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ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
WHITEVILLE METHODS DEVELOPMENT CENTER
IMPORTED FIRE ANT STATION

3505 25TH AVENUE
P.O. Box 2278
GULFPORT MS 39505

1984 ANNUAL REPORT

Imported Fire Ant Station

Whiteville Methods Development Center

Plant Protection and Quarantine Programs

Animal and Plant Health Inspection Service

U. S. Department of Agriculture

Homer L. Collins	Station Leader
Dudley J. Adams	Biological Technician
Paul M. Bishop	Biological Technician
Avel L. Ladner	Biological Technician
Claude J. Mauffray	Biological Technician
Florence M. Moran	Secretary

These reports were assembled for the information of the U. S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine personnel and key personnel in other agencies engaged in imported fire ant programs. Statements in some instances are based on preliminary uncompleted, or unconfirmed experiments or observations; therefore, the data are not ready for publication or public distribution.

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

CONTENTS

INTRODUCTION

The major activity of the Imported Fire Ant Station in 1984 was to assist in the development of technology compatible with Plant Protection and Quarantine (PPQ) policy regarding imported fire ant control (See Appendix I). In order to accomplish this objective, extensive travel was required in order to secure adequate test sites and to collect efficacy data on several bait toxicants in various stages of development. The interest, support and encouragement received from the public, State cooperators, and the pesticide industry has been very rewarding. The current status of registration of all products with which we have worked in recent years is summarized in Appendix II of this report. New products which have shown potential for IFA control in preliminary trials conducted by the Agricultural Research Service (ARS) are listed in Appendix III. We anticipate working with some of these new products after an Experimental Use Permit has been obtained by the registrant.

SUMMARY

Aerial Application of Bait Toxicants: (Page 1).

Field trials with bait toxicants applied by aircraft were conducted in three states in the fall of 1983, and spring and fall of 1984. Logic(R), formulated as a 1% PGD bait was the most effective formulation evaluated in the fall 1983 series of trials. Colony mortality averaged 99% 40 weeks after treatment with this product. Amdro was the most effective treatment in the spring 1984 trials, averaging 93% colony mortality 12 weeks after application. A preliminary evaluation of the fall 1984 program indicated that very little colony mortality had occurred 6 weeks after treatment. However, drastic reductions in brood production and population indices were noted, indicating that subsequent evaluations (spring and summer 1985) should disclose a pronounced improvement in control.

Four post-treatment evaluations of the Kendall/Kerr County Texas Prodrone program revealed that an acceptable level of population suppression was not achieved.

IFA Control with Amdro Mixed with Fertilizer or Rye Grass Seed: (Page 21).

Amdro mixed with fertilizer prior to application was not effective; however Amdro mixed with rye grass seed provided good IFA control 6 weeks after application.

Phytotoxicity of Carbaryl to Bedding Plants: (Page 24).

Carbaryl applied as a quarantine treatment to tender young bedding plants was phytotoxic regardless of the formulation applied.

Evaluation of Various Insecticides for Grass Sod Quarantine Treatments: (Page 29).

Lorsban 15G and Dursban 50WP provided longer residual activity against alate queens than other treatments evaluated in two series of field tests.

Evaluation of Potting Soil Toxicants: (Page 34).

Only a limited number of products were evaluated in 1984, and none of those tested showed promise for this use pattern.

Shelf Life Studies with Bait Toxicants: (Page 39).

Affirm stored at elevated temperatures deteriorated rather rapidly, but bait stored at room temperature remained highly acceptable for well over a year.

Evaluation of an Alternate Procedure for Quarantine Treatment of "B and B" Plants: (Page 47).

A procedure whereby chlorpyrifos treated potting soil was used to backfill plastic pots containing field grown ornamental plants was investigated as a means of certifying B and B plants. Ants avoided contact with the treated soil by tunnelling out of the drainage holes in the bottom of the plastic pots.

Evaluation of Nitroethane for Quarantine Treatments of Nursery Stock: (Page 51).

Nitroethane exhibits both contact and fumigant activity (at concentrations as low as .Ø1 ml/liter) against the IFA. However, severe phytotoxic effects were noted when woody ornamental plants were treated with 1 fl. oz. of nitroethane per plant.

Evaluation of Bait Toxicants for Control of Individual IFA Colonies: (Page 55).

Several IFA baits were used to hand treat individual IFA mounds in July 1984. The poor control obtained with all treatments is extremely difficult to explain since efficacy of these products has been demonstrated in numerous other tests.

Retention of Bait Toxicants in Fire Ant Repletes: (Page 59).

It is assumed that bait toxicants in solution with soybean oil are stored for an undetermined time by repletes. However, Logic(R) was not detected by GLC analysis of IFA workers collected from field test plots at various intervals following application. Additional studies to clarify the issue are planned for 1985.

Effects of Affirm (Avermectin B1a) on Field Collected Alates of the Red Imported Fire Ant: (Page 64).

Approximately 1ØØ acres of pastureland infested with the red imported fire ant, Solenopsis invicta Buren, were sprayed with Avermectin B1a, Affirm. Two formulations of Affirm were used on separate plots: WØØØ2 and AØØ3. Alates were collected pretreatment and at 6, 9 and 12 weeks post-treatment. Although colony mortality was 76 - 84% at 12 weeks, no morphological or histological changes could be detected in the ovarioles, oocytes, nurse cells or the general reproductive tract of sectioned alates. A number of possible explanations for these findings are discussed.

PROJECT NO.: FA012084.16

PROJECT TITLE: Aerial Application of Bait Toxicants

PROJECT LEADERS: Homer Collins, Dudley Adams, C. J. Mauffray, Avel Ladner and Paul M. Bishop

A. Fall 1983 Tests

I. Introduction:

Aerial application of palatable bait formulations containing a feeding attractant, an inert carrier, and a slow-acting toxicant remains the most cost-effective approach to control of imported fire ants. Recent advance in the testing and development of two relatively new products justified large-scale field trials in the fall of 1983. All treatments were applied by a USDA-owned and operated Cessna spray plane equipped with a modified bait delivery system.

II. Aircraft Specifications:

1. 1977 Cessna Ag-Truck
2. Delivery System
   A. Transland slim-line spreader (Model 20241).
   B. Ram-air system installed in hopper to prevent bridging.
3. 120 mph operating speed.
4. 50' altitude.
5. 50' working swath.
6. Operated by Tim Roland, USDA pilot.

III. Guidance:

Aircraft guidance and swath spacings were provided by flagmen who were in radio contact with the aircraft.

IV. Treatments applied and bait formulation specifications:

Affirm(R) (formerly MK-936) is an experimental product under development by Merck and Co., Inc. Logic(R) (formerly RO 13-5223) is under development by Maag Agrochemicals. Two formulations of Affirm and Logic were applied at each test site. Physical characteristics of each formulation applied were as follows:

TOXICANT	MANUFACTURER	INERT CARRIER 1/	% OIL	AVG. BULK DENSITY (Lbs/ft.3)	% AI
Affirm	Merck and Co.	PGDC(1A)	30	21.5	0.011
Affirm	Merck and Co.	PGDC(C3)	30	17.4	0.0055
Amdro	American Cyan.	PGDC	30	17.6	0.88
Logic	Maag Agrochem.	PGDC	30	15.5	1.0
Logic	Maag Agrochem.	ECG	25	31.0	1.0

1/ PGDC = Pregelled defatted corn; ECG = Expanded cob grits.

V. Description of Test Sites:

Affirm and Logic were applied under Experimental Use Permits (618-EUP-10 and 35977-EUP-2 respectively) which restricted bait application to non-cropland. Test sites were chosen on the basis of relative fire ant populations, height of vegetation, absence of domestic animals and exclusion of entry by humans. After on-site inspections of several possible locations, the following sites were selected:

(1) Pounds Field; Tyler, Texas.

(2) Dannelley Field; Montgomery, Alabama.

(3) Municipal Airport; Valdosta, Georgia.

Five treatment blocks approximately 150 acres in size (plus an untreated check) were established at each site.

VI. Procedures Used to Determine Efficacy:

Efficacy of each treatment was determined by procedures described elsewhere (Harlan et al 1981, Collins 1982, Banks et al 1983). However, the colony classification system devised by Lofgren and Williams (1982) was used to categorize all colonies and to compute population indices.

VII. Results and Discussion:

Formulations applied, rates and dates of application, etc. are summarized in Table 1. All formulations were highly uniform and flowable. No lumps or foreign debris were noted. Colony mortality (% kill), population index changes, and percentage of surviving colonies with worker brood at each test site and evaluation interval are shown in Table 2. Very little colony mortality was noted during the first evaluation which was conducted 6 weeks after treatment. However, the reduction in pretreatment population indices as well as the decreased brood production was an indication of activity of all treatments. The third and final evaluation of this test series was conducted 40 weeks after application. Good to excellent control was

TABLE 1. Summary of Fall 1983 Field Trials with IFA Bait Toxicants.

IFA Station, USDA, APHIS, PPQ

TEST SITE LOCATION	PLOT NO.	BAIT FORMULATION APPLIED [1]	DATE APPLIED	DESIRED RATE OF APPLICATION (Lbs/Acre)	ACTUAL RATE OF APPL./ACRE BULK(Lbs)	AI(Gms)	ACREAGE TREATED
Tyler, Texas	I	MK-936 (3C)	10/18/83	1.0	1.0	.050	139
	II	MK-936 (1A)	10/18/83	1.0	1.2	.060	127
	III	RO 13-5223 (ECG)	10/19/83	1.0	1.0	4.54	110
	IV	RO 13-5223 (PGD)	10/18/83	1.0	1.7	7.72	135
	V	Amdro	10/18/83	1.0	.9	3.60	50
Mont-gomery, Alabama	I	MK-936 (3C)	10/25/83	1.0	.9	.045	69
	II	MK-936 (1A)	10/25/83	1.0	1.1	.055	60
	III	RO 13-5223 (ECG)	10/25/83	1.0	1.2	5.45	58
	IV	RO 13-5223 (PGD)	10/25/83	1.0	1.2	5.45	59
	V	Amdro	10/26/83	1.0	1.0	4.0	500
Valdosta, Georgia	I	RO 13-5223 (ECG)	10/27/83	1.0	1.0	4.54	106
	II	RO 13-5223 (PGD)	10/27/83	1.0	1.0	4.54	106
	III	MK-936 (3C)	10/27/83	1.0	.9	.045	106
	IV	MK-936 (1A)	10/27/83	1.0	1.2	.060	106
	V	Amdro	10/27/83	1.0	1.0	4.0	99

[1] ECG = Expanded cob grit; PGD = Pregelled defatted corn.

TABLE 2. Results of Fall 1983 Field Tests with IFA Bait Toxicants.

USDA, APHIS, PPQ. Imported Fire Ant Station. Gulfport, Mississippi.

Test Site Location	TREATMENTS APPLIED					PRETREAT POPULATION[2]		STATUS OF POPULATION AT INDICATED POST-TREAT INTERVAL (WEEKS)[2]								
	Bait Formulation			Rate/Acre				$\bar{X}$ Colony Mortality			$\bar{X}$% Change in Pop. Index[3]			% Surviving Colonies with Worker Brood		
	Toxicant	Carrier[1]	% AI	Bulk (Lbs.)	AI (Gms.)	$\bar{X}$ No. Colonies Per Subplot	$\bar{X}$ Pop. Index Per Subplot	(6)	(30)	(40)[6]	(6)	(30)	(40)[6]	(6)	(30)	(40)[6]
Tyler[4]	Logic	PGD	1.0	1.7	7.72	4.3	75	0	28	100	-76	-91	-100	0	0	0
	MK-936 (1A)	PGD	.011	1.2	.060	6.6	104	28	96	95	-84	-97	- 98	4	40	33
	MK-936 (C-3)	PGD	.011	1.0	.050	13.1	191	5/	78	88	5/	-84	- 96	5/	90	39
	Amdro	PGD	.88	.9	3.60	15.2	224	18	55	61	-37	-65	- 62	87	70	87
	Logic	ECG	1.0	1.0	4.54	12.8	178	0	4	29	-51	+60	+ 33	9	77	89
	Untreated Ck.	-	-	-	-	4.6	71	0	6	18	+23	+75	+ 92	96	77	98
Montgomery, Alabama	Logic	PGD	1.0	1.2	5.45	7.1	146	2	48	100	-32	-91	-100	60	4	0
	MK-936 (3C)	PGD	.011	.9	.045	15.7	299	21	76	97	-82	-91	- 98	0	33	100
	Amdro	PGD	.88	1.0	4.0	9.6	207	33	83	94	-67	-97	- 95	48	4	75
	MK-936 (1A)	PGD	.011	1.1	.055	10.2	221	28	94	93	-84	-96	- 99	0	57	25
	Logic	ECG	1.0	1.2	5.45	7.7	171	12	37	88	-59	-88	- 97	33	1	38
	Untreated Ck.	-	-	-	-	8.7	185	10	11	34	- 1	-45	- 39	99	53	98
Valdosta, Georgia	Logic	PGD	1.0	1.0	4.54	6.3	113	8	19	98	-57	-83	- 99	21	1	66
	Logic	ECG	1.0	1.0	4.54	7.6	122	5	17	96	-61	-80	- 98	19	2	60
	Amdro	PGD	.88	1.0	4.0	9.1	130	54	78	83	-68	-95	- 81	30	8	100
	MK-936 (1A)	PGD	.011	1.2	.060	9.1	125	31	79	46	-86	-93	- 49	0	27	93
	MK-936 (C-3)	PGD	.011	.9	.045	9.6	153	8	55	44	-78	-85	- 29	0	14	94
	Untreated Ck.	-	-	-	-	11.1	172	0	8	21	+29	+17	+ 17	98	94	96

1/ PGD = Pregelled defatted corn; ECG = Expanded cob grit.
2/ Population parameters based on evaluations conducted in (15) ¼-acre subplots within each treatment block unless otherwise indicated.
3/ Population index based on Lofgren scale (Lofgren and Williams, 1982. Jour. Econ. Ent. 75:798-803).
4/ 6-Week evaluation at Tyler, Texas was based on 8 subplots/treatment due to inclement weather.
5/ Evaluation cancelled by rain.
6/ Caste composition of most colonies was indicative of reinfestation of test plots by incipient colonies at this rating interval.

achieved with most treatments, but some variation was noted except for Logic formulated as a 1% PGD bait. This formulation provided excellent control at all sites (average of 99.3% colony mortality).

B. Spring 1984 Tests

I. Introduction:

The spring 1984 series of trials was very similar to those conducted in the fall of 1983. All treatments were applied in May by a USDA spray equipped with a new bait delivery system designed and constructed by the PPQ Equipment Development Center in Mission, Texas. This system employs electrically driven augers to move the bait from the aircraft hopper to the inboard side of a series of tubes mounted underneath the aircraft wings. Venturi action then moves the bait to the outboard end of the tubes where it is dispersed into the airstream. This system provides a much wider swath than the previously used "Ram-air" system and also results in more accurate applications.

II. Aircraft Specifications:

1. 1977 Cessna Ag-truck
2. Delivery System
   MDEC Model Ø1-Auger system
3. 12Ø mph operating speed
4. 5Ø' altitude
5. 75' working swath (9Ø' overall)

6. Operated by Tim Roland, PPQ aircraft operations

III. Guidance:

Aircraft guidance and swath spacing were provided by flagmen who were in radio contact with the aircraft.

IV. Treaments applied:

Amdro(R), Prodrone(R), and two formulations of Affirm were applied. Some characteristics of each product are as follows:

Toxicant	Manufacturer	% SBO	Avg. Bulk Density (Lbs/ft 3)	%AI
Affirm	Merck and Co.	3Ø	19.3	Ø.Ø11
Amdro	American Cyanamid	3Ø	21.Ø	Ø.88
Prodrone	Stauffer	3Ø	2Ø.2	1.2Ø

Due to the increased nocturnal foraging activity of the IFA relative to other ant species (Wojcik 1984), it was suggested that late PM bait applications might result in more effective IFA control than would early AM applications. To test this hypothesis, a small unreplicated study was conducted at one site (a grazed pasture adjacent to the Decatur County, Georgia Airport). The 2ØØ-acre pasture was divided into halves with one half receiving an early morning treatment with Amdro while the second half of the pasture was treated with Amdro in the late afternoon of the same day. The morning treatment was completed at 9:15 AM, and the afternoon treatment was completed at 7:ØØ PM. Standard

evaluation procedures described elsewhere in this report were used to determine the effectiveness of each application.

V. Test Sites:

Affirm was applied under Experimental Use Permit 618-EUP-10, which restricts application to non-cropland. Both Amdro and Prodrone are conditionally registered for application to pastures, rangeland and non-cropland. The following sites were selected for treatment:

(1) Municipal Airport; Victoria, Texas.

(2) Regional Airport; Lafayette, Louisiana.

(3) Decatur County Airport; Bainbridge, Georgia.

VI. Procedures Used to Determine Efficacy:

Efficacy of each treatment was determined by procedures described elsewhere (Harlan et al 1981, Collins 1982, Banks et al 1983). However, the colony classification system devised by Lofgren and Williams (1982) was used to categorize all colonies and to compute population indices.

VII. Results and Discussion:

Formulations applied, rates and dates of application, etc. are summarized in Table 3. Results appear in Table 4. Plots were evaluated at 6 and 12 weeks after application at which time the test was terminated. When the

TABLE 3. Summary of Spring 1984 Field Trials with IFA Bait Toxicants.

Imported Fire Ant Station, USDA, APHIS, PPQ, Gulfport, Mississippi.

TEST SITE LOCATION	PLOT NO.	BAIT FORMULATION APPLIED	DATE APPLIED	DESIRED RATE OF APPL. (LBS./ACRE)	ACTUAL RATE OF APPL./ACRE BULK(LBS.)	AI(GMS.)	ACREAGE TREATED
	I	Amdro	05/09/84	1.0	1.0	4.0	101
Victoria,	II	Affirm (W0002)	05/09/84	1.0	1.0	.050	110
	III	Affirm (A0003)	05/09/84	1.0	1.0	.050	148
Texas	IV	Prodrone	05/09/84	.88	.9	5.0	134
	V	Void	-	-	-	-	-
	VI	Untreated Chk.	-	-	-	-	-
	I	Prodrone	05/11/84	.88	.9	5.0	110
Lafayette,	II	Affirm (A003)	05/11/84	1.0	1.2	.060	122
	III	Amdro	05/11/84	1.0	1.0	4.0	66
Louisiana	IV	Void	-	-	-	-	-
	V	Affirm (W0002)	05/11/84	1.0	1.1	.055	105
	VI	Untreated Chk.	-	-	-	-	-
Bainbridge,	I	Amdro (pm appl.)	05/15/84	1.0	1.0	4.0	92
	II	Amdro (am appl.)	05/15/84	1.0	1.0	4.0	103
Georgia	III	Prodrone	05/15/84	.88	.9	5.0	128
	IV	Untreated Chk.	-	-	-	-	-
	V	Void	-	-	-	-	-
	VI	Affirm (A003)	05/15/84	1.0	1.0	.050	125
	VII	Affirm (W0002)	05/15/84	1.0	1.0	.050	125

TABLE 4. Spring 1984 Field Trials with IFA Bait Toxicants.

USDA, APHIS, PPQ. Imported Fire Ant Station, Gulfport, Mississippi.

Test Site Location	Treatments Applied: Bait Formulation Toxicant	Carrier[1]	% AI	Rate/Acre: Bulk (Lbs.)	AI (Gms.)	Pretreatment Population[2]: X No. Colonies Per Subplot	X Pop. Index Per Subplot[3]	Status of Population at Indicated Post-Treat Interval (Wks.)[2]: X Colony Mortality (6)	(12)	X Change in Pretreat Pop. Index[3] (6)	(12)	% Surviving Colonies with Worker Brood (6)	(12)
Victoria, Texas	Amdro	PGD	.88	1.0	4.0	12.8	205	88	87	-98	-95	10	33
	Affirm(W0002)	PGD	.011	1.0	.050	8.4	131	38	71	-89	-95	0	0
	Affirm (A003)	PGD	.011	1.0	.050	12.7	184	52	68	-91	-89	1	0
	Prodrone	PGD	1.2	.88	4.8	12.8	186	35	51	-83	-71	7	50
	Untreated Ck.	-	-	-	-	8.9	145	10	16	- 9	- 4	87	93
Lafayette, Louisiana	Amdro	PGD	.88	1.0	4.0	12.3	197	91	96	-98	-98	12	36
	Affirm(W0002)	PGD	.011	1.1	.055	8.5	143	59	68	-94	-90	0	19
	Affirm (A003)	PGD	.011	1.2	.060	13.5	223	55	67	-93	-94	0	11
	Prodrone	PGD	1.2	.88	4.8	10.9	184	27	51	-78	-68	14	74
	Untreated Ck.	-	-	-	-	12.9	117	25	24	-22	-19	95	94
Bainbridge, Georgia	Amdro (AM)	PGD	.88	1.0	4.0	5.5	106	94	97	-99	-98	0	100
	Amdro (PM)	PGD	.88	1.0	4.0	6.6	125	91	93	-87	-98	0	17
	Affirm(W0002)	PGD	.011	1.0	.050	8.3	137	64	84	-95	-96	0	10
	Affirm (A003)	PGD	.011	1.0	.050	6.3	105	61	76	-81	-96	0	0
	Prodrone	PGD	1.2	.88	4.8	7.9	107	40	65	-68	-88	22	18
	Untreated Ck.	-	-	-	-	10.3	156	46	40	-45	-36	88	94

1/ PGD = Pregelled Defatted Corn.
2/ Population parameters based on evaluations conducted in (15) ¼-acre subplots within each treatment block.
3/ Population index based on Lofgren scale (Lofgren and Williams. 1982. J. Econ. Ent. 75:798-803).

results from all sites were combined and averaged, Amdro provided 93% colony mortality 12 weeks after treatment versus 74%, 70%, and 56% for Affirm(W0002), Affirm(A003), and Prodrone respectively.

No appreciable difference in the two Amdro treatments (AM versus PM) was noted. Ninety-seven percent colony mortality was obtained from the AM treatment versus 93% for the PM treatment.

C. Fall 1984 Tests

I. Introduction:

Six treatments (two formulations of Affirm, two formulations of Logic, Amdro and an untreated check) were evaluated at three sites in the fall 1984 series of trials. All treatments were applied in September by the PPQ Cessna Ag-truck equipped with the bait dispersal system developed at the PPQ Equipment Development Center.

II. Aircraft Specifications:

1. 1977 Cessna Ag-truck
2. Delivery system
   MDEC Model 01-Auger system
3. 120 mph operating speed
4. 50' altitude
5. 75' working swath (90' overall swath)
6. Operated by Tim Roland, PPQ Aircraft Operations

III. Guidance:

Aircraft guidance and swath spacings were provided by flagmen who were in radio contact with the aircraft.

IV. Treaments Applied:

As previously mentioned, 6 treatments are under evaluation in this set of trials. Some characteristics of each bait formulation are as follows:

Toxicant	Manufacturer	Inert Carrier 1/	% SBO	Avg. Bulk Density (Lbs/ft3)	% AI
Amdro	American Cyanamid	PGD	30	20.8	.88
Affirm(A003)	Merck and Co.	PGD	30	19.4	.011
Affirm(W0001)	Merck and Co.	PGD	30	20.8	.011
Logic (ECG)	Maag	ECG	25	32.3	1.0
Logic (PGD)	Maag	PGD	30	22.2	1.0

1/ PGD = Pregelled defatted corn; ECG = Expanded cob grit.

V. Description of Test Sites:

Both Affirm and Logic were applied under Experimental Use Permits (618-EUP-10 and 35977-EUP-2, respectively) which restricted bait application to non-cropland. Test sites were chosen on the basis of relative fire ant populations, height of vegetation, absence of domestic animals and crops. After on-site inspections of several possible locations, the following airport properties were selected as test sites:

(1) Orange County Airport; Orange, Texas.

(2) Gulfport/Biloxi Regional Airport; Gulfport, Mississippi.

(3) Marianna Municipal Airport; Marianna, Florida.

Five treatment blocks approximately 100 acres in size (plus an untreated check) were established at each airport.

VI. Procedures Used to Determine Efficacy:

Efficacy was determined by procedures described elsewhere. The colony classification system described by Lofgren and Williams (1982) was used to categorize all IFA colonies and to compute population indices before and after treatment.

VII. Results and Discussion:

Formulation applied, rates, and dates of application, etc. are summarized in Table 5. Preliminary results (6 weeks after application) are shown in Table 6. All though very little colony mortality was observed during the first rating interval, the drastic reduction in brood production is indicative that control will improve in subsequent ratings.

D. Prodrone Program in Kendall and Kerr County, Texas.

Introduction:

Prodrone(R) formerly Stauffer MV-678) was registered as a fire ant bait in March, 1983. Prodrone is not an acute toxicant but is instead an insect growth regulator (IGR)

TABLE 5 . Summary of Fall 1984 Field Trials with IFA Bait Toxicants.

Imported Fire Ant Station, USDA, APHIS, PPQ, Gulfport, Mississippi.

TEST SITE LOCATION	PLOT NO.	BAIT FORMULATION APPLIED	DATE APPLIED	DESIRED RATE OF APPL. (LBS./ACRE)	ACTUAL RATE OF APPL./ACRE BULK(LBS.)	AI(GMS.)	ACREAGE TREATED
	I	Amdro	09/18/84	1.0	1.0	4.0	70
Orange,	II	Logic (ECG)	09/18/84	1.0	1.2	5.5	80
	III	Logic (PGD)	09/18/84	1.0	1.0	4.5	77
Texas	IV	Affirm (A003)	09/18/84	1.0	1.0	.050	101
	V	Affirm (W0001)	09/18/84	1.0	1.0	.050	90
	VI	Untreated Chk.	-	-	-	-	-
	I	Logic (PGD)	09/20/84	1.0	1.0	4.5	137
Gulfport,	II	Amdro	09/20/84	1.0	1.0	4.0	163
	III	Affirm (W0001)	09/20/84	1.0	1.0	.050	83
Missis-	IV	Affirm (A003)	09/20/84	1.0	1.0	.050	90
sippi	V	Logic (ECG)	09/20/84	1.0	1.0	4.5	92
	VI	Untreated Chk.	-	-	-	-	-
	I	Logic (PGD)	09/25/84	1.0	1.0	4.5	162
Marianna,	II	Logic (ECG)	09/25/84	1.0	1.0	4.5	120
	III	Affirm (W0001)	09/25/84	1.0	1.0	.050	94
Florida	IV	Affirm (A003)	09/25/84	1.0	1.0	.050	97
	V	Amdro	09/25/84	1.0	1.0	4.0	50
	VI	Untreated Chk.	-	-	-	-	-

TABLE 6. Preliminary Results of Fall 1984 Field Tests with IFA Bait Toxicants.

USDA, APHIS, PPQ Imported Fire Ant Station, Gulfport, Mississippi.

TEST SITE LOCATION	Treatments Applied: Bait Formulation Toxicant	Carrier[1]	% AI	Rate/Acre Bulk (Lbs)	Rate/Acre AI (Gms)	Pretreat Population[2]: $\bar{X}$ No. Colonies Per Subplot	$\bar{X}$ Pop. Index Per Subplot[3]	Status of IFA Population at Indicated Post-Treat Interval (Weeks)[2]: X% Colony Mortality (6)	X% Change in Pop. Index[3] (6)	% Surviving Colonies with Worker Brood (6)
Orange, Texas	Amdro	PGD	.88	1.0	4.0	9.2	174	52	-61	73
	Affirm (WOOO1)	PGD	.011	1.0	.050	9.4	82	40	-82	0
	Affirm (AOO3)	PGD	.011	1.0	.050	11.6	180	10	-79	0
	Logic	PGD	1.0	1.0	4.5	9.0	144	0	-60	0
	Logic	ECG	1.0	1.2	5.4	7.5	145	0	-59	2
	Untreated Ck.	-	-	-	-	8.8	128	0	+114	96
Gulfport, Missis-sippi	Amdro	PGD	.88	1.0	4.0	6.2	123	73	-95	6
	Affirm (AOO3)	PGD	.011	1.1	.055	6.2	105	29	-85	0
	Affirm (WOOO1)	PGD	.011	1.0	.050	5.4	91	20	-82	0
	Logic	ECG	1.0	1.0	4.5	6.8	112	3	-73	0
	Logic	PGD	1.0	1.0	4.5	5.6	100	0	-68	0
	Untreated Ck.	-	-	-	-	4.4	82	4	+51	96
Marianna, Florida	Amdro	PGD	.88	1.0	4.0	4.4	72	71	-89	30
	Affirm (AOO3)	PGD	.011	1.0	.050	4.1	66	49	-91	0
	Affirm (WOOO1)	PGD	.011	1.0	.050	4.5	80	31	-88	0
	Logic	ECG	1.0	1.0	4.5	6.8	148	20	-84	0
	Logic	PGD	1.0	1.0	4.5	5.1	86	16	-83	0
	Untreated Ck.	-	-	-	-	5.2	93	5	+44	95

1/ PGD = Pregelled defatted corn. ECG = Expanded cob grit.

2/ Population parameters based on evaluations conducted in (10) 1/4-acre subplots within each treatment block.

3/ Population index based on Lofgren scale (Lofgren and Williams, 1982. Jour. Econ. Ent. 75:798-803.

(REVISED 12/21/84.)

which disrupts caste differentiation and inhibits egg production (Banks and Schwarz 1980, Banks et al 1983).

In 1983, the Texas Department of Agriculture in cooperation with USDA, APHIS, PPQ applied two applications of Prodrone(R) to approximately 500,000 acres in Kendall and Kerr Counties, Texas. The first application was completed on June 20, 1983 and the second application was completed on October 01, 1983. Both treatments were applied at a rate of .88 lbs. of bait per acre by contract aircraft utilizing electronic guidance.

At the request of TDA, we agreed to monitor the effects of this program on the Kendall/Kerr County IFA population. The fourth and final evaluation of this program was completed on November 02, 1984 (approximately 12 months after the second Prodrone(R) application).

A pretreatment population survey based on visual inspection of 65 sites within the treated area and 25 sites in an adjacent untreated county (Bexar) was completed in June, 1983. Survey procedures described elsewhere (Harlan et al 1983), and a colony classification system devised by Lofgren and Williams (1982) was used to enumerate and categorize all IFA colonies at each site prior to the first treatment and on four occasions following treatment. Site selection for the population surveys was based on habitat and the presence of an IFA infestation rather than purely random distribution. Preferred habitats (i.e. grazed

pastures, highway medians and other grassy areas) were chosen over other sites such as brushy hillsides, etc. However, an attempt was made to uniformly distribute the 1/4-acre survey sites throughout the treated area.

Results:

Results of the pretreatment survey and each of the four post-treatment surveys (evaluations) are shown in Table 7. An average of 8.8 active IFA nests per 1/4-acre survey site was recorded prior to treatment within the treated area (Kendall and Kerr Counties). An average of 16.3 nests per site was recorded in Bexar County which is adjacent to Kendall and was not treated. The first post-treatment evaluation was conducted 12 weeks after the first application (September, 1983). At that time, a 58% (±29)% decrease in the number of active nests within the treated areas was observed. However, a 33% (±25)% decrease in the number of active nests in the untreated areas was also observed. Similar results were obtained during each of the three subsequent evaluations which were conducted ten weeks after the second application, six months after the second application, and 12 months after the second application.

In summary, four post-treatment surveys conducted within Kendall and Kerr Counties, Texas revealed that an acceptable level of population suppression was not achieved by this program. Since this was, in fact, an actual control

TABLE 7.. Effects of Two Prodrone Applications on the IFA Population in Kendall and Kerr County, Texas.

Location	Pretreatment IFA Pop. (June 1983)		Status of IFA Population at the Indicated Post-Treatment Interval							
			Mean (±SD)% Reduction in No. of Active Nests				Mean (±SD)% Change in Pretreat Pop. Index[1/]			
	Mean No. Active IFA Nests Per ¼-Acre Site	Mean Index Per Site[1/]	12 Wks. After 1st Appl. (Sep 83)	10 Wks. After 2nd. Appl. (Nov 83)	6 Months After 2nd. Appl. (Apr 84)	12 Months After 2nd Appl. (Oct 84)	12 Wks. After 1st. Appl. (Sep 83)	10 Wks. After 2nd. Appl. (Nov 83)	6 Months After 2nd. Appl. (Apr 84)	12 Months After 2nd. Appl. (Oct 84)
Kendall & Kerr County (Treated area)	8.8	165.0	58(±29)	37(±35)	55(±32)	32(±32)	-72(±25)	-62(±39)	-72(±31)	-14(±73)
Bexar County	16.3	321.8	33(±25)	24(±21)	33(±23)	27(±27)	-41(±25)	-19(±30)	-32(±27)	-12(±45)

1/ Population index based on Lofgren scale (Lofgren and Williams, 1982. Jour. Econ. Ent. 75:798-803).

program rather than a controlled scientific experiment, we can only speculate as to what factors might have influenced the results of this project.

REFERENCES CITED

Banks, W. A. and M. Schwarz. 1980. The effects of insect growth regulators on laboratory and field colonies of red imported fire ants. Proc. Tall Timbers Conf. Ecol. Anim. Control Habitat Mgt. 7:95-105.

Banks, W. A., L. R. Miles and D. P. Harlan. 1983. The effects of insect growth regulators and their potential as control agents for imported fire ants. Florida Entomologist 66:172-181.

Collins, H. L. 1982. Annual Report, USDA, APHIS, PPQ Imported Fire Ant Station. 79 pages mimeo.

Glancey, B. Michael, C. S. Lofgren and D. F. Williams. 1982. Avermectin B1a: Effects on the ovaries of red imported fire ant queens. Jour. Med. Entomo. 19:743-747.

Harlan, Donald P., W. A. Banks, H. L. Collins, and C. E. Stringer, 1981. Large area tests of AC-217, 300 bait for control of imported fire ants in Alabama, Louisiana and Texas. Southwestern Entomologist 6(2):150-157.

Lofgren, C. S. and D. F. Williams, 1982. Avermectin B1a, a highly potent inhibitor of reproduction by queens of the red imported fire ant. Jour. Econ. Ent. 75:798-803.

Wojcik, D. P., R. J. Burges and C. M. Blanton. 1984. Diurnal and seasonal differences in red imported fire ant roadside abundance. Proceedings of the 1984 Imported Fire Ant Conference. 120-130.

PROJECT NO.: FA012184.01

PROJECT TITLE: IFA Control with Amdro Mixed with Fertilizer or Rye Grass Seed

Project Leaders: Avel Ladner, Paul Michael Bishop, C. J. Mauffray, and Dudley J. Adams

I. Introduction:

Preliminary research conducted in the late 1960s (G. P. Markin, unpublished data) indicated that acceptable IFA control could be achieved when Mirex was mixed with fertilizer (i.e. tank-mixed) prior to application. This procedure is of primary interest to farmers since it eliminates the cost of application. In recent years, we have received several inquiries regarding the application of Amdro mixed with fertilizer. Due to the vast differences in the physical characteristics of the two formulations (pregelled defatted corn versus corn cob grits), we were unable to extrapolate from the results of the previous Mirex trials. On October 04, 1984 a small field trial was initiated to determine if Amdro could be premixed with either fertilizer or rye grass seed and used for IFA control in pastures or hay fields.

II. Methods and Materials:

Rye grass seed (Lolium perenne var. Gulf) was mixed with Amdro (50 lbs. seed plus 3 lbs. Amdro) with a portable cement mixer (20 minutes per batch) on October 02, 1984. Fertilizer (13-13-13) was mixed at a rate of 170 gms. Amdro

to each 50 lbs. of fertilizer. A Gandy(R) spreader (Model 605) was calibrated to deliver the seed/Amdro mixture at a broadcast rate of 25 lbs. seed and 1.5 lbs. Amdro per acre. This spreader was also calibrated to deliver the fertilizer/Amdro mixture at a rate of 200 lbs. fertilizer and 1.5 lbs. Amdro per care. A tractor-mounted shop-built granular applicator was used to broadcast Amdro at 1.5 lbs. per acre. All treatments were applied to 5-acre plots located in a Bahia grass (Paspalm notatum) pasture in Harrison County, Mississippi on October 04, 1984.

Prior to treatment, three 1/4-acre subplots were established within each plot, and all IFA colonies enumerated and categorized using the population index method (Lofgren and Williams, 1982).

III. Results:

Preliminary results are shown in Table 8. Amdro alone provided 98% colony mortality six weeks after application. The rye grass/Amdro mixture provided 84% colony mortality whereas no control was obtained with the fertilizer/Amdro mixture.

Since overseeding permanent pastures with rye grass is a common practice to supplement winter grazing, the use of a seed/Amdro mixture has a definite potential for use on farmland. The procedure might also be useful in lawns, parks and playgrounds which are planted to rye in the fall or when new lawns are initially established by seeding.

TABLE 8. IFA Control with Amdro Mixed with Fertilizer or Rye Grass Seed.

Treatment	Bulk Rate/Acre	Pretreat IFA Pop. 1/		Status of Pop. at Indicated Wks. after Tmt. 1/	
		$\bar{X}$ No. Nests/ 1/4-acre subplot	X Pop. Index Subplot	$\bar{X}$ Colony Mortality (6)	$\bar{X}$% Chg. in Pretreat Pop. Index (6)
Amdro alone	1.5 lbs.	16.3	113	98	-97
Amdro + rye grass seed	1.5 lbs. + 25 lbs.	17.7	300	84	-92
Amdro + 13-13-13 fertilizer	1.5 lbs. + 200 lbs.	15.6	315	0	-31
Untreated Check	-	15.3	278	14	-28

1/ Average of three 1/4-acre subplots/treatment.

PROJECT NO.: FA122284.12

PROJECT TITLE: Phytotoxicity of Carbaryl to Bedding Plants

PROJECT LEADER: Dudley J. Adams

INTRODUCTION:

Carbaryl applied under a Specific Exemption which expires June 01, 1985 is an accepted means of certification of bedding plants. Carbaryl applied in the prescribed manner is not only effective against fire ants, but the broad and extensive label allows its use on many different types of plants. However, indications of phytotoxicity were noted in previous trials with carbaryl (Collins 1982). Additional tests were conducted in an effort to confirm these previous findings.

Methods:

Baccto(R) potting soil (Michigan Peat Co., P. O. Box 66388, Houston TX) was used as the growing medium. Round peat pots (3" diameter) were filled with potting soil and planted to the following species on September 28, 1984:

Plant	Scientific Name	Variety
Bell pepper	Capsicum frutescens	Keystone giant
Broccoli	Brassica oleracea	Green Sprouting
Cabbage	Brassica oleracea	Early Round Dutch
Collards	Brassica oleracea	Vates
Egg plant	Solanum molongonia	Midnight
Hot pepper	Capsicum frutescens	Long Cayenne
Petunia	Petunia hybrida	Happy Talk
Tomato	Lycoperscion esculentum	Rutger's
Zinnia	Zinnia sp.	Lilliput

Emerged seedlings were thinned to one plant per pot after they reached the first true leaf stage. The plants were

maintained in a greenhouse and watered as needed. Liquid fertilizer (12-6-6) was applied weekly according to label directions.

Insecticide Treatment:

On October 26, 1984 the plants had reached market size and the following treatments were applied to the point of run-off with a standard sprinkler can at a rate of 1.5 lbs. AI per 100 gallons of water:

Carbaryl Formulation:

Sevin XLR
Sevin 50W
Sevin SL
Sevin 80S

Each treatment was applied to 4 plants (replicates) of each plant species listed above.

Phytotoxicity:

Phytotoxicity ratings were conducted at 2, 4, and 9 weeks following treatment. Damage was evaluated based on the overall appearance of the plants compared to an untreated check of the same variety. The phytotoxicity rating scale used to compare the effects of each treatment was as follows:

(1.) Plants healthy; not different from untreated check.

(2.) Slight yellowing, wilting or other mild symptoms such as marginal chlorosis.

(3.) Symptoms more severe, leaf drop or necrosis.

(4.) Severe stunting, abnormal leaf or stem structure.

(5.) Dead.

Results and Discussion:

As shown in Table 9, only minor differences were noted among the four carbaryl formulations evaluated. All produced deleterious effects upon all plant species, but the most dramatic effect was upon tomatoes. All tomato plants were dead at the first rating interval (2 weeks post-treat), but the effects were first observed 24 hours after treatment. Most other plants outgrew their injury and recovered by the 9-week rating interval, but these results clearly indicate the necessity to avoid contact with foliage and treat only the growing media when using carbaryl for quarantine treatment of tender young bedding plants.

TABLE 9. Phytotoxicity Ratings for Various Carbaryl Formulations Applied to Run-Off at 1.5 Lbs. AI/100 Gallons Water to Market Size Bedding Plants

Plant	Phytotoxicity Rating for Indicated Formulation and Rating Interval 1/ (Wks. After Treatment)											
	SEVIN XLR			SEVIN 50W			SEVIN SL			SEVIN 80S		
	2	4	9	2	4	9	2	4	9	2	4	9
Bell pepper	2	2	2	2	2	2	2	2	2	2	2	2
Broccoli	2	2	1	2	2	1	2	2	1	2	2	1
Cabbage	1.75	1.75	1	1.5	1.5	1	1.75	1.75	1	1.75	1.5	1
Collards	1.25	1.25	1	1.75	1.75	1	1.5	1.5	1	1.75	2	1
Egg plant	2.25	2.25	1	2.75	2.5	1	2.25	2.25	1	2.5	2.25	1
Hot pepper	2	2	2	2	2	2	2	2	2	2	2	2
Tomato	5	-	-	5	-	-	5	-	-	5	-	-
Petunia	2	2	1	2	2	1	2	2	1	2	2	1
Zinnia	2.75	2.5	1	3	2.75	1	2.50	2.25	1	2.75	2.75	1

1/ Average of 4 plants (replicates).

*RATING SCALE: 1 - Health; not different from check. 2 - Slight yellowing, wilting or other mild symptoms. 3 - Symptoms more severe, some leaf drop. 4 - Severe stunting, abnormal leaf or stem structure. 5 - Dead.

References Cited:

Collins, H. L. 1982. Annual Report. USDA, APHIS, PPQ, Imported Fire Ant Station. 79 pages mimeo.

PROJECT NO.: FA082584.08

PROJECT TITLE: Evaluation of Various Insecticides for Grass Sod Quarantine treatments

PROJECT LEADERS: C. J. Mauffray, Paul Michael Bishop, Dudley J. Adams and Avel Ladner

INTRODUCTION:

Commercial shipments of ornamental nursery plants and grass sod were associated with accidental introduction of imported fire ants into previously noninfested areas as early as 1953 (Culpepper 1953). Due to their effectiveness and residual activity, chlorinated hydrocarbon insecticides were used as a quarantine treatment to prevent this accidental spread until EPA issued a cancellation order for the use of chlordane for this purpose on March 6, 1978. Efforts by this laboratory to develop alternate treatments have indicated that chlorpyrifos applications, if properly timed and applied, will control certain life forms infesting grass sod. Granular chlorpyrifos at 4.0 to 6.0 lbs. AI/acre has been used for several years to certify movement of grass sod under a specific exemption (Section 18, FIFRA) which was filed each year by PPQ. Registration of a 10% chlorpyrifos granule for this use pattern was obtained in July 1984 by Ford's Chemical and Service, Inc., Pasadena, Texas.

It is assumed that the greatest pest risk associated with shipment of grass sod is transport of newly mated queens that may be either on the sod surface or slightly below the surface in the initial brood chamber, This

assumption is based on the fact that the likelihood of removing and shipping a mature queen is nil, since vibrations from approaching harvest machinery would cause her to retreat deeply within the mound. Therefore, the intent and purpose of current insecticide treatments is not to eliminate mature fire ant colonies, but instead to provide mortality to newly mated queens.

Two series of field tests to evaluate several chlorpyrifos formulations and other insecticides were conducted on the Alboa Grass Farm near Gulfport, Mississippi.

METHODS AND MATERIALS:

Test I - Test I was initiated on June Ø6, 1984. Granular formulations were applied with a Gandy(R) Model 6Ø5 granular applicator calibrated to apply the desired rate. The WP formulations were applied at the rate of 5Ø gallons finished spray per acre with a handheld compressed air sprayer equipped with a hollow cone nozzle. Immediately following treatment, each unreplicated 1Ø' x 5Ø' test plot was irrigated with 1/2" of water by an overhead irrigation system. Standard agronomic practices were utilized prior to and following treatment. Due to the difficulty in obtaining large numbers of newly mated queens, the more easily collected unmated queens (female alates) were utilized to bioassay the effectiveness of each insecticide. The following treatments were evaluated:

INSECTICIDE	MANUFACTURER	FORMULATION	RATE/ACRE (LBS. AI)
Amaze	Mobay	5 G	5.Ø
Broot	Union Carbide	5Ø WP	5.Ø
Broot	Union Carbide	15 G	5.Ø
Dursban	Dow	5Ø WP	5.Ø
Dursban	Ford's	1Ø G	5.Ø
Dyfonate	Stauffer	5 G	5.Ø
Lorsban	Dow	15 G	5.Ø
Untreated Ck.	-	-	-

Residual activity of each product was determined in the following manner: A wheel-type soil sampler was used to collect and composite approximately 3ØØ soil cores (.5" x 2.Ø") from each plot at various intervals following treatment. Samples were passed through a 1/4" mesh sieve to remove grass, rhizomes and other debris from the soil. Each composited soil sample was then bioassayed with alate queens. Bioassays were conducted in the laboratory by confining alate queens to treated soil which was placed in 2" x 2" plastic flower pots equipped with a Labstone(R) bottom. The Labstone absorbed moisture from an underlying bed of damp peat moss, while a Fluon(R) coating prevented the ants from escaping from the top of the open pots. Each pot (replicate) contained 2Ø cc. of treated soil and 5 alate queens. Queen mortality was assessed after 14 days of continuous exposure to the treated soils.

Test II - Test II was initiated on October 25, 1984 and was very similar to Test I. However, test plots were 4Ø' x 9Ø' in size and all WP formulations were applied with a tractor-mounted PTO-driven sprayer calibrated to deliver 52

gallons finished spray/acre at 30 PSI. Six whirljet nozzles (BSS-3) spaced 20" apart on a 10 ft. boom were utilized.

RESULTS:

Test I:

As shown in Table 10, all products provided excellent control at 48 hours and 1 week after treatment. Both Lorsban 15G and Dursban 50-WP remained effective for ten weeks, but the residual activity of other products began to diminish after one week.

Test II:

All chlorpyrifos formulations and Dyfonate 5G provided 100% mortality 12 weeks after application. In general each treatment except Broot 50WP seemed to be more active and/or provide longer residual activity in Test II than in Test I. Although we can only speculate, seasonal effects may have influenced the results of these two trials. Additional tests will be conducted in 1985.

TABLE 10. Residual Effectiveness of Various Insecticides for Control of IFA Queens in Grass Sod.

Treatment	Rate/Acre (Lbs./AI)	$\bar{X}$ Kill of Alate Queens Confined for 14 Days to Treated Soil Collected at Indicated Post-Treat Interval[1]						
		48 hours	1 week	4 weeks	6 weeks	8 weeks	10 weeks	12 weeks
TEST SERIES I: (June 06, 1984)								
Lorsban 15G	5.0	100	100	100	100	-	100	90
Dursban 50 WP	5.0	100	100	100	100	-	100	40
Amaze 5G	5.0	95	100	80	10	-	60	-
Dyfonate 5G	5.0	100	100	15	30	-	50	-
Dursban 10G	5.0	100	100	100	45	-	45	20
Broot 15G	5.0	100	100	20	10	-	15	-
Broot 50 WP	5.0	95	100	5	0	-	0	-
Untreated Check	-	0	15	10	10	-	25	0
TEST SERIES II: (October 25, 1984)								
Lorsban 15G	5.0			100		100		100
Dursban 50 WP	5.0			100		100		100
Amaze 5G	5.0			50		5		95
Dyfonate 5G	5.0			100		100		100
Dursban 10G	5.0			100		100		100
Broot 15G	5.0			100		10		85
Broot 50 WP	5.0			0		15		5
Untreated Check	-			0		0		15

PROJECT NO. FA122684.12

PROJECT TITLE: Evaluation of potting soil toxicants

PROJECT LEADER: C. J. Mauffray

INTRODUCTION:

Chlordane applied at a rate of 4 ozs. 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 this laboratory since 1974. The most efficacious treatment disclosed thus far is chlorpyrifos (Collins et al 1980). In January 1980, Dow Chemical Company obtained registration of a 5% chlorpyrifos granule which was marketed under the trade name FA-5. This product was applied at a rate of 0.5 lbs FA-5 per cubic yard of potting media. Several cases of possible FA-5 related phytotoxicity to greenhouse grown succulent plants in Central Florida prompted the registrant to withdraw this product from the market in the Fall of 1981. Registration of a second chlorpyrifos formulation (a 2.5% granule) for treatment of potting soil was obtained in July 1984 by Ford's Chemical and Service, Inc. Pasadena, Texas.

We evaluated a limited number of candidate potting soil toxicants in 1984 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 candidates suitable for this use pattern.

METHODS AND MATERIALS:

Test procedures used to evaluate all candidate toxicants were as follows: Granular or dust formulations of each candidate tested were blended into nursery potting soil, (Baccto(R), 818 lbs per cu. yd.) at an initial rate of 10 lbs AI per three-inch acre (equivalent to 11.2 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 one-gallon plastic pots and weathered outdoors under natural conditions for one month prior to the first bioassay. Bioassays were conducted by confining 40 cc. of a fragmented fire ant colony (presence of queen not determined) on the soil from each of three pots from each treatment series. The test "colonies" were then observed for 14 days or until mortality of 90% or more of all life forms in each of the three colonies occurred. Treatments which allowed survival of more than 10% of a colony were considered ineffective. Treatments which were judged 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 over 24 months residual activity when applied at a rate of 11.2 gms AI/cu. yd. of potting soil.

RESULTS AND DISCUSSION:

As shown in Table 11, none of the candidates evaluated in 1984 were as effective as chlorpyrifos.

TABLE 11. Residual Activity of Candidate Potting Soil Toxicants Weathered Outdoors in Plastic Pots Under Natural Conditions.

TOXICANT	FORMULATION	FORMULATOR	RATE (Gms. AI/yd3 soil)	MONTHS RESIDUAL ACTIVITY (90% OR MORE MORTALITY OF TEST COLONIES)
Chlorpyrifos	1% WP	Ford's	11.2	12
Chlorpyrifos	2.5 G	Ford's	11.2	12
Broot	15 G	Union Carbide	11.2	N/A
Broot	50 WP	Union Carbide	11.2	N/A
Dyfonate	5 G	Stauffer	11.2	1
Standak	28% F	Union Carbide	11.2	N/A

N/A = No activity at the dose rate indicated.

REFERENCES CITED:

Collins, H. L.,C. L. Mangum, J. G. Medley and A. W. Guenther. 1980. Evaluation of soil insecticides for quarantine treatments against imported fire ants, 1976-1979. Insecticide and Acaracide Tests. 5:209.

PROJECT NO.: FA212784.21

PROJECT TITLE: Shelf Life Studies with Bait Toxicants

PROJECT LEADER: Dudley J. Adams

INTRODUCTION:

Storage or shelf life of imported fire ant baits has long been a problem with certain types of formulations. Some inert carriers'are known to enhance oxidation and rancidity of the soybean oil. Since rancid baits are not actively accepted and fed upon by foraging workers (Lofgren et al 1964), poor control may result from field applications of baits in this condition. In early studies with degradable formulations of Mirex, a copper catalyst was used to enhance the degradation process. However, the copper also promoted oxidation and subsequent rancidity of the oil and was excluded from further testing. Several studies with various formulations of MK-936 were initiated in 1983 and continued in 1984.

Test I:

All previous shelf life studies with MK-936 baits were based on storage of subsamples in closed plastic (zip-lock) bags. On April 27, 1983, a study was initiated whereby the effects of storage in the original opened container (15 lb. polyethylene lined bag) were investigated. The containers were stored under three different temperature regimes:

(1.) In the laboratory at ambient conditions of 70 - 74 degrees F.
(2.) Constant temperature chamber programmed to maintain 38 degrees C.
(3.) Constant temperature chamber programmed to maintain

50 degrees C.

Samples were removed at approximately 1-month intervals and subjected to the following bioassay procedures:

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 three to four 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 with 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 five test colonies. Simultaneously, four grams of the freshly prepared standard bait in an identical container are placed approximately four to five 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:

$$\frac{\text{gms. candidate consumed}}{\text{gms. standard consumed}} = \text{Accept. ratio}$$

An acceptance ratio with a value of less than 1.Ø indicates that a given candidate is less attractive than the standard. Values equal to or greater than 1.Ø indicates that a candidate is equally or more attractive than the standard.

Lofgren et al (1961) reported on the evaluation of 222 different food materials and provided a list of

those which gave an acceptance ratio of Ø.75 or higher. By convention, this figure has become the minimum ratio recognized as acceptable by most IFA researchers.

RESULTS:

Test I:

As shown in Table 12, storage of MK-936 for 15 months at room temperature did not adversely affect acceptability. However, bait stored at 38 degrees C. became rancid in less than four months and bait stored at 5Ø degrees C. was not acceptable after three months' storage.

Test II:

Test II was initiated on July 19, 1983 and consisted of an evaluation of two MK-936 formulations which were coded L676,863-17ØGØ1 and L676,836-169XØ1. As shown in Table 13, storage at room temperature for 18 months did not affect acceptance of either formulation. Formulation L676-8Ø3 169XØ1 stored at 38 degrees C. retained a higher acceptance ratio than did L676,863-17ØGØ1. Both formulations stored at 5Ø degrees C. were unacceptable after one month.

Test III:

Two formulations of MK-936 .Ø11% PGD bait were field tested in the fall of 1983 (Table 1). Shelf life studies with these two formulations (coded 1-A and C-3) were initiated on October 12, 1983. Results appear in Table 14.

TABLE 12. Shelf Life of MK-936 (.011% PGD) Stored at Various Temperatures in Opened Bags.

Storage Temperature	$\bar{X}$ Acceptance Ratio After Storage for Indicated Time Period (Months)[1/]											
	0	1	3	4	5	7	8	9	10	11	14	15
Room	1.0	1.0	.9	.7	1.0	1.1	1.0	.8	1.0	.86	.81	1.01
38° C. (Constant)	-	1.0	.8	.2	.7	.4	0	0	-	-	-	-
50° C. (Constant)	-	1.2	.2	0	.2	0	0	0	-	-	-	-

1/ Mean based on laboratory observations of 5 field-collected colonies. Acceptance ratios computed after a 24-hour feeding period wherein ants were allowed equal opportunity to feed upon a candidate bait versus a freshly prepared standard bait. Test initiated April 27, 1983.

TABLE 13. Shelf Life of MK-936 Bait Formulations Stored in Sealed "Zip-Lock" Plastic Bags at Room Temperature, 38° C., and 50° C.

Formulation Code	Storage Temperature	$\bar{X}$ Acceptance Ratio After Storage for Indicated Time (Months) 1/									
		0	1	4	5	6	7	8	11	12	18
L676-863 170G01	Room	.92	1	1.51	.88	1.0	1.02	1.22	1.0	1.0	.94
	38° C.	-	.97	2.08	.73	.11	.48	.55	.62	.14	0
	50° C.	-	.97	.08	.05	0	0	-	-	-	-
L676-863 169X01	Room	.98	1.20	2.29	.88	1.39	.97	.97	1.0	1.07	.96
	38° C.	-	.98	2.06	.71	.09	.9	.80	.73	.81	.25
	50° C.	-	1.08	.47	0	0	0	-	-	-	-

1/ Mean based on laboratory observations of 5 field-collected colonies. Acceptance ratios computed after a 24-hour feeding period wherein ants were allowed equal opportunity to feed upon a candidate bait versus a freshly prepared standard bait. Test initiated July 19, 1983.

TABLE 14. Shelf Life of MK-936 Bait Formulations Stored in Open Bags at Room Temperature, 38° C., and 50° C.

Formulation Code	Storage Temperature	$\bar{X}$ Acceptance Ratio After Storage for Indicated Time (Months) 1/									
		0	1	2	3 2/	4	5	8	9	12	15
1-A	Room	1.1	1.9	1.4	.3	1.1	.84	1.0	1.0	.75	.75
	38° C. (Constant)	-	.5	.2	0	0	-	-	-	-	-
	50° C. (Constant)	-	.3	0	0	0	-	-	-	-	-
3-C	Room	1.1	1.8	1.4	.5	.99	1.18	.71	.97	.85	.74
	38° C. (Constant)	-	1.0	1.6	.9	.76	.48	.48	.92	.94	.15
	50° C. (Constant)	-	1.0	.3	.3	0	-	-	-	-	-

1/ Mean based on laboratory observations of 5 field-collected colonies. Acceptance ratios computed after a 24-hour feeding period wherein ants were allowed equal opportunity to feed upon a candidate bait versus a freshly prepared standard bait. Test initiated October 12, 1983.

2/ Decreased consumption of the standard bait was noted at this bioassay interval; possibly related to the time of year (January).

REFERENCES CITED:

Lofgren, C. S., F. J. Bartlett, and C. E. Stringer. 1961. Imported fire ant toxic bait studies: The evaluation of various food materials. J. Econ. Ent. 54:1096-1100.

Lofgren, C. S., F. J. Bartlett, and C. E. Stringer. 1964. The acceptability of some fats and oils as food to imported fire ants. J. Econ. Ent. 75:601-602.

PROJECT NO. FA052384.05

PROJECT TITLE: Evaluation of an Alternate Procedure for Quarantine Treatment of "Balled and Burlapped" Plants

PROJECT LEADER: Paul M. Bishop

I. Introduction:

In compliance with Federal Quarantine No. 81, applications of long residual insecticides such as dieldrin, heptachlor, and chlordane were used to certify shipment of field grown ornamental plants ("balled and burlapped" plants) until all use patterns of these products were cancelled on December 31, 1979. A root dip treatment (total immersion of the root ball) in chlorpyrifos solution (8 fl. oz. 2EC/100 gals. H20) was published in the March 1980 revision of PPQ Control Manual 805-25.2230.

Less labor intensive and more economical treatments are needed to replace root dip treatment for field grown balled and burlapped plants. Granular chlorpyrifos applied as a preplant incorporated treatment has been shown to be an effective quarantine treatment for container grown plants (Collins et al 1980). Two formulations of granular chlorpyrifos have been registered for this use but only one product is commercially available at this time. A small study was initiated to determine if a highly modified version of the treatment for containerized plants could be adapted for use on field grown plants. The proposed treatment was based on the assumption that plastic pots could be substituted'for the burlap liner normally used on

"balled and burlapped" plants and that potting soil treated with granular chlorpyrifos could be used to "backfill" pots containing root balls of field grown plants.

Methods and Materials:

Test I - 12 shrubs (assorted species, ca. 3 inch height) were field dug on December 14, 1983 and placed in 2-gallon plastic pots. All plants were artificially infested with a fragmented ant colony (queen status not determined) on January 10, 1984. After 48 hours, chlorpyrifos treated potting soil (11.2 Gms. AI/cu.yd. of Ford's 2.5% G) was used to treat the surface of each root ball at a volume equivalent to 1/5 the volume of the pot. Infested pots were placed in 16" x 20" x 3" fiberglass trays (talced to prevent ants from escaping) and maintained in the greenhouse. After 30-day exposure, the contents of each pot were "dumped" and evenly spread in order to determine the status of each ant colony.

Test II - Test II was initiated on April 27, 1984. 12 soil "balls" approximately 6" in diameter were excavated and placed individually in 2-gallon plastic pots to simulate placement of a root ball in the pots. Prior to placing the soil ball in the pot, each ball was artificially infested with an ant colony. Treated potting soil (11.2 Gms. AI/yd3 of Ford's 2.5% G) was placed in the bottom of each pot. As in Test I, the volume of treated potting soil was equivalent to 1/5 the total volume of the plastic container. Infested pots were maintained as described above for 30 days at which

time the contents of each pot were "dumped" and evenly spread in order to determine the status of each ant colony.

Test III - Test III was initiated on May 01, 1984. Treated potting soil was placed in the bottom, top, and sides of the pots, distributed evenly as possible at a volume equivalent to 1/5 the volume of the pot. Infested pots were maintained as described above for 30 days at which time the test was terminated and the condition of all colonies was determined.

Results:

Regardless of the application procedure (placement of the treated potting soil), the results of all tests were the same; all colonies survived and worked out of the drainage holes in the bottom of the pot. If treated soil was placed in the bottom of the pots (Tests II and III), the ants avoided contact by bringing out soil from the root ball. We have observed this avoidance behavior in other tests, and it appears to be more prevalent with Dursban than with other insecticides. Since all colonies were judged viable at the end of the 30-day exposure period, it was concluded that this procedure cannot be used as an alternate treatment for "balled and burlapped" plant material.

REFERENCES CITED

Collins, H. L., C. L. Mangum, J. G. Medley, and A. W. Guenther. 1980. Evaluation of soil insecticides for quarantine treatments against imported fire ants, 1976-1979. Insecticide and Acaracide Tests. 5:209.

PROJECT NO.: FA 052484.05

PROJECT LEADER: Homer L. Collins

PROJECT TITLE: Evaluation of Nitroethane for Quarantine Treatment of Nursery Stock

Introduction:

Nitroethane ($CH_3CH_2NO_2$) is used as an industrial solvent in a variety of commercial applications as well as a chemical intermediate for synthesis of other compounds. Nitroethane is highly volatile (vapor pressure 20.9 mm. Hg. at 25 degrees C.) and has been evaluated as a liquid fumigant for treatment of IFA colonies (Kass, personal communication). At the request of Angus Chemical Company, Northbrook, Illinois, we investigated nitroethane as a post-harvest quarantine treatment for nursery stock.

Methods:

Fumigant activity against IFA was established in a series of laboratory tests conducted by confining IFA workers in 9 liter bell jars containing various quantities of nitroethane. Although an acute LC50 was not determined, exposure to concentration of .01 ml./liter for 24 hours at 76 degrees F. produced 100% mortality to IFA workers.

In order to evaluate the potential of nitroethane as a regulatory treatment, a test with six species of potted ornamental plants artificially infested with IFA was conducted in June 1984, Three specimens of the following species (ca. 24" in height, growing in 4-quart plastic pots) were artificially infested with a "fragmented" IFA colony

(25 cc. of ants, presence of queen not determined) on June 08, 1984:

Common Name	Scientific Name
Golden Euonymus	Euonymus japonicus
Varigated Acuba	Acuba japonica
Holly	Ilex cornuta
Gardenia	Gardenia jasminoides
Oleander	Nervium oleander
Rhaphiolepis	Rhaphiolepis spp.

After allowing the colonies to acclimate for five days, two specimens of each plant species were treated with one fl. oz. nitroethane per plant. The nitroethane was applied directly to the soil surface at the base of the plant. The third specimen served as an untreated check for each plant species. The plants were then placed in open 16" x 20" x 3" fiberglass pans with talced sides to prevent the ants from escaping. A subjective evaluation of the effects of the nitroethane on both the ant colonies and the potted plants was made 4 hours; 10 days; and 3 weeks following treatment.

Results and Discussion:

Four hours after application, all treated colonies were highly agitated and excited. Many ants were clustered on the sides and bottom of the pots near the drainage holes in an apparent effort to evacuate or escape from the pot. This behavior was probably similar to the colony movement from pesticide treated nests as reported by Williams and Lofgren (1983). On June 18 (10 days after treatment), Acuba, Rhaphiolepis, and Gardenia were showing definite and

typical phytotoxic effects. Large "bone-piles" (dead ants) were piled in the fiberglass pans used to confine the ants, indicating activity against the ants (probably both contact and fumigant). Although all colonies were decreased in vigor, none were rated as "dead". Three weeks after treatment, all treated plants were dead whereas the untreated checks were normal and healthy. All ant colonies were highly active although the presence of large bone piles indicated that many ants had been killed. Like many other highly volatile chemicals (i.e. chloroform, methylene chloride, etc.), nitroethane does exhibit fumigant activity against the IFA but undesirable side effects (phytotoxicity) seem to preclude its use as a regulatory tool.

REFERENCES CITED

Williams, David F. and Clifford S. Lofgren. 1983. Imported fire ant control: Evaluation of several chemicals for individual mound treatments. Jour. Econ. Ent. 76:1201-1205.

PROJECT TITLE: FA 012884.01

PROJECT TITLE: Evaluation of Bait Toxicants for Control of Individual IFA Colonies

PROJECT LEADERS: Homer Collins, Dudley Adams, C. J. Mauffray, Paul Michael Bishop and Avel Ladner

Introduction:

A small plot field test with four bait formulations (Affirm, Amdro, Logic and Prodrone) was conducted in Harrison County, Mississippi to determine the effectiveness of simulated "homeowner treatments" with these products. Numerous studies comparing efficacy of these baits applied broadcast by both aerial and ground equipment have been conducted, but additional information on their effectiveness as individual colony treatments was needed.

Methods:

All formulations were applied by hand at a rate of 3 to 5 Tbs. per colony to each colony in unreplicated 1-acre test plots by an application team comprised of 5 individuals. Treatments were applied on July 10, 1984 in an 8-acre fallow field (mixed vegetation, mostly crabgrass and broadleaf weeds).. Efficacy of each treatment was determined by establishing one 1/4-acre subplot within each test plot and monitoring treatment effects according to procedures described elsewhere (Harlan et al 1981, Collins 1982, Lofgren and Williams 1982). Plots were rated prior to treatment and at 6, 12, and 20 weeks after treatment.

Results:

The results of this test are shown in Table 15, and

TABLE 15. Single Mound Treatments with IFA Bait Toxicants.

Plot	Treatment [1]	Pretreat. Pop. No. Col.	Pretreat. Pop. Pop. Index	% Colony Mortality at Indicated Post-Treat Interval (Wks) (6)	(12)	(20)	% Chg. in Pretreat Pop. Index at Indicated Post-Treat Interval (Wks) (6) [2]	(12)	(20)	% Colonies with Worker Brood at Indicated Post-Treat Interval (Wks) (6)	(12)	(20)
1	Amdro 5 Tbs./colony	20	340	35	20	0	-26	-73	-23	92	19	68
2	Prodrone 5 Tbs./colony	15	260	0	0	0	0	-56	+30	100	37	74
3	Logic 3 Tbs./colony	17	285	65	23	29	-87	-88	-65	17	0	50
4	Affirm (A003) 4 Tbs./ colony	14	200	64	0	0	-93	-63	-38	0	5	50
5	Affirm (W0002) 4 Tbs./ colony	23	288	65	0	30	-84	-69	-59	25	13	37
6	Untreated Check	17	267	23	0	23	-15	- 8	-12	92	82	100

[1] Plots treated 07/10/84.

[2] High vegetation impeded detection of colonies at this rating interval.

are inconsistent with our previous findings as well as the findings of others since an acceptable level of control was not obtained with any treatment. These results are not easily explained but may be related to method of application. Broadcast treatments afford much more uniform coverage than do single colony treatments, thereby eliminating the human error associated with detecting and treating all colonies in a given area. Weather conditions, seasonal effects and application procedures can be ruled out as causal factors for the poor results obtained in this tests. Size and caste composition of surviving colonies at the last evaluation interval (20 weeks post-treat) was not indicative of reinfestation. Although these results cannot be explained, they do serve to clearly demonstrate the vagaries of the bait method of control, i.e. ad lib ingestion of the toxicant by the target pest. Apperson et al (1984) also failed to achieve high levels of control with MK-936 (Affirm) or Amdro when applied to individual IFA colonies. Most other studies in which these products were applied broadcast indicated that acceptable control could be achieved with either product.

REFERENCES CITED

Apperson, C. S., E. E. Powell and M. Browne. 1984. Efficacy of individual mound treatments of MK-936 and Amdro against the red imported fire ant. Jour. Ga. Ent. Soc. 19:508-516.

Collins, H. L. 1982. Annual Report, USDA, APHIS, PPQ Imported Fire Ant Station. 79 pages mimeo.

Harlan, Donald P., W. A. Banks, H. L. Collins, and C. E. Stringer. 1981. Large area test of AC-217, 300 bait for control of Imported Fire Ant in Alabama, Louisiana and Texas. Southwestern Entomologist 6(2):150-157.

Lofgren, C. S. and D. F. Williams. 1982. Avermectin B1a, a highly potent inhibitor of reproduction by queens of the red imported fire ant. Jour. Econ. Ent. 75:798-803.

PROJECT NO: FA012984.01

PROJECT TITLE: Retention of Bait Toxicants in Fire Ant Repletes

PROJECT LEADERS: James H. Spence 1/ and P. M. Bishop

I. Introduction

Glancey et al (1973) found that large major workers function as a replete caste by storing liquid food (soybean oil) in their crop. This stored oil is fed to other colony members during stress periods when natural food supplies are limited. Since bait toxicants are delivered to fire ant colonies in solution with soybean oil, it is assumed that storage of the toxicant-soybean oil solution by repletes also occurs and retention time (as measured by GLC analysis) for the oil-toxicant solution by the repletes would be dependent upon several factors:

(1.) Whether or not a lethal dose was consumed and passed into the alimentary tract. Theoretically, the entire dose could be stored in the crop and not actually consumed. Conversely, morbid repletes can't store oil.

(2.) The time required for ingested toxicants to produce lethal effects on the recipient (our collection procedures allowed only the collection of live active worker ants).

1/ Chemist, National Monitoring and Residue Analysis Laboratory, USDA, APHIS, PPQ, Gulfport, Mississippi.

(3.) Stability of the toxicant under the conditions encountered in the crops of the repletes.

We initiated a study in October 1983 to determine how long various bait toxicants are retained in the "communal IFA stomach" following aerial application of these toxicants.

II. METHODS AND MATERIALS:

A. Collection of Ant Samples

Test plots at Dannelley Field (Montgomery, Ala.) were treated by PPQ aircraft with Affirm, Logic, and Amdro, October 25 and 26, 1983 (Table 1). Prior to application, approximately 1Ø cc. of workers were collected from each of 25 colonies within each test plot. 1ØØ cc. glass vials containing a light film of talc were used to trap and collect workers which swarmed into the vials after the nest was disturbed. After collection, samples from each plot were composited and stored on ice until they were returned to the laboratory and frozen. Post treatment samples were collected in an identical fashion at 24hrs, 1 week, and 6 weeks.

B. GLC Analyses

Ants were washed with tap water to remove foreigh matter and then air dried. A one gram sample, free of foreign matter, was placed in a mortar and pestle

along with sufficient anhydrous sodium sulfate to cover the ants. They were then ground to a salt and pepper consistancy. The mixture was quantitatively transferred to a 250 ml Erlenmeyer flask with hexane and additional hexane added to give 25 ml. To this was added 25 ml acetonitrile (both solvents were saturated in one another before using). The flask was capped and placed on a reciprocating shaker for one hour, after which the mixture was filtered through a Whatman 2V fluted filter paper previously rinsed with hexane. The extract was transferred to a 500 ml separatory funnel and the phases allowed to separate. The bottom layer (CH_3CN) was drained off into a round-bottom flask, the hexane layer again drained off into the round-bottom flask. The CH_3CN extract was concentrated to near dryness on a vacuum rotary evaporator. Acetone was added to the residue in the flask, and it was again concentrated to near dryness. The residue was transferred to a 15 ml centrifuge tube with acetone and concentrated to 1 ml on a Pierce Reacti-Therm/Reacti-Vap(R) using nitrogen gas under a hood. The sample was then ready for analysis.

Instrument Operating Parameters:

1. Hewlett-Packard 5880-A Gas Chromatograph
2. Column: Ultra-bond 20M, 3' glass, 4mm Id
3. Flow rate (ml/min): air.....75
   hydrogen.....7.8
   methane/argon....48
4. Detector: Nitrogen-phosporous (NPD)
5. Temperatures: detector.....300 deg. C

oven.....235 deg. C
injector.....225 deg. C

6. Attenuation: 24 (32)
7. Chart speed (cm/min): 1.Ø
8. Retention time (min): 1.2

Fortification

a. 1Ø4.45 micrograms - 74.23%
b. 2Ø8.9 micrograms - 84.97%
c. 522.45 micrograms - 96.53%

Avg. = 85.24%

III. RESULTS AND DISCUSSION:

Since the procedures used for analysis of Logic is relatively easy compared to Amdro or Affirm, this product was selected for preliminary studies. Analyses of field collected ant samples taken at 1,7, and 42 days posttreat were all negative (limit of detection 1 ppm). Three laboratory IFA colonies allowed to feed on Logic 1%PGD bait contained an average of 1238 ppm 24 hrs after the bait was offered to the colonies. From these very preliminary data we have tentatively concluded that the parent compound in Logic bait must be quickly metabolized or converted to various breakdown products. Whether this occurs in the crop or during the process of ingestion is not known. Additional studies utilizing mass spectometry (GC-MS) are planned for 1985.

REFERENCES CITED:

Glancey, B. Michael, C.E. Stringer, Jr.,C. H. Craig, P. M. Bishop and B.B. Martin. 1973. Evidence of a replete caste in the fire ant Solenopsis invicta. Ann. Ent. Soc. Amer. 66:233-234.

Anon. 1984. Determinination of RO13-5223 in agricultural products and environmental samples. Maag Agrochemical Res. and Dev. Vero Beach,Fla.

Anon. 1965. Methods of analyses for pesticides in Agr. Monitoring. USDA,PPCD,ARS,Gulfport, Ms.

PROJECT NO.: FA013084.10

PROJECT TITLE: Effects of Affirm (Avermectin Bla) on Field Collected Alates of the Red Imported Fire Ant

PROJECT LEADER: Dr. Michael E. Mispagel 1/

Introduction

In 1982, Glancey et al. conducted a laboratory investigation on the effects of Avermectin on the ovaries of red imported fire ant queens. At 22 weeks posttreatment, ovarioles of queens expressing permanent sterility were examined. Both hypertrophy of the squamous epithelium sheathing the ovarioles and pycnosis of nurse cell nuclei were observed in these queens which showed either total sterility or a reduction in the number and size of eggs laid.

Colonies fed low concentrations of avermectin temporarily decreased brood production (Glancey et al. 1982). Within 16 weeks, normal production was again observed. The potential reversibility of the sterility caused by Affirm at low doses was of great concern to Merck & Co. and it was thought that an attempt should be made to observe this phenomenon in the field. Since individual queens are virtually impossible to collect in large numbers in the field, female alates were chosen to be investigated with the assumption that they would respond similarly to fertilized queens.

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1/ College of Veterinary Medicine, University of Georgia, Athens GA 30602.

Methods

On May 15, 1984, Affirm (Avermectin B_1a) was distributed by air at the rate of 1 lb. per acre on two 100 acre plots at the airport near Bainbridge, GA. Two formulations were used: W0002 and A003. Prior to treatment, alates were collected from randomly selected nests near the plots' center. Collections were made by digging up the nest and spreading the tumulus on a shallow 4x4 ft. cardboard box. Alates, both male and female, were collected. At the minimum, 10-20 alates from 6 nests from each plot were collected at 6, 9 and 12 weeks posttreatment. At 12 weeks, reinfestation was evident by the presence of small colonies with minims. It was concluded that alates collected after this time most probably would be from new colonies and consequently would never have been exposed to the pesticide. Therefore, no further collections were made after August 7, 12 weeks posttreatment.

Upon capture, specimens were cut at the petiole for infusion of either Trumps solution for light and electron microscopy staining techniques, or methacarn for histopathological staining techniques.

Because we wanted to observe the entire female reproductive tract, dissection was initially kept to a minimum. However, the large amount of oil in these unfertilized alates and the impermeability of the cuticle, prevented total penetration of the fixative. The ovarioles of the alates were in various stages of development depending on the age of the individual. In general, the ovarioles were too small to be dissected from the specimens. To allow maximum penetration of the fixatives, the anterior 3 or 4 sternites and tergites were removed and a hole was cut posteriorly in tergites 6 and 7. This left enough cuticular material to provide mechanical support to the developing ovarioles and reproductive tract while permitting penetration of the fixatives.

Dissected specimens were fixed in McDowell and Trumps fixative, rinsed

twice in 0.1 M phosphate buffer, osmicated in 1% OsO_4/0.1 M phosphate buffer for 60 minutes, rinsed 3 times in water, soaked in ethanol at 50%, 75%, 95% and 100% concentrations to remove all water, mixed in 50% Spurr plastic with 100% acetone and embedded in 100% Spurr plastic. Tissues were sectioned at 1 μm and stained with 1% toluene blue in 1% sodium borate and basic fuchian.

Results and Discussion

Homer Collins, USDA/APHIS/PPQ, of the Imported Fire Ant Station in Gulfport, MS, has reported (pers. comm.) that colony mortality was 61-64% at 6 weeks and 76-84% at 12 weeks. The population index declined by a range of 81-95% at 6 weeks to 96% at 12 weeks posttreatment based on fifteen (15) 1/4-acre subplots within each treatment block. The population index is based upon both the estimated number of workers in the colony and the presence or absence of worker brood.

Female alates which were collected 6, 9 or 12 weeks posttreatment did not show any morphological or histological effects of the pesticide compared with control specimens. Specimens were examined by Dr. W. L. "Buddy" Steffens of the UGA College of Veterinary Medicine who concurred in this evaluation. Photomicrographs were taken of some of these sections and are included as Plates 1-3.

Glancey et al. (1982) reported hypertrophy of the squamous epithelium sheathing the ovarioles and clumping of chromatin in nuclei of nurse cells in specimens treated with avermectin. We observed no hypertrophy of the squamous epithelium and noted occasional chromatin clumping even in control specimens.

The number of eggs developing may have been reduced but this could not be ascertained with any degree of certainty because ovarioles were in various

stages of development depending on the age and maturity of the individual alate. Young individuals would be expected to have few ovarioles and oocytes independent of their exposure to Affirm. This problem of age and ovarian development is inherent in the use of alates for this type of investigation in contrast to the use of fertilized queens. Related to this alate age problem in a field population, is the question of whether the individual alates collected had even been exposed to the pesticide while in the adult stage. It is very possible that those mature alates which had been fed the compound through trophallaxis had swarmed from the nest sometime prior to the 6 week sampling period. It is also possible that those collected were either in a non-feeding stage at the time of exposure, such as the egg or pupal stage, or may not even have been oviposited at the time of treatment.

We observed that reproductive brood replaced worker brood in most colonies examined. Banks et al. (1978) have shown that the hormonal imbalances caused by insect growth regulators (IGR's) will effect a shift in caste differentiation from worker to sexual brood. This is apparently caused in the early larval instars and not by any effect on the queen or the eggs. Although Affirm is not a bona fide IGR, the queen sterility and the increased number of reproductive brood observed would tend to indicate that it may confuse the hormonal balance of the ants. Thus there may have been two groups of alates exposed to Affirm: those which received it as an adult prior to a mating flight and those which received it as an early instar worker larva which may then have differentiated into a reproductive form due to a hormonal imbalance. One would expect that the alates collected early after the treatment would most likely be the former kind, and alates collected later post-treatment would be probably of the latter derivation. We do not know how quickly the compound Affirm is metabolised out of the ant's system nor, therefore, how persistent it is from the larval stage through eclosion. Our data would indicate that it is not persistent enough to

cause morphological or histological malformation of ovarioles or oocytes as previously observed in queens by Glancey et al. (1982).

Whether any of these events occurred or not, we, of course, do not know. But any one of them could explain the lack of observable effects to alates by Affirm in this field investigation.

Many studies have investigated food flow through a fire ant colony (Vinson 1968; Glunn et al. 1981; Sorenson and Vinson 1981; Howard and Tschinkel 1981). However, none of these studies have dealt directly with food distribution to the alates. Consequently, we don't really know, other than through supposition, whether the alates received much of the tainted bait directly. Nor do we know wheher or not all those that did receive it, were mature enough to have dispersed in a mating flight soon thereafter. If this flight occurred, we do not know if the reproductive capacity of the newly mated queens which had been treated with Affirm earlier, was affected. If so, the rate of incipient colonies in the area would be decreased.

In contrast, since one affect of IGR's is to cause an alteration of worker brood to reproductive brood, the potential number of new queens from a single colony is increased. If Affirm is not residual in its effect on egg production of newly mated queens, as is indicated by these data, the rate of incipient colonies in an area could be greatly increased.

As with most studies of this nature, more questions were raised than were answered. I would suggest that further laboratory investigations be undertaken to address some of these questions. One approach would be to use polygynous colonies from which a queen and some alates could be sacrificed biweekly after exposure to Affirm. One could then simultaneously observe the effects on the queen's ovarioles, which we know, and the alate's ovarioles, which we are less sure about. Moreover, treated alates could be induced to produce brood to determine the effects of Affirm on ovarioles of incipient queens.

In other experiments, radiolabelled Affirm could be fed to colonies and its persistence assessed in both adult alates and worker larvae which may differentiate into reproductive brood due to a hormonal imbalance possibly caused by Affirm. The fertility of these new reproductives should be of greatest concern.

In summary, the results of this field study were inconclusive in that no effect of Affirm was observed on female alates. The lack of control over the experimental animals probably contributed to these findings. A laboratory-based investigation has been initiated to answer some of the questions regarding the effect of Affirm on fire ant alates.

References

Banks, W. A., C. S. Lofgren, and J. K. Plumley. 1978. Red imported fire ants: effects of insect growth regulators on caste formation and colony growth and survival. J. Econ. Entomol. 71:75-78.

Glancey, B. M., C. S. Lofgren and D. F. Williams. 1982. Avermectin B_1a: Effects on the ovaries of red imported fire ant queens (Hymentoptera: Formicidae). J. Med. Entomol. 19(6):743-747.

Glunn, F. J., D. F. Howard and W. R. Tschinkel. 1981. Food preference in colonies of the fire ant, Solenopsis invicta. Insectes Sociaux, Paris 28(2):217-222.

Howard, D. F. and W. R. Tschinkel. 1981. The flow of food in colonies of the fire ant, Solenopsis invicta: A multifactorial study. Physiol. Entomol. 6(3):297-306.

Sorenson, A. A., J. T. Mirenda and S. B. Vinson. 1981. Food exchange and distribution by three functional worker groups of the imported fire ant Solenopsis invicta Buren. Insectes Sociaux, Paris 28(4):383-394.

Sorenson, A. A. and S. B. Vinson. 1981. Quantitative food distribution studies within laboratory colonies of the imported fire ant, Solenopsis invicta Buren. Insectes Sociaux, Paris 28(2):129-160.

Vinson, S. B. 1968. The distribution of an oil, carbohydrate, and protein food source to members of the imported fire ant colony. J. Econ. Entomol. 61(3):712-714.

Plate 1

(A) Longitudinal section of oocytes (O) and nurse cells (N) with normal follicular epithelium (FE) in untreated alate. (Section 520-35-AA-4. August 7, 1984. 650x)

(B) Oocytes (O), nurse cells (N) and follicular epithelium (FE) of untreated alate. (Section 520-35-C-2. August 7, 1984. 650x)

(C) Oocytes (O), nurse cells (N) and squamous epithelium (SE) around nurse cells of untreated alate. (Section 520-15-C-2. March 14, 1984. 650x)

(D) Nurse cells (N) of untreated alate showing some clumping of chromatin (C) in nurse cell nuclei. (Section 520-15-A-3. March 14, 1984. 650x)

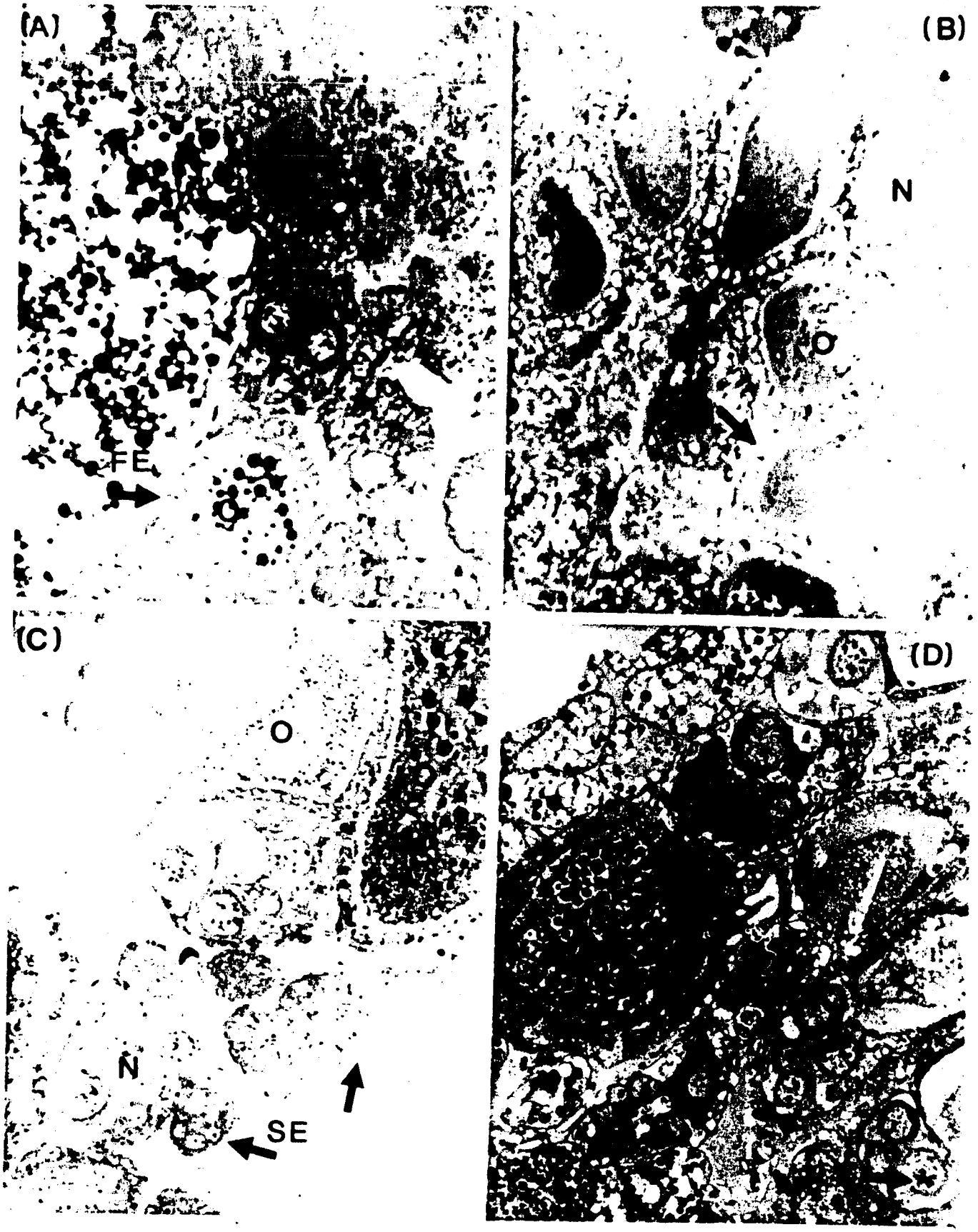

Plate 1

Plate 2

(A) Affirm-treated alate showing the squamous epithelium (SE) and chromatin (C) in nurse cells (N) and ovarioles (OV). (Section 37-C-2. June 26, 1984. 650x)

(B) Ovarioles (OV) of Affirm-treated alate showing oocytes (O) and nurse cells (N). (Section 520-37-B-1. June 26, 1984. 650x)

(C) Oocytes (O) and nurse cells (N) of Affirm-treated alate showing chromatin (C). (Section 520-39-D-1. June 26, 1984. 650x)

(D) Ooccytes (O) and nurse cells (N) of Affirm-treated alate showing some clumping of chromatin (C) in nurse cell nuclei. (Section 520-40-C-2. June 26, 1984. 650x)

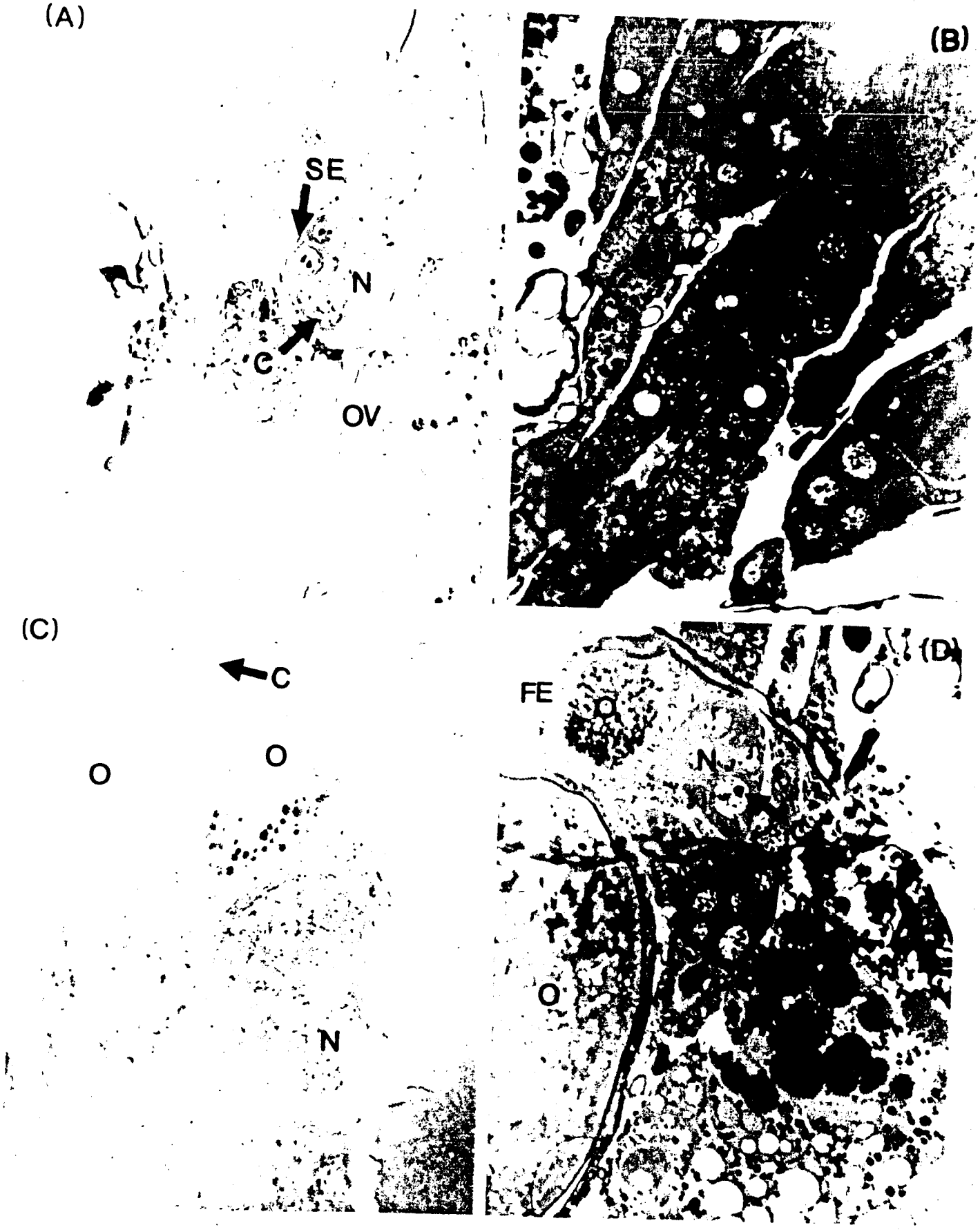

Plate 2

Plate 3

(A) Follicular epithelium (FE) of oocytes and chromatin (C) of nurse cells in Affirm-treated alate. (Section 520-38-D-3. June 26, 1984. 650x)

(B) Chromatin (C) in nurse cell nucleus of Affirm-treated alate. (Section 520-39-A-3. June 26, 1984. 650x)

(C) Follicular epithelium (FE) around oocyte (O) and squamous epithelium (SE) around nurse cells (N) adjacent to calyx (CA) in Affirm-treated alate. (Section 520-41-B-4. June 26, 1984. 650x)

(D) Ovarioles (OV) and chromatin (C) in nurse cell nuclei of Affirm-treated alate. (Section 520-38-C-2. June 26, 1984. 650x)

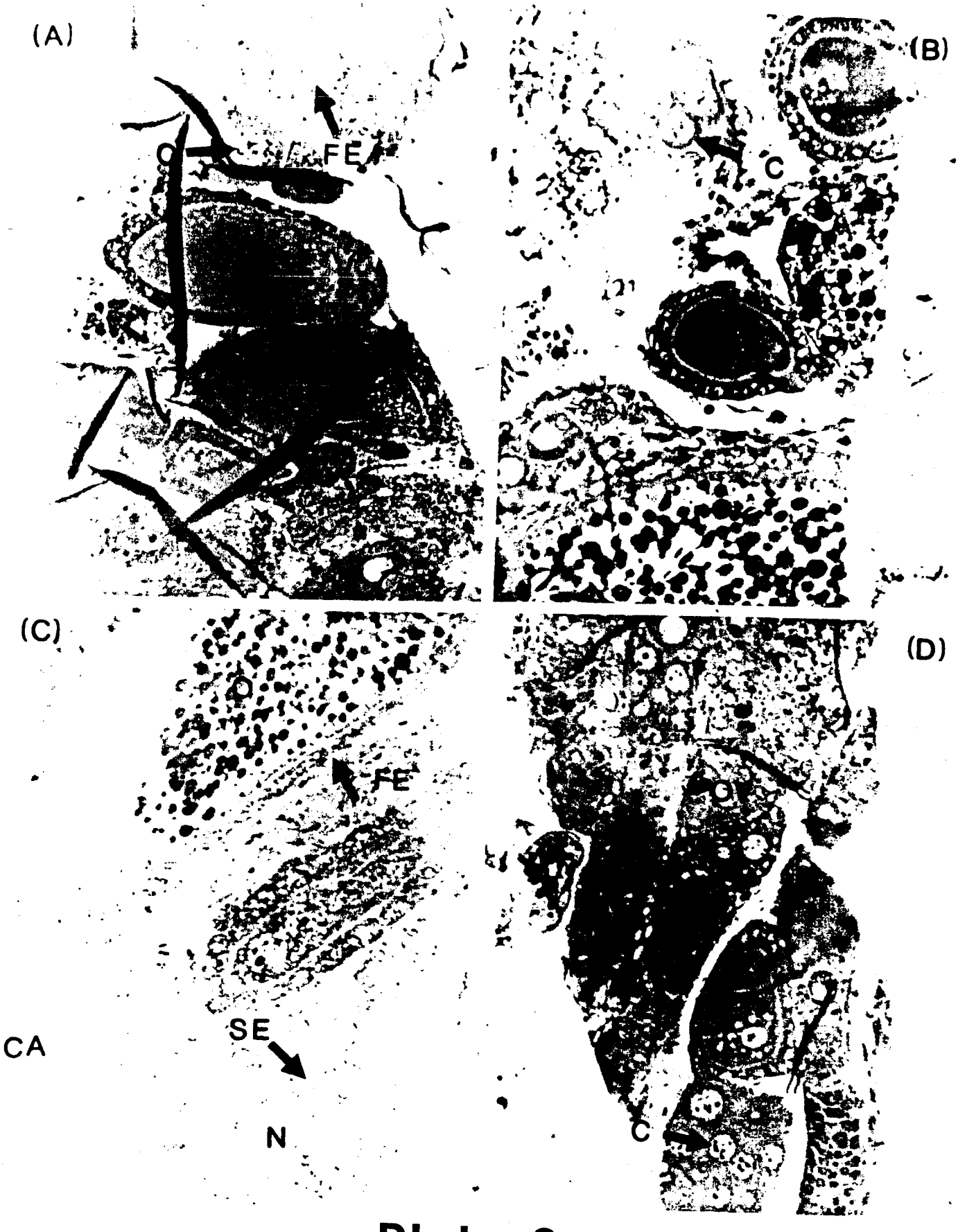

Plate 3

APPENDIX I.

A Criteria for the Participation of
Plant Protection and Quarantine
Animal and Plant Health Inspection Service,
U. S. Department of Agriculture,
in the Control of Imported Fire Ant with
Cooperating States

The imported fire ant (IFA) program goal for 1985 is to provide control techniques through methods development, continue environmental monitoring of treatment sites, and maintain a limited survey in support of regulatory action to reduce artificial spread outside the regulated area.

The program activities conducted since 1957 consist of the enforcement of quarantine regulations and surveys to support the regulatory program, and these activities provide a basis for insecticide application. Plant Protection and Quarantine (PPQ) with State cooperation applies insecticides to control infestations. Application sites are monitored to determine levels of residues occurring in the environment. The methods development activities are conducted to develop improved or alternate regulatory and control tools.

In recent years, environmental issues and the lack of registration for environmentally acceptable and efficacious insecticides have precluded the large-scale treatment of areas infested with the IFA.

The PPQ program has continued to recognize a responsibility to the public in states infested with IFA. In an effort to meet this responsibility, in an efficient and effective manner, PPQ has developed the following criteria for participating in cooperative control efforts with interested states on a cost-sharing basis. This policy differs from past practices in that PPQ will not participate in pesticide distribution or give-away programs for ground treatment by individuals.

Application Procedures: The most cost-effective applications providing maximum relief are those which involve the broadcast treatment of all land allowable under the pesticide label on a farm-by-farm basis. The approach should be followed at the community level using aerial applications where possible.

Furthermore, PPQ will cost-share in the purchase of pesticides for single mound treatments only when the treatment of public lands which are owned or controlled by a governmental unit (i.e., State, county, city, or township) is involved. The intention is to assist with the treatment of high public-use areas such as school grounds, picnic or park areas, cemeteries, etc.

Animal and Plant Health Inspection Service
November 05, 1984.

Appendix II. Current status of registered IFA baits and those with pending registrations as of February, 1985.

Trade name:	Affirm	Amdro	Logic	Prodrone
Common name:	Avermectin	Amdro	Fenoxycarb	Prodrone
Chemical name:	(5-0-demethylavermectin Ala and (5-O-demethyl-25-de-1-methylpropyl)-25 (1-methylethyl) avermectin Ala	Tetrahydro-5, 5-dimethyl-2(1H) pyrimidinone(3-[4-trifluoromethyl) phenyl] 1-(2-[4-trifluoromethyl phenyl] ethenyl -2-propenylidene) hydrazone	Ethyl[2-(p-phenoxyphenoxy) ethyl] carbamate	1-(8-methoxy -4,8-dimethy lnonyl)-4- (1-methylethyl benzene
Type formulation:	.011% deffated Corn	.88% defatted Corn	1% defatted corn or 1% cob grits	1.2% defatted Corn
Application rate:	1 lb/acre (50 mg AI)	1 lb/acre (4 gms AI)	1 lb/acre (4.5 gms AI)	0.88 lbs/acre per application (4.8 gms AI/app.)
Registration Status:	Pending. (Request filed Feb 1984)	Approved Aug. '80 for use on pasture & Non-crop	Pending. '(Request filed Aug 1983)	Approved Mar '83 for use on pasture & Non-crop
Cost:	?	$2.53/lb	?	$.93/lb
Mode of action:	Disruption of queen's reproductive system.	Direct toxicant Affects all life stages.	Primarily IGR	IGR
Manufacturer:	Merck & Co.	American Cyanamid	Maag Agrochemicals	Stauffer

Appendix III.
Numbered Compounds Showing Potential
For IFA Control in Preliminary Tests

Company Designation	Manufacturer	Primary Mode of Action
JH-286	Montedison	JH
S-4496	Sumitomo	JH
S-4624	Sumitomo	JH
Fluorocarbons	Griffin	Direct toxicant

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This list was furnished by W. A. Banks, Entomologist, USDA, ARS, Insects Affecting Man and Animals Laboratory, Gainesville, Florida.

APPENDIX IV. Efficacy of Bait Toxicants: A Summary of Results of Recent Trials Conducted By the Imported Fire Ant Station. USDA, APHIS, PPQ.

PRODUCT	Spring 1982 1/		Fall 1982		Spring 1983		Fall 1983		Spring 1984		AVERAGE FOR ALL TRIALS Spring 1982 to Spring 1984	
	% Colony Mortality	% Change in Pop. Index	% Colony Mortality	% Change in Pop. Index	% Colony Mortality	% Change in Pop. Index	% Colony Mortality	% Change in Pop. Index	% Colony Mortality	% Change in Pop. Index	% Colony Mortality	% Change in Pop. Index
Affirm .01% (PGD)	76	-95	67	-83	75	-97	78	-82	74	-94	74	-90
Amdro (.88% PGD)	74	-89	79	-92	86	-97	83	-79	93	-97	83	-91
Logic (1% PGD)					87	-99	99	-100			93	-99.5
Prodrone (1.2% PGD) 3/									56	-76	56	-76
Untreated Chk.	34	-35	13	+19	28	-33	24	+23	27	-20	25	- 9

1/ Average obtained at three test sites unless otherwise noted. Aerial application, test plots approximately 100 acres in size. Results of Spring trials based on 12-week post-treat evaluation. Fall trials based on results obtained 38 to 40 weeks after treatment.

2/ Two sites only: (Bainbridge, Georgia and Montgomery, Alabama).

3/ Single application applied at a rate of .88 lbs/acre.