/ Spring	2/27/90-10/23/90 & Spring '91	538	-80	--	-90	-97	--	--	-88	-93	--	--	--
Untreated Ck.	--	301	-44	-22	+8	-2	+5	+36	--	+2	-6	+35	+58

1/ Mean based on 5 1/4 acre subplots per treatment.
2/ Intervals relative to the first bait application for any given treatment sequence.

PROJECT NO: FA01G109

PROJECT TITLE: Evaluation of Chlorpyrifos Formulations in Potting Media.

LEADER/PARTICIPANT(s): Avel Ladner

TYPE REPORT: Interim

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 done 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[a] liquid and Dow's 50% 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 1 1/2 cu. ft. electric cement mixer and mixed 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 10 CR, 2EC, WDG 50%, 1% Dust, XRD 429, Lorsban 15G, Dursban 50 WP 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 16, 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 17. All formulations were active through the 2 month post-treat bioactivity, but only the 1% Dust remained active at 3 months. These results are totally consistent with numerous other studies conducted in 1989.

TEST II:

Preliminary results are shown in Table 18, confirming results of Trial I and others. Empire 20%, applied as a drench, has generally shown good control for 13 months.

Table 16. 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.	Soil 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 17. Residual Activity of Various Formulations of Chlorpyrifos in Two Types of Potting Media 11.3 g. AI/cu. yd. of Media. 1/

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 18. 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: FA01G139

PROJECT TITLE: Determination of Optimum Dose Rate of Triumph® 1G and Suscon 10 CR in Nursery Potting Media.

TYPE REPORT: Final

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

INTRODUCTION:

Triumph 1G is a relatively new organophosphate insecticide produced by Ciba-Geigy. Several previously completed studies have demonstrated efficacy of the product, but very recent studies are producing mixed results. Serious data gaps relative to the optimum dose rate for incorporation into nursery potting media exist. Most information on the effectiveness of this product was based on a weight to volume dose rate relationship i.e., (x) grams of insecticide per (n) volume of media. Although this is the historical manner in which granular incorporated treatments are administered, widely differing dose rates occur due to differences in bulk density of the potting media. Therefore, rates of 20, 40, 60, 80 and 100 ppm (based on dry weight bulk density of the potting media) were evaluated in the present study.

Suscon 10G is a controlled release chlorpyrifos formulation produced by Incitec International, Brisbane, Australia. Although extremely long residual activity of this product has been achieved for grub control in sugarcane (3 years), essentially no data on effectiveness against IFA after incorporation into nursery potting media is available.

METHODS AND MATERIALS:

The following dose rates were blended into Strong-Lite® potting media (382 lbs/cu. yd) [Strong-Lite Products Corp., P.O. Box 8029, Pinebluff, AR] with the aid of a 2 cu. ft. capacity cement mixer on November 22, 1989.

Dose Rate (PPM)	Grams Formulation/ 1.5 cu. ft. Batch	
	Triumph 1G	Suscon 10G
20	19	1.9
40	38	3.8
60	57	5.7
80	76	7.6
100	95	9.5

Treated media was placed in trade 1-gallon plastic containers and then weathered outdoors. A minimum of 1" of water/week was supplied by either rainfall or irrigation. Standard laboratory bioassays with alate IFA queens will be conducted until activity of each treatment ceases (Appendix II).

RESULTS:

Results that are in Table 19 indicate little residual control with either Triumph or Suscon 10G.

Table 19. Residual Activity of Suscon 10 CR and Triumph 1G in Nursery Potting Media.

Treatment		% Mortality at Indicated Months Post-Treatment 1/					
Formulation	Dose Rate	(1)	(2)	(3)	(4)	(5)	(6)
Suscon 10 CR	20 ppm	40	0	75	5	0	0
	40 ppm	80	100	100	5	25	10
	60 ppm	65	100	75	0	25	35
	80 ppm	70	100	80	0	25	15
	100 ppm	100	100	95	0	60	10
Triumph 1G	20 ppm	100	100	40	5	30	10
	40 ppm	100	100	30	0	25	10
	60 ppm	100	100	40	0	35	5
	80 ppm	100	100	20	0	35	15
	100 ppm	100	100	15	0	15	10
Dursban 2.5G	11.2 g. AI/ cu. yd. (65 ppm)	100	100	35	0	25	20
Untreated Ck.	--	10	10	5	5	5	0

1/ Trial initiated November 22, 1989.

PROJECT NO: FA01G149

PROJECT TITLE: Residual Activity of Granular Insecticides Irrigated with Distilled versus Tap Water.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott

INTRODUCTION:

Recent problems with the rapid degradation of granular Dursban® and Triumph™ in nursery soils have prompted many studies to determine the cause of this degradation. Factors causing this phenomenon may be related to formulation changes, microbial action, or irrigation water. Nurserymen may use pond or lake water, well water or city water for irrigation, all of which vary in chemical and microbial content. A study on the effects of irrigation (city water - Gulfport, MS) on various granular insecticides showed that irrigation rapidly increased degradation of Dursban 2.5G, Triumph 1G and Lorsban 15G (FA01G039 this report). The present study was initiated to compare the effects of city tap water and distilled water on the degradation rates of Dursban 2.5G, Triumph 1G and Lorsban 15G in nursery potting media.

METHODS AND MATERIALS:

The various granular insecticides listed above were mixed into Strong-Lite® potting media(Strong-Lite Products, P.O. Box 8029, Pine Bluff, AR) using a 2 cu. ft. portable cement mixer. Each pesticide was incorporated at a rate of 11.3 g. AI/cu. yd. of media and blended for 1 hour. This rate was chosen

because it is the labelled rate of application for Dursban 2.5G, and Triumph 1G and has provided 14 months residual at this rate in previous trials (FA02G036 1989 Report). Treated media was placed in standard 6" plastic pots and maintained in the greenhouse for the duration of the test. Replicates of each treatment and an untreated check were set up. Each pot received 2 inches of either tap water or distilled water per week. Source of the tap water was the Gulfport, MS Municipal Water Department. This water is heavily chlorinated, high in carbonates (146 mg./liter), and has a relatively high pH (9.20). Bioassays using alate queens were performed monthly using a composite of two pots from each treatment and water group (Appendix II).

RESULTS:

At three months post-treatment, none of the chemicals remained 100% effective (Table 20), and the study was discontinued. Thus, the type of water or its chemical content, does not seem to have an effect on the residual activity of any of these pesticides. Each lost activity at the same accelerated rate as has been shown in other projects in this and other reports.

Table 20. Effects of Tap Water vs. Distilled Water on Residual Activity of Various Granular Insecticides in Potting Media.

Treatment		% Mortality at Indicated Months Post Treatment 1/		
Insecticide	Type Irrigation Water	(1)	(2)	(3)
Dursban 2.5G	Tap	100	30	0
	Distilled	100	10	10
Triumph 1G	Tap	100	15	50
	Distilled	100	5	10
Lorsban 15G	Tap	100	85	5
	Distilled	100	70	0
Check	Tap	0	15	5
	Distilled	10	0	0

1/ Standard laboratory bioassay using alate queen IFA.

PROJECT NO: FA01G159

PROJECT TITLE: Degradation of Dursban® 2EC in Sterile and Non-sterile Potting Media.

TYPE REPORT: Final

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

INTRODUCTION:

Recent problems with the rapid degradation of granular Dursban and Triumph[B] in nursery media have prompted many studies to determine the cause of this degradation. Factors causing this degradation may be related to formula changes, irrigation water, or even microbial action. Research has shown that chlorpyrifos does degrade more rapidly in non-sterile than in sterile muck and sand, but this is not a major route of degradation (Miles et al. 1979, 1983, 1984). A study was initiated to compare the rate of chlorpyrifos degradation in sterile versus non-sterile nursery potting media and open versus closed containers.

METHODS AND MATERIALS:

Morris Magic Mix® (Morris Magic Soil, Hialeah, FL) potting media was used in this study. This brand of potting media was chosen because it has shown accelerated degradation in previous trials.

Approximately 500 cc. (387 g.) of potting media were placed in 1 qt. mason jars and sealed with standard metal lids. One-half of the jars were steam sterilized at 17 psi for 1 hour on 2 consecutive days (Getzin 1981). One

hundred ml. of a Dursban drench solution (8 fl. oz. Dursban 2E/100 gal. distilled water) was aseptically added to half of the sterilized media as well as to half of the non-sterilized media. All the jars were placed in a greenhouse to simulate normal environmental conditions of light and temperature. One-half of each group (sterile, non-sterile, treated and untreated) was opened; whereas the remainder was remained sealed. Bioassays were performed monthly using potting media from one jar of each group.

RESULTS:

Potting media treated with Dursban 2E and kept in closed containers remained active longer than media treated and kept in open containers (Table 21). Media treated following steam sterilization and kept closed was active 1 month longer than treated non-sterile media. The odd activity of the soil in the open containers, i.e. its "rejuvenated activity" at 4 months, is unexplained.

Table 21. Residual Activity of Dursban 2EC in Sterile vs. Natural Media and Open vs. Closed Containers.

Treatment Conditions Media/Dursban/Container	% Mortality to Alate IFA Queens at Indicated Months Post-Treatment 1/ (1)	(2)	(3)	(4)	(5)	(6)
Sterile/Treated/Open	100	5	45	100	5	35
Sterile/Treated/Closed	100	100	100	100	100	100
Natural/Treated/Open	100	75	0	100	5	0
Natural/Treated/Closed	80	100	100	100	100	0
Sterile/Untreated/Open	5	5	5	5	20	0
Sterile/Untreated/Closed	0	0	0	10	25	5
Natural/Untreated/Open	5	0	0	20	10	0
Natural/Untreated/Closed	10	0	0	5	5	50

1/ Standard laboratory bioassay.

PROJECT NO: FA01G169

PROJECT TITLE: Seasonal Effectiveness of Amdro® and Logic™ for IFA Control.

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

TYPE REPORT: Interim

INTRODUCTION:

Successful control of red imported fire ants, Solenopsis invicta Buren (RIFA), with bait toxicants is based on a complex set of poorly understood variables. It is assumed that all fire ant bait toxicants must be quickly ingested by foraging workers soon after bait application in order to prevent photolysis or other forms of bait degradation. Weather conditions such as rain, dew, soil moisture, and temperature are assumed to impact foraging behavior of the ant as well as bait palatability. Lofgren et al. (1964) noted that pickup (harvest) of bait by poikilothermic ants is dependent on their being warm and active enough to forage. Markin et al. (1974) reported that, with the exception of the very coldest weeks in northern Mississippi and South Carolina, some foraging was recorded through winter at six different study sites throughout the range of the RIFA. Lofgren et al. (1964) found that mirex bait applied in the cooler part of the year (November-April) eventually gave good control (96-100%). However, fast and complete kill was dependent upon warm weather. Markin et al. (1975) showed that winter applications of mirex in south Mississippi resulted in 84-94% kill, but required 4-6 months to occur. An additional study by Summerlin et al. (1976) showed that temperature at the time of treatment seemed to be the main factor affecting mortality and

rate of kill with mirex bait.

Harlan et al. (1981) reported that large scale field tests with American Cyanamid AC-217,300 (Amdro) provided 90% control 22 weeks after a spring application. Banks et al. (1988) showed that baits containing fenoxycarb (Logic) eliminated 60% of the RIFA colonies and reduced the population indices by 67-99% within 12-13 weeks in a series of spring/summer treatments. Collins (1986) reported that maximum colony mortality and reduction in pre-treatment population indices were obtained 42 weeks after fall applications of both Amdro and Logic.

It is generally desirable to achieve maximum RIFA control as soon as possible after bait application. Although all RIFA baits must provide delayed toxicity in order to be effective, homeowners often demand rapid control. Since longer delays in kill are usually associated with cool weather applications, it was assumed that a "window of opportunity" for maximum control in the shortest period of time exists. A study to better define that "window of opportunity" was initiated in June 1989.

METHODS AND MATERIALS:

Test plots were located in non-grazed permanent pastures in Harrison County, Mississippi infested with a moderate RIFA population (average of 77.6 totally monogynous colonies per acre). Treatments were applied at monthly intervals beginning in June 1989, ending with a May 1990 application. Each month three

1-acre test plots (replicates) were treated with Amdro while three adjacent plots received Logic bait. All treatments were made with a shop built granular applicator mounted on a farm tractor (Collins, 1987 unpublished). Effects of the treatments were evaluated for 12 months or until reinfestation occurred. Reinfestation of test plots was evident when the appearance of many new or incipient colonies were observed during any post-treatment rating interval. 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 test plots. Soil temperature at the 1" depth and a subjective rating of foraging activity was also recorded immediately prior to each application.

RESULTS:

This study has not been completed; therefore all results should be considered preliminary.

Environmental Conditions

Soil temperatures at the time of application ranged from a low of 46°(January 1990), to a high of 90° in July 1989 (Table 22). Soil moisture ranged from dry to moist, and foraging conditions were poor to excellent, depending on the month of application. Therefore, a wide spectrum of environmental conditions were encountered during this trial. Rain did not occur within 12 hours of any application. Although lower levels of control were generally associated with soil temperature extremes, careful analysis of the data indicated that soil

temperature and maximum control obtained with either bait were not correlated (Figure 1).

Rates and Levels of Control

Amdro:

Treatment effects are summarized in Table 23. One month after treatment, control with Amdro ranged from a high of 91.3% (February 1990) to a low of 42.3% (October 1989). The highest level of control with Amdro occurred 3 months after the October application. When averaged over the entire year, RIFA control following Amdro applications generally peaked about three and a half months after treatment, versus about 6 months for Logic (Table 24). Amdro treatments maintained population suppression $\geq$ 75% of pretreatment levels for 1 to 10 months, averaging 6 months.

Logic:

Logic reduced the pretreatment population by 89.0% 1 month after a May 1990 application, but only a 6.7% reduction was achieved 30 days after treatment in October (Table 23) . One-hundred percent (100%) control was observed 9 and 10 months following both October and November applications with Logic. Thus very distinct differences in the levels of population suppression at various treatment intervals were apparent. However, with only few exceptions (January, 3 months post, February, 6 months post and August, 12 months post), treatment means for any given month and post-treat interval were not

significantly different. Population suppression $\geq$ 75% of pretreat levels with Logic ranged from 2 to over 12 months, with an average of 8.3 months. Differences in the length of control afforded by each bait were not statistically significant (Table 24).

Seasonal Trends

By pooling treatment means into seasonal categories and graphically presenting the pooled data, definite trends in the seasonal effectiveness of both baits becomes apparent. Seasonal categories were arbitrarily established into the following groups: spring (March, April, and May); summer (June, July, and August); fall (September, October, and November); and winter (January and February.

Logic:

As shown in Figure 2, spring treatments with Logic rapidly reduced the pre-treatment population indices achieving maximum reduction 4 months after treatment. Resurgence was initiated 6 months after application. Summer applications rapidly reduced pretreatment population indices and maintained good control for about 11 months at which time resurgence was noted. Confirming previous results (Collins, 1986), fall treatments were much slower in activity, achieving maximum reduction 8-10 months after application with resurgence beginning in the 12th month. Winter treatments were similar to fall, except that maximum control was achieved sooner (4-6 months post-treat),

with population resurgence 9 months post-treatment. These seasonal reinfestation differences may be due to the heavy influx of new queens from the spring peak in mating flights (Markin and Dillier, 1971; Morrill, 1974) i.e., control following winter treatments peaked March-July resulting in very little competition to founding queens and incipient colonies resulting from spring flights. Fall applications peaked June-September (after the maximum mating flight period). Thus, surviving colony remnants (colony classes 1-4 on the population index rating scale) that were present during the maximum mating flight period may have defended their territory against reinvasion by founding queens. Another possibility would be that surviving major workers (repletes as reported by Glancey et al. 1973), may have served as a reservoir to re-introduce fenoxycarb to founding queens. Either mechanism, (territorial defense or retention of fenoxycarb in the replete caste with subsequent transfer to founding queens) could account for the delay in reinfestation associated with fall treatments.

Amdro:

Control with spring Amdro treatments peaked 2-5 months after application, followed by relatively rapid resurgence of incipient colonies (Figure 3). Summer applications, though slightly less effective, maintained population suppression for about 11 months. The prolonged delay in activity of fall treatments was readily apparent. Winter treatments produced highly erratic results which peaked one month after treatment. Heavy reinfestation was recorded 7-9 months after application.

Table 22. Environmental Conditions During Monthly Applications of Amdro and Logic Baits.

Month of Application	Air Temp. ° F	Soil Temp. °F 1/	Rainfall (inches) 2/	Foraging Condition 3/
May 1989	--	--	10.8	-
June 1989	85	85	8.3	5
July 1989	90	90	11.4	5
August 1989	85	82	1.4	3
September 1989	86	86	6.1	4
October 1989	74	68	1.7	4
November 1989	72	66	10.2	4
January 1990	65	46	6.7	2
February 1990	76	52	11.7	5
March 1990	80	70	6.7	5
April 1990	78	60	3.0	5
May 1990	82	72	6.6	4

1/ 1" depth, indirect sun.
2/ Monthly cumulative total
3/ Subjective rating based on combination of soil moisture, soil temperature and cloud cover according to the following scale: 5= excellent; 4= good; 3= fair; 2= poor; 1= very poor.

Table 23. Mean % ± (SEM) Reduction in Pretreat IFA Population Indices at Various Post-Treatment Intervals Following Monthly Applications of Amdro and Logic Baits.

Month of Application	Pretreat 1/ Pop Index		Percent Reduction in Pretreat Population Index for each Indicated Bait and Post-Treatment Interval (Months) 1/ 2/					
			(1)		(2)		(3)	
	Amdro	Logic	Amdro	Logic	Amdro	Logic	Amdro	Logic
January	401.6 ± (25.2)	421.7 ± (64.1)	81.6 ± (3.4)a	79.3 ± (.7)a	70.3 ± (2.7)a	78.0 ± (.6)a	15.3 ± (2.9)a	78.3 ± (1.2)b
February	266.7 ± (33.2)	308.3 ± (35.3)	91.3 ± (4.2)a	71.3 ± (5.6)a	66.7 ± (3.2)a	80.0 ± (1.1)a	87.7 ± (1.7)a	93.7 ± (2.9)a
March	400.0 ± (16.0)	403.3 ± (10.9)	62.6 ± (4.4)a	76.3 ± (1.7)a	81.0 ± (2.1)a	77.7 ± (4.0)a	93.6 ± (.9)a	89.0 ± (2.6)a
April	390.0 ± (72.9)	481.6 ± (66.2)	75.7 ± (6.6)a	80.0 ± (2.0)a	94.7 ± (1.8)a	91.3 ± (.9)a	97.0 ± (1.5)a	98.3 ± (.6)a
May	421.6 ± (19.7)	473.3 ± (68.0)	85.3 ± (4.9)a	89.0 ± (2.0)a	98.0 ± (1.0)a	94.0 ± (1.0)a	98.3 ± (1.5)a	99.9 ± (.1)a
June	227.6 ± (26.5)	236.6 ± (60.0)	74.3 ± (10.6)a	87.0 ± (6.0)a	95.0 ± (1.7)a	93.7 ± (2.4)a	97.0 ± (1.5)a	80.7 ± (11.9)a
July	145.0 ± (10.0)	170.0 ± (38.2)	-----	-----	86.0 ± (3.8)a	95.3 ± (1.4)a	88.0 ± (2.3)a	78.0 ± (8.4)a
August	283.3 ± (37.2)	303.3 ± (55.3)	88.7 ± (3.3)a	80.3 ± (4.2)a	91.3 ± (.3)a	73.0 ± (7.6)a	90.3 ± (4.2)a	78.6 ± (2.4)a
September	226.3 ± (40.2)	261.6 ± (15.9)	70.3 ± (19.3)a	68.3 ± (3.3)a	88.6 ± (4.3)a	76.3 ± (1.4)a	96.6 ± (3.2)a	76.0 ± (2.6)a
October	466.7 ± (34.2)	274.0 ± (45.6)	42.3 ± (6.3)a	6.7 ± (14.1)a	75.0 ± (9.0)a	86.0 ± (2.0)a	78.7 ± (.9)a	76.3 ± (4.0)a
November	341.3 ± (36.6)	381.7 ± (46.7)	-----	-----	-----	------	88.0 ± (3.6)a	80.0 ± (2.1)a

1/ Mean based on 3 replicates per treatment ± (SEM).

2/ Treatment means for any given month and post-treat interval followed by the same letter are not significantly different (P > 0.05) according to a "t" test.

Table 23. (Continued)

Month of Application	Percent Reduction in Pretreat Population Index for each Indicated 1/ 2/ Bait and Post-Treatment Interval (Months)									
	(6)		(8)		(9)		(10)		(12)	
	Amdro	Logic	Amdro	Logic	Amdro	Logic	Amdro	Logic	Amdro	Logic
January	72.3 ± (8.9)a	68.0 ± (7.4)a	---	87.5 ± (4.7)	---	85.3 ± (4.2)	---	79.4 ± (2.7)	---	---
February	96.7 ± (2.0)a	72.3 ± (3.3)b	66.9 ± (9.9)a	64.9 ± (14.8)a	9.4 ± (30.4)a	38.0 ± (24.5)a	---	29.7 ± (30.2)	---	---
March	84.0 ± (2.9)a	88.0 ± (3.6)a	65.0 ± (4.9)a	63.1 ± (2.1)a	60.7 ± (3.9)a	50.3 ± (8.3)a	---	---	---	---
April	79.6 ± (3.3)a	94.0 ± (1.1)a	77.0 ± (6.0)a	78.3 ± (3.8)a	---	---	---	---	---	---
May	49.6 ± (27.8)a	88.3 ± (1.8)a	---	94.3 ± (2.2)	---	---	---	---	---	---
June	82.7 ± (3.7)a	94.7 ± (2.0)a	82.6 ± (3.9)	94.5 ± (2.1)	95.2 ± (.7)a	90.4 ± (6.3)a	57.8 ± (4.6)a	77.6 ± (11.2)a	51.3 ± (13.0)a	50.8 ± (19.9)a
July	61.3 ± (16.5)a	70.6 ± (7.4)a	74.9 ± (7.9)a	70.7 ± (.6)a	66.4 ± (17.0)a	36.4 ± (25.6)a	---	---	---	---
August	92.3 ± (1.8)a	85.6 ± (.9)a	88.3 ± (2.5)a	88.6 ± (2.6)a	---	---	97.6 ± (1.0)a	92.4 ± (2.3)a	74.0 ± (3.3)a	97.8 ± (2.2)b
September	92.0 ± (4.0)a	75.3 ± (2.3)a	83.0 ± (8.6)a	79.3 ± (5.7)a	93.0 ± (1.9)a	95.3 ± (2.3)a	93.0 ± (1.9)a	95.3 ± (2.3)a	50.6 ± (8.8)a	81.8 ± (6.5)a
October	80.7 ± (3.8)a	92.0 ± (3.8)a	80.7 ± (3.7)a	92.1 ± (3.8)	93.1 ± (1.3)a	100 ± (0)a	88.6 ± (3.8)	100 ± (0)	88.9 ± (3.2)a	97.5 ± (2.5)a
November	79.3 ± (5.9)a	91.6 ± (1.8)a	95.3 ± (1.2)a	99.6 ± (.2)a	89.0 ± (1.6)a	100 ± (0)a	61.4 ± (6.8)a	100 ± (0)b	74.8 ± (3.8)a	61.7 ± (4.7)a

1/ Mean based on 3 replicates per treatment ± (SEM).
2/ Treatment means for any given month and post-treat interval followed by the same letter are not significantly different ($P > 0.05$) according to a "t" test.

Table 24. Time Required to Achieve Maximum Control and Maintain Population Suppression ≥ 75% of Pretreatment Levels Following Monthly Applications of Amdro and Logic Baits.

Application Period	Months required to achieve maximum reduction in pretreatment population index [1/]		Months population suppression ≥ 75% of pretreatment levels [1/]	
	Amdro	Logic	Amdro	Logic
January	1	8	1	10^{+}
February	6	3	6	2
March	3	3	4	6
April	3	3	8^{+}	8^{+}
May	3	3	3	8^{+}
June	3	6	5	10
July	3	2	3	3
August	6	12	10	12^{+}
September	3	10	8	12^{+}
October	6	9	10^{+}	10^{+}
November	3	6	9	10
$\bar{x} \pm$ (SEM)	3.6 ± (0.5)a	5.9 ± (1.0)a	6.0 ± (0.9)	8.3 ± (1.0)

1/ Means followed by same letter are not significantly different ($P>0.05$) according to a "t" test.

Figure 1. Scattergram of Soil Temperature and IFA Colony Mortality with Amdro and Logic

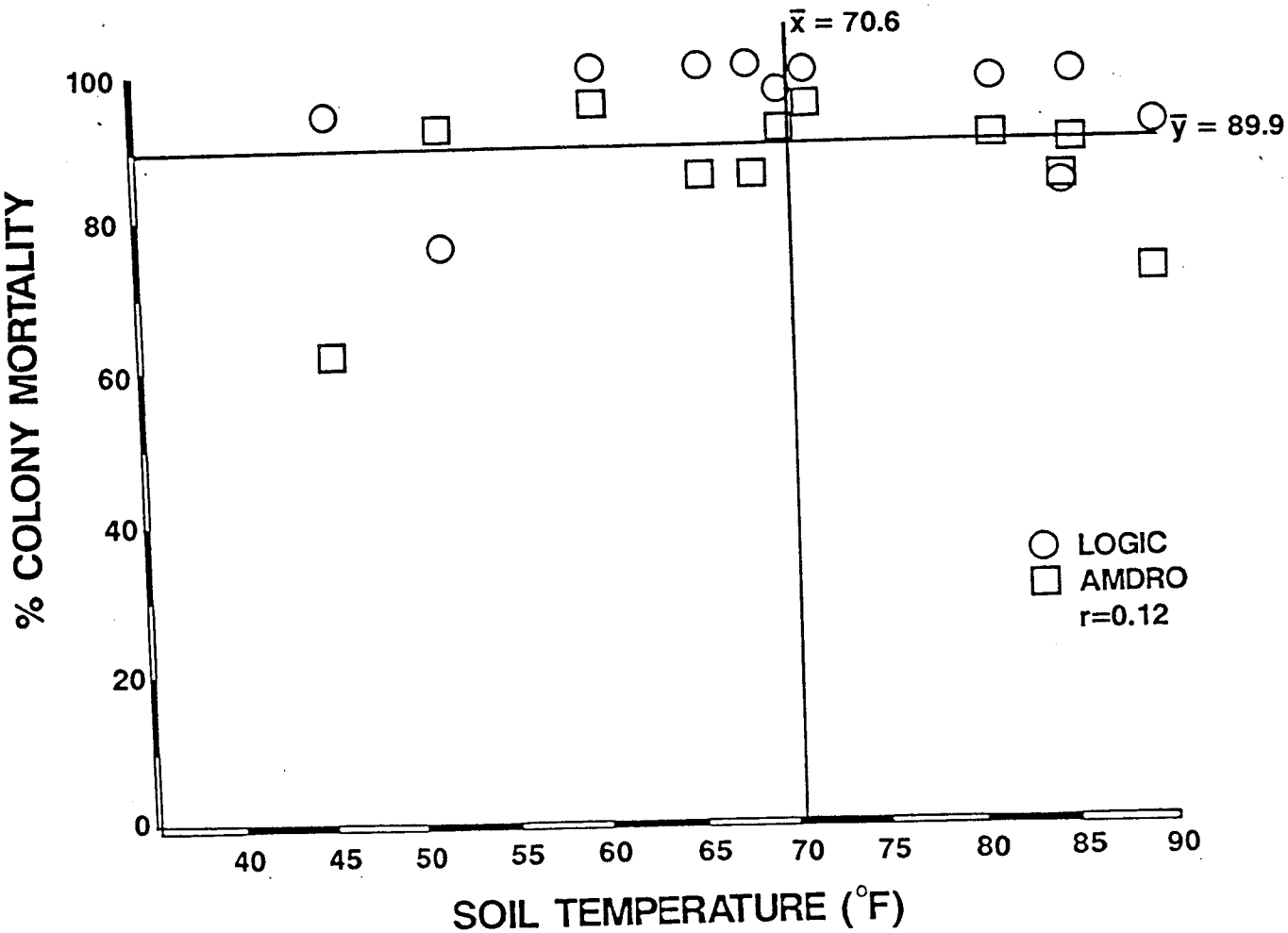


FIGURE 2

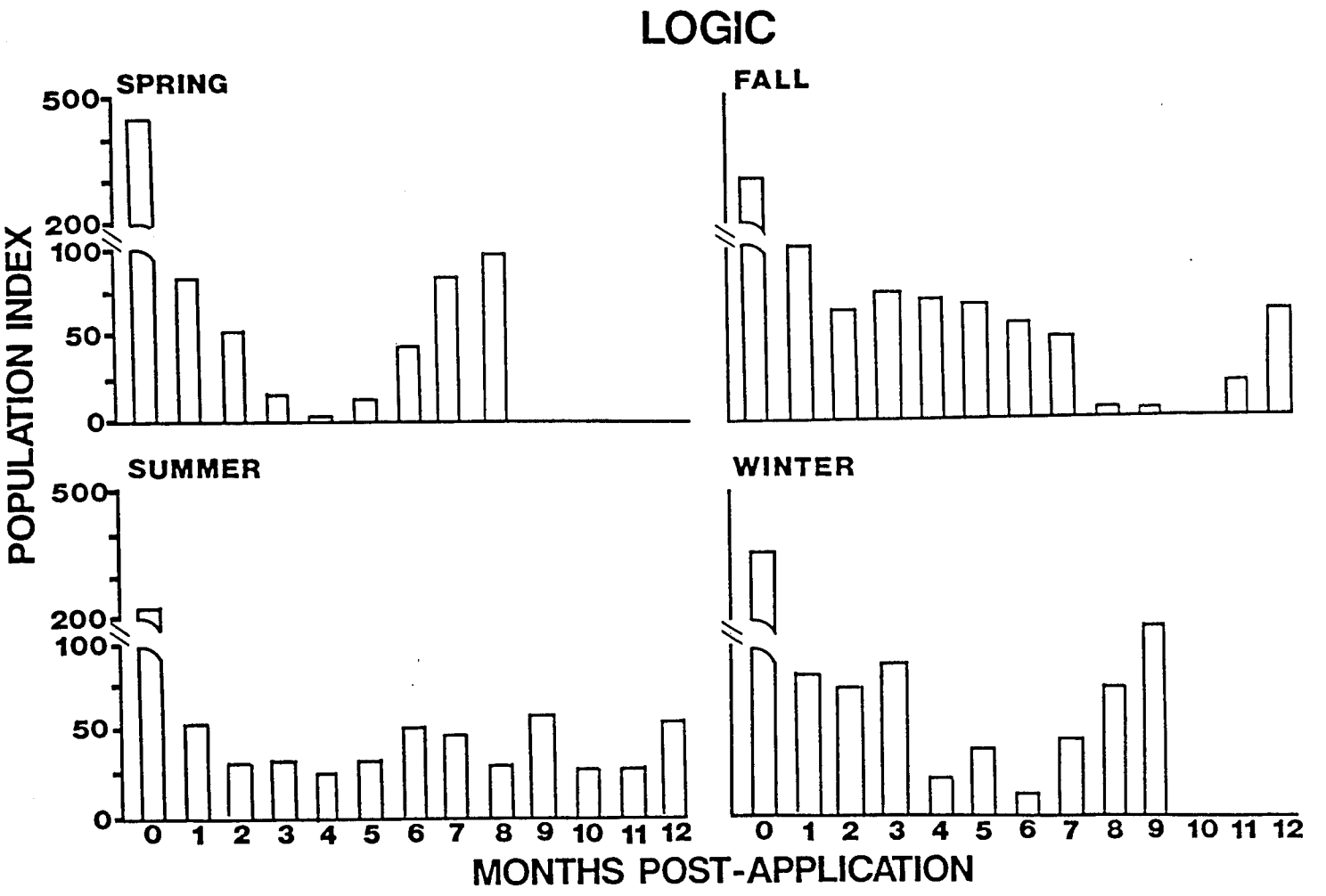
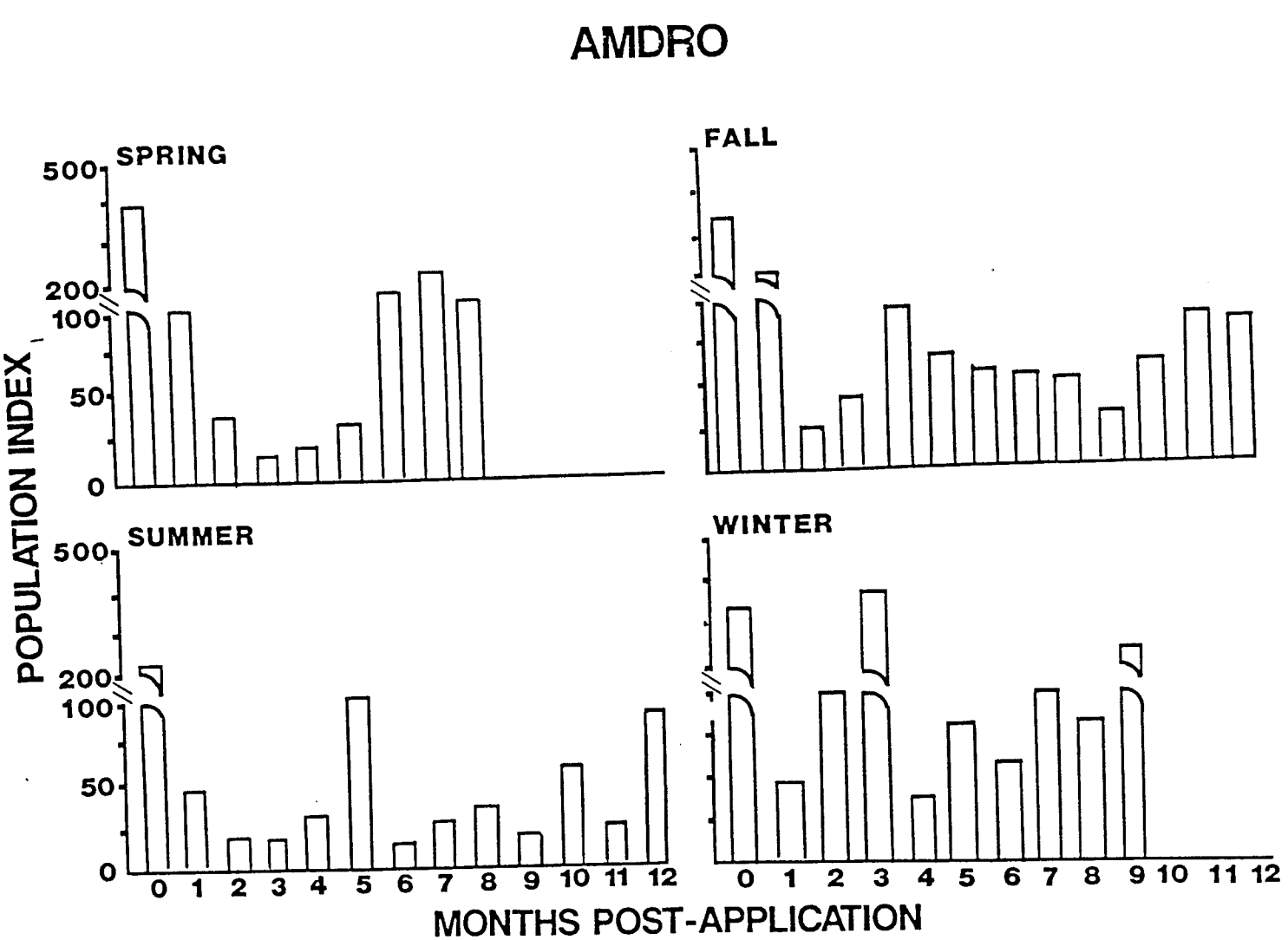
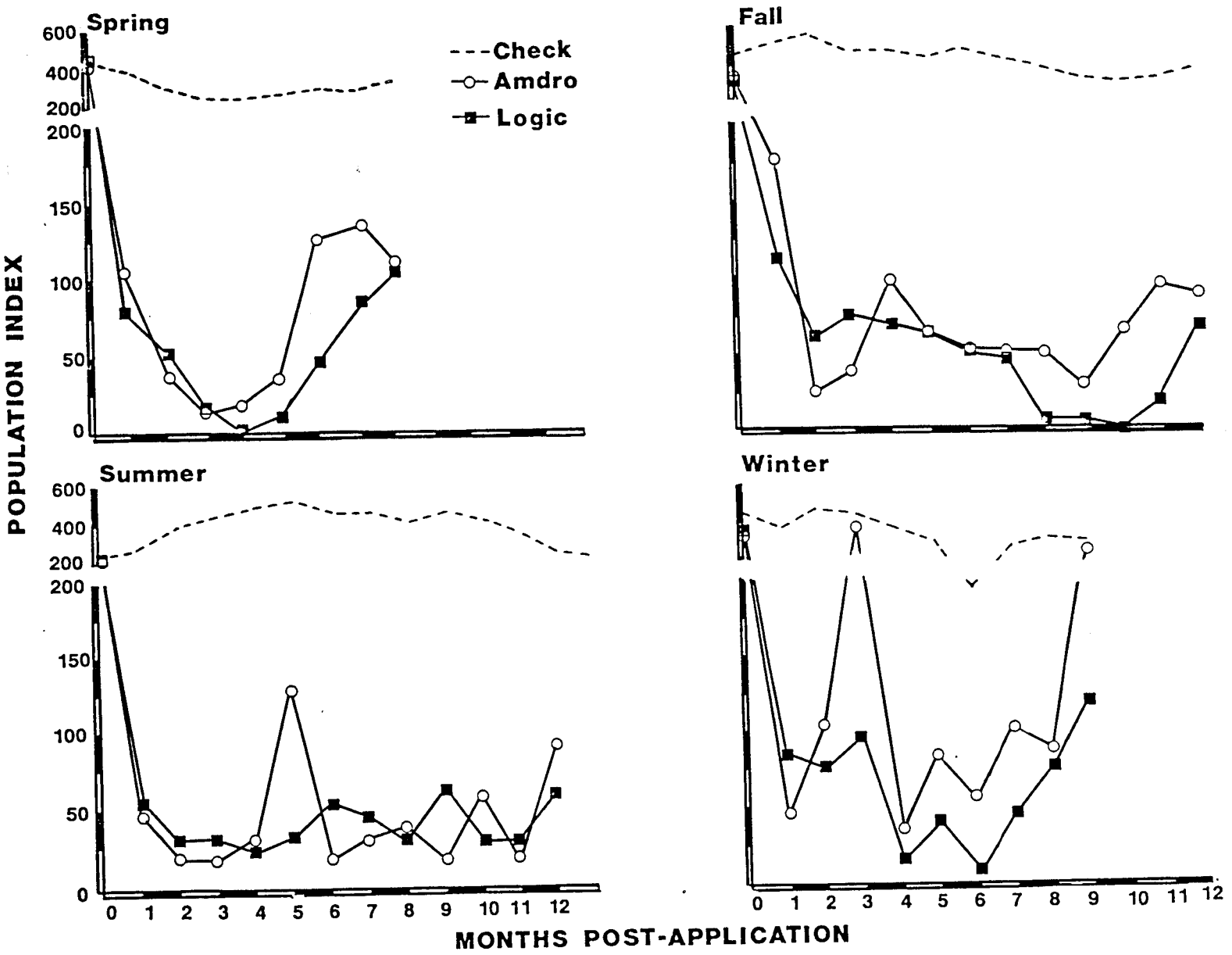

LOGIC
SPRING
FALL
SUMMER
WINTER
POPULATION INDEX
500
200
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12
MONTHS POST-APPLICATION

FIGURE 3


AMDRO
SPRING
FALL
SUMMER
WINTER
POPULATION INDEX
500
200
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12
MONTHS POST-APPLICATION


Spring
Fall
Summer
Winter
Check
Amdro
Logic
POPULATION INDEX
MONTHS POST-APPLICATION
600
400
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12

PROJECT NO: FA01C219

PROJECT TITLE: Quarantine Treatments for Polygynous IFA in Commercial Grass Sod.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Homer Collins, Tim Lockley, Avel Ladner, Lee McAnally, Mark Trostle, and Octavio Garza [Texas Department of Agriculture]

INTRODUCTION:

Grass sod is certified for movement outside the regulated area following an application of granular chlorpyrifos at either 4 or 6 lbs. AI/acre (PPQ Treatment Manual 301.81). This treatment may or may not totally eliminate large mature IFA colonies from a treated area. Approval for this treatment is based on the premise that, with monogynous IFA populations, the greatest risk associated with sod movement is from the thousands of newly mated queens that could be present during the cutting or harvesting operation. The chances of removing a mature fertile queen from a single queen colony is presumed to be nill, especially since populations of single queen colonies on commercial sod farms are usually relatively low (10-30 nest/acre) over most of the IFA infested area.

However, with the large numbers of queens and nests present in a polygynous population, there is a high probability that gravid queens can be removed during the harvesting operation. This has been known to occur experimentally (Lockley, unpublished data). One of the major sod growing areas in the infested area is within Matagorda, Brazoria, and Wharton Counties, Texas. Polygynous IFA are prevalent throughout this area, and populations of two to

three-hundred nests/acre are not uncommon. Two series of trials were conducted near Bay City, Texas in 1989 to determine efficacy of the currently approved treatment and to evaluate various combinations of baits plus short term residual pesticides.

METHODS AND MATERIALS:

Test plots were located in commercial turf in Matagorda County, Texas. Baits and granular pesticide formulations were applied with a HERD GT-77A Spreader mounted on a John Deer AMT-600. operated at 10 mph with a 24' swath. Liquid treatments were applied with a PTO driven Beam® Sprayer using Tee-Jet© 8003 nozzels spaced 20" apart on a 27' boom. The system was calibrated to deliver 30 GPA at 250 PSI.

One-acre test plots were established and population counts were made in 1/4 acre circular subplots located in the center of each treatment plot. The population index system described by Lofgren and Williams (1982) was used to rate all colonies prior to treatment and at semi-monthly intervals after treatment. Two trials were conducted. Treatments in the first series were applied in May, and treatment in the second trial was applied in August 1989.

RESULTS:

Trial I - May 1989

Both Dursban® 10G at 6 lbs. AI/acre and Amdro® bait at 1.5 lbs./acre were highly effective, providing good control through the 26 week evaluation interval (Table 25).

Trial II - August 1989

Excellent control was achieved with several combination treatments. Amdro (1.5 lbs. bait/acre) plus Dursban 10G (6 lbs. AI/acre) provided 100% control 5-30 weeks after treatment at which time the trial was terminated. Amdro plus Triumph 4E was only slightly less effective (Table 26).

Table 25. IFA Control in Commercial Sod.

TREATMENT		PRE-TREAT POPULATION		RESULTS AT INDICATED WEEKS AFTER TREATMENT 1/									
Insecticide & Formulation	Rate/Acre (lbs.)	$\bar{x}$ No. of Colonies	$\bar{x}$ Population Index	% Colony Mortality (8)	(12)	(16)	(20)	(26)	% Change in Pre-Treat Population Index (8)	(12)	(16)	(20)	(26)
TRIAL I - MAY 1989													
Dursban 10G	60	18	207	82	100	96	99	98	-97	-100	-99	-99	-99.7
Amdro	1.5	20.3	290	98.6	99	95	89	97.5	-99	-99.6	-98	-90	-74
Triumph 1G	100	16	190	75	100	87	12.5	25	-79	-100	-84	+16	+10
Logic	1.5	22.3	303	5	64	86	97	85	-74	-93	-98	-99.6	-89
Triumph 4E	1.0AI	17	215	50	82	65	0	0	-65	-84	-62	+49	+67
Untreated Ck.	--	16	175	0	12.5	0	0	0	+131	+11.4	+20	+134	+149

1/ Based on 1/4 acre subplot within 1.0 acre treatment plots. Some treatments in Trial 1 replicated; others unreplicated. Population index described by Lofgren and Williams (1982). Jour. Econ. Ent. 75:798-803.

Table 26. Evaluation of Insecticide Combinations for IFA Control in Commercial Sod.

TREATMENT		PRE-TREAT POPULATION		RESULTS AT INDICATED WEEKS AFTER TREATMENT 1/											
				% Colony Mortality						% Change in Pre-Treat Population Index					
Insecticide & Formulation	Rate/Acre (lbs.)	x̄ No. of Colonies	x̄ Population Index	(5)	(10	(15)	(20)	(25)	(30)	(5)	(10)	(15)	(20)	(25)	(30)
TRIAL II - AUGUST 1989															
Amdro + Dursban 10G	1.5 & 60	7	95	100	100	100	100	100	100	-100	-100	-100	-100	-100	-100
Amdro + Triumph 4E	1.5 & .75AI	10	120	100	90	100	100	100	100	-100	-88	-100	-100	-100	-100
Logic + Triumph 4E (2X)	1.5 & 2.5AI	13	145	92	85	100	92	100	92	-98.6	-98.6	-100	-99	-100	-98.6
Logic + Dursban 10G	1.5 & 60	7	85	43	100	86	86	100	100	-89	-100	-98	-98	-100	-100
Amdro	1.5	10	125	100	90	80	90	90	80	-100	-88	-90	-98	-96	-64
Triumph 4E	.75 AI	8	100	50	37	25	62	37	62	-91	-35	-51	-79	-40	-65
Dursban 10G	60	13	155	38	85	92	100	92	92	-86	-96	-99	-100	-98	-96.8
Logic + Triumph 4E	1.5 &.75 AI	18	235	33	28	61	83	78	61	-86	-86	-93	-97	-95	-89.4
Logic	1.5	8	100	0	0	25	25	62	12	-79	-82	-76	-85	-92	-83
Untreated Ck.	--	17	205	47	0	12	0	29	6	-40	+54	+42	+12	-2	+14.6

1/ Based on 1/4 acre subplot within 1.0 acre treatment plots. Some treatments in Trial 1 replicated; others unreplicated. Population index described by Lofgren and Williams (1982). Jour. Econ. Ent. 75:798-803.

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. Several synthetic pyrethroid insecticides including bifenthrin 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® 10 WP, 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 10 WP and Dursban 2EC.

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

METHODS AND MATERIALS:

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

Copolymer	$\bar{x}$ 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 10 WP insecticide- 100 ppm
2. Talstar 10 WP insecticide- 100 ppm + Terra-sorb GB
3. Talstar 10 WP insecticide- 100 ppm + Terra-sorb HB
4. Talstar 10 WP 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.

RESULTS:

The test results to date are shown in Table 27. The addition of copolymers did not extend the residual of Dursban 2EC, and all treatments with Talstar 10WP remained effective through the 11 month post-treatment evaluation. The trials will be continued until all activity ceases.

Table 27. Evaluation of Acrylamide Copolymers for Extended Residual Activity of Pesticides in Potting Media.

Formulation	Pesticide Dose Rate (PPM)	% Mortality of Alate Queens at Indicated Post-Treatment Intervals (Months) (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Talstar 10WP	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
Talstar + GB	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
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	10	5	5	0

* Dropped from test

PROJECT NO: FA01G020

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

TYPE REPORT: Interim

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, Tnc., 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, (Stronglite®, 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. Several granular formulations of chlorpyrifos have provided up to 24 months residual activity under these conditions.

RESULTS:

Results are shown in Table 28, and indicate that no candidate provided sufficient residual activity to warrant additional trials.

Table 28. Residual Activity of Candidate Insecticides Incorporated Into Potting Media.

Candidate Formulation	Initial Concentration (PPM)	% Mortality at Indicated Months Post-Treatment (1)	(2)	(3)	(4)	(5)	(6)
Tempo .1% dust	12.5	30	35	10	80	20	50
	25	80	70	35	95	55	80
	50	85	75	20	90	35	85
	150	95	100	85	100	95	90
Suscon 10% chlorpyrifos - 0.6 [1/]	200	100	100	100	100	100	75
- 1.5 [1/]	200	100	100	100	100	100	80
- 2.0 [1/]	200	100	100	100	40	0	20
Suscon 10% carbosulfan - 1.0mm [1/]	200	5	10	10	10	0	5
- 1.5mm [1/]	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	--	--	--	--
	100	95	80	--	--	--	--

[1/] size of granule in millimeters (mm)

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 several months activity when incorporated into potting media at various rates of application. Empire® 20, a micro-

encapsulated chlorpyrifos formulation by Dow Chemical, has provided up to 6 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 10 WP (Batch TH8006).

Treated media was then placed in 6"x6" 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.

RESULTS:

Preliminary, uncompleted results are listed in Table 29, and indicate that Talstar 10 WP remained active through 7 months post-treatment. Empire was very erratic.

Table 29. 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 Post-Treatment Intervals (Months)						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Talstar 10WP	100	100	100	100	100	100	100	100
Empire 20%	100	100	10	30	100	85	15	5
Check	--	20	0	5	20	15	5	10

PROJECT NUMBER: FA01G040

PROJECT TITLE: Toxicity of Bifenthrin in Various Media to IFA Workers and Alate Queens.

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Anne-Marie Callcott

INTRODUCTION:

A number of candidate insecticides, some registered for other pests and some experimental, have been tested for use against IFA in nursery stock. One pyrethroid insecticide which has shown good toxicity against IFA and residual activity in containerized nursery stock when incorporated into potting media is bifenthrin (Capture® 0.3G) (Lockley & Ladner 1989). Because of these promising results, a study was initiated to establish the initial toxicity and the LD_{99} of bifenthrin in various media to IFA workers and alate queens.

MATERIALS AND METHODS:

Technical bifenthrin (93.7%) was obtained from Dr. Rusty Mitchell of FMC Corporation. Test procedures described elsewhere were slightly modified prior to use in this study (Banks et al. 1964, Collins & Ladner 1981, Collins et al. 1982). A stock solution of technical bifenthrin was mixed in acetone. Serial dilutions of each stock were then added to 100 g. of Strong-Lite® Potting Soil (a blend of composted pine bark, peat moss, vermiculite and perlite, Strong-Lite Products Corp., P.O. Box 8029, Pinebluff, Arkansas) to obtain various dosage rates. Additional acetone, to bring total liquid to 100 ml.,

was added to acquire a thoroughly saturated soil mixture. The solvent was evaporated by drying under a hood for 2-3 hours. Bioassays, using 20 major workers or 5 alate queens per replicate, and four replicates per soil sample (treated or check), were performed (Appendix II). Check soil was treated with a proportional amount of acetone and dried under a hood. All soil was moistened with tap water prior to introducing ants. PPM dosage rates showing 10% to 90% mortality were bioassayed three times and percent mortality of each rate recorded at 7 days post-treatment.

Various substrates were used to determine the difference in bifenthrin bioactivity in organic and mineral soils. River sand, peat moss, pine bark, and a 1:1:1 (by volume) mixture of these three were tested. Above procedures were followed except various amounts of total liquid were used to obtain a thorough saturated mixture. Dry weight and total volume of liquid (acetone plus serial dilution) per substrate was as follows:

Media	Manufacturer	Dry Weight	Total Liquid
river sand	collected from Biloxi River off Three Rivers Rd., Harrison Co., MS	200 g.	50 ml.
Top Notch BWI Pine Bark Mulch	B.W.I. of Jackson, Inc. Jackson, MS 39209	50 g.	75 ml.
Premier Spagnum Peat Moss	Premier Brands, Inc. New Rochelle, NY 10801	25 g.	100 ml.
IFA station laboratory mix	IFA station, Gulfport MS 1:1:1 sand:pine bark:peat moss	200 g.	75 ml.

In vitro toxicity of bifenthrin to IFA alate queens was also determined. Procedures described by Dobbs (1985) were slightly modified. Stock solutions were prepared as above. One ml. of various serial dilutions were applied to the bottom of 100 mm. (diameter) glass petri dishes and the dishes dried for 2 hours under a hood. Five alate queens were placed in each dish, with four replicates per dose rate. Dosage rates showing 10% to 90% mortality were bioassayed in this method three times and percent mortality of each rate recorded at 24 hours post-treatment.

RESULTS:

Toxicity of bifenthrin in Strong-Lite potting media to major workers and alate queens:

Major Workers:

Dose rates, ranging from 0.107 to 3.44 were evaluated (Table 30). Highly variable results were obtained in all trials. For example, at 1.72 ppm, mortality ranged from 92.5% in trial III to 6.25% in trial IV. Coefficients of variation (CV) was calculated for rates with more than two trials. The highest rated tested to date (3.44 ppm) produced an average of 83.7% mortality in four separate trials. Additional tests at higher rates are needed to establish an LD_{90}, but the predicted LD_{90} (linear regression analysis) is 3.7 ppm for major workers confined to treated media for a 7 day exposure period (Table 40).

Alate Queens:

Preliminary results shown in Table 31, again indicate highly variable results with alate queens as was seen with major workers (extremely high variations between individual trials). Additional tests are needed to establish an LD_{90}, but the predicted value is 11.62 ppm (Table 40).

Toxicity of bifenthrin in river sand to major workers and alate queens:

Again extremely variable results were seen, as indicated by high CV values, when bifenthrin was evaluated in river sand against major workers and alate queens (Tables 32 and 33). However, the predicted LD_{90} for workers is 0.057 ppm and for queens is 0.99 ppm (Table 40). Additional tests are needed to determine these values more accurately.

Toxicity of bifenthrin in milled pine bark to major workers and alate queens:

There is insufficient data with bifenthrin in pine bark against workers to predict a LD_{90} (Table 34). Preliminary results of trials using alate queens are extremely variable (Table 35), but the predicted LD_{90} is 2.16 ppm (Table 40).

Toxicity of bifenthrin in peat moss to major workers and alate queens:

Again, insufficient data is available to predict a LD_{90} for either major workers (Table 36) or alate queens (Table 37). Additional tests will be initiated.

Table 31. Bifenthrin Toxicity to IFA Alate Queens in Strong-Lite Potting Media.

PPM	$\bar{X}$ % mortality to alate queens at indicated dose rate 1/					
	Trial I	Trial II	Trial III	Trial IV	Avg. for all trials	CV 2/
.107	0	-	-	-	0.0	-
.535	10	-	-	-	10.0	-
1.07	10	-	-	-	10.0	-
2.14	30	-	-	-	30.0	-
2.67	20	-	-	-	20.0	-
2.795	0	35	5	-	13.3	142%
3.21	15	-	-	-	15.0	-
3.225	65	20	0	-	28.3	118%
3.547	10	10	-	-	10.0	-
3.87	90	45	0	15	37.5	105%
4.085	35	5	-	-	20.0	-
4.3	75	25	25	60	46.2	55%
4.622	15	10	-	-	12.5	-
4.945	100	85	35	60	70.0	41%
Check	15	0	5	-	6.7	113%

1/ Mean based on 4 replicates/dose rate with 5 alate queens/replicate. All trials conducted on different days.

2/ Coefficient of variation among trials.

Table 32. Toxicity of Bifenthrin to IFA Major Workers in River Sand.

PPM	$\bar{X}$ % mortality to major workers at indicated dose rate [1/]						Avg. for all trials	CV [2/]
	Trial I	Trial II	Trial III	Trial IV	Trial V	Trial VI		
.005	7.5	1.25	-	-	-	-	4.375	-
.01	12.5	3.75	8.75	12.5	22.25	22.5	13.71	54%
.015	7.5	21.25	25.0	10.0	-	-	15.94	53%
.02	13.75	10.0	30.0	35.0	85.0	3.75	29.58	100%
.025	46.6	90.0	51.25	-	-	-	62.62	38%
.03	23.75	37.5	100.0	76.25	-	-	59.375	59%
.035	80.0	76.25	83.75	-	-	-	80.0	5%
.04	33.75	16.25	77.5	75.0	32.5	-	47.0	59%
.045	77.5	86.25	23.75	-	-	-	62.5	54%
05	35.0	60.0 [3/]	88.75	53.75	-	-	59.375	38%
.05375	97.5	-	-	-	-	-	97.5	-
.06	96.25	96.25	85.0	-	-	-	92.5	7%
.1075	100	-	-	-	-	-	100.0	-
.5375	100	-	-	-	-	-	100.0	-
1.075	100	-	-	-	-	-	100.0	-
1.6125	100	-	-	-	-	-	100.0	-
Check	2.5	6.25	3.75	31.25	0	1.25	7.5	158%

1/ Mean based on 4 replicates/dose rate with 20 workers/replicate. All trials conducted on different days.

2/ Coefficient of variation among trials.

3/ ants escaped - avg. of three replicates.

Table 33. Toxicity of Bifenthrin to IFA Alate Queens in River Sand.

PPM	$\bar{X}$ % mortality to alate queens at indicated dose rate[1/]							Avg. for all trials	CV[2/]
	Trial I	Trial II	Trial III	Trial IV	Trial V	Trial VI	Trial VII		
.01	10	5	15	5	0	40	-	12.5	115%
.015	15	-	-	-	-	-	-	15.0	-
.02	35	5	0 3/	35	15	5	30	17.9	85%
.025	50	10	0	15	-	-	-	18.75	116%
.03	20	55	25	85	-	-	-	46.25	65%
.035	45	20	30	30	-	-	-	31.25	33%
.04	60	25	85	70	60	40	-	56.7	38%
.045	50	15	25	25	-	-	-	28.75	52%
.05	80	80	95	20	-	-	-	68.75	48%
.06	100	85	95	30	-	-	-	77.5	42%
.07	90	85	30	-	-	-	-	68.3	49%
.08	100	95	90	50	-	-	-	83.75	27%
.09	100	100	45	-	-	-	-	81.7	39%
.10	100	100	85	60	-	-	-	86.25	22%
.1075	80							80.0	-
.5375	100							100	-
1.075	100							100	-
1.6125	100							100	-
2.15	100							100	-
3.225	100							100	-
Check	0	10	0	0 3/	5	0		2.14	184%

1/ Mean based on 4 replicates/dose rate with 5 alate queens/replicate. All trials conducted on different days.

2/ Coefficient of variation among trials.

3/ queens escaped - avg. of three replicates

Table 34. Toxicity of Bifenthrin to IFA Major Workers in Pine Bark.

PPM	$\bar{X}$ % mortality to major workers at indicated dose rate[1/]		
	Trial I	Trial II	Avg. for all trials
.02	10.0	-	10.0
.1	2.5	5.0	3.75
.2	6.25	-	6.25
.43	3.75	3.33	3.5
.644	5.0	-	5.0
.86	22.5	10.0	16.25
1.074	5.0	-	5.0
1.29	95.0	55.0	75.0
Check	3.75	2.5	3.1

1/ Mean based on 4 replicates/dose rate with 20 workers/replicate. All trials conducted on different days.

Table 35. Toxicity of Bifenthrin to IFA Alate Queens in Pine Bark.

PPM	$\bar{X}$ % mortality to alate queens at indicated dose rate[1/]					
	Trial I	Trial II	Trial III	Trial IV	Avg. for all trials	CV[2/]
.43	0	-	-	-	0	-
.86	45	15	-	-	30	-
1.074	20	0	10	-	10	100%
1.161	5	15	-	-	10	-
1.29	65	5	30	35	33.75	73%
1.376	75	35	-	-	55	-
1.504	75	65	15	-	51.7	62%
1.59	20	80	-	-	50	-
1.72	90	95	65	85	83.75	16%
1.806	90	-	-	-	90	-
1.934	85	25	-	-	55	-
2.15	100	100	85	-	95	9%
Check	0	5	5	10	5	82%

1/ Mean based on 4 replicates/dose rate with 5 alate queens/replicate. All trials conducted on different days.

2/ Coefficient of variation among trials.

Table 36 . Toxicity of Bifenthrin to IFA Major Workers in Peat Moss.

	$\bar{X}$ % mortality to major workers at indicated dose rate[1/]	
PPM	Trial I	Trial II
.08	3.75	0
.12	6.25	2.5
.2	1.25	1.25
.428	1.25	6.25
.86	3.75	6.25
1.28	13.75	1.25
1.72	2.5	0
Check	1.25	0

1/ Mean based on 4 replicates/dose rate with 20 workers/replicate. All trials conducted on different days.

Table 37. Toxicity of Bifenthrin to IFA Alate Queens in Peat Moss.

	$\bar{X}$ % mortality to alate queens at indicated dose rate[1/]	
PPM	Trial I	Trial II
.2	5	-
.428	10	-
.86	20	-
1.28	25	-
1.72	10	0
2.148	5	0
2.58	5	5
3.008	0	-
3.44	0	-
3.868	15	-
4.3	5	-
Check	10	0

1/ Mean based on 4 replicates/dose rate with 5 alate queens/replicate. All trials conducted on different days.

Table 38. Bifenthrin Toxicity to IFA Alate Queens in IFA Station Potting Mix.[1/]

PPM	$\bar{X}$ % mortality to alate queens at indicated dose rate[2/] Trial I
.1075	65
.5375	40
1.075	20
1.6125	90
2.15	100
2.6875	100
Check	25

1/ 1:1:1 mixture of sand, peat moss and pine bark.

2/ Mean based on 4 replicates/dose rate with 5 alate queens/replicate. All trials conducted on different days.

Table 39 . *In vitro* Toxicity of Bifenthrin to IFA Alate Queens After 24 Hours Exposure.

ng/cm2	$\bar{X}$ % mortality to alate queens at indicated dose rate[1/]					
	Trial I	Trial II	Trial III	Trial IV	Avg. for all trials	CV[2/]
0.847	0	0	5	-	1.7	170%
1.13	30	20	5	5	15.0	82%
1.36	25	0	5	-	10.0	132%
1.69	35	60	20	5	30.0	78%
1.88	55	10	5	-	23.3	118%
2.26	80	25	0	-	35.0	117%
2.42	75	85	5	10	43.75	96%
2.61	20	30	-	-	25.0	-
2.82	50	15	-	-	32.5	-
3.39	100	100	85	30	53.75	87%
Check	0	0	10	0	2.5	200%

1/ Mean based on 4 replicates/dose rate with 5 alate queens/replicate. All trials conducted on different days.
2/ Coefficient of variation among trials.

Table 40. Preliminary estimated LD_{90} values for bifenthrin against IFA workers and alate queens in various substrates.

Substrate	Life Form	Predicted LD_{90} (ppm) [1/]
Strong-Lite® Potting Media	major workers	3.70
	alate queens	11.62
River sand	major workers	0.057
	alate queens	0.99
Milled pine bark	major workers	insufficient data
	alate queens	2.16
Peat moss	major workers	insufficient data
	alate queens	insufficient data
IFA station potting mix	alate queens	3.73
In vitro	alate queens	5.72 ng/cm^2

1/ Preliminary estimate based on linear regression analysis of existing data (not including rates with average of all trials = 100). More definite tests currently in progress.

PROJECT NO: FA01G060

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

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

Three synthetic pyrethroids, cypermethrin 0.75G, bifenthrin 0.2G, and Force® 1.5G have produced up to 24 months residual activity at dose rates of approximately 85ppm 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; 2.5ppm, 5ppm, and 10ppm using portable electric cement mixers. Each replicate 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. 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	2.5ppm	5ppm	10ppm
Cypermethrin 0.75G	3.2gm	6.4gm	12.8gm
Force 1.5G	1.6gm	3.2gm	6.4gm
Bifenthrin 0.2G	12.04gm	24.1gm	48.2gm

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 to date are summarized in Table 41. With the exception of Force 1.5G and bifenthrin .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.

PROJECT NO: FA01G070

PROJECT TITLE: Residual Activity of Insecticidal Drenches, 1989.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

Drench treatments with chlorpyrifos (Dursban®) and diazinon are listed in USDA, APHIS, PPQ Manual M301.81 for certification of containerized plants. The Dursban treatment provides a 30 day certification period: diazinon provides 14 days certification. As part of the ongoing process of evaluating chemicals for use as a quarantine treatment, a study comparing the residual activity of insecticidal drenches was initiated in April 1989.

METHODS AND MATERIALS:

Treatments listed below were applied to 6" pots containing Strong-Lite™ potting media. Total volume of drench (finished solution) was 1/5 that of the pot to be drenched, i.e. if using 1 gallon pots (128 oz), then 26 oz. of drench was applied. Pots were weathered outdoors under natural conditions. Irrigation water was added to simulate normal agronomic practices (a minimum of 2" pet week). At monthly intervals 3 pots from each treatment were collected, composited and subjected to an alate queen

Table 41. Activity of Selected Pyrethroid Insecticides at Low Rates of Application.

Insecticide	Dose Rate (PPM)	Average % Mortality to Alate IFA Queens at Post-Treatment Interval (Months) (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cypermethrin .75G	2.5	5	35	90	5	15	0	60	70
	5.0	10	15	60	5	15	15	90	70
	10.0	25	40	95	45	10	5	95	100
Force 1.5G	2.5	20	55	65	55	10	0	15	55
	5.0	85	100	100	15	95	0	20	15
	10.0	100	100	100	100	100	100	100	100
Bifenthrin .2G	2.5	10	35	100	60	70	30	95	95
	5.0	10	70	100	20	100	85	100	100
	10.0	40	60	100	100	100	100	100	100
Check	0	5	5	5	0	0	5	10	5

bioassay (Appendix II).

Insecticide & Formulation	fl oz./gal. water	Theoretical Dose Rate (PPM)
Cypermethrin 2.5EC	.06 (1.8 ml) 1/	216
Talstar 2EC	.08 (2.4 ml) 1/	230
Cymbush 3EC	.05 (1.5 ml) 1/	216
Diazinon 2EC	.32 (9.4 ml) 1/	904
Dursban 2EC	.08 (2.4 ml) 1/	230
Empire (M/E Dursban)	3 (88.7 ml) 2/	7120
Empire	.09 (2.6 ml) 1/	212
Oftanol 2EC	.08 (2.4 ml) 1/	230
Tempo 2EC	.08 (2.4 ml) 1/	230

1/ Labelled rate or equivalent to labelled rate for Dursban 2EC IFA drench.
2/ Maximum labelled rate for other pests.

RESULTS:

Results are summarized in Table 42. Talstar 2EC, Tempo 2EC and Empire (both rates) have proven to be excellent candidates for further study because all three compounds maintained 100% mortality for 6 months. Since this test was only designed to run 6 months, an expanded test was conducted in 1990 to determine activity beyond 6 months.

Table 42. Drench Treatments, 1989.

Treatment	Average % Mortality at Indicated Post-Treatment Interval (Days)						
	(1)	(30)	(60)	(90)	(120)	(150)	(180)
Talstar	100	100	100	100	100	100	100
Empire 88.7ml/gal	100	100	100	100	100	100	100
Empire 2.6ml/gal	100	100	95	100	100	100	100
Tempo	100	100	100	100	100	100	100
Cypermethrin	100	100	100	100	100	100	95
Cymbush	100	100	100	100	100	95	95
Dursban	100	100	50	25	10	*	*
Diazinon	100	10	30	*	*	*	*
Oftanol	100	5	50	*	*	*	*
Check	5	10	45	15	5	5	0

* Compounds were removed from the test after dropping below 50% mortality on two consecutive bioassays.

PROJECT NO: FA01G080

PROJECT TITLE: Residual Activity of Drench Candidates, 1990.

TYPE REPORT: Interim

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, this report). 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 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 80-100 cc subsample was subjected to standard laboratory bioassay using field collected alate queens (Appendix II). Treatment rates and theoretical dose rates for each treatment are shown as follows:

Pesticide & Formulation	Rate of Application (fl. oz./100 H_2O)	(ml./gal. H_2O)	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:

Preliminary results are summarized in Table 43. All treatments provided excellent control up to 7 months post-treatment, with the exception of Tempo 1ME (both rates), Empire (both rates), Pounce (100 ppm) and Torpedo (100 ppm). This trial will continue until activity of all treatments cease.

MATERIALS AND METHODS:

On March 7, 1990, granular formulations of bifenthrin 0.2G and tefluthrin (Force 1.5G) were mechanically incorporated into a commercial nursery potting media (Strong-lite®, 382 lbs/cu. yd.) at rates of 12.5, 25, 50, 75 and 100 ppm. A portable cement mixer was used to blend the toxicants into the media and was operated for 1 hour to insure a thorough blending. Treated media was placed into 75 standard trade gallon capacity plastic post (per treatment) and weathered outdoors under natural conditions for one month prior to first bioassay. Some supplemental irrigation was added.

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

RESULTS:

Both toxicants have shown excellent results at all rates. Results to date can be seen in Table 44.

Table 44. Evaluation of Bifenthrin 0.2G and Force 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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Force 1.5G	12.5	100	100	100	100	100	100	100	100	100	100
	25.0	100	100	100	100	100	100	100	100	100	100
	50.0	100	100	100	100	100	100	100	100	100	100
	75.0	100	100	100	100	100	100	100	100	100	100
	100.0	100	100	100	100	100	100	100	100	100	100
Bifenthrin 0.2G	12.5	100	100	100	100	100	100	100	100	100	100
	25.0	100	100	100	100	100	100	100	100	100	100
	50.0	100	100	100	100	100	100	100	100	100	100
	75.0	100	100	100	100	100	100	100	100	100	100
	100.0	100	100	100	100	100	100	100	100	100	100

1/ Trial initiated March 7, 1990.

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 soil 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 lb. of chlorpyrifos (Dursban 2.5G) per cu. yd. initially afforded a 24 month certification (PPQ Control Manual M301.81). (PPQ Control Manual M301.81).

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

MATERIALS AND METHODS:

In October 1989, three chlorpyrifos formulations (Dursban® 10G, Lorsban® 15G and Suscon® 10CR), Triumph 1G and bifenthrin 0.2G were all incorporated into a standard potting media (Strong-lite®) as described in Appendix II. Each toxicant was blended into the media at a rate of 100 ppm. The incorporated media was divided into three equal lots per replicate, bagged and transported to three separate experimental sites in Gulfport, MS; Miami, FL and Whiteville, NC. Treated media was aged outdoors in trade 1 gallon plastic pots. In addition to natural rainfall, some irrigation was added at irregular intervals, but the amount was not recorded. Samples were collected from all three sites at monthly intervals and bioassays carried out at the IFA Station in Gulfport, MS.

RESULTS:

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 Whiteville or Gulfport sites. Bifenthrin 0.2G has remained 100% effective for 16 months (as of January 1991). Results can be seen in Table 45.

Table 45. Relative Degradation of Selected Insecticides at Different Geographical Locations.

CANDIDATE	SITE	% Mortality to Alate Queens at Indicated Post-Treatment Intervals (Months)															
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	14)	(15)	(16)
Bifenthrin 0.2G	MS	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	NC	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	FL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Dursban 10G	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 15G	MS	100	100	100	100	100	25	5	*								
	NC	100	100	100	55	10	40	0	*								
	FL	100	100	100	10	5	20	5	*								
Triumph 1G	MS	100	100	5	5	10	15	*									
	NC	100	100	100	30	20	0	*									
	FL	55	25	20	10	5	0	*									
Suscon 10CR	MS	100	100	50	10	25	0	*									
	NC	100	100	100	95	60	5	*									
	FL	95	25	15	20	65	0	*									

* Dropped from trial due to loss of efficacy.

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, and Avel Ladner

INTRODUCTION:

As part of a continuing program to evaluate bifenthrin as a quarantine treatment for IFA, and as an extension of the 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 diversified containerized operation, and cooperated in the trials described herein.

MATERIALS AND METHODS:

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 as previously described on January 23, 1990. Dursban® 10G and Lorsban® 10G were mixed at the standard rate (11.2g AI/ cu.yd.). Suscon® 10CR and Talstar® 10WP (bifenthrin) were incorporated at rates of 25, 50, and 100 ppm. Bifenthrin 0.2G was mixed at rates of 25 and 50 ppm. Plots of each replicate were established on site and were subjected to normal

horticultural practices. Samples were collected at monthly intervals and bioassayed at the Gulfport Lab.

RESULTS:

As shown in Table 46, Triumph® 1G sustained efficacy for only one month. Dursban 10G at the standard rate and Suscon 10CR at 25 and 50 ppm remained active for 2 months. By month 5, Suscon 10CR (100 ppm), and Lorsban 15G had begun to deteriorate. Talstar 10WP and bifenthrin 0.2G continue to show 100% efficacy at 12 months post-incorporation (Jan. 91).

Table 46. Degradation of Candidate Insecticides in a Commercial Nursery Environment.

CANDIDATE	Rate of Applic. (PPM)	% Mortality to Alate Queens at Indicated Post-Treatment Intervals (Months)												
		(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Bifenthrin 0.2G	25	100	100	100	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100
Talstar 10WP	25	100	100	100	100	100	100	100	100	100	100	100	100	100
	50	100	100	100	100	100	100	100	100	100	100	100	100	100
	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Suscon 10CR	25	60	100	100	95	85	35	10	5	*				
	50	100	100	100	90	60	40	20	5	*				
	100	100	100	100	100	35	65	45	20	*				
Dursban 10G	STD	100	100	100	95	10	15	5	10	*				
Lorsban 15G	STD	100	100	100	100	5	0	0	0	*				
Triumph 1G	150	100	100	85	65	10	0	0	10	*				

* Dropped from trial due to loss of efficacy.

PROJECT NO: FA01G120

PROJECT TITLE: Residual Activity of Talstar® 10WP as a Preplant Incorporated Treatment.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

Dursban® 2.5G applied as a ~replantincorporated treatment is approved for certification for nursery potting soil under the IFA Quarantine. A certification period of 24 months is listed in USDA, APHIS, PPQ Manual M301.81 The degradation of Dursban is well documented (1989 Annual Report, IFA Lab), leading to a search for replacement treatments. Several insecticides have shown promise as a replacement treatment, including Talstar 10WP, a formulation of bifenthrin.

METHODS AND MATERIALS:

Talstar 10WP was blended into Strong-lite™ potting media, on December 21, 1989, at four theoretical dose rates; 12.5, 25, 50, and 100 ppm. Three cubic feet of media was blended at each rate and placed into 36 6"x 6" plastic nursery pots. The pots were then placed outdoors to weather naturally at Gulfport, MS. Irrigation water was added to natural rainfall as needed to maintain a minimum of 1" of irrigation per week. At monthly intervals 3 pots from each treatment were composited and an 80-100cc subsample subjected to standard laboratory bioassay procedures using alate IFA queens (Appendix II).

RESULTS:

The 12.5 ppm rate showed a slight decrease in efficacy at 8, 9, and 10 months post-treatment, but returned to 100% efficacy through 12 months (Table 47). The other rates all provided excellent residual activity up to 12 months post-treatment. At that time the test was terminated. Tests to determine residual activity after 1 year have been initiated.

Table 47. Efficacy of Talstar 10WP Incorporated into Nursery Potting Media.

Rate of Application	Percent Mortality at Indicated Months 1/ Post-Incorporation											
(PPM)	(1)	(2)	(3)	(4)	(5))	(6)	(7)	(8)	(9)	(10)	(11)	(12)
12.5	100	100	100	100	100	100	100	95	95	90	100	100
25	100	100	100	100	100	100	100	100	100	100	100	100
50	100	100	100	100	100	100	100	100	100	100	100	100
100	100	100	100	100	100	100	100	100	100	100	100	100

1/ Standard laboratory bioassay using alate IFA queens.

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 and Homer Collins

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. More recent trials using topical applications at 100 ppm have provided 9 months residual activity against alate IFA queens. The need for more information on performance of bifenthrin in various types of media and influence of application procedure on efficacy prompted the present study.

METHODS AND MATERIALS:

Four types of nursery potting media were included in this study. Characteristics of each media are 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
Dodds	332	1:1 pinebark:peat moss 1 cu ft/cu yd airolite 8 lbs lime/cu yd 1.5 lbs micromax/cu yd (micronutrients)
Lab mix	1124	1:1:1 sand:peat moss: pinebark

Each type of media was treated by two different procedures; both topical and 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 .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 are 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
Lab 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:

Preliminary results appear in Table 48. One to four months post-treatment, Talstar 10 WP, applied to various media topically or by incorporation, was 100% effective against IFA alate queens. The study will continue until activity of all treatments ceases.

Table 48. 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)
Strong-Lite	topical	25	100	100	100	100
	incorporation	25	100	100	100	100
	Untreated Check	0	10	0	15	15
Baccto	topical	14.1	100	100	100	100
	incorporation	16.6	100	100	100	100
	Untreated Check	0	0	0	0	15
Dodds	topical	23.2	100	95	100	100
	incorporation	30.1	100	100	100	100
	Untreated Check	0	0	5	5	10
Lab mix	topical	9.8	100	100	80	100
	incorporation	8.9	100	100	100	100
	Untreated Check	0	10	5	0	5

PROJECT NO: FA01G140

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

TYPE REPORT: Interim

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.

RESULTS:

Results appear in Table 49, and generally indicate that rates of 25 ppm or greater provided at least 6 months of excellent control. This trial is

still in progress, but augments and confirms other studies regarding topical applications of Talstar 10WP for treatment of containerized nursery plants.

Table 49 . 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)
Jackson, MS	5	100	100	85	100	85	--
R. Mitchell	10	100	100	100	55	100	--
FMC Corp.	25	100	100	100	100	100	--
	50	100	100	100	100	100	--
	75	100	100	100	100	100	--
	Check	5	5	15	15	5	--
Tifton, GA	5	100	45	100	100	100	100
B. Sparks	10	100	100	100	100	100	100
Ga. Ext. Ser.	25	100	100	100	100	100	100
	50	100	100	100	100	100	100
	75	100	100	100	100	100	100
	Check	0	25	5	10	45	35
Monticello, FL	5	100	100	100	100	85	100
R. Mizell	10	85	85	100	100	100	100
Agric. Res. &	25	100	100	100	100	100	100
Educ. Center	50	100	100	100	100	100	100
	75	100	100	100	100	100	100
	Check	0	25	50 2/	0	45 2/	5
Mobile, AL	5	80	100	95	100	90	50
J. Stephenson	10	80	90	100	80	70	100
Auburn Univ.	25	100	100	60	100	100	95
Hort. Sta.	50	100	100	75	100	100	100
	75	100	100	100	100	100	100
	Check	25	15	0	15	5	0

1/ Standard laboratory bioassay using IFA alate queens

2/ High check mortality unexplained

PROJECT NO: FA01G150

PROJECT TITLE: Effect of Irrigation on Residual Activity of Talstar® 10 WP Incorporated into Potting Media.

TYPE REPORT: Interim

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

INTRODUCTION:

Talstar 10WP (bifenthrin) is a synthetic pyrethroid which has shown great promise as an IFA toxicant when applied topically or incorporated into potting media. Talstar 10WP incorporated into potting media and subjected to normal horticultural practices have shown residual activity up to 12 months (FA01G110 and FA01G120). More recent trials using topical application at 25-75 ppm have provided 6 months residual activity against IFA alate queens (FA01G140). This study was initiated to determine what effect varying amounts of irrigation may have on the residual activity of bifenthrin.

METHODS AND MATERIALS:

Talstar 10WP 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 receives a different amount of irrigation (in addition to natural rainfall) per week. Irrigation rates are 1 inch, 2 inches, and 4

inches.

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

RESULTS:

At four months post-treatment, all irrigation treatments are providing 100% efficacy against alate queens while receiving in excess of 90 inches of rainfall and irrigation (ca. 5 inches of water per week) [Table 50].

Table 50. 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	
	% 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/
2	100	11.35	100	22.75	100	33.70	100	+59.14
4	100	21.35	100	40.75	100	59.70	100	+90.14
Check 1/	10	6.35	0	10.75	15	14.70	15	+31.14

1/ check received approximately 1 inch 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"

PROJECT NO: FA01G160

PROJECT TITLE: Tests of Candidates for IFA Control in Commercial Grass Sod, 1989.

TYPE REPORT: Final

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

INTRODUCTION:

Commercial shipments of grass sod have been directly associated with the movement and introduction of the imported fire ant (IFA) into previously uninfested areas since 1953 (Culpepper 1953). Chlorinated hydrocarbons were initially used as effective quarantine treatments. In 1978, the EPA issued a cancellation order eliminating the last chlorinated hydrocarbon pesticide (chlordane) for this use pattern. Currently, there exists only two registered products (Dursban® 10G or 50 WP) applied at either 4 or 6 pounds AI/acre.

MATERIALS AND METHODS:

This study was undertaken at the Pearl River Grass Farm located 9 km east of Wiggins, Stone County, Mississippi, beginning on August 11, 1989. A total of 22 toxicants/formulations were evaluated. Candidates were applied at rates indicated to plots measuring 20 x 50 feet. Granular formulations were applied using a cyclone type seeder. Liquid applications were made using a tractor mounted spray system. All materials were applied uniformly. Soil core samples were collected every thirty days during the study. A core sampler was used to collect soil. The cores were composited for each formulation assuring

sufficient amounts available for bioassay. Samples were screened to remove extraneous plant material, placed in marked containers and removed to the laboratory for analysis.

Laboratory bioassays were conducted using IFA alate queens as described in Appendix II.

RESULTS:

Within 24 hours of application, ca. 1 inch of irrigation water was applied to the treated plots. All subsequent waterings were the result of normal precipitation. Along with the chlorpyrifos controls (Lorsban® 15G and Dursban® 10G), three candidates (bifenthrin 0.2G, Talstar® 2EC and Karate® 1EC) gave consistently excellent results. All three are synthetic pyrethroids and exhibited long-term residual activity as well as an exceptionally quick "knock-down" of the test subjects. Plots were destroyed by harvest on May 15, 1990, and tests were terminated as of that date. Final results are listed in Table 51.

Table 51. Grass Sod Tests, 1989.

Candidate	Rate (lbs AI per acre)	Percent Mortality to Alate Queens at Indicated Months Post-Application (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bifenthrin 0.2G	1.0	100	100	100	100	100	100	100	100
Talstar 2EC	1.0	100	100	100	100	100	100	100	40
Lorsban 15G	6.0	100	100	100	100	100	100	100	100
Dursban 10G	6.0	100	100	100	100	100	100	100	100
Karate 1EC	1.0	100	100	100	100	100	100	100	70
Cypermethrin 0.75G	1.0	100	100	100	75	100	95	85	
Force 1.5G	1.0	100	100	100	100	80	80	60	
Fortress 5G	6.0	100	100	100	5	0			
Torpedo 2EC	1.0	100	40	0					
Dyfonate 20G	6.0	100	75	20					
Cypermethrin 2.5EC	1.0	100	0	0					
Dursban 2EC	6.0	100	5						
Triumph 1G	1.0	35	0						
	2.0	35	0						
Triumph 1EC	1.0	25	75						
	2.0	30	0						
Pounce 3.2EC	1.0	50	0						
Cymbush 3EC	1.0	70	0						
Mocap 5G	6.0	25	15						
Oftanol 5G	6.0	25	5						
XPM 4902 1G	6.0	60	0						
Tempo 2EC	1.0	95	25						
Check	---	5	0	10	5	0	5	5	5

PROJECT NO: FA01G170

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

TYPE REPORT: Interim

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 (bifenthrin 0.2G, Talstar 2EC, and Karate 1EC) in commercial grass sod. However, those test 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 August 29, 1990, to plots measuring 50'x 20' at the Pearl River Sod Farm, Wiggins, MS. Granular formulations were applied by hand held radial spreader. Applications of liquid formulations were made on August 30, 1990. 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 gallons finished spray/acre. Five candidate materials were applied at the rates ranging from 0.125 to 6.0 lbs.AI/acre.

RESULTS:

Results at 4 months post-application show 100% efficacy for all granular materials at all rates (Table 52). Talstar 2EC and Karate 1EC showed 100% efficacy at 1 month post-application. However, by month 2, both showed significant reduction in efficacy at the 0.125 lb. rate. The higher rates (>0.25 lbs.) continue to have 100% success to date. Evaluations will continue until efficacy fails for all treatments.

Table 52. Efficacy of Two Synthetic Pyrethroids Applied at Varying Rates/Formulations to Commercial Grass Sod, 1990.

CANDIDATE	Rate (lb. per Acre AI)	Percent Mortality to IFA Alate Queens at Indicated Months Post-Application 1/ (1)	(2)	(3)	(4)
Lorsban 15G	6.00	100	100	100	100
Dursban 10G	6.00	100	100	100	100
Bifenthrin 0.2G	1.00	100	100	100	100
	0.50	100	100	100	100
	0.25	100	100	100	100
	0.125	100	100	100	100
Talstar 2EC	1.00	100	100	100	100
	0.50	100	100	100	100
	0.25	100	65	100	100
	0.125	100	85	35	25
Karate 1EC	0.50	100	100	100	100
	0.25	100	100	100	100
	0.125	100	10	65	65
Check	--	0	5	5	5

1/ Standard laboratory bioassay (Appendix II).

Table 53. Relative Phytotoxicity of Bifenthrin (Talstar 10WP) Applied as a Drench to Various Succulent and Woody Ornamental Containerized Plants at Two Rates.

CULTIVAR	SHOOT FRESH WEIGHT (grams) 1/ CHECK	1X	3X
SUCCULENTS-			
Firmiana simplex	77.5a	82.5a	75.5a
Impatiens wallerana (Blue Pearl)	248.3a	176.9a	273.5a
Caladium sp.	162.9a	127.8a	120.8a
Ageratum houstonianum (Blue Puffs)	236.0a	258.3a	245.6a
Begonia semperflorens	688.1a	667.7a	726.1a
Colius blumei (Red Wizard)	370.0a	352.2a	318.9a
Hibiscus sp.	136.5a	126.9a	129.6a
WOODY ORNAMENTALS-			
Azalea sp. (Carror)	88.0a	81.4a	84.6a
Azalea sp. (Eriocarpum)	153.1a	149.3a	170.7a
Azalea sp. (Sunglow)	84.4a	88.9a	81.8a
Azalea sp. (Wakaebisiu)	94.9a	85.5a	83.6a
Ilex #4878 (China Girl)	57.7a	63.1a	62.4a
Ilex compacta	55.7a	54.5a	56.8a
Ilex cornuta	40.4a	38.9a	41.2a
Ilex latifolia	56.5a	61.8a	56.1a
Ilex vomitoria (Shillings)	57.4a	61.7a	58.0a
Prunus carolinianum	84.1a	84.9a	93.3a

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

PROJECT NO: FA01G190

PROJECT TITLE: Duplication of Early Efficacy Trials with Granular Chlorpyrifos.

TYPE REPORT: Final

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

INTRODUCTION:

Efficacy trials conducted in the late 1970's indicated that granular chlorpyrifos (Lorsban® 10G) incorporated into potting media at a rate of 11.3 grams AI per cubic yard of media provided over 24 months residual activity (Collins et. al. 1980, & numerous unpublished in-house reports). These original studies were conducted using an potting media consisting of equal parts sand, peat moss and pine bark. However several trials conducted in 1989 showed that the residual activity of granular chlorpyrifos (primarily Ford's 2.5G) was somewhat variable, but in no case more than 3-4 months. Several factors may be involved in the apparent discrepancy in residual activity of granular chlorpyrifos in nursery potting media. Obviously formulation differences may be responsible, and other trials are underway to determine this. Although none of the tests conducted in 1989 indicated any differences in the 6-8 different potting media tested, the effect of soil type on the toxicity of chlorpyrifos to a variety of other insects is well documented (Harris and Svec 1968, Harris 1977, Getzin 1981).

This study was initiated to verify data obtained in those previous

in-house studies using the same potting media and procedures.

METHODS AND MATERIALS:

On December 21, 1989 an effort was made to duplicate the results achieved in the original efficacy trials. A potting media consisting of milled pine bark (Baccto brand, Atlanta, Ga.), spagnum peat (Premier Brands, Inc., New Rochelle, NY), and masonary sand in a 1:1:1 ratio was prepared by tumbling all components in a portable cement mixer. Dry weight bulk density of the media was determined to be 1480 lbs. per cubic yard. Lorsban 15G (Dow Chemical, Midland, MI) was added to the media at a rate of 11.3 gms AI/ cubic yard. The cement mixer was operated for 1 hour after the toxicant was added in order to achieve a uniform media:toxicant blend. A second batch of media was treated with Dursban 2.5G (Ford's Chemical and Specialty Co., Pasadena, TX) at the same rate of 11.3 gms AI/cubic yard. Treated media was then placed in 6"x6" plastic floral pots and weathered outside under natural rainfall and temperature conditions. Pots were on raised benches located under a partial canopy of 10-12" diameter pine trees. Residual activity of each treatment was determined at monthly intervals by the "fragmented colony" bioassay procedure described elsewhere.

RESULTS:

At 1 year post-treatment, both chlorpyrifos formulations were providing 100% colony mortality. At six months, standard alate queen bioassays (Appendix II) were initiated in addition to the colony bioassays. For 6 - 12 months post-treatment, both formulations were 100% effective against alate queens in addition to fragmented colonies. These results confirm efficacy of granular chlorpyrifos in certain types of media. However, rapid degradation in most types of media remains unexplained. In addition to 1 year of activity in the 1:1:1 nursery mix of sand, peat moss, and pine bark used in this trial, Lorsban 15G remained active for over 12 months in pure peat moss (See FA01G069 this report).

PROJECT NUMBER: FA01G200

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

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, spagnum 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, spagnum peat, and milled pine bark were blended and Ford's 2.5G Dursban® 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 degradation 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 2 inches of water per week.

At monthly intervals, three pots from each treatment were composited and an 80-100 cc sub-sample subjected to standard laboratory alate queen bioassay (Appendix II). Remaining composited soil was submitted monthly to NMRAL for residue analysis by gas chromatography (GC).

RESULTS:

Five months post-treatment, Lorsban 15G in sand has shown decreased efficacy (Table 54). Sand has also shown the lowest amounts of chlorpyrifos present by GC analysis.

RESULTS:

Results are shown in Table 55. Rates of 60 ppm and higher have shown effective residual activity through 9 months post-treatment. At the 10 months post-treatment, only 80 and 100 ppm were effective. The 20 ppm rate was very erratic and proved 100% effective only at 5 months post-treatment.

Table 55. Residual Activity of Suscon 10G Incorporated into Whiteville, North Carolina 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)
20 ppm	20	60	80	55	100	35	45	25	0	15
40 ppm	90	100	100	100	100	80	100	100	100	75
60 ppm	100	100	100	100	100	100	100	100	100	45
80 ppm	100	100	100	100	100	100	100	100	90	100
100 ppm	100	100	100	100	100	100	100	100	100	100
Check	0	10	0	5	0	0	10	5	5	--

PROJECT NO: FA01G220

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

TYPE REPORT: Interim

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 56). 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 56. 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 MS	Triumph	100	0.0	100	0.30	100	0.70	100	2.45	100	6.46	100	ND	60	ND
	Check	10		5		0		15		10		10		10	
Tifton GA	Triumph	-		15	6.40	5	13.20	30	21.60	25	29.10	0	ND	5	ND
	Check	-		5		0		70*		15		5		10	
Corpus Christi TX	Triumph	100	0.87	100	2.63	100	3.18	10	5.53	65	7.33	5	ND	5	ND
	Check	10		10		0		10		5		0		10	

* - high check mortality unexplained
ND - no data

PROJECT NO: FA01G230

PROJECT TITLE: Residual Activity of Triumph® 4E and 1G in Potting Media in South Florida.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Anne-Marie Callcott and Marvin Swart (Ciba-Geigy, Lady Lake, FL)

INTRODUCTION:

Recent studies have shown rapid degradation, and thus decreased efficacy of Triumph in nursery soil. Many studies, most located in Gulfport, MS, are underway to determine what factor(s) are involved in this degradation. This study was initiated to determine the effect of geographical location (South Florida) and actual nursery conditions on Triumph in nursery soil.

METHODS AND MATERIALS:

Two south Florida nurseries were chosen for this project; Jones' Nursery and Engelmann's Nursery. In November 1989, per company protocol, Marvin Swart treated the potting media used at each nursery with various rates and formulations of Triumph. Treated media was then exposed to normal nursery conditions. Application rates were as follows:

Triumph 4E - .0125 oz/gal
- .025 oz/gal

Triumph 1G - 5 lbs/cu yd
- 10 lbs/cu yd

Monthly soil samples were taken and sent to Gulfport, MS where the IFA Station performed standard laboratory queen bioassays (Appendix II), and the National Monitoring and Residue Analysis Laboratory (NMRAL) analyzed for Triumph by GC analysis.

RESULTS:

Due to the small size of the containers used at Engelmann's Nursery, samples were pulled only within 2 weeks of treatment and at six months post-treatment (the final sample). All rates and formulations were effective against IFA alate queens in laboratory tests 2 months after treatment (Table 57). After this time, efficacy decreased in all rates.

Table 57. Residual Activity and GC Results of Triumph 4E and 1G in Potting Media Aged at Two South Florida Locations.

			Results at Indicated Time Post-Treatment							
			24 hours		14 days		1 month		2 months	
Nursery / Code	Treatment	Date Treated	% Mort Bioassay1/	Chemical Analysis2/	% Mort Bioassay	Chemical Analysis	% Mort Bioassay	Chemical Analysis	% Mort Bioassay	Chemical Analysis
Jones' / JL1X	Triumph 4E .0125 oz/gal	11/10/89	---	---	100	13.53	100	19.59	100	53.54
Jones' / JL2X	Triumph 4E .025 oz/gal	11/10/89	---	---	100	22.18	100	84.81	100	211.18
Jones' / JG1X	Triumph 1G 5 lbs/cu yd	11/10/89	---	---	100	10.30	100	8.62	100	25.99
Jones' / JG2X	Triumph 1G 10 lbs/cu yd	11/10/89	---	---	100	17.86	100	28.27	100	42.17
Jones' / JC	Untreated check	11/10/89	---	---	5	---	0	---	10	---
Engelmann's / EL1X	Triumph 4E .0125 oz/gal	11/21/89	100	168.95	---	---	---	---	---	---
Engelmann's / EL2X	Triumph 4E .025 oz/gal	11/21/89	100	421.28	---	---	---	---	---	---
Engelmann's / EG1X	Triumph 1G 5 lbs/cu yd	11/13/89	---	---	100	38.00	---	---	---	---
Engelmann's / EG2X	Triumph 1G 10 lbs/cu yd	11/13/89	---	---	100	129.51	---	---	---	---
Engelmann's / EC	Untreated check	11/13/89	---	---	0	---	---	---	---	---

1/ As determined by standard laboratory bioassays; average based on 4 replicates/treatment with 5 alate queens/replicate.
2/ As determined by NMRAL, Gulfport, MS by standard GC. Reported in ppm.

Table 57. (Cont'd).

Nursery / Code	Treatment	Date Treated	Results at Indicated Time Post-Treatment							
			3 months		4 months		5 months		6 months	
			% Mort Bioassay	Chemical Analysis	% Mort Bioassay	Chemical Analysis	% Mort Bioassay	Chemical Analysis	% Mort Bioassay	Chemical Analysis
Jones' / JL1X	Triumph 4E .0125 oz/gal	11/10/89	100	20.80	50	10.46	55	10.30	10	1.97
Jones' / JL2X	Triumph 4E .025 oz/gal	11/10/89	90	93.40	80	24.00	60	14.69	85	14.97
Jones' / JG1X	Triumph 1G 5 lbs/cu yd	11/10/89	20	4.72	100	2.16	35	1.38	30	3.63
Jones' / JG2X	Triumph 1G 10 lbs/cu yd	11/10/89	85	8.76	90	5.94	15	2.74	5	3.11
Jones' / JC	Untreated check	11/10/89	0	---	10	---	10	---	30	---
Engelmann's / EL1X	Triumph 4E .0125 oz/gal	11/21/89	---	---	---	---	---	---	5	56.24
Engelmann's / EL2X	Triumph 4E .025 oz/gal	11/21/89	---	---	---	---	---	---	30	62.49
Engelmann's / EG1X	Triumph 1G 5 lbs/cu yd	11/13/89	---	---	---	---	---	---	90	135.17
Engelmann's / EG2X	Triumph 1G 10 lbs/cu yd	11/13/89	---	---	---	---	---	---	100	119.21
Engelmann's / EC	Untreated check	11/13/89	---	---	---	---	---	---	20	---

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 9 months post-treatment (Table 58). Rates of 15-60 mls/gal. water have generally provided good control 8 to 9 months post-treatment. Lower rates have been variable.

Table 58. 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)
1.90	100	100	25	0	100	20	30	0	10
3.75	100	100	25	35	100	5	100	20	10
7.50	100	100	65	90	100	95	100	45	100
15	100	100	100	100	100	100	100	100	35
30	100	100	85	100	100	100	100	100	90
60	100	100	100	100	100	100	65	100	100
90	100	100	100	100	100	100	100	100	100
Check	5	40	0	0	0	10	5	5	10

PROJECT NO: FA01G250

PROJECT TITLE: Dose Rate Trials with Triumph[q] 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 10 months post-treatment, all dose rates remain 100% effective (Table 59). These and other data confirm the effects of irrigation on residual activity of Triumph in potting media.

Table 59. 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)
11.2	100	100	100	100	100	100	100	100	100	100
22.4	100	100	100	100	100	100	100	100	100	100
44.8	100	100	100	100	100	100	100	100	100	100
Check	0	0	15	0	0	20	0	5	0	0

PROJECT NO: FA01G260

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

TYPE REPORT: Interim

LEADERS/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 0.5cm, 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% Talstar to 5%were prepared by FMC and submitted to us for evaluation. A list of concentrations to be 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

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

METHODS AND MATERIALS:

Efficacy of the Talstar tablets was determined by (1) comparing rate of kill of 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 and 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 remain active.

Test II - Residual activity against alate IFA queens:

6" x 6" plastic pots 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:

At 2 months post-treatment, all treatments are 100% effective (Table 60). Data will continue to be collected until activity ceases.

Table 60. 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 Indicated Months Post-Treat (1)	(2)
0.5	12	100	100
1.0	24	100	100
2.0	48	100	100
6.0	120	100	100
Check	--	5	15

PROJECT NO: FA02G010

PROJECT TITLE: Laboratory Tests with Steinernema carpocapsae.

TYPE REPORT: Final

LEADER/PARTICIPANT(s): Homer Collins and Dr. James Lindregren [ARS, Fresno, CA]

INTRODUCTION:

A mexican isolate of an entomogeneous nematode, Steinernema carpocapsae var. "Kapow" was evaluated for IFA control under laboratory conditions. This isolate has been known to be faster and more virulent than other strains against other insects.

METHODS AND MATERIALS:

TEST I - 6/14/90:

Six (6) tissue culture vials containing 5×10^6 nematodes each were received on 6/13/90 via Airborne Express from Dr. James Lindregren, USDA, ARS, Fresno, California. "Cool pack" and nematode vials arrived in good condition, except nematodes had migrated out of the vials because lids were loosened to facilitate respiration while in transit. Nematodes were retained in original package overnite under ambient laboratory conditions (Ca. 72°F).

Twelve (12) IFA colonies were collected on the morning of 6/14 by shoveling approximately 7.5 liters of nest tumulus and ants into 12 liter plastic pails. Ant colonies contained all life stages including worker

ants, immatures, and reproductive forms, but queen status was not determined. Colonies were returned to the lab for nematode application later in the day.

Each tissue culture vial was rinsed in distilled water three times to obtain a total of 100 ml. rinseate (i.e., 50,000 nematodes/ml).

Dilutions were made to obtain the following dose rates:

5,000,000	nematodes/colony
1,500,000	nematodes/colony
500,000	nematodes/colony
0	nematodes/colony

Treatments were applied to 3 nests (replicates) in a total of 1 liter of water/nest as a pour-on drench. Observations for mortality were made on 6/18, 6/29, and 7/18.

TEST II - 6/29/90

Procedures described for Test I were duplicated except nematodes were refrigerated at 40°F upon arrival on 6/28 until drenches were employed on 6/29. Dose rates were as follows:

15×10^6 nematodes/ant colony.
5×10^6 nematodes/ant colony.
1.5×10^6 nematodes/ant colony.
0×10^6 nematodes/ant colony.

RESULTS:

Test I:

Date 6/18/90	TREATMENT (Nematodes/colony)	OBSERVATIONS
	0×10^6	colony #1 - normal, very active colony #2 - normal, very active colony #3 - normal, very active
	5×10^6	colony #1 - slightly decreased activity soil not worked up as in checks colony #2 - less activity than in colony #1 colony #3 - greatly diminished activity. Estimated greater than 75% mortality.
	1.5×10^6	colony #1 - different from checks; decreased activity but not as much as in 5×10^6 dose rate colony #2 - active; little if any mortality colony #3 - active; little if any mortality
	$.5 \times 10^6$	colony #1 - slightly less activity than checks, but still vigorous; definitely different from heaviest dose rate. colony #2 - slightly less activity than checks, but still vigorous; definitely different from heaviest dose rate. colony #3 - slightly less activity than checks, but still vigorous; definitely different from heaviest dose rate.

Date 6/29/90	TREATMENT (Nematodes/colony)	OBSERVATIONS
	0×10^6	colony #1 - normal, very active colony #2 - normal, very active colony #3 - normal, very active
	5×10^6	colony #1 - not different from checks colony #2 - not different from checks colony #3 - greatly diminished activity. Estimated 80% mortality
	1.5×10^6	colony #1 - not different from checks colony #2 - not different from checks colony #3 - not different from checks
	$.5 \times 10^6$	colony #1 - not different from checks colony #2 - not different from checks colony #3 - not different from checks

TEST II:

Date 7/2/90	Dose Rate	Observations
	15×10^6	All three colonies exhibiting avoidance behavior by clinging to sides of pails. Little or no worker mortality but immatures and alates dead on surface.
	5×10^6	Similar to above, but less avoidance.
	1.5×10^6	No worker mortality; less avoidance behavior, dead brood and alates.
		The dead brood and immatures seen in Test II were not observed in Test I, possibly due to the better condition of the nematodes.

Date 7/9/90	Dose Rate	Observations
	0×10^6	Colony #1 - Normal activity Colony #2 - Normal activity Colony #3 - Normal activity
	1.5×10^6	Colony #1 - not significantly different from checks Colony #2 - not significantly different from checks Colony #3 - not significantly different from checks
	5×10^6	Colony #1 - not significantly different from checks Colony #2 - not significantly different from checks Colony #3 - not significantly different from checks
	15×10^6	Colony #1 - more "clustering" on sides of buckets; otherwise similar to checks and other treatments. Colony #2 - more "clustering" on sides of buckets; otherwise similar to checks and other treatments. Colony #3 - more "clustering" on sides of buckets; otherwise similar to checks and other treatments.

Date 7/19/90	Dose Rate	Observations
	0×10^6	Normal activity
	all others	Not different from untreated checks except larger "bone piles" indicating some mortality to adult workers, alates and immatures.

SUMMARY AND CONCLUSIONS:

1. Presence of nematodes in laboratory ant colonies generally caused avoidance behavior by worker ants. This avoidance behavior was typified by ants "clustering" on sides of container, soil surface, etc.

2. Presence of dead and untended ant brood on the soil surface indicated that immature forms are more susceptible to infection than adult worker ants.

3. Although a dose rate response was evident, even massive rates of 15×10^6 nematodes/nest did not provide adequate control under laboratory conditions.

4. A commercial strain of the same nematode species did not provide acceptable control in several field trials conducted in 1988.

PROJECT NO: FA02G020

PROJECT TITLE: Evaluation of Neem Seed Extract for IFA 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 acceptance studies:

Acceptability of various concentrations of azadirachtin in soybean oil and/or sucrose solutions was determined by standard laboratory bioassay procedures described in Appendix III.

2. Determination of JH or other growth disruptive properties:

Effects of azadirachtin baits on growth and development of treated colonies will be observed in the laboratory. Queen-right IFA colonies will be established in the laboratory and fed azadirachtin baits (assuming an acceptable formulation can be prepared as a result of bait acceptance studies). Brood production in treated colonies will be compared to untreated colonies.

3. Drench treatments:

A. Laboratory tests:

Fragmented IFA colonies will be dipped in various concentrations of aqueous solutions of NSE to observe effects of NSE on immature ants as well as adult workers.

B. Field trials:

Based on results of laboratory drench tests, field trials with the most efficacious concentration may be indicated. If so, efficacy of

NSE drenches will be determined by applying 1 gallon of NSE solution to all IFA nests in replicated 1 acre field plots according to procedures described in Appendix III.

RESULTS:

Very few studies have been completed to date. However, preliminary results are as follows:

1. Bait acceptance studies:

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 or pregelled defatted corn grits. (Table 61).

2. Determination of IH or other growth disruptive properties:

Trials will be initiated in the spring when weather conditions are conducive to collection of queen-right IFA colonies.

3. Drench Treatments:

Preliminary drench trials in the laboratory are underway. No results as yet.

Table 61. Bait Acceptance Ratios of Various Formulations of Azadirachtin.

Formulation		Trial I (10/30/90) $\bar{x}$ Acceptance Ratio 1/	SD	Trial II (11/6/90) $\bar{x}$ Acceptance Ratio	SD	Trial III (12/20/90) $\bar{x}$ Acceptance Ratio	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/ Acceptance ratio = grams candidate bait removed/grams standard bait removed.
Mean acceptance ratio = average acceptance of 5 colonies tested.

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APPENDIX I

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Collins, H.L. 4/90. "Overview of Current USDA, APHIS, S&T Research and Development of Quarantine Treatments". 1990 Imported Fire Ant Conference, College Station, TX.

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Lockley, T.C. 4/90. "Systematic Survey of the Three Coastal Counties of of Mississippi for Incidences of Polygynous Colonies of the Red Imported Fire Ant, Solenopsis invicta". 1990 Imported Fire Ant Conference, College Station, TX.

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Lockley, T.C. 10/90. "Evaluation of Talstar 10W for Phytotoxic Responses by Selected Foliage and Woody Ornamental Landscape Plants". Mississippi Agriculture and Forestry Experiment Station, Poplarville, MS.

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APPENDIX II

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

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

Collection of test insects: Field collected alate imported fire queens are used as the test insect. IFA colonies are opened with a spade and given a cursory examination for the presence of this life stage. Alate queens are seldom, if ever, present in all IFA colonies in a given area. Some colonies will contain only males, others may have few or no reproductive forms present, others may contain both males and queens, while some will contain only alate queens. Seasonal differences in the abundance of queens is quite evident; in the warmer months of the year 50% or more of the colonies in a given area may contain queens. However, in the cooler months, it is not uncommon to find that less that 10% of the colonies checked will contain an abundance of alate queens. Therefore, it is necessary to examine numerous colonies, selecting only those which contain large numbers of alate queens for collection. During winter, ants will often cluster near the surface of the mound facing the sun. Collection during midday on bright, sunny days is highly recommended for winter; whereas the cooler time of day is recommended for hot, dry days of summer. Once a colony (or colonies) has been selected for collection, the entire nest tumulus is shovelled into a 3-5 gallon pail. Pails should be given a liberal dusting with talcum powder on the interior sides to prevent the ants from climbing up the sides of the pail and escaping. Approximately 3-6" head room should be left to prevent escape. An effort should be made to collect as many ants as possible while minimizing the collection of adjacent soil which will contain few ants. Collected colonies are then transported to the laboratory for a 3-5 day acclimation period. The addition of food or water during this short acclimation period is not necessary. Alate queens are collected with forceps after placing a 1-2 liter aliquot of the nest tumulus in a shallow laboratory pan. Again, the use of talc on the sides of containers prevents escape while talced

rubber gloves minimizes the number of stings experienced by the collector. The forceps should be used to grasp the queens by the wings in order to prevent mechanical injury. An experienced collector can collect 2-300 queens per hour. It is generally advisable to place collected queens in a 500 cc beaker or other suitable vessel containing moist paper towels prior to being introduced into the test chamber.

Test chambers: Test chambers are 2.5" x 2.5" plastic flower pots which have been equipped with a labstone bottom. Labstone is generally avalable 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 dessication so humidity/moisture levels must be optimized. Pots should be soaked in water to moisten the labstone prior to placing potting media in the pots. Plastic petri dishes are inverted over the tops of the pots to prevent escape from the top of the test chambers. Prior to placing queens in the test chamber, 50 cc of treated potting media is placed in the bottom of each pot. Due to possible pesticide contamination, test chambers are discarded after use.

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

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

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

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

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

2.) Number of treatments to be evaluated; e.g., if only a single treatment and an untreated check are to be evaluated

only 40 queens/month are needed. Conversely, a test involving 4 insecticides at 3 rates of application (12 treatments + untreated check) will require 260 queens monthly for the duration of the test.

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

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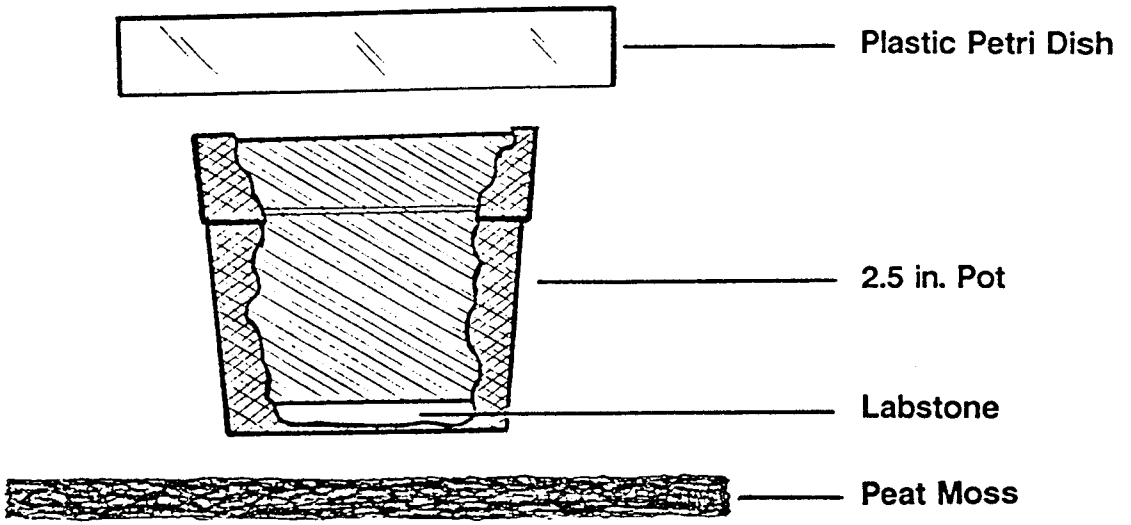

Figure 1. Test Chambers & Peat Moss Used in IFA Alate Queen Bioassays

APPENDIX III

PROTOCOL FOR CONDUCTING BAIT ACCEPTANCE STUDIES

USDA, APHIS, S&T
IFA LABORATORY
GULFPORT, MS

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 dish pan. 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 ratio of 0.75 or higher. By convention, this figure has become the minimum ratio recognized as acceptable by most IFA researchers.