1996
ANNUAL REPORT

GULFPORT PLANT PROTECTION STATION

U.S. DEPARTMENT OF AGRICULTURE

ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
CENTER FOR PLANT HEALTH SCIENCE AND TECHNOLOGY

3505 25th Ave., Bldg. 16
Gulfport, MS 39501

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HOMER L. COLLINS	Station Leader
ANNE-MARIE CALLCOTT	Asst. Station Leader
TIMOTHY C. LOCKLEY	Entomologist
AVEL L. LADNER	Biological Science Tech. (Insects)
LEE R. McANALLY	Agriculturist
CHARLENE HEBERT	Biological Science Tech. (Insects)
RANDY CUEVAS	Biological Science Tech. (Insects) (Resigned April 1996)
KIRK IRBY	Biological Aide (Temporary appt. expired May 1996)

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

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

Compiled and Edited by:

Anne-Marie Callcott and Homer L. Collins

February 1997

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IMPORTED FIRE ANT

FY 1996 IMPORTED FIRE ANT OBJECTIVES

GULFPORT PLANT PROTECTION STATION
GULFPORT, MS

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

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

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

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

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

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

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SECTION I

DEVELOPMENT O
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PROJECT NO: FA01G025

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

TYPE REPORT: Interim

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

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

INTRODUCTION:

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

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

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

MATERIALS AND METHODS:

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

practices. Fipronil 0.1G (EXP 60818A) was incorporated at rates of 5, 10, 25 and 50 ppm.

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

At monthly intervals, three pots from each treatment rate were collected, composited, and sent to the IFA lab. IFA personnel subjected the treated media to a standard alate female bioassay as described in Appendix II (1994 Annual Report).

RESULTS:

Media was treated at Flowerwood Nursery, Loxley, AL on April 25, 1995. The 10 ppm rate was effective for 4 mths and rates of 25 and 50 ppm provided excellent control through 15 mths PT (Table 1). However, all test pots were accidently destroyed after 15 mths.

Media at Wight Nursery in Cairo, GA was treated on August 9, 1995. The 5 ppm rate was effective for 9 mths, the 10 and 25 rates for 12 mths, while the 50 ppm rate has been effective for 15 mths.

Media was treated at Windmill Nursery, Folsom, LA on October 24, 1995. The 10 ppm rate was effective for 2 mths, and the 25 and 50 ppm rates have been effective for 13 mths.

At this time, there appears to be some variability at the 5 and 10 ppm rates of application, but the 25 and 50 ppm rates are providing excellent control.

Table 1. Efficacy of Fipronil Incorporated into Nursery Potting Media and Aged Under Actual Nursery Conditions.

Nursery	Rate (ppm)	% Mortality to Alate Females at Indicated Mths PT												
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Flowerwood	5	95	45	50	30	15	20	0	5	100	45	55	--	--
	10	100	100	100	95	65	10	100	100	100	100	100	--	--
	25	100	100	100	100	100	100	100	100	100	100	100	--	--
	50	100	100	100	100	100	100	100	100	100	100	100	--	--
	Check	80	20	5	0	0	5	10	0	0	10	5	--	--
Wight	5	100	100	100	100	100	100	100	100	100	85	75	100	--
	10	100	100	100	100	100	100	100	100	100	100	100	100	--
	25	100	100	100	100	100	100	100	100	100	100	100	100	--
	50	100	100	100	100	100	100	100	100	100	100	100	100	--
	Check	10	10	15	25	0	100*	100*	10	55	0	25	40	--
Windmill	5	0	65	5	55	5	30	20	35	10	60	35	15	10
	10	95	100	75	100	100	100	90	65	15	100	25	90	25
	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
	Check	5	0	5	10	0	15	5	15	5	30	20	20	5

* high check mortality unexplained, possibly human error in collection

Table 1. Cont.

Nursery	Rate (ppm)	% Mortality to Alate Females at Indicated Mths PT												
		(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
Flowerwood	5	50	45											
	10	55	80	*										
	25	100	100	*										
	50	100	100	*										
	Check	55	10	*										
Wight	5	0	35											
	10	20	100											
	25	40	100											
	50	100	100											
	Check	0	0											
Windmill	5													
	10													
	25													
	50													
	Check													

* trial terminated prematurely due to destruction by nursery workers

PROJECT NO: FA01G076

PROJECT TITLE: Expanded Trials with Fipronil as a Quarantine Treatment for Containerized Nursery Stock - Incorporated and Drench Treatments

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott and Lee McAnally

COOPERATORS: Turkey Creek Farms, Houston, TX
Tavo Garza. Texas Dept. of Agriculture

INTRODUCTION:

Fipronil (common name) is produced by Rhone-Poulenc Ag. Co. (Research Triangle Park, NC) and is currently marketed in numerous countries for control of many insect pests in a variety of crops. Currently, the only U.S. registration for the product is for mole cricket control in sod. Our laboratory has achieved excellent results with a granular formulation of the product when used as a preplant incorporated treatment (FA01G123, FA01G025). In 1996, we expanded our evaluation of the 0.1% granular formulation of fipronil, and also began preliminary testing of a water dispersable formulation as a drench treatment.

MATERIALS AND METHODS:

Incorporated *trial*:
Treatments were applied at Turkey Creek Farms, Houston, TX on July 9, 1996. Media and space was provided by the nursery. We traveled to Turkey Creek Farms and incorporated granular fipronil (EXP60818A) into the nursery media at rates of 10. 15, 20 and 25 ppm. Incorporation was achieved by using a portable cement mixer to blend the toxicant into the media. Media was aged on site, under normal agronomic practices of irrigation, weeding, etc. On a monthly basis, three pots from each treatment group were collected and composited into one sample, and sent to the IFA laboratory. At the IFA lab. the samples were subjected to standard alate female bioassay.'

Drench trial:
Treatments were applied at the IFA laboratory on June 25. 1996. Media consisted of the standard IFA media mix (MAFES mix - 3:1:1 pine bark:sphagnum

peat moss: sand). One gallon nursery pots were filled with the untreated potting media. Fipronil 80WD (EXP60720A) was applied at rates of 10 and 20 ppm. The drench solution was applied at a rate of 400 ml of finished solution per container. Containers were placed outdoors under simulated nursery conditions, including a pulsating overhead irrigation system which supplied ca 1-1½" water per week. At monthly intervals, three pots from each treatment were composited and subjected to standard alate female bioassay.

RESULTS:

Incorporated trial:
At 5 mths after treatment, the 5 ppm rate has provided ≥90% control of IFA, while all other rates have provided 100% control of IFA (Table 2).

Drench trial:
The 10 ppm rate has provided 80-100% control of IFA for 5 months, while the 20 ppm rate provided >95% control for 5 months (Table 3).

Table 2. Residual Activity of Granular Fipronil Incorporated into Nursery Potting Media at Turkey Creek Farms.

Treatment	Rate of Application (ppm)	% mortality of alate females at indicated mths PT						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fipronil	10	100	100	100	90	100		
	15	100	100	100	100	100		
	20	100	100	100	100	100		
	25	100	100	100	100	100		
Check	--	40	0	10	5	30		

Table 3. Residual Activity of Fipronil 80WD Applied as a Drench Treatment to Containerized Nursery Stock.

Treatment	Rate of Application (ppm)	% mortality of alate females at indicated mths PT					
		(1)	(2)	(3)	(4)	(5)	(6)
Fipronil	10	80	90	100	100	80	45
	20	100	100	100	100	95	75
Check	--	20	15	10	0	5	0

PROJECT NO: FA01G145

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

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Anne-Marie Callcott, Lee McAnally and Kirk Irby

INTRODUCTION:

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

MATERIALS AND METHODS:

Standard commercial Talstar T&O Granular (0.2G on a sand carrier) and bifenthrin 0.2G on an experimental organic carrier (SPG 95-07) were incorporated into standard nursery potting media at rates of 10, 12, 15 and 25 ppm. The standard MAFES media used by the IFA Laboratory (3:1:1 pine bark:peat moss:sand) was used. Treated media was placed into trade gallon pots and weathered under simulated nursery conditions, including irrigation (ca 1½ inches/week) plus rainfall. Three pots from each treatment were collected monthly and subjected to a standard alate female bioassay (Appendix II).

RESULTS:

Results to date show 100% efficacy, regardless of carrier or rate of application, through 16 months posttreatment (Table 4).

Table 4. Efficacy of Bifenthrin 0.2% on an Organic Carrier (SPG95-07) vs. the Standard Sand Carrier (Talstar T&O).

Formulation	Rate of Application (ppm)	Mean % mortality to alate females at indicated months PT										
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Talstar T&O Granular	10	100	100	100	100	100	100	100	100	100	100	100
	12	100	100	100	100	100	100	100	100	100	100	100
	15	100	100	100	100	100	100	100	100	100	100	100
	25	100	100	100	100	100	100	100	100	100	100	100
SPG95-07	10	100	100	100	100	100	100	100	100	100	100	100
	12	100	100	100	100	100	100	100	100	100	100	100
	15	100	100	100	100	100	100	100	100	100	100	100
	25	100	100	100	100	100	100	100	100	100	100	100
Untreated Check	---	5	20	5	15	5	5	5	0	10	15	10

Table 4. Cont.

Formulation	Rate of Application (ppm)	Mean % mortality to alate females at indicated months PT								
		(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Talstar T&O Granular	10	100	100	100	--	100				
	12	100	100	100	--	100				
	15	100	100	100	--	100				
	25	100	100	100	--	100				
SPG95-07	10	100	100	100	--	100				
	12	100	100	100	--	100				
	15	100	100	100	--	100				
	25	100	100	100	--	100				
Untreated Check	---	5	60	5	--	10				

PROJECT NO. FA01G035

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

TYPE REPORT: Interim

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

INTRODUCTION:

Historically, insecticidal treatments for nursery potting media were administered on a weight to volume basis, i.e. 1 lb of Dursban® 2.5G per cubic yard of media. However, this resulted in tremendous variations in the effective dose rates, with "lighter" media receiving far more actual toxicant than "heavier" media. In order to compensate for these differences, Talstar T&O Granular®, and tefluthrin 1.5G are applied at a rates of 10 to 25 ppm, based on the dry weight bulk density of the potting media. Potting media is a tremendously variable entity containing highly organic components such as milled pine bark, hardwood sawdust, rice hulls, sphagnum peat, etc. Undoubtedly, the most common component of all southern nursery media is pine bark. Some media contain sand in varying amounts, while others do not. The ratio of sand to bark may vary from 1 part sand to 2 parts bark, to 1 part sand to 8 parts bark. Sand is an inert component that contributes little other than weight to the media. Pesticide binding to sand particles is not known to occur. However, the weight of the sand influences the amount of pesticide required because dose rates are bulk density dependent.

Due to the high costs of the insecticides approved for IFA containerized quarantine treatments, nurserymen would prefer to disregard sand and base their application rates on the bulk density of the other components in their media mix. In other words, incorporate 25 ppm of bifenthrin or tefluthrin into the potting media based on the bulk density of all the components of the media except the sand. However, in a trial initiated in 1993 (FA01G053), we found that large quantities of sand, and the bulk density that it adds, appeared to affect the efficacy of both bifenthrin and tefluthrin. In that trial, insecticides were incorporated into media of various pine bark to sand ratios at 3.915 g AI/cu (equivalent to 25 ppm in pure pine bark).

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

MATERIALS AND METHODS:

Two media types were used in this trial: Flowerwood Nursery media (Mobile, AL) and MAFES media. Flowerwood Nursery provided the bark component of their 19:3 (pine bark:sand) basic potting mix. The MAFES mix is a 3:1:1 (pine bark:peatmoss:sand) potting media used by the IFA Station. The IFA lab provided masonry sand for the sand component. At the IFA Station, lab personnel blended the candidate toxicants into the potting media at 25 ppm, based on the bulk density of the non-sand components. The ratios of other media components to sand used are indicated in Table 5. The two products currently registered for IFA quarantine use, bifenthrin (Talstar T&O® Granular 0.2%) and tefluthrin (Fireban® 1.5%) were used as test toxicants. After blending, treated media was potted up in trade gallon nursery pots and aged under simulated nursery conditions of irrigation (ca 1-1½ inches per week).

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

RESULTS:

Results are summarized in Table 5. Talstar in media with no sand (ratio 1:0; 25 ppm) has provided excellent control for 18 mths. Talstar in all other media ratios provided excellent control through 14 mths. At 15 mths through the present, there has been a slight decrease in efficacy in MAFES media, and a more definite decrease in efficacy in Flowerwood media.

Fireban in both media types with no sand showed excellent control for 12 mths with variable control through 18 mths. All other media ratios began to show variable control after 12 mths.

Results of this trial are in general agreement with a prior study (FA01G053) that indicates that sand, i.e. bulk density, definitely affects efficacy of bifenthrin and tefluthrin. Therefore, at this time, it would not be prudent to disregard sand in bulk density determinations and subsequent blending techniques.

Table 5. Effect of Sand Content in Nursery Media on Residual Activity of Bifenthrin and Tefluthrin.

TREATMENT			PERCENT MORTALITY AT INDICATED MONTHS POST-TREATMENT											
INSECT-ICIDE	MEDIA TYPE	RATIO*	1	2	3	4	5	6	7	8	9	10	11	12
TALSTAR	MAFES	1:0	100	100	100	100	100	100	100	100	100	100	100	100
		1:1	100	100	100	100	100	100	100	100	100	100	100	95
		2:1	100	100	100	100	100	100	100	100	100	100	100	100
		3:1	100	100	100	100	100	100	100	100	100	100	100	100
		6:1	100	100	100	100	100	100	100	100	100	100	100	100
		8:1	100	100	100	100	100	100	100	100	100	100	100	100
	FLOWER-WOOD	1:0	100	100	100	100	100	100	100	100	100	100	100	100
		1:1	100	100	100	100	100	100	100	100	100	100	75	90
		2:1	100	100	100	100	100	100	100	100	100	100	100	100
		3:1	100	100	100	100	100	100	100	100	100	100	95	100
		6:1	100	100	100	100	100	100	100	100	100	100	80	80
		8:1	100	100	100	100	100	100	100	100	100	100	100	95
	SAND	0:1	100	100	100	100	100	100	100	90	100	100	100	65
FIREBAN	MAFES	1:0	100	100	100	100	100	100	100	100	100	100	100	100
		1:1	100	100	100	100	100	100	100	100	100	100	100	90
		2:1	100	100	100	100	100	100	100	100	100	100	100	95
		3:1	100	100	100	100	100	100	100	100	100	100	100	85
		6:1	100	100	100	100	100	100	100	100	100	100	100	100
		8:1	100	100	100	100	100	100	100	100	100	100	100	85
	FLOWER-WOOD	1:0	100	100	100	100	100	100	100	100	100	100	100	100
		1:1	100	100	100	100	100	100	100	100	100	100	100	100
		2:1	100	100	100	100	100	100	100	100	100	100	100	85
		3:1	100	100	100	100	100	100	100	100	100	100	100	100
		6:1	100	100	100	100	100	100	100	100	100	100	100	100
		8:1	100	100	100	100	100	100	100	100	100	100	100	100
	SAND	0:1	100	100	100	100	100	100	100	100	100	100	100	100
CHECK	SAND		0	20	0	0	5	5	5	0	0	0	25	10
	FLOWER-WOOD		55	35	5	20	5	15	5	15	0	15	30	0
	MAFES		10	0	5	15	25	10	10	0	0	5	45	0

* non-sand components:sand

Table 5. Cont.

TREATMENT			PERCENT MORTALITY AT INDICATED MONTHS POST-TREATMENT											
INSECT-ICIDE	MEDIA TYPE	RATIO*	13	14	15	16	17	18	19	20	21	22	23	24
TALSTAR	MAFES	1:0	100	100	100	100	100	100						
		1:1	100	100	85	100	90	95						
		2:1	100	100	90	100	100	100						
		3:1	100	100	100	100	100	100						
		6:1	100	100	95	100	100	100						
		8:1	100	100	95	100	100	100						
	FLOWER-WOOD	1:0	100	100	100	100	90	100						
		1:1	100	100	85	95	95	100						
		2:1	100	100	100	95	85	100						
		3:1	100	100	65	95	100	100						
		6:1	100	100	100	100	100	100						
		8:1	100	100	95	100	100	100						
	SAND	0:1	55	95	5	70	85	70						
FIREBAN	MAFES	1:0	55	100	100	100	75	70						
		1:1	90	90	75	100	55	100						
		2:1	95	100	100	75	85	75						
		3:1	85	65	40	50	30	100						
		6:1	95	50	90	90	75	100						
		8:1	95	65	95	95	70	100						
	FLOWER-WOOD	1:0	100	50	100	85	75	100						
		1:1	100	100	100	95	80	60						
		2:1	100	40	100	15	95	100						
		3:1	100	85	100	100	40	100						
		6:1	100	70	100	95	85	100						
		8:1	100	100	95	100	95	100						
	SAND	0:1	100	100	100	100	100	100						
CHECK	SAND		0	5	0	0	0	20						
	FLOWER-WOOD		10	10	5	20	5	30						
	MAFES		10	5	0	30	0	0						

* non-sand component:sand

PROJECT NO: FA01G085

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

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Numerous prior studies conducted by this laboratory have conclusively shown that the residual activity of chlorpyrifos, regardless of formulation, is media dependent (Callcott et al. 1995). Similar effects have been observed when suSCon Green is incorporated into a limited number of media (McAnally 1995). In that study, suSCon green incorporated into the media at 400ppm was active against alate IFA queens for 24 months in MAFES potting media versus only 3 months in Grace Sierra media. Theoretically, it may be possible to compile a list of media in which suSCon Green can be expected to provide the 1ong residual activity required of an effective IFA quarantine treatment. Some growers might then opt to use a given media treated with suSCon green in lieu of other treatment options.

MATERIALS AND METHODS:

Potting media from 10 different sources (commercial nurseries that custom blend their own media, bulk media from firms that sell media, and commercially bagged media) were acquired. Exact media composition was not available for all mixes, especially the commercially pre-bagged mixes (Table 6). suSCon Green was incorporated into each media at a rate of 400 ppm based on the dry weight bulk density of the media. Certain characteristics of each media including pH, % organic matter, bulk density, ion exchange capacity, etc. was determined by the Mississippi State University Soil Testing Laboratory (Mississippi State, MS). After treatment. media was placed in one-gallon plastic nursery containers and weathered outdoors under simulated nursery conditions (black groundcloth culture, overhead pulsating irrigation system). At monthly intervals, three pots from each treatment were destructively sampled and subjected to a standard alate queen bioassay (Appendix II).

RESULTS:

Results to date show 4 months of residual activity in Wight potting media (Table 7). The Mobile and Mafes media have produced 100% efficacy through 14 and 15 months respectively. All other media gave at least one month of activity.

Soil analyses indicate that high hydrogen ion content in the soil, and thus low pH, is very important in the prolonged activity of chlorpyrifos (Table 8). Past trials investigated the role of the pH of the irrigation water on chlorpyrifos degradation (1990 IFA Annual Report - FA01G079), but not the pH of the media itself. The technical data sheet for Dursban® insecticides (Form No. 134-289-R585, Dow Chemical U.S.A., Agric. Prod. Dept., Midland, MI) shows a negative relationship between pH of water and half-life of chlorpyrifos in water (pH 7, half-life 35 days; pH 5, half-life 63 days). However, it does not address the effect of soil pH on the half-life of the insecticide in soil. In this trial, when soil pH exceeded 7.0, chlorpyrifos was no longer effective against IFA. Apparently soil pH should be below 6 for chlorpyrifos to be effective as a long term residual treatment. However, if low soil pH is necessary for IFA control with chlorpyrifos in containerized nursery stock, this will not be an acceptable option for nursery growers since most amend their media to a pH of ca. 7 for plant health.

Table 6. Composition and Producer of Various Media Mixes.

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

Table 7. Residual Activity of suSCon Green 10CR in Various Potting Media.

TREATED SOIL

Media Type	% Mortality to Alate Females at Indicated Mths PT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAFES	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Mobile	100	100	100	100	100	100	100	100	100	100	100	100	100	100	80
Wight	100	100	100	100	65	35	--	--	--	--	--	--	--	--	--
Flowerwood	100	100	55	50	45	--	--	--	--	--	--	--	--	--	--
Reliable Potting	100	45	25	--	--	--	--	--	--	--	--	--	--	--	--
Montage Blend	100	25	40	--	--	--	--	--	--	--	--	--	--	--	--
Florida Peat	100	55	50	--	--	--	--	--	--	--	--	--	--	--	--
Fafard	100	15	25	--	--	--	--	--	--	--	--	--	--	--	--
ProMix	100	95	75	0	5	--	--	--	--	--	--	--	--	--	--
MetroMix	100	25	100	0	10	--	--	--	--	--	--	--	--	--	--

Table 7. Cont.

CHECK SOIL

Media Type	% Mortality to Alate Females at Indicated Mths PT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAFES	25	10	10	0	5	10	5	0	10	5	25	5	30	10	0
Mobile	30	0	20	5	10	10	5	20	5	15	5	0	25	15	40
Wight	90	45	0	50	0	0	--	--	--	--	--	--	--	--	--
Flowerwood	35	0	10	5	10	--	--	--	--	--	--	--	--	--	--
Reliable Potting	0	15	35	--	--	--	--	--	--	--	--	--	--	--	--
Montage Blend	20	15	20	--	--	--	--	--	--	--	--	--	--	--	--
Florida Peat	0	10	10	--	--	--	--	--	--	--	--	--	--	--	--
Fafard	0	5	5	--	--	--	--	--	--	--	--	--	--	--	--
ProMix	0	10	5	0	0	--	--	--	--	--	--	--	--	--	--
MetroMix	5	10	5	5	0	--	--	--	--	--	--	--	--	--	--

Table 8. Presence of Hydrogen in the Media As Indicated by Various Soil Analyses.

Media Type	Presence of Hydrogen at Indicated Months Post treatment								
	pH			CEC (meq/100 g)			% Base Saturation		
	0	3	6	0	3	6	0	3	6
MAFES	4.0	5.3	5.4	10.4	7.0	5.2	79.0	65.6	82.93
Mobile	4.3	5.0	5.8	5.9	4.8	2.9	56.9	58.2	45.96
Wight	6.0	6.9	7.8	1.5	1.6	0.0	19.0	14.7	0.0
Flowerwood	5.8	6.7	7.5	2.4	2.1	0.0	14.9	14.9	0.0
Reliable Potting	5.8	7.7	7.8	1.2	0.0	0.0	6.2	0.0	0.0
Montage Blend	6.5	7.7	8.1	0.3	0.0	0.0	1.5	0.0	0.0
Florida Peat	6.8	8.1	8.0	0.4	0.0	0.0	2.9	0.0	0.0
Fafard	5.7	8.1	8.2	0.6	0.0	0.0	7.2	0.0	0.0
ProMix	6.1	7.3	8.3	1.5	0.0	0.0	11.7	0.0	0.0
MetroMix	6.6	7.3	8.2	0.0	0.0	0.0	6.5	0.0	0.0

PROJECT NO: FA01G135

PROJECT TITLE: Residual Activity of Cyfluthrin on Various Carriers

TYPE REPORT: Final

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

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

MATERIALS AND METHODS:

Olympic Horticultural Products provided cyfluthrin on various carriers (Table 9). Each formulation was blended into standard lab potting media (3:1:1, pine bark: peat moss: sand) using portable electric cement mixers. The rate of application for all formulations was 100 ppm. Due to limited amounts of formulations available, different quantities of treated media were available for testing. The formulations therefore were evaluated for different time periods.

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

RESULTS:

The formulation coded "CB" provided excellent control through 6 months post-treatment, while the SB and UB formulations provided excellent control through 9 months. The KB and Bentonite formulations provided excellent control through 10 months (Table 9). All formulations may have provided control for

longer periods of time, but it was necessary to terminate the trial based on limited quantities of test formulations, as mentioned above. Each formulation was still providing excellent control when available material for testing was exhausted.

Table 9. Efficacy of Cyfluthrin on Different Carriers Incorporated into Standard Nursery Potting Media at 100 ppm.

FORMULATION (Carrier)	% Mortality at Indicated Months Post-treatment									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bentonite	100	100	100	100	100	100	100	100	100	100
KB (potassium prills)	100	100	100	100	100	100	100	100	100	100
SB (sand)	100	100	100	95	100	100	100	100	100	---
CB (cob base)	100	100	100	100	100	100	---	---	---	---
UB (urea base)	100	100	100	100	100	100	100	100	100	---
Untreated Check	25	10	5	0	15	5	0	0	10	15

PROJECT NO: FA01G016

PROJECT TITLE: Preliminary Testing of Organic Solutions™ Multipurpose Fireant Killer for Use as a Containerized Nursery Stock Treatment

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally and Kirk Irby

INTRODUCTION:

Organic Solutions™ (San Antonio, Texas) produces a dust formulation that contains pyrethrins (0.1%), piperonyl butoxide (1.0%), and silicon dioxide (83.3%) as the active ingredients. At this time the product is promoted for homeowner control of IFA as a dust or drench treatment. The label directs the user to "dust the perimeter of the mound first. With a stick, disturb the mound, then dust the mound in a circular motion working toward the center until the entire mound is thoroughly dusted." The drench treatment is applied using 6 oz. of product per gal. of water (1 gal. of drench per 12-14" dia. mound). The company is interested in the possible use of this product as a containerized stock treatment in the Federal IFA quarantine.

MATERIALS AND METHODS:

Preplant incorporation treatment:
Organic Solutions Fireant Killer™ was incorporated into the standard laboratory MAFES potting media at rates of 1, 2, 6, 10, 100 and 200 ppm based on the 0.1% pyrethrins as the active ingredient. Pots filled with treated media were weathered outdoors under simulated nursery conditions. A pulsating overhead irrigation system supplied ca 1-1½" water per week. On a monthly basis, three pots from each treatment group were composited, brought to the laboratory and subjected to standard IFA alate female bioassay.

Containerized drench treatment:
The product was used to drench 1 gal. nursery pots containing the standard laboratory MAFES potting media at a rate of 17.0g material per pot (equivalent to 0.6 oz per "mound" as stated on label). The drench solution was applied at a rate of 400 mls of finished solution per container. Pots were weathered as

above. Bioassays were performed at 1, 2, 4, and 8 weeks after treatment.

Elimination of established colonies:
One gal. nursery pots were filled with MAFES media and placed on a brick in a 12" x 18" x 5" plastic pan. The sides of the pan were talced and ca. 1" of water was added to prevent escape. A hole 1½" from the bottom of the pan allowed excess water to drain. Five replicates were utilized. Field collected colonies were separated from their nest tumulus by the floatation method (Banks et al. 1981) and 50 cc of workers and brood were added to each media-filled pot. The fragmented colonies were allowed to acclimate 3-5 days before treatment. Organic Solutions Fireant Killer at a rate of 17.0g per pot was used to drench each container (400 ml finished solution per container). Containers were watered twice a week, or as needed for the duration of the trial. Pots were inspected daily for mortality and were considered dead when less than 20 workers were present.

Repellency determination:
At monthly intervals (beginning at four months post-treatment), 1 pot each from the 6, 10, 100, & 200 ppm incorporated treatments was placed in 2' X 8' test arenas along with untreated check pots so that each arena contained one treated and one untreated pot at opposite ends. A freshly collected field colony with nest tumulus was evenly spread over the bottom of the test arena. Sides of the arenas were talced to prevent escape. Colonies were allowed 7 days to move into either the treated or check pots. Estimations of the percentage of the colony that moved into each pot were made on a daily basis.

RESULTS:

Preplant incorporation treatment:
The 200 ppm rate produced 100% mortality through three months post-treatment and began to decline thereafter (Table 10). The 100 ppm rate provided 100% mortality through two months. All other rates failed to provide more than 65% mortality at any time and were dropped from the test after two months.

Containerized drench treatment:
Drench treatment provided 65% mortality at one week post-treatment, 30% mortality at 2 and 4 weeks post-treatment and 5% at 8 weeks post-treatment.

Elimination of established colonies:
Drench of existing colonies eliminated 75-80% at 24 hours post-treatment and 100% within 5 days post-treatment.

Repellency determination:
Results shown in Table 11 indicate estimated percentage of ants moved into each pot at 7 days post-exposure. Rates of 6 and 10 PPM have no apparent effect on colony movement. Rates of 100 and 200 PPM effectively prevented movement into treated pots at 4 and 5 months post-treatment and 200 PPM prevented movement at 6 months. However, by month 7 approximately 50% of the test colony had invaded the 200 PPM pot. By months 8 and 9, it appears that the ants moved into treated pots.

Table 10. Residual Activity of Organic Solutions Incorporated into Potting Media.

Rate of Application	Percent mortality at indicated months post-treatment									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1 PPM	0	5	---	---	---	---	---	---	---	---
2 PPM	5	0	---	---	---	---	---	---	---	---
6 PPM	15	10	---	---	---	---	---	---	---	---
10 PPM	65	15	---	---	---	---	---	---	---	---
100 PPM	100	100	80	25	35	10	0	15	10	0
200 PPM	100	100	100	95	85	75	80	10	25	10
CHECK	0	0	5	10	15	15	10	5	0	0

Table 11. Efficacy of Organic Solutions as a Repellant when Incorporated into Potting Media.

Treatment Rate	Estimated percentage of Ants in Pots @ Indicated Post-Treatment Interval (months)													
	(4)		(5)		(6)		(7)		(8)		(9)		(10)	
	TR	CK	TR	CK	TR	CK	TR	CK	TR	CK	TR	CK	TR	CK
6 PPM	50	50	0	100	100	0	5	95	100	0	---	---	---	---
10 PPM	0	100	100	0	100	0	10	90	100	0	---	---	---	---
100 PPM	0	100	0	100	90	10	100	0	100	0	10	90	75	25
200 PPM	0	100	0	100	0	100	50	50	75	25	0	100	25	75

PROJECT NO: FA01G056

PROJECT TITLE: Preliminary Testing of Organic Plus Multipurpose Fireant Killer for Use as a Containerized Nursery Stock Treatment

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Organic Plus Inc. (Albuquerque, NM) produces a dust formulation that contains pyrethrins (0.2%), piperonyl butoxide (1.1%). and silicon dioxide (97.9%) as the active ingredients. This product is labelled for homeowner control of IFA as a drench treatment. The label directs the user to "drench both the mound and the area within six inches of the mound" using 1 pound of product per 25 gal. of water or 4 tablespoons per gal. of water (1 gal. of drench per mound). The company is interested in the possible use of this product as a containerized stock treatment in the Federal IFA Quarantine Program.

MATERIALS AND METHODS:

Preplant incorporation treatment:
Organic Plus™ Fireant Killer was incorporated into the standard laboratory MAFES potting media at rates of 1, 2, 6, 10, 100 and 200 ppm. Pots filled with treated media were weathered outdoors under simulated nursery conditions. A pulsating overhead irrigation system supplied ca 1-1½" water per week. On a monthly basis, three pots from each treatment group were composited, brought to the laboratory and subjected to standard IFA alate female bioassay.

Containerized drench treatment:
The product was used to drench 1 gal. nursery pots containing the standard laboratory MAFES potting media at a rate of 1.97 grams per container (approximately 3 ppm). The drench solution was applied at a rate of 400 mls of finished solution per container. Pots were weathered as above. Bioassays were performed at 1, 2, 4, and 8 weeks after treatment.

Elimination of established colonies:
One gal. nursery pots were filled with MAFES media and placed on a brick in a

12" x 18" x 5" plastic pan. The sides of the pan were talced and ca. 1" of water was added to prevent escape. A hole 1½" from the bottom of the pan allowed excess water to drain. Five replicates were set up. Field collected colonies were separated from their nest tumulus by the floatation method (Banks et al. 1981) and 50 cc of workers and brood were added to each media-filled pot. The fragmented colonies were allowed to acclimate 3-5 days before treatment. Organic Plus Fireant Killer at a rate of 1 pound per 25 gallons of water (18.2 grams per gallon) was used to drench each container (400 ml finished solution per container). Containers were watered twice a week, or as needed for the duration of the trial. Pots were inspected daily for mortality and were considered dead when less than 20 workers were present.

Repellency determination:
At monthly intervals (beginning at four months post-treatment), 1 pot each from the 6, 10, 100, & 200 ppm incorporated treatments was placed in 2' X 8' test arenas along with untreated check pots so that each arena contained one treated and one untreated pot at opposite ends. A freshly collected field colony with nest tumulus was evenly spread over the bottom of the test area. Sides of the arenas were talced to prevent escape. Colonies were allowed 7 days to move into either the treated or check pots. Estimations of the percentage of the colony that moved into each pot were made on a daily basis.

RESULTS:

Preplant incorporation treatment:
The 200 ppm rate produced 100% mortality through three months post-treatment and began to decline thereafter (Table 12). The 100 ppm rate provided 100% mortality through two months. All other rates failed to provide more than 45% mortality at any time and were dropped from the test after two months.

Containerized drench treatment:
The drench treatment provided 0% mortality at one week post-treatment, 5% mortality at 2 weeks post-treatment, 0% mortality at 4 weeks post-treatment, and 5% mortality at 8 weeks post-treatment.

Elimination of established colonies:
The drenching of existing colonies provided 75% mortality at 24 hours post-treatment and 90% at 48 hours through 1 week post-treatment.

Repellency determination:
Results shown in Table 13 indicate estimated percentage of ants that moved into each pot at 7 days post-exposure. Rates of 100 and 200 PPM effectively prevented movement into treated pots at 4 and 5 months post-treatment, however, by month 6 approximately 5% of the test colonies had invaded the bottom portion of the pots. By 7-9 months 25-50% of the colonies were moving into the treated pots.

Table 12. Residual Activity of Organic Plus Incorporated into Potting Media.

Rate of Application	Percent mortality at indicated months post-treatment								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1 PPM	5	5	---	---	---	---	---	---	---
2 PPM	5	5	---	---	---	---	---	---	---
6 PPM	25	15	---	---	---	---	---	---	---
10 PPM	45	20	---	---	---	---	---	---	---
100 PPM	100	100	45	30	25	65	20	30	20
200 PPM	100	100	100	80	85	70	55	45	55
CHECK	5	10	5	10	10	15	0	5	10

Table 13. Efficacy of Organic Plus as a Repellant when Incorporated into Potting Media.

Treatment Rate	Estimated percentage of Ants in Pots @ Indicated Post-Treatment Interval (months)													
	(4)		(5)		(6)		(7)		(8)		(9)		(10)	
	TR	CK	TR	CK	TR	CK	TR	CK	TR	CK	TR	CK	TR	CK
6 PPM	50	50	0	100	95	5	100	0	100	0	---	---	---	---
10 PPM	100	0	0	100	0	100	100	0	100	0	---	---	---	---
100 PPM	0	100	0	100	5	95	50	50	25	75	50	50	95	5
200 PPM	0	100	0	100	5	95	25	75	25	75	25	75	50	50

PROJECT NO: FA01G086

PROJECT TITLE: Evaluation of Candidate Potting Media Toxicants, 1996

TYPE REPORT: Interim

LEADER/PARTICIPANT(s): Lee McAnally

INTRODUCTION:

An ongoing screening program to evaluate insecticides for use as quarantine treatments for nursery potting media has been conducted by the IFA Station since 1974. This trial tested a 0.1% granular formulation of deltamethrin produced by AgrEvo USA.

MATERIALS AND METHODS:

The product was blended into nursery potting soil (MAFES mix, 750 pounds per cubic yard). A portable cement mixer (2 cu ft capacity) was used to blend the toxicant into the potting media, and was operated for 15 minutes per batch to insure thorough blending. Treated media was then poured into one-gallon capacity plastic pots and weathered outdoors under simulated nursery conditions. Treatment rates used were 10, 20, 30, and 40 ppm.

A pulsating overhead irrigation system supplied ca 1-1½" water per week. At monthly intervals, 3 pots from each treatment were composited and subjected to alate queen bioassay.

RESULTS:

The 10 ppm rate showed some variability at 3 months post-treatment. All other rates maintained 100% efficacy through 6 months post-treatment (Table 13), and the trial is still on-going.

Table 14. Residual Activity of Deltamethrin Granule.

Rate of Application (ppm)	Mean % mortality to alate females at indicated months PT					
	(1)	(2)	(3)	(4)	(5)	(6)
10	95	100	95	80	95	85
20	100	100	100	100	100	100
30	100	100	100	100	100	100
40	100	100	100	100	100	100
Check	10	15	10	0	5	0

PROJECT NO: FA01G026

PROJECT TITLE: Residual Activity of Silafluofen Drench

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Lee McAnally

INTRODUCTION:

Drench trials are a part of the ongoing search for new and/or better toxicants for use in the IFA quarantine program. While granular incorporation treatments are commonly used by large nurseries which routinely ship outside the quarantine area, drench treatments are used by smaller nurseries which ship limited quantities of plant material outside the quarantine area. We routinely test new compounds and products not currently registered for IFA use. Silafluofen is a relatively new product by AgrEvo Environmental Health (Montvale, NJ). We tested silafluofen earlier as a drench and obtained 100% efficacy for 6 mths at rates of 1,300, 6,500 and 13,000 ppm (FA01G074). A later test at rates of 5, 10, 15 & 25 ppm produced 30% efficacy or less (FA01G115). This trial was set up to test rates between the first and second trials.

MATERIALS AND METHODS:

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

The formulation evaluated in this trial was an 80% EC formulation (800 g AI/L). Rates of 50, 100, 200. 300 and 500 ppm were tested.

RESULTS:

As indicated in Table 15, the 50 ppm rate was effective through 3 months. The

100 ppm rate obtained 100% efficacy through 4 months and at 6 & 7 months posttreatment. Rates of 200 ppm and above are still at 100% efficacy through 11 months.

Table 15. Efficacy of Silafluofen as a Containerized Drench Treatment.

Rate of Application (ppm)	Mean % mortality to alate females at indicated months Post-Treatment										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
50	100	100	100	75	40	95	35	70	50	45	90
100	100	100	100	100	85	100	100	45	55	90	70
200	100	100	100	100	100	100	100	100	100	100	100
300	100	100	100	100	100	100	100	100	100	100	100
500	100	100	100	100	100	100	100	100	100	100	100
untreated check	0	15	5	10	20	5	5	0	5	5	25

PROJECT NO: FA01G155

PROJECT TITLE: Evaluation of Spin Out® Technology in Combination with Insecticides as a Quarantine Procedure for Containerized Nursery Stock.

TYPE REPORT: Interim

PROJECT LEADER: Anne-Marie Callcott, Lee McAnally and Randy Cuevas

INTRODUCTION:

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

MATERIALS AND METHODS:

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

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

In January, 1996, Griffin Corporation supplied us with the Spin Out product containing 0.1% tefluthrin. This mixture was applied with a paint brush to the interior of 25 pots. Pots were filled with media, aged and periodically bioassayed as described above.

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

Bioassay - partitioning of bifenthrin between Spin Out coating and potting media: To determine whether partitioning of bifenthrin between the Spin Out coating and the potting media was occurring, a second bioassay was performed beginning at 15 months after treatment. Media from each bifenthrin treated pot was placed in a new untreated pot. Untreated MAFES media was placed in the now empty Spin Out/bifenthrin treated pot. Each newly matched pair was bioassayed as described above.

Bioassay - invasion by "newly mated" queens: To determine whether Spin Out/bifenthrin treated pots could prevent a newly mated queen from founding an

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

incipient colony, a trial simulating a newly mated queen flying into the top of a pot was initiated. Nursery pots from the original set of bifenthrin treated pots described above (0.25% AI, 0.5% AI, and 1.0% AI) were filled with potting media on December 4, 1996, and placed in a simulated can yard with irrigation for 4-6 days. Due to the time of year, and the difficulty in collecting newly mated females, we collected fertile queens from polygynous colonies in Hancock County, MS, along with workers from the same colonies. Since mature, mated queens do not have a reserve of wing muscle for a nutrient source, workers to tend her in our trial were necessary. One fertile female, along with approximately 100 workers, was introduced into each test nursery pot. Treatments included three bifenthrin rates, one Spin Out treatment, and one untreated check. There were four replicates per treatment. Pots were watered as needed. Meal worm larvae or peanut butter was placed near the drain holes of each pot twice a week. Treatments were observed daily for the first week and then twice weekly thereafter for an additional ??? weeks. Observations included noting feeding habits, worker activity, mortality, movement out of the pot, etc.

RESULTS:

Bioassay - prevention of whole colony infestation: All rates of bifenthrin in the Spin Out technology have successfully prevented RIFA infestation in nursery pots for 14 months (Table 16). The Spin Out technology without an insecticide does not exclude RIFA. Tefluthrin has successfully prevented IFA infestation for 11 months, although a few workers (<30) were found under the tefluthrin treated pot at 11 months. These preliminary results demonstrate the potential for Spin Out technology as a quarantine treatment for containerized plants. Additional studies on a larger scale will be initiated in the spring of 1997.

Bioassay - partitioning of bifenthrin between Spin Out coating and potting media: At 15 months after treatment, ants did not readily move into the Spin Out pot or the media from a Spin Out pot, and 50-75% of the ants died. However, after 7 days, some ants had moved into the center of the "clean" pots filled with "treated" media (media originally in treated Spin Out pot) from the 0.25 and 1.0% rates (1000 and 500 ants, respectively). These ants did not inhabit the entire pot as is normal, nor did they respond to outside stimuli

such as watering, or tapping on the pot. As previously stated, they had moved into the center of the media from the Spin Out treated pots. No ants invaded the Spin Out treated pots which had been refilled with fresh media.

The position of the ants in the media suggests that some bifenthrin leached into the outer edges of the media, but did not penetrate into the center of the media. Media from the Spin Out treated pots was inverted into the clean pots for this trial, meaning that the original top of the media was now on the bottom of the new pot. Therefore, ants were able to move into the media through the bottom of the pot through the media that had not been in direct contact with the bifenthrin treated Spin Out coating. Ants exposed to all rates avoided the original Spin Out treated pots.

Bioassay - invasion by "newly mated" queens: Trial was initiated on December 10, 1996. Observations are underway at this time.

Table 16. Efficacy of bifenthrin and tefluthrin combined with Spin Out technology in preventing RIFA infestation of treated nursery pots. (each treatment is paired with its corresponding untreated check)

Treatment	% AI	number of ants infesting pot at indicated mths PT*													
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Bifenthrin	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Check	---	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Bifenthrin	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Check	---	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Bifenthrin	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Check	---	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Spin Out	7.1	2000	2000	2000	2000	0	0	2000	0	0	0	<100	0	0	5000
Check	---	2000	2000	2000	2000	*	*	2000	*	*	*	5000	*	*	0
Tefluthrin	0.1	0	0	0	0	0	0	0	0	0	0	<30			
Check	---	*	*	*	*	*	*	*	*	*	*	5000			

* entire colony infested untreated check pot

PROJECT NO: FA01G055

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

TYPE REPORT: Final

COOPERATORS: Crop Care Ltd. (Brisbane, Australia) and Harrison County Farm

PARTICIPANTS: Homer Collins, Avel Ladner, and Randy Cuevas

INTRODUCTION:

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

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

MATERIALS AND METHODS:

Test site for this study was the County Farm Property which is owned and maintained by the Harrison County, Mississippi Sheriff's Department. Plots consisted of rows 6' wide x 50' long. Each plot was thoroughly disked (tilled) to prepare a seed bed. A furrow ca. 12" x 12" deep was then opened with a moldboard plow, and "liners" of various species of woody ornamental were planted at 36" intervals along each plot. suSCon Green was applied to four plots (replicates) at a rate equivalent to 4 lbs AI/acre while four other plots served as untreated controls. suSCon Green granules were applied in a 12" band 2" below the set, and then covered with 4-5" of soil which was

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

RESULTS:

No fire ant colonies were detected in treated plots at 3 and 6 months posttreatment. Untreated control plots contained 2 colonies at 3 months posttreatment, and 5 colonies at 6 months. By 9 months posttreatment, all plots treated with suSCon Green were infested with one or more active IFA nests. These results indicate that short term control of IFA can be achieved with suSCon Green applied in furrow at planting. However, since longer term control is needed for a successful quarantine treatment for B & B nursery stock, this study was terminated.

PROJECT NO: FA01G116

TITLE: Evaluation of Surface Applied Granular Insecticides for Quarantine Treatment of Red Imported Fire Ants in Field Grown Nursery Stock

TYPE REPORT: Interim

LEADERS/PARTICIPANTS: Homer Collins, Avel Ladner, Charlene Hebert, and Lee McAnally

COOPERATORS: Windmill Nurseries, Inc., Folsom. LA, Harrison County Farm, Gulfport, MS

INTRODUCTION:

Nursery stock and other regulated articles cannot be shipped outside the quarantined area unless treated with an approved insecticide (7 CFR Ch III (1-1-95 edition. § 301.81). Balled and burlapped plants can be immersed in a chlorpyrifos solution or subjected to a twice daily spray-on with chlorpyrifos for three consecutive days. The immersion process is labor intensive and disruptive to the root ball. The spray-on treatment is also labor intensive and somewhat impractical. A simple, cost effective, and practical treatment is needed to enable growers to ship non-infested plants outside the quarantined area.

Numerous granular formulations of common insecticides such as diazinon. chlorpyrifos, acephate, and others are labelled for spot treatment of imported fire ant colonies. Talstar T & O Granular (0.2% bifenthrin) can be applied broadcast to turfgrass and nursery crops for control of imported fire ants under sln labelling (§ 24c FIFRA as amended), in Georgia and Florida. Rate of application is 100-200 1bs formulated product per acre. Talstar T & O Granular is in general use in most nurseries because it is also labelled for incorporation into nursery potting media as a fire ant quarantine treatment for containerized nursery stock. We evaluated 1% granular Dursban® (Hi-Yield@ Kill-a-Bug Lawn Granules), Orthene® 75S, and Talstar T & O Granular at various rates of application for quarantine treatment of B & B nursery stock.

MATERIALS AND METHODS:

Test I - Windmill Nursery, Folsom, LA. (Nov. 5, 1996): A twenty acre

planting of field grown nursery stock (Crepe Myrtles, approximately 2' in height) was closely inspected for presence of live fire ant colonies. Ants typically nest adjacent to the trunks of woody ornamentals which are grown on raised beds. Nests are less commonly located away from the trunks in areas such as the "middles", or between plants on the row. When a nest in direct contact with the trunk or roots was detected, the plant was marked with an engineering flag, and the nest was rated on the population index scale described by Lofgren and Williams (1982). All marked plants were then treated. Treatments evaluated included three rates of Talstar T & O, plus an untreated check. Each treatment was replicated 10 times. Rates tested were 200, 100, and 50 lb formulated material per acre. Treatments were applied with a shaker can in a circular pattern beginning at the trunk of each infested plant and extending outward to the drip line (ca. 12.5 ft^2).

Treatments were evaluated at 2, 7, 14, and 21 days after application. Evaluation consisted of a re-examination of each previously marked and treated fire ant nest (replicate) to determine if the nest remained active. Again, all active nests were rated on the population index scale at each posttreatment rating interval. Inactive nests, whether the colony had succumbed to the treatment or simply relocated to a new site, were rated as "0". Data for each posttreatment rating interval were analyzed by ANOVA and treatment means separated by LSD test.

Test II - Harrison County Farm, Gulfport, MS. (Nov. 5, 1996):
Procedures described above were essentially repeated except the test site was an open, mowed field located at the Harrison County Farm. Individual IFA nests were marked with a stake prior to treatment. Talstar Granular was applied at rates of 200, 100, and 50 lbs of formulated material per acre to a two foot diameter circular area around each replicate (nest). There were 24 replicates per treatment.

Test III - Windmill Nursery, Folsom, LA. (Nov. 19, 1996):
Procedures described above were used to evaluate labelled rates of application of Orthene and Dursban. Rates of application were two teaspoons of orthene and 2 ounces (56.7g Dursban per mound), with 10 replicates per treatment.

Test IV - Harrison County Farm, Gulfport, MS. (Nov. 20, 1996)
Procedures described above were used to evaluate labelled rates of application of Orthene and Dursban. Rates of application were two teaspoons of orthene and 2 ounces (56.7g Dursban per mound), with 24 replicates per treatment.

RESULTS AND DISCUSSION:

Test I - Windmill Nursery, Folsom, LA
Treatments were applied on November 5, 1996. Air and soil temperature were 71°F and 70°F, respectively at the time of application. Talstar T & O Granular applied at a rate of 200 lb/acre (2g/ft^2) resulted in an 94.8% reduction in the pretreatment population index 2 d after application (Table 17). By 21 d after application a 100% reduction in the pretreatment population was achieved with all applications.

Table 17. Efficacy of Talstar T & O Granular as a quarantine treatment for field grown nursery stock

Treatment	Pretreat Pop. Index†	% Change in Pretreat Pop. Index at indicated days posttreatment			
		(2)	(7)	(14)	(21)
200 lb/acre	17.0	-94.8a	-99.2a	-100a	-100a
100 lb/acre	15.0	-98.0a	-90.0a	-93.3a	-100a
50 lb/acre	14.5	-73.3a	-83.3a	-94.3a	-100a
Untreated Check	16.0	0.0b	-30.0b	-34.0b	-54.0b

† mean based on 10 replicates

Test II - Harrison County Farm, Gulfport, MS

Air and soil temperatures were 82°F and 72°F, respectively at the time of application. All rates of application provided 100% control or colony relocation by 21 d after treatment, but in general, lower rates of application required more time to reach this level of control (Table 18).

Table 18. Efficacy of Talstar T & O Granular as a quarantine treatment for field grown nursery stock

Treatment	Pretreat Pop. Index†	% Change in Pretreat Pop. Index at indicated days posttreatment			
		(2)	(7)	(14)	(21)
200 lb/acre	13.5	-51.5a	-58.5a	-100a	-100a
100 lb/acre	17.5	-43.1ab	-53.2a	-97.5a	-100a
50 lb/acre	13.3	-18.4bc	-25.3ab	-99.9a	-100a
Untreated Check	15.6	-5.3c	-5.3b	-30.1b	-27.8b

† Mean based on 24 replicates

Test III - Windmill Nursery, Folsom, LA

Air and soil temperatures were 75°F and 70°F, respectively at the time of application. Both Orthene 75S and 1% Dursban granules were highly effective in eliminating treated IFA colonies. Both treatments were 100% effective within 7 days of application (Table 19).

Table 19. Efficacy of Orthene 75S and Dursban 1% Granular in causing colony mortality or relocation.

Treatment	Pretreat Pop. Index†	% Change in Pretreat Pop. Index at indicated days posttreatment			
		(2)	(7)	(14)	(21)
Orthene 75S	13.5	-93.3a	-100a	-100a	-100a
Dursban 1G	15.5	-51.8b	-100a	-100a	-100a
Untreated Check	14.5	0.0c	8.0b	-3.7b	1.3b

† Mean based on 10 replicates

Test IV - Harrison County Farm, Gulfport, MS.

As shown in Table 20, Orthene was very effective in eliminating treated IFA colonies. Dursban 1G did not perform as well in this trial as it did in the previous trial.

Table 20. Efficacy of Orthene 75S and Dursban 1% Granular in causing colony mortality or relocation.

Treatment	Pretreat Pop. Index†	% Change in Pretreat Pop. Index at indicated days posttreatment			
		(2)	(7)	(14)	(21)
Orthene 75S	15.0	-100a	-100a	-100a	-100a
Dursban 1G	15.0	-46.5b	-83.3b	-83.3b	-91.7a
Untreated Check	14.0	4.2c	2.8c	2.8c	5.9b

† Mean based on 24 replicates

DISCUSSION:

Imported fire ant colonies readily respond to any insecticide application made directly to the nest by relocating the colony (Collins & Callcott 1995, Hays et al. 1982, Franke 1983, Williams & Lofgren 1983). This insecticide induced movement is usually over a relatively short distance (1.5 to 3.0 meters), but can be greater (personal observation). The objective of a quarantine treatment for field grown nursery stock is to render the plants fire ant free. Therefore, it does not matter if colonies are killed outright by the treatment or simply induced to move away from the root ball of plants intended for harvest. The results of these preliminary trials indicate that Orthene 75S, and Talstar T & O are effective in eliminating active IFA colonies from treated nests and could possibly be used as a quarantine treatment for field grown nursery stock. Since Orthene 75S is already labelled for spot treatment of individual IFA nests, we plan to conduct additional trials with this product under varying climatic conditions in 1997.

ACKNOWLEDGEMENTS:

We thank Anne-Marie Callcott for providing statistical analysis of raw data.

PROJECT NO: FA05G055

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

TYPE REPORT: Interim

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

INTRODUCTION:

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

MATERIALS & METHODS:

Blueberries/treatments were established in April 1995 as shown in Table 21. Plot design for the Biobarrier treatment is shown in Table 22. Plants were spaced ca. 1.0 m apart. Peatmoss was incorporated into the plantings with the exception of the Tung Press Cake treatment. Post planting treatments of Ridomil and Subdue were applied in the spring of 1996. Plants were visually rated for phytophera root rot symptoms every 3 months and were assayed for the

presence of *Phytophera cinammoni* every 6 months. Fire ant populations were determined every 6 months.

RESULTS:

At 18 months post-planting, the presence of fire ant colonies was indicated within four untreated plots: Misty-None; Misty-Ridomil Post; Gulfcoast-Ridomil Post; & Tifblu Tungcake. All but the Misty-None were located on raised beds. No sign of fire ant activity was indicated in the Biobarrier plots.

Table 21. Phytophera Root Rot/Fire Ant Experimental Protocol.

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

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

Table 22. Phytophera Root Rot Study Biobarrier Plot Protocol.

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

PROJECT NO: FA05G075

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

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Timothy C. Lockley and Lee McAnally

INTRODUCTION:

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

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

MATERIALS AND METHODS:

PROJECT I:

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

PROJECT II:

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

RESULTS:

PROJECT I:

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

PROJECT II:

At 18 months post planting, no fire ant activity has been observed at any of the plants contained in the Biobarrier bags. Examinations will continue for until May 1997.

SECTION II

DEVELOPMENT OF QUARANTINE TREATMENTS FO GRASS SO

PROJECT NO: FA01G066

PROJECT TITLE: Evaluation of Candidate Chemicals for Control of IFA in Commercial Grass Sod, 1996.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, Avel Ladner, Lee McAnally, Tim Lockley and Charlene Hebert

COOPERATOR(S): Jack Allegri, Woerner Turf Farm, Elberta, AL

INTRODUCTION:

Currently, the only product available for certification of grass sod under the Federal IFA Quarantine is Dursban® 50-WP, which is applied at a rate of 8 lbs AI/acre. Therefore, our laboratory continuously investigates other products to add to this use pattern. In 1996, we tested three candidate insecticides for use on grass sod. Fipronil is a relatively new product produced by Rhone-Poulenc Ag. Co. (Research Triangle Park, NC), and is presently marketed in the U.S. for control of mole crickets in sod when applied with a granular slit applicator. Last year, in an unreplicated trial, suSCon® on a starch carrier (10% chlorpyrifos - Crop Care. Brisbane, Australia) showed promising results. Talstar® (FMC Corp., Princeton, NJ) granular and flowable formulations have also shown excellent results in previous trials conducted by this laboratory (FA01G063, FA01G065). Fipronil 0.1G, suSCon 10G, and Talstar granular and flowable were evaluated in 1996.

MATERIALS AND METHODS:

Woerner Turf Farms in Elberta, AL was the site for this trial. All treatments were applied to one-acre test plots on July 2, 1996. Air temperature ranged from 82-92°F and the soil temperature ranged form 75-80°F. Treatments and rates of application are listed below:

Treatment	Formulation	Rate of Application (lb AI/acre)	Rate of Application (lb material/acre
starch suSCon	10% chlorpyrifos	4.0	40
Fipronil-EXP60818A	0.1% fipronil	0.0125	12.5
Talstar granular	0.2% bifenthrin	0.40	200
Talstar flowable*	7.9% bifenthrin	0.20 0.20	1135 ml/acre 1135 ml/acre
Untreated check	----	----	----

* split application applied one week apart per FMC instructions

Applications of fipronil (EXP60818A) were made using a shop-built spreader mounted on a farm tractor. The suSCon and Talstar granular applications were made with a Herd® 96 granular applicator mounted on a farm tractor. The Talstar flowable application was made using a 16-ft roller pump boom sprayer calibrated to deliver 40 gallons of finished spray per acre.

Prior to treatment and at 6 week intervals thereafter, evaluations of IFA populations were made in ¼-acre circular plots in the center of each one-acre test plot, using the procedures described by Lofgren and Williams (1982) and Collins and Callcott (1995). Differences in treatment means were separated by a LSD test (P=0.05).

RESULTS:

Preliminary results indicate that all treatments provide significant reduction in population indices and number of colonies at 6 weeks after treatment (Table 23 & 24). Split applications with Talstar Flowable provided greater than 95% reduction in pretreatment population indices as well as colony mortality at 6 weeks PT, and 100% control at 12 and 20 weeks. Fipronil EXP60818A provided 100% control at 6 and 12 weeks posttreatment (PT), but reinfestation had begun at 20 weeks PT. The suSCon starch formulation has provided greater than 85% reduction in population index and number of active colonies at 12 weeks PT. Also at 12 weeks PT, reinfestation was noted on two of the Talstar granular plots, while the other plot remained IFA free. By 20 weeks PT, reinfestation was evident on both the suSCon starch granule and Talstar granule plots.

At the time of the second Talstar Flowable application, 1 week after the initial application, no phytotoxic effects on the sod were noted. At the 6, 12 and 18 week PT counts, no phytotoxic effects were noted on the Talstar Flowable plots, or any other treated plots.

Overall, the Talstar flowable treatment has provided excellent control for at least 4.5 months (20 weeks), and the Fipronil granule for 3 months (12 weeks). The suSCon starch granule did not preform as well as the previously tested extruded plastic granule. The Talstar granular formulation provided good control at 6 weeks, but did not provide any residual activity after that time.

The Talstar flowable and the Fipronil plots along with the untreated checks will continue to be evaluated until reinfestation is noted.

Table 23. Efficacy of Candidate Grass Sod Treatments - reduction in pretreatment population index.

Treatment	Rate of Application (lb material/ acre)	Mean % change in population index at indicated wks PT			
		(6)	(12)	(20)	(28)
Fipronil EXP60818A	12.0	-100a	-100a	-82.3a	
Talstar flowable	2270 ml/acre	-99.2a	-100a	-100a	
Talstar granular	200.0	-95.1a	-39.5a	78.2ab	
starch suSCon	40.0	-77.4a	-87.7a	-74.9a	
Untreated check	----	-39.3b	85.3b	207.6b	

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

Table 24. Efficacy of Candidate Grass Sod Treatments - colony kill.

Treatment	Rate of Application (lb material/ acre)	Mean % decrease in number of colonies at indicated wks PT			
		(6)	(12)	(20)	(28)
Fipronil EXP60818A	12.0	100a	100a	83.3ab	
Talstar flowable	2270 ml/acre	95.2a	100a	100a	
Talstar granular	200.0	90.5a	52.4bc	0.0c	
starch suSCon	40.0	77.3a	85.9ab	66.4b	
Untreated check	----	32.1b	12.1c	0.0c	

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

SECTION III

POPULATION SUPPRESSION T

PROJECT NO: FA02G075

PROJECT TITLE: Laboratory Evaluation of Suredye for Control of Imported Fire Ants

TYPE REPORT: Final

LEADER1PARTICIPANTS: Homer Collins

INTRODUCTION:

Lethal photo-oxidation reactions have been reported for a number of insects (house flies, imported fire ants, boll weevils, etc) following ingestion of various dyes such as rose bengal, methylene blue, xanthene, etc. (Broome et al. 1975, Callaham et al. 1975, David & Heitz 1978, and others). Suredye has been tested against several species of fruit flies. We were asked to test this product as a bait toxicant for control of fire ants.

MATERIALS AND METHODS:

Test *I* – In April 1995 we were contacted by a representative from Photodye International, 517 LaClaire Ave, Linthicum, MD 21090 and asked to evaluate a product known as Suredye for control of imported fire ants. Suredye is a mixture of 69% phloxine B (a red dye), and 31% uranine (a yellow dye) [Risk Assessment: Suredye Insecticide Trials, Jan. 1995, USDA, APHIS]. On April 17, 1995 we received by mail three containers of dye labelled as follows: D&C Red No. 27, Code No. 10-25-DA-3427, Cert. No. AF 7453 or AF 9580. The labels indicated that the dye was manufactured by Hilton-Davis Company, 2235 Langdon Farm Rd., Cincinnati, Ohio 45237. Fifty grams of 1% bait were prepared by mixing the dye from one container into soybean oil, and then coating defatted corn granules with the oil/dye solution. Bait components were as follows:

0.5 g dye (Cert. No. AF 7453)
12.5 g soybean oil
37.0 g defatted corn granules (Illinois Cereals Mills, Paris, IL)

After thoroughly blending the bait components in a laboratory beaker, the prepared bait was transferred to a zip-lock plastic bag and maintained under ambient temperature and light conditions in the laboratory prior to testing.

On April 21, 1995 the bait was used to conduct a free-choice feeding/mortality experiment in the laboratory. Field collected IFA colonies were collected by shovelling nest tumulus, along with as many ants as possible (all stages and castes), into 3-gallon plastic pails. Five colonies were collected and starved for 5 days prior to testing. Tests were conducted by placing 5 grams of prepared bait in a petri dish which was then placed on the surface of each nest.

RESULTS:

Test I - Observations indicated that 3 of 5 colonies fed liberally on the bait, but all colonies consumed some as indicated below (average of 3.9 g per colony):

BAIT CONSUMPTION

Colony Number	#1	#2	#3	#4	#5	Avg.
g consumed	4.1	5.0	2.9	5.0	2.3	3.9

On April 25 (4 days after feeding), 160 ants were randomly collected from all colonies and composited into a single sample. All 160 ants were then anesthetized with CO_2 and crushed between two sheets of white paper with a photographic roller. Pinkish-red spots indicated the presence of the dyed bait in alimentary tracts of the ants. 42.8% contained dye.

All colonies were observed for mortality until May 9 at which time they were discarded. The 1% bait was readily fed on by the ants. After 4 days 42.8% of adult worker ants contained dye in the alimentary tract. However, all colonies remained live and healthy throughout the duration of the 18 day trial.

Test II – On April 25, 1995 a 3% bait was prepared as above and introduced into 5 different field collected colonies which had been starved for 4 days prior to testing. Bait consumption was as follows:

BAIT CONSUMPTION

Colony Number	#6	#7	#8	#9	#10	Avg.
g consumed	2.3	.2	.1	1.0	.1	0.74

Five days after treatment, ants from Test II were crushed as above. 32.7% of the ants fed on the 3% bait containing dye. These results indicate that the 3% Suredye bait was not consumed as well as the 1% bait, possibly indicating that as concentration increases, acceptance decreases. As in Test I, colonies were maintained and observed for 21 days. At the termination of the trial, all colonies were normal and healthy.

PROJECT NO: FA02G015

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

TYPE REPORT: Final

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

INTRODUCTION:

Due to the low rate of application (1.0 - 1½ lbs/acre), all fire ant baits are difficult to apply with most commonly used granular applicators. Most other dry agricultural products such as seeds, fertilizers, etc. are dispersed at much higher rates of application. Therefore, dispersal equipment is designed for these higher rates of application and cannot be calibrated to deliver labelled rates of fire ant baits. One method of eliminating these problems would be to blend fire ant baits into fertilizer or grass seeds which would then be applied as a "tank mix" of the two products. Early attempts to control fire ants with a blend of fire ant baits and conventional fertilizers were not successful (1984 IFA Station Annual Report). It was hypothesized that the loss in efficacy was due to the dust granules from the fertilizer which adhered to the bait particles rendering then unpalatable to the ants. In 1992, Award® fire ant bait was blended with a controlled release fertilizer formulation, which was essentially non-dusty. This fertilizer did not adversely affect the efficacy of the bait (1993 IFA Station Annual Report - FA02G022). In 1994, Award blended into Pursell fertilizer gave marginal control of IFA (FA02G024). These poor results were probably due to the product being applied in the hottest. driest part of the summer (late July).

In 1995, Ciba again supplied us with premixed Award and controlled release fertilizer to test the efficacy of the bait when blended with fertilizer.

MATERIALS AND METHODS:

Laboratory bait acceptance trial:
To evaluate attractiveness of various IFA bait formulations, a standard bait acceptance trial is performed (Appendix III). On May 30, 1995. an

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

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

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

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

RESULTS:

Laboratory bait acceptance trial:
Under the "normal" conditions, both fenoxycarb baits were less attractive than the standard non-toxic bait (Table 25). Under excessive starvation, both baits were as acceptable to the ants as the non-toxic standard.

Field trial:

Results to date are shown in Tables 26 & 27. All treatments provided excellent control through 24 weeks posttreatment (PT), except the Award blended with the 35-0-0 fertilizer. This treatment was very effective through 18 weeks, but began to show signs of reinfestation at 24 weeks PT. By 33 weeks PT, both bait formulations blended with the 35-0-0 fertilizer showed positive signs of reinfestation. Both bait formulations blended with the 33-0-11 showed slight indications of reinfestation at this time, and by 39 to 45 weeks PT, these plots showed definite reinfestation. Little or no reinfestation was noted in the plots treated with the bait formulations alone at 33 weeks PT, but by 39 and 45 weeks PT slow reinfestation was observed in these plots.

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

Table 25. Attractiveness of Two Fenoxycarb Bait Formulations.

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

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

Table 26. Efficacy of Various Fertilizer plus Fenoxycarb Bait Against Imported Fire Ants Populations.

Treatment	Mean % change in population index*						
	(6)	(12)	(18)	(24)	(33)	(39)	(45)
Award Std	-90.7a	-99.0a	-99.8a	-98.5a	-100a	-98.4a	-94.3a
33-0-11 + Award	-94.9a	-99.1a	-99.7a	-98.4a	-95.7ab	-91.1a	-69.2ab
35-0-0 + Award	-92.2a	-98.1a	-98.7a	-82.3b	-77.6d	-65.0b	-56.1b
CGA-114597	-92.7a	-98.6a	-99.8a	-98.3a	-97.1ab	-94.6a	-94.5a
33-0-11 + CGA	-92.5a	-97.5a	-99.5a	-96.7a	-89.0bc	-89.1a	-74.2ab
35-0-0 + CGA	-90.3a	-95.5a	-99.2a	-95.1a	-83.0cd	-83.8a	-79.3ab
Check	-47.5b	-62.9b	-81.5b	-63.0c	-43.0e	-38.3c	-0.8c

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

Table 27. Efficacy of Various Fertilizer plus Fenoxycarb Bait Against Imported Fire Ants Colonies.

Treatment	Mean % decrease in number of colonies*						
	(6)	(12)	(18)	(24)	(33)	(39)	(45)
Award Std	35.6a	90.7a	98.4a	98.3a	100a	97.5a	92.3a
33-0-11 + Award	66.0a	93.2a	97.5a	92.2ab	94.4a	87.8a	62.1ab
35-0-0 + Award	43.7a	83.2a	95.1a	72.7b	66.4c	44.8b	29.0bc
CGA-114597	58.8a	90.7a	98.8a	90.6ab	95.7a	94.0a	92.7a
33-0-11 + CGA	53.2a	86.9a	96.8a	94.6a	88.0ab	85.9a	66.5ab
35-0-0 + CGA	34.9a	78.3a	93.5a	94.6a	75.7bc	78.2a	73.4a
Check	31.1a	47.1b	70.8b	51.9c	34.0d	27.0b	4.3c

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

PROJECT NO: FA02G026

PROJECT TITLE: Evaluation of New Bait Products for Control of Imported Fire Ants

REPORT TYPE: Interim

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, Lee McAnally, Avel Ladner and Tim Lockley

INTRODUCTION:

In 1996, we evaluated two relatively new bait products. Fipronil (common name) is produced by Rhone-Poulenc Ag. Co. (Research Triangle Park, NC) and is currently marketed in numerous countries for control of many insect pests in a variety of crops. It is also labeled in Germany as a bait against cockroaches and ants for use by homeowners. Currently, the only U.S. registration for the product is for mole cricket control on golf courses. Several laboratory trials had previously shown that fipronil has excellent potential as a fire ant bait (see internal report on fipronil dated December 1995). This season Rhone-Poulenc produced a 15 ppm fipronil bait on the traditional pregelled corn grit carrier, using corn oil as the attractant.

Valent USA (Walnut Creek, CA) provided a 0.5% pyriproxyfen bait for these trials.

MATERIALS AND METHODS:

The test site was located in Harrison Co., MS. All baits were applied to test plots using a shop-built granular applicator on a farm tractor on June 18, 1996. There were 3 replicates per treatment. The fipronil bait was applied at rates of 1.5 and 3.0 lb/acre. The pyriproxyfen bait was applied at 1.0 and 1.5 lb/acre. Logic® and Amdro® were each applied as standards at 1.5 lb bait per acre. All test plots were 1.0 acre in size except for the fipronil plots which were 0.5 acres each.

A ¼-acre circular efficacy plot was established in the center of each 0.5 or 1.0 acre test plot. Prior to application and at 6 week intervals thereafter, IFA populations in each efficacy plot were evaluated using the population

system developed by Lofgren and Williams (1982). Using this data, both colony mortality and decrease in population index were calculated. Experimental data were statistically analyzed using analysis of variance and means separated using Tukey's test (P=0.05) for each posttreatment rating interval.

RESULTS:

At 6 and 12 weeks posttreatment (PT), all treatments provided excellent control, 88 - 98% decrease in population indices (Table 28 & 29). Prior to the 18 week count, the land owner lightly disked many of the treated areas, and as a result, one Amdro and one check replicate were not included in the 18 week count, but were included in the following 24 week count. Therefore, means for the Amdro and check evaluations at 18 weeks include 2 replicates, rather than 3. All the Logic and pyriproxyfen plots were also disked, but all were included in the all the counts. However, the results are probably biased due to the disturbance. At 18 weeks PT, both pyriproxyfen rates and the Logic treatment provided 100% control of IFA. As stated above, this is probably a result of the disturbance caused by the owner disking the plots as well as the action of the treatments. Also at 18 weeks PT, the 1.5 lb fipronil rate provided 94.2% reduction in pretreatment population indices and 87.5% reduction in pretreatment colony numbers. The 3.0 lb rate of fipronil and the Amdro standard were both reinfested with healthy colonies 18 weeks after treatment.

By 24 weeks PT, the fipronil 1.5 lb rate, the Logic and the pyriproxyfen plots were being reinfested with small class 7 colonies.

We have previously reported the importance of using RIFA test plots at least 1.0 acre in size. Plots this large (1.0 acre) provide a treated buffer area of 14.2 m (46.6 ft), which minimizes colony relocation into the ¼ acre efficacy plots from adjacent untreated areas (Collins & Callcott 1995). However, treated buffers as large as 75 m do not necessarily prevent all movement from outside the treated area since Callcott & Collins (1992) noted the appearance of large, mature colonies in treated test plots with a 75 m treated buffer approximately 16 weeks PT. As stated in the materials and methods above, plot size for the fipronil plots was 0.5 acres. This was due to limited availability of the experimental bait, and therefore, these plots

had treated buffers of only 4.8 m (15.7 ft). At 6 and 12 weeks PT, the few remaining colonies in fipronil plots did not contain worker brood, indicating abnormal colonies and the absence of a functioning queen. However, at 18 weeks PT, all of the plots treated at the 3.0 lb rate contained 1-4 large, normal colonies (colony class 8 according to the population index scale of Lofgren & Williams 1981 and modified by Harlan et al. 1982). While it is possible for these colonies to have developed from newly mated queens entering the treated area just after treatment, it is more likely that the entire colonies migrated into test plots from the adjacent untreated area. Adoption of newly mated queens by surviving broodless colonies could also account for the sudden appearance of category 8 nests within the test plots.

Ultimately, fipronil and pyriproxyfen candidate baits controlled IFA in the field as well as the standard commercial baits.

Table 28. 1996 Bait Trials - population index change.

Treatment	Rate of Application (lb/acre)	% change in population indices at indicated wks PT*			
		(6)	(12)	(18)	(24)
Fipronil	1.5	-96.6a	-96.9a	-94.2ab	-67.1a
Fipronil	3.0	-97.3a	-96.2a	-81.7b	-62.8a
Pyriproxyfen	1.0	-92.9a	-97.6a	-100a	-95.5a
Pyriproxyfen	1.5	-90.8a	-97.7a	-100a	-98.8a
Logic	1.5	-88.5a	-98.8a	-100a	-97.0a
Amdro	1.5	-90.1a	-88.3a	-82.4b	-76.0a
Untreated Check	---	-36.3b	-28.2b	12.0c	54.4b

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

Table 29. 1996 Bait Trials - decrease in number of colonies.

Treatment	Rate of Application (lb/acre)	% decrease in no. of colonies at indicated wks PT*			
		(6)	(12)	(18)	(24)
Fipronil	1.5	81.9a	87.5a	87.4a	61.6ab
Fipronil	3.0	84.1a	84.6a	68.6b	56.9b
Pyriproxyfen	1.0	65.2a	83.3a	100a	91.8ab
Pyriproxyfen	1.5	63.5a	84.9a	100a	98.4a
Logic	1.5	65.3a	92.4a	100a	96.5a
Amdro	1.5	77.4a	79.3a	79.6ab	76.1ab
Untreated Check	---	47.5a	36.3b	3.6c	0.0c

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

PROJECT NO: FA02G016

PROJECT TITLE: Control of Imported Fire Ants in Poultry Broiler Production Houses, 1996.

REPORT TYPE: Final

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, Lee McAnally, Avel Ladner

COOPERATORS: Poultry Growers associated with Tyson Foods: Guy Berry, Todd Dupree, Pat Barr, Jr. and Barry Johnson, Jimmy Parkman, Darryl Wedgeworth, Tobias Hodge, Glenn Wicker, Hershel1 Warren

INTRODUCTION:

In 1994 and 1995, we conducted trials examining control of imported fire ants around broiler houses using commercially available IFA baits (FA02G044 and FA02G025). In 1994, Amdro® and Logic@were applied as individual mound treatments and as broadcast treatments. The individual mound treatments were applied to mounds within 5' of a house, and the broadcast treatment was applied in one 20' swath around a house. One house was considered a replicate. In 1995, we applied Amdro, Logic and MaxForce® as broadcast treatments, again using one production house as a replicate. In neither of these trials did we obtain consistent or acceptable results. We concluded that the superabundance of alternate food sources, such as poultry feed, fly pupae, etc., may have rendered the baits less attractive to the ants, and therefore they were not ingested.

In 1996, we again attempted to control IFA around poultry houses by modifying our experimental plot design. Instead of each house on a farm being considered as a single replicate and being treated with a different bait, each farm was designated as a replicate, and a 100' buffer area around the houses was treated (Figure 1).

MATERIALS AND METHODS:

Commercially available Logic and Amdro baits were used in this trial. Both baits were applied as broadcast treatments at a rate of 1.5 lb/acre on June 10, 1996. Applications were made with a USDA. APHIS shop built spreader

mounted on a farm tractor. Treatments were applied in a solid pattern around and between individual houses, and included a 100' buffer area where accessible. Each replicate (farm) consisted of 2 to 4 broiler houses.

Prior to application and at 6 week intervals thereafter, the fire ant population was assessed by counting and characterizing each nest within 5' of the exterior wall of 2 houses on each farm (replicate); preferably one outside house and one inside house. Assessments were made using the population index system described by Lofgren and Williams (1982). The total number of colonies around the 2 "count" houses and their total population index was used as raw data for each replicate. Using this data, both colony mortality and decrease in population index were calculated. Experimental data were statistically analyzed using analysis of variance and Tukey's test (P=0.05) for each posttreatment rating interval.

RESULTS:

At 6 weeks posttreatment >90.0% reduction in population indices was obtained with both Amdro or Logic (Table 30 & 31). At 12 weeks PT, Logic still provided >90.0% reduction in population indices, but the Amdro plots were reinfested. At 18 wks PT, the Logic plots were reinfested by small, incipient colonies.

These results indicate that temporary suppression of IFA can be achieved with either Amdro or Logic bait. However, broadcast treatments with large (>100') buffer zones are needed to minimize re-invasion of treated areas. The ideal nesting and foraging conditions provided by poultry houses make them superior habitat for IFA. We speculate that to maintain poultry houses relatively free of IFA, two bait applications per year (spring and fall) will be required.

Figure 1. Graphic of change in experimental plot design between 1995 and 1996.

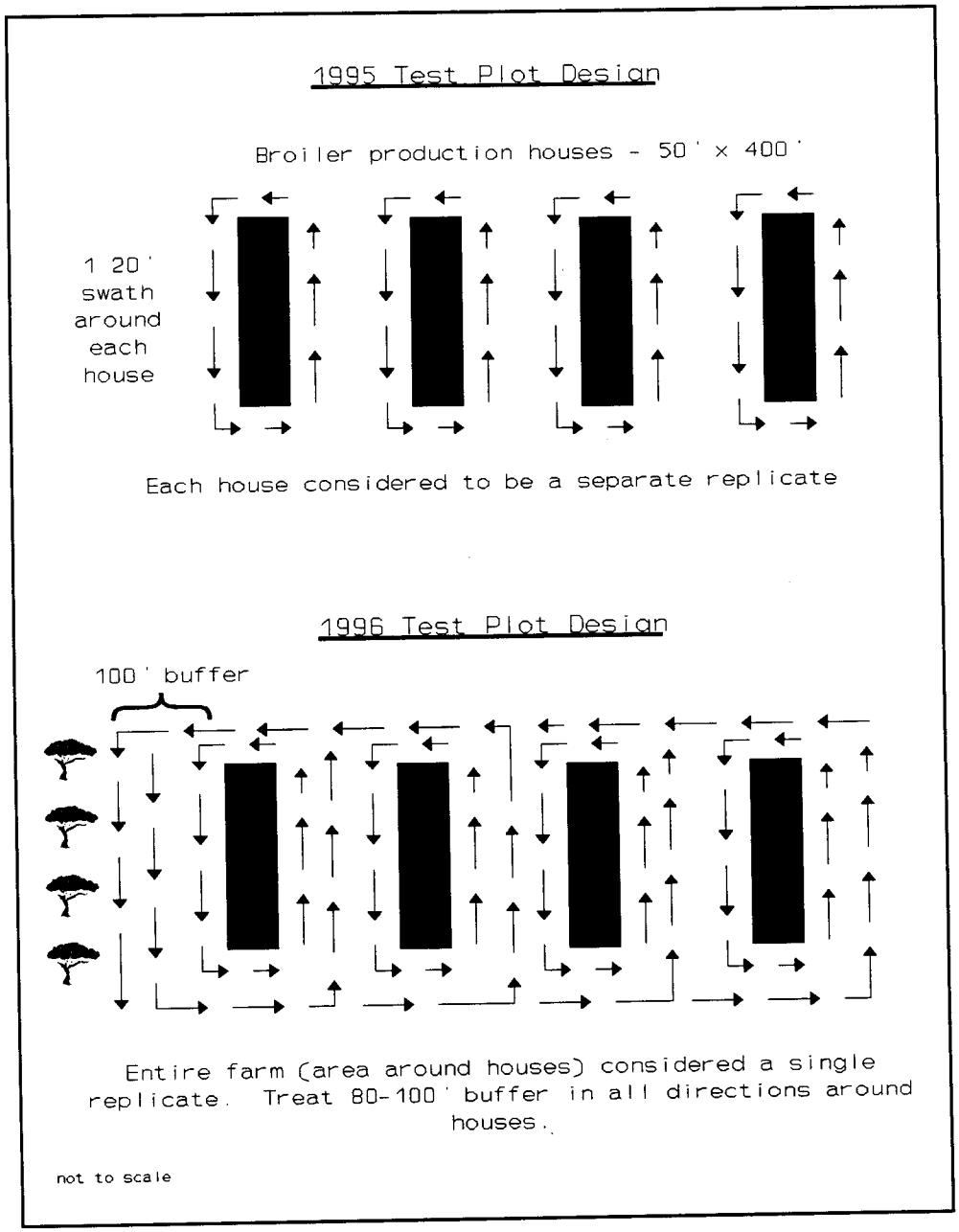


Table 30. Efficacy of IFA Baits Applied Broadcast to Poultry Houses, 1996 - % Change in Population Indices.

Treatment	% change in population indices at indicated wks PT*		
	(6)	(12)	(18)
Logic	-92.9a	-92.4a	-77.9a
Amdro	-90.0a	-54.9a	-16.0ab
Untreated Check	-7.5b	114.6b	112.1b

* means within a column followed by the same letter are not significantly different

Table 31. Efficacy of IFA Baits Applied Broadcast to Poultry Houses, 1996 - % Decrease in Number of Colonies Present.

Treatment	% decrease in number of colonies at indicated wks PT*		
	(6)	(12)	(18)
Logic	67.0a	78.2a	71.3a
Amdro	82.1a	45.6a	16.3b
Untreated Check	11.8b	0.0b	0.0b

* means within a column followed by the same letter are not significantly different

SECTION IV

MISCELLANEOUS PROJECTS

PROJECT NO: FA05G035

PROJECT TITLE: The Ants of Mobile County, Alabama: a Twenty and Seventy-Five Year Perspective.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Tim Lockley and Kirk Irby

INTRODUCTION:

Black and red imported fire ants first arrived in the United States ca. 1918 and 1940, respectively. Both species entered this country through the port of Mobile, AL. Currently, the black imported fire ant (*Solenopsis* richteri) is isolated in extreme northeast Mississippi, northwest Alabama and a few counties in Tennessee. The red imported fire ant, S. invicta, has spread throughout the southeastern United States from Norfolk, VA to the Florida Keys and west into eastern Texas. Currently, 12 states and commonwealths and Puerto Rico are infested. As this pest has spread, it has depauperized native species of ants (Porter & Savignano 1990). Some native species of ants (as well as some other imported species) however seem to be able to compete successfully with IFA (Lofgren et a7. 1975). Glancey et al. (1976) conducted a survey of Mobile Co., AL in 1974 to determine what effect IFA had upon native species in the area longest infested by fire ants. Their data indicated that a total of 16 species had been able to survive over 50 years of occupation by IFA. A survey was conducted using the same three transects traveled by the Glancey team to determine if any significant changes had occurred in ant populations in the ensuing 20+ years since the last survey.

MATERIALS AND METHODS:

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

Glancey et al. in 1976.

RESULTS & DISCUSSION:

In the September 1995 sampling, from 580 traps at 290 sites, 24,347 ants were collected. They were represented by 21 species from 10 genera (Table 32). *Solenopsis invicta, Linepithema humilis, Pheidole fallax obscurithorax, Pheidole moerens* and *Brachymyrmex* spp. represented 97.9% of all ants collected. Five species were reported in the new survey that were not collected by the previous search (*Odontomachus sp., P. fallax obscurithorax, P. floridana, P. metallescens*, and *P. tysoni*). Three species collected by Glancey were not found in the current survey (*Aphaenogaster texana, Crematogaster clara* and *Tetramorium guineese*) (Table 32). In the survey carried out in April 1996, eleven species in eleven genera were taken. Among these, *Leptothorax pergandei* and *Stenemma* were not reported in the Glancey survey nor were they trapped in the 1995 study. A species previously reported in the 1974 study, *Crematogaster clara*, was collected in 1996. Since the initial survey in 1974, numbers of the red imported fire ant have declined sharply (Table 33). In 1974, RIFA represented 84.3% of all the ants collected and was recovered from 37.6% of the sites baited. In 1995, numbers of RIFA had fallen to 47.0% of the total number of ants and they were collected from only 25.9% of the sites. During this same period, the Argentine Ant had increased its numbers from 13.1% of the total in 1974 to 41.5% in 1995. Results from the 1996 survey were similar with RIFA representing 50.1% of all ants taken and Argentine ants representing 44.8%. In 1974, the Argentine ant had been collected from only 8.5% of the sample sites; in 1995 and 1996, they were taken from 27.9% and 18.9%of the sites. Another introduced species, *P. fallax obscurithorax*, represented 3.4% and 0.7% of the total ants taken in 1995 and 1996 but was collected at 17.2% and 5.4% of the sites respectively. This ant had not been collected by Glancey in his survey; but had been introduced into southern Alabama ca. during the same period as RIFA.

A possible explanation for the decline in RIFA numbers and distribution may be the rapid urbanization of Mobile County; yet, the decline was consistent throughout the rural, suburban and urban areas. The two dominant and the senior subdominant species are all introduced and the fluctuations in numbers and sites collected may be results of competition among "weeds". Does this

fluctuation occur throughout the monogyne range of RIFA? It will require similar surveys over similar periods of time to answer that question. If RIFA populations are inherently unstable, or are subject to pressure by other competitive species, then perhaps RIFA isn't the environmental juggernaut it is supposed to be. Further collections will be made in April 1996.

Table 32. Comparative Collections of the Myrmycofauna of Mobile Co., AL: 1974, 1995 & 1996.

TAXON	1974	1995	1996
Odontomachus sp.		X	
Aphaenogaster nr. texana	X		
Crematogaster clara	X		X
Leptothorax pergandei			X
Monomorium minimum	X	X	X
M. viridum	X	X	
Pheidole dentata	X	X	
P. fallax obscurithorax		X	X
P. floridana		X	
P. metallescens		X	
P. moerens	X	X	
P. tysoni		X	
Pheidole spp.	X	X	
Solenopsis invicta	X	X	X
S. molesta		X	
Tetramorium guineese	X		
Dorymyrmex sp.	X		
D. bureni		X	X
Forelius sp.		X	
Linepithema humilis	X	X	X
Brachymyrmex sp.	X	X	X
Camponotus abdominalis floridanus		X	
C. castaeus		X	
C. pennsylvanicus	X	X	X
Formica dolosa	X	X	X
Paratrechina arenivaga		X	
Stenemma sp.			X

Table 33. Dominant and Subdominant Species of Ants Collected from Mobile Co., AL - 1974 and 1995.

TAXON	PERCENT COLLECTED 1974	1995	1996	PERCENT OF SITES 1974	1995	1996
Solenopsis invicta	84.3	47.0	50.1	37.6	25.9	38.5
Linepithema humilis	13.1	41.5	44.8	8.5	27.9	18.9
Pheidole fallax obscurithorax	0.0	3.4	*	0.0	17.2	5.4
P. moerens	0.9	2.5	0.0	0.3	2.9	0.0
Brachymyrmex sp.	*	2.5	1.2	*	12.8	6.2
Monomorium minimum	*	*	2.7	*	*	1.2

* less than 1.0%

PROJECT NO: FA05G013

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

TYPE REPORT: Interim

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

INTRODUCTION:

Red imported fire ants (RIFA), *Solenopsis invicta,* currently infest over 281,000,000 acres in 11 states and Puerto Rico. A congener species S. *richteri,* inhabits a relatively small area in northwestern Alabama, northeastern Mississippi, and southern Tennessee. Interbreeding between S. *invicta* and *S. richteri* occurs and results in the production of a fertile hybrid form. Range expansion primarily by *S. invicta* and the hybrid form, by both natural and artificial means, continues. Recent isolated infestation in Phoenix, AZ (Collins unpublished), several sites in Virginia (Waller 1993), and numerous sites in Tennessee (Milam unpublished), are suggestive that acclimation to harsh environments may result in continued range expansion by this serious pest. Many scientists have speculated that hybrid vigor may enable the hybrid to survive in colder areas than either parental form.

In December 1992 an isolated infestation approximately 3000 acres in size was detected approximately 45 miles northeast of Chattanooga, TN near the town of Calhoun, TN. A wood pulp processing plant (Bowater Corporation) appears to be the source of the infestation. The original infestation may have been introduced onto the plant site on construction equipment or material; however this cannot be proven. This population appears to be well adapted and thriving. A site visit by HLC and RGM in April 1993 revealed numerous large nests in open areas, presence of alate forms, and generally healthy colonies.

Various ecological studies of this isolated population were initiated in 1993

[2] USDA, APHIS, PPQ Imported Fire Ant Station, Gulfport, MS.
[3] USDA, ARS. MAVERL, Gainesville, FL
[4] Dept. of Entomology, Auburn University, AL
[5] USDA, APHIS, PPQ, Nashville, TN

in an effort to learn more about this highly adaptable insect. Results of these studies could lead to better estimates of the ultimate range of imported fire ants.

MATERIALS AND METHODS:

Four different, but interrelated, studies were conducted. Winter kill, seasonal life cycle, survivability of incipient colonies/newly mated queens under sub-optimal temperatures, and impact of RIFA on local myrmecofauna were determined.

WINTER KILL: Winter kill (survival) of colonies in the Calhoun, TN infestation were compared to a control site at Gulfport, MS. Population estimates in eight 0.25 acre test plots were made in October 1993 at each site using the population indexing system described by Harlan et al. (1981) and modified by Lofgren and Williams (1982). Test plots were re-evaluated in April, July and October of 1994 and 1995. Maximum and minimum air temperatures and rainfall were collected at both sites. Mean number of colonies present at each site was compared with a *t*-test, as were mean population indices.

SEASONAL LIFE CYCLE: Markin and Dillier (1971) reported on the seasonal life cycle of RIFA along the Gulf Coast of Mississippi. Techniques and procedures used in that study were utilized to compare life cycle of RIFA in Calhoun, TN with Gulfport, MS. Briefly, those procedures consisted of monthly collections of field colonies of RIFA (n=4) and using the desiccation technique described by Markin (1968) to separate all life stages of the ant from the associated nest tumulus. Separated colonies were then preserved in 500 ml high density polyethylene bottles filled with isopropyl alcohol. The preserved colonies were thoroughly mixed using a magnetic stirrer, and while the solution was mixing, a 5 ml subsample was removed by dipping a ¼ teaspoon into the mixture 3-6 time. Each "spoonful" or aliquot was dumped into a calibrated beaker with a screen bottom. This allowed the alcohol to drain off and to accurately obtain a 5 ml ant subsample. The 5 ml subsample was then placed on filter paper and the excess alcohol drawn off through a Buchner funnel. Finally, each subsample was dried under a hood for 1 hr prior to evaluation. Each life stage present was then enumerated. From this data, the percentage of all life

stages present on each sample date was determined for each location.

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

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

Bait transect: Transects, 200 meters in length (n=4), were placed in similar habitats at both infested and non-infested sites, i.e. open fields, old field successional habitats, etc. These transects were used for both bait and pitfall traps. Bait and pitfall stations were alternated along each transect at 5 m intervals. Each bait transect was comprised of 10 bait stations, five baited with canned sausage and five baited with maple syrup. Baits were placed in snap-top vials, and were left in place for 1 hr prior to collecting. Collections were immediately frozen and returned to the IFA laboratory in Gulfport, MS for sorting and identification. Bait transects provided a measure of the abundance and diversity of ants that might compete for food resources with RIFA.

Pitfall traps: Pitfall traps were also employed to collect ants and other arthropods in both the RIFA infested and a nearby non-infested site. These traps indicated the abundance and diversity of ants and other arthropods that may not be attracted to the diurnally placed baits used in the bait transect. A total of 10 pitfall traps located along the 200 meter transect were utilized at each site. Each transect traversed similar habitats and efforts were made to include as much habitat diversity as possible. "Permanent" type pitfalls were utilized. Pitfall traps at each site consisted of test tubes containing 70% ethanol placed in preset PVC sleeves spaced 10 meters apart along the transect. Traps were collected ca. 24 hrs after placement. All samples from the site were composited, placed in a 50 cc polyethylene bottles, and mailed to the IFA laboratory in Gulfport, MS for sorting and identification.

RESULTS:

WINTER KILL: Winter kill data collected thus far has been compiled. Both sites in October 1993 had similar population indices and numbers of colonies present (Figures 2 & 3). By April 1994 the Tennessee site had significantly lower IFA populations and colony numbers compared to the Mississippi site, indicating notable winter kill. Temperatures at the Tennessee site between December 20, 1993 and January 20, 1994 averaged a high of 39.8°F (range 16°-58°F) and a low of 23.7°F (range 0°-42°F) (Figure 4). During the end of this period there were 7 days in a row in which the high temperature did not exceed 34°F (avg. high = 27.7°F, range 16°-34°F; avg. low = 8.1°F, range 0°-16°F). On February 8, 1994, Greg Adyelotte (USDA, APHIS, PPQ Officer, Knoxville, TN) observed considerable mound mortality, and stated that it was very difficult to find active mounds (temperature range on 2/8 was 58°-67°F). This dramatic decline, indicating winter kill, was quantitatively noted in our April 1994 population assessment which showed 87% colony mortality between October 1993 and April 1994.

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

respectively.

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

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

There was, again, a substantial decrease in both population indices and colony numbers over the winter of 1995-1996 in the Tennessee plots. There was a 90% decrease in the mean population index and a 79% decrease in mean colony number between October 1995 and May 1996. We are missing December temperature data for this site, but the data we do have indicates that the 1995-1996 winter was colder than the 1994-1995 winter, but not as severe as the 1993-1994 winter. The coldest temperatures were between January 20, 1996 and February 20, 1996, with an average high of 43.9°F (range 22-63°F), and an average low of 28.7°F (range 0-45°F). Records show at least 7 days this winter where the high temperature did not exceed 32°F; 4 of these were consecutive days in early February (avg. high = 23.5°F, range 22-25°F; avg. low = 8.5°F, range 0-19°F). This cold weather impacted the RIFA populations as indicated by the substantial winter kill.

By October 1996, mean number of colonies present at the Tennessee site had not increased significantly (16% increase), however, those colonies that had

survived the previous winter were increasing in size, as indicated by an increase in mean population index between May 1996 and October 1996 (166% increase). Summer temperatures were similar to the two previous summers; June average high temperature was 84.8°F (range 74-92°F), July average high temperature was 89.9°F (range 83-95°F), and August average high temperature was 89.2°F (range 79-96°F). Rainfall during these months was 7.89, 1.16, and 5.94 inches, respectively.

The Mississippi site showed a large reduction in population indices and number of colonies at the July 1994 assessment (Figures 2 & 3). This mid-summer drop in RIFA populations appears to be a natural phenomenon in the hot dry summer climate of south Mississippi (pers. obs.). Populations had rebounded well by the October 1994 counts. There was another dramatic decrease in populations at the July 1995 assessment reinforcing the observation of this summer decline phenomenon. However, populations did not rebound in October 1995 as they had the previous year. 1995 was an exceptionally hot, dry and long summer in south Mississippi which probably attributed to the slow recovery. Again, the Mississippi RIFA populations showed an increase between October 1995 and May 1996, and a decrease over the hot summer months. Temperature and rainfall data will be obtained and assessed as with the Tennessee data, to determine any associations between these factors and RIFA populations at the Mississippi site. RIFA population and colony assessments at both sites will continue for the course of the study.

SEASONAL LIFE CYCLE: The dramatic reduction in RIFA colonies in the Tennessee plots over the winter of 1993-1994, made colony collection for this portion of the study somewhat difficult. In February and June 1994, no colonies were collected. In May and December 1994, only three colonies were evaluated to determine life stages present, and in July 1994, only two colonies were evaluated. In 1995, no colonies in Tennessee were collected in May, and in July only three colonies were evaluated. Gravid females and eggs were rarely collected. The biology of the insect precludes easy collection of gravid females and our extraction technique may be the cause of the low egg numbers. The mesh screens used in the process may not have been fine enough to retain all the eggs in the samples.

Preliminary life stage data (through Nov. 1995) shows some interesting trends.

In the immature forms, small larvae were produced year round, with a drop in production in the winter months (December-March) at both sites (Figure 5). In general, there was no significant difference between small larvae production in Mississippi vs. Tennessee colonies (15/22 similar). However, when there was a difference, Mississippi colonies contained significantly more small larvae than did the Tennessee colonies in 6 of the 7 significant comparisons (t-test, $P<0.05$). Mississippi colonies contained more small larvae in March 1994 and 1995, April 1995, August 1994, November 1993 and December 1994. Only in August 1995 were there more small larvae in the Tennessee colonies. The Mississippi site experienced a cessation in worker pupae production in January 1994, and a substantial drop in February 1995, while the Tennessee site ceased or substantially dropped worker pupae production January through March 1994, and December 1994 through March 1995.

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

Minor workers were the most abundant life stage year round in both sites, and in general, minor production was similar at both sites (Figure 6). However, in January 1994, the Mississippi colonies had significantly more minors than the Tennessee colonies and in March 1994, the Tennessee colonies had significantly more present (t-test, $P<0.05$). The most interesting trend at this time is that of the alate females. At the Tennessee site alate females were present continuously from November 1993 through March 1995. The only time alate females were not collected in Tennessee was April 1995 and August through September 1995. At the Mississippi site, where climatic conditions

seem more suitable for continuous alate female production, no alate females were collected December 1993 through February 1994, or in January, April or November 1995. However, only in November 1994 were there significantly more alate females produced in the Tennessee colonies (t-test, $P<0.05$).

SURVIVABILITY OF QUEENS & INCIPIENT UNDER SUBOPTIMAL TEMPERATURES IN THE LABORATORY: This portion of the study was conducted at USDA, ARS, CMAVE, in Gainesville, FL. Eight alate queens in Chattanooga, TN were sent by overnight mail to Gainesville, FL in June 1994. Alate queens were collected in Gainesville within a week of receiving the Tennessee queens. When eggs were observed, queens from each location were placed in temperature chambers that followed the average monthly temperatures of either Orlando, FL, or Chattanooga, TN. After 3 months (October), the Florida queens had produced small colonies under both temperature regimes, but all the eggs from the Tennessee queens did not hatch or were eaten. It was assumed that the Tennessee queens had not mated and the study was terminated.

1996 data has not been analyzed at this time.

IMPACT OF RIFA ON LOCAL MYRMECOFAUNA: For this report, data from all trap types at a site were combined. A total of 16,918 ants (including RIFA) were collected in the RIFA infested area (Table 34) compared to 7,104 in the non-RIFA infested area (Table 35), through November 1995. Excluding RIFA in the infested site, 14,229 other ants were collected. Total number of species collected from October 1993 through October 1996, excluding RIFA, was 27 in the infested plots, and 32 in the non-infested plots, of which 25 species were common to both sites. No *Solenopsis richteri* were collected.

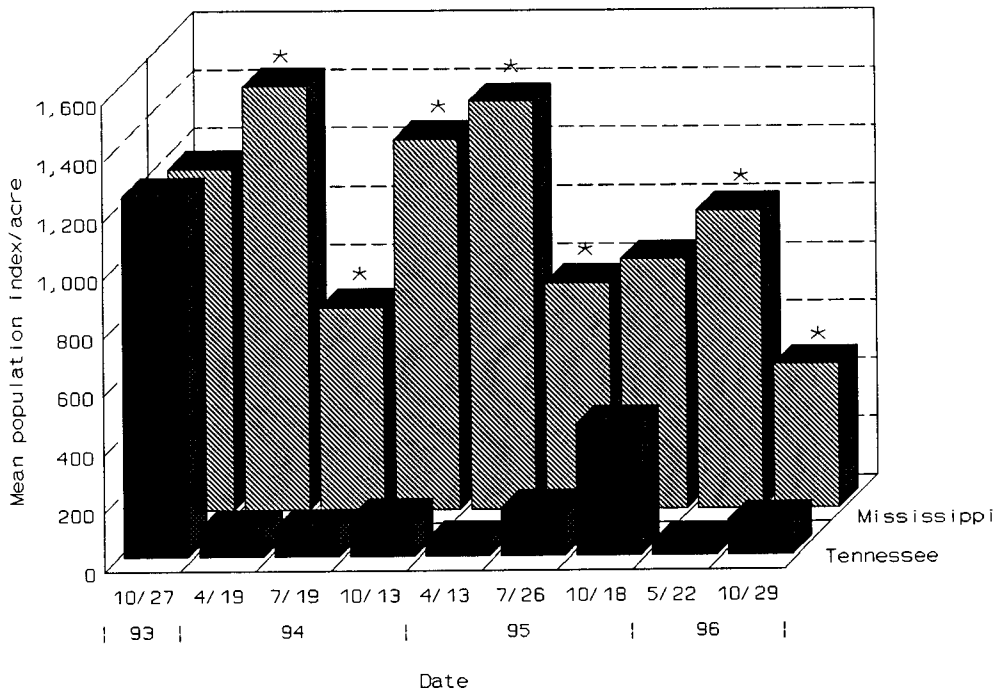
We arranged the data seasonally for presentation: spring = March, April, May; summer = June, July, August; fall = September, October, November; winter = December, January, February. Over the winter months very few ants were collected in any of the traps, so this data has been omitted from this discussion. The number of non-RIFA species collected in both infested and non-infested plots varied seasonally. Within a year's cycle, more species of ants were collected in the summer months in both the RIFA-infested (2.83 in summer 1994, 5.5 in summer 1995, and 6.08 in summer 1996) and the non-infested plots (4.89 in summer 1994, 7.67 in summer 1995, and 7.11 in summer 1996)

(Figure 7). Significantly more species of non-RIFA ants were collected in the non-infested plots in the spring of 1994 and the summer of 1995 than in the RIFA-infested plots.

The most common ants collected in the infested area were *Forelius pruinosus*, *Forelius* sp. A, and *Solenopsis invicta*, with 36.6%, 26.4%, and 15.9%, respectively, of the total number of ants collected through October 1996 (Table 34). *Forelius* sp. A was most prevalent in the spring of 1994, after the extremely cold winter of 1993-1994 had severely depleted the RIFA populations (Figure 8), indicating a negative, though insignificant correlation between the two species (df=23, r=-0.18, P=0.39). On the other hand, *F. pruinosus* was most prevalent in the summer of 1995 when RIFA populations had increased dramatically, and again in the summer of 1996 when RIFA populations were moderate. Initially, it appeared that there may be a positive correlation between RIFA and *F. pruinosus*, however data from this third year of sampling has negated that possibility. There is a slight positive, though very insignificant, correlation between these two species after 3 years of collecting (df=23, r=0.027, P=0.90). However, at the beginning of this trial, fall of 1993, when the RIFA population was at its strongest, no *F. pruinosus* were present and only a few *Forelius* sp. A were present (Table 34, Figure 8). As of October 1995, there was no correlation between RIFA density and number of other ant species present (df=25, r=-0.016, P=0.94).

In the non-RIFA infested area, the most common ants were *Forelius* sp. A, *Monomorium minimum*, and *Crematogaster clara* with 21.1%, 19.9%, and 17.4%, respectively, of the total number of ants collected between October 1993 and October 1996 (Table 35).

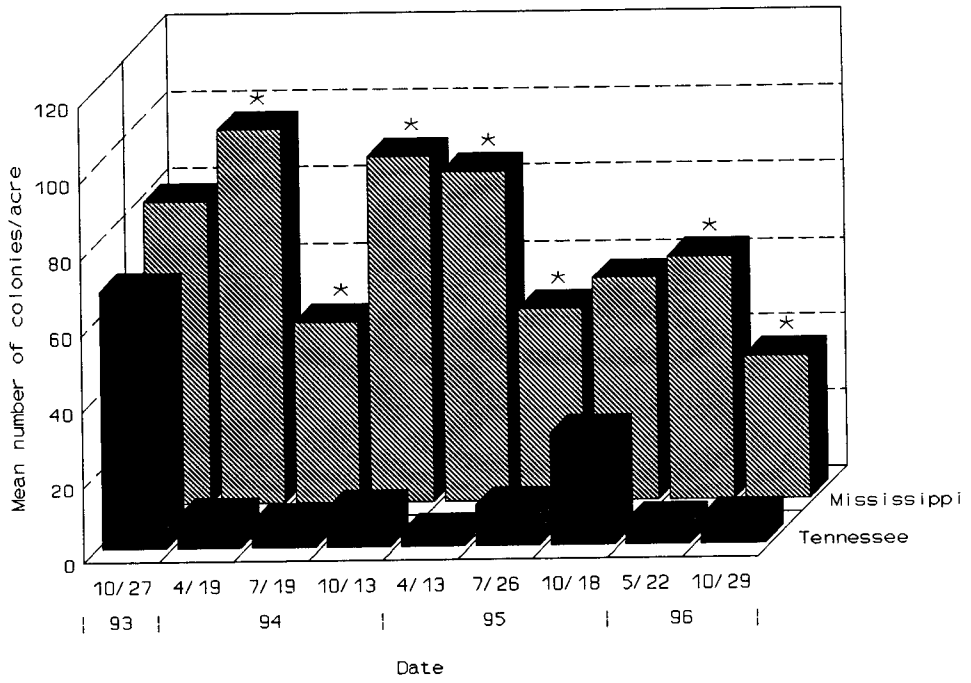
Figure 2. RIFA Population Indices Over Time at Two Climatically Different Sites.



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

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

Figure 3. Number of Colonies Present Over time at Two Climatically Different Sites.



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

Figure 4. Trends of Temperature vs. Number of RIFA Colonies Present in Tennessee

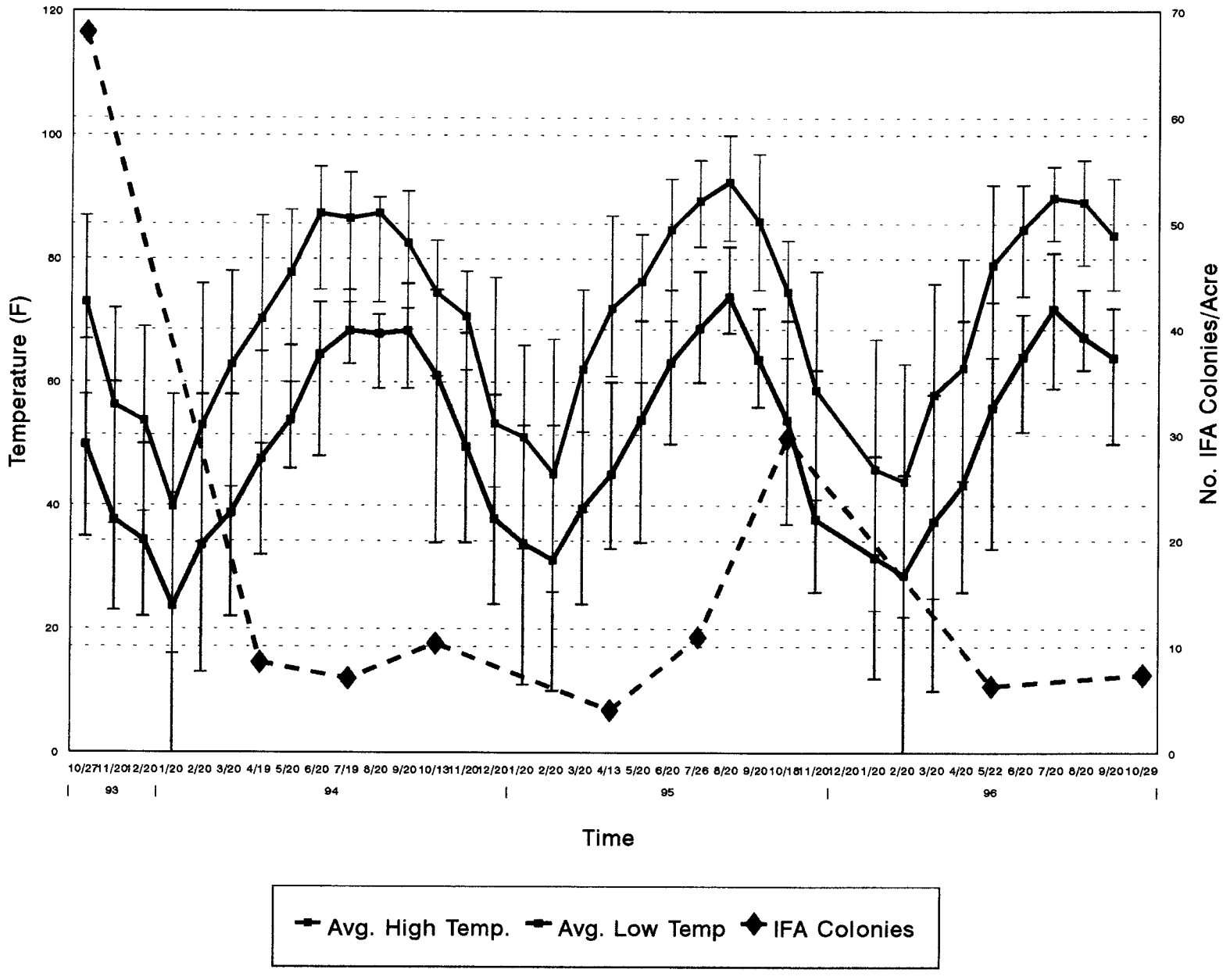
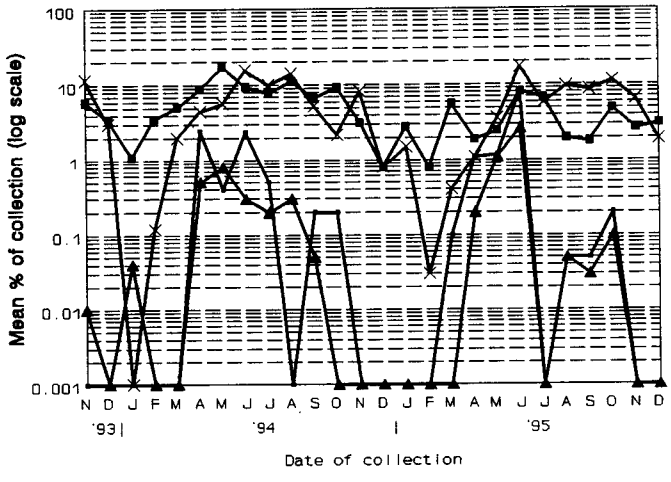


Figure 5. Life Stage Data for Immature Forms Collected at Mississippi and Tennessee Sites; a) Mississippi, b) Tennessee.

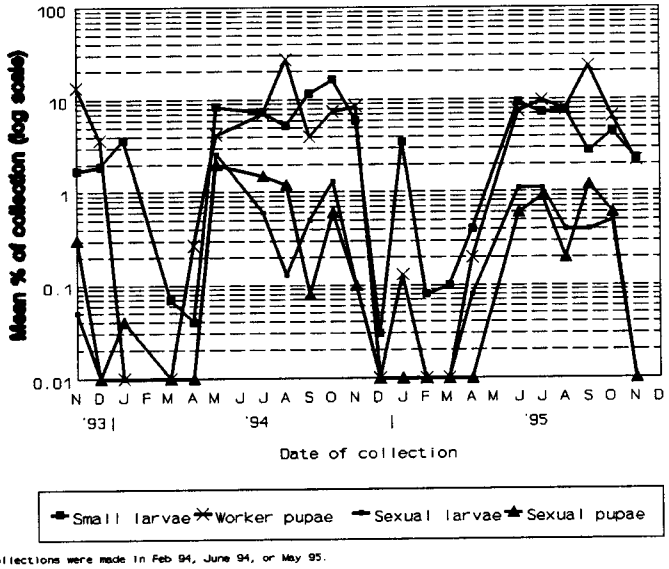
a)

Percentage of immature forms present in Mississippi plots over time



b)

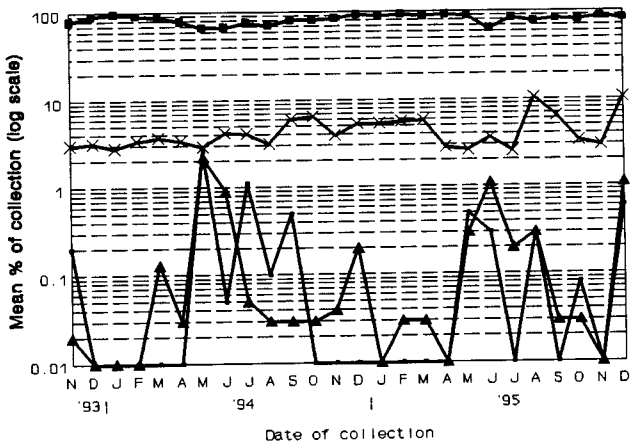
Percentage of immature forms present in Tennessee plots over time



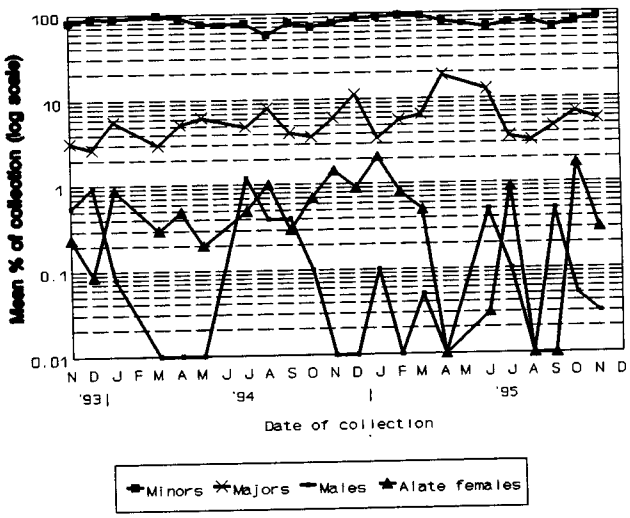
No TN collections were made in Feb 94, June 94, or May 95.

Figure 6. Life Stage Data for Adult Forms Collected at Mississippi and Tennessee Sites; a) Mississippi, b) Tennessee.

a) Percentage of adult forms present in Mississippi plots over time

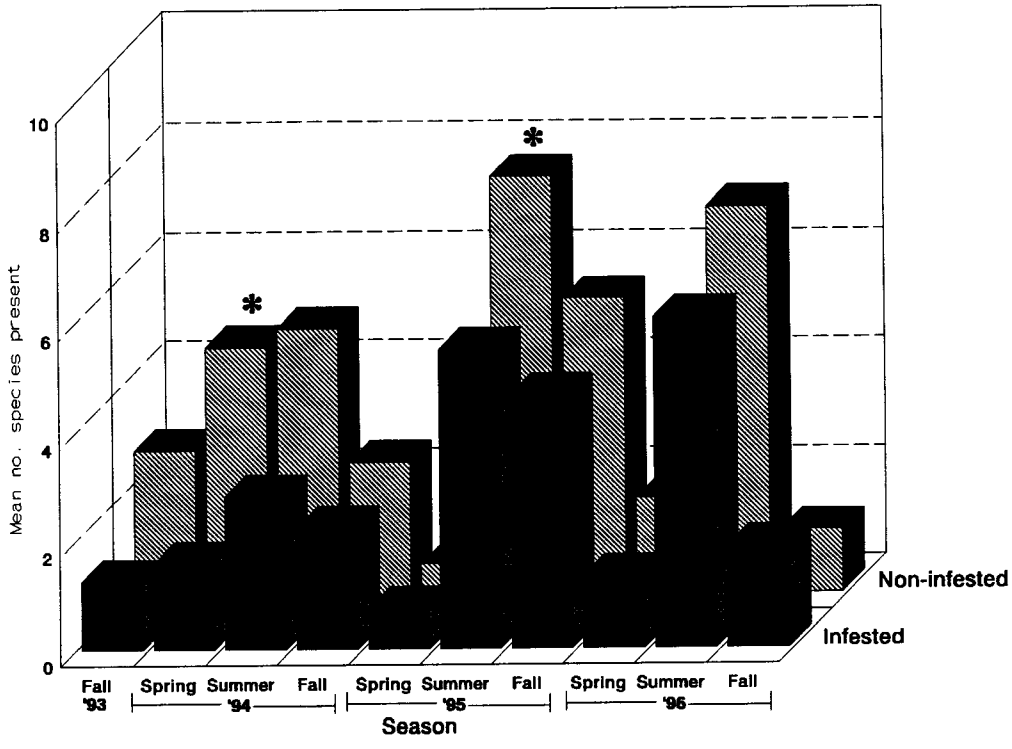


b) Percentage of adult forms present in Tennessee plots over time



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

Figure 7. Number of Non-RIFA Ant Species Present in RIFA Infested vs. Non-infested Plots.



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

Figure 8. Number of Most Abundant Ant Species Present in RIFA-infested Plots.

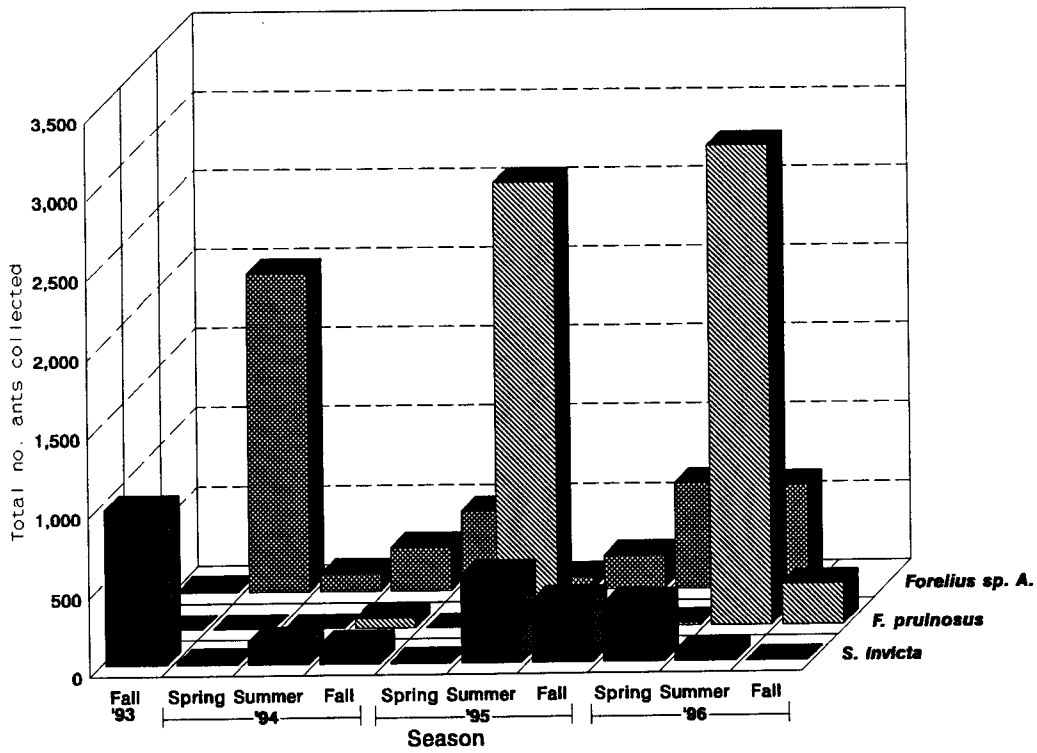


Table 34. Mean no. of ants trapped in bait and pitfall traps seasonally in INFESTED plots.

Species name	1993	1994			995			1995			TOTAL	PERCENT OF TOTAL
	Fall	Spr	Summ	Fall	Spr	Summ	Fall	Spr	Summ	Fall		
Aphaenogaster sp. A.			1			2					3	0.02
A. lamellidens											0	0.00
A. treatae											0	0.00
Crematogaster sp. A.											0	0.00
C. ashmeadi		7			45						52	0.31
C. clara		6	1			430	66	9	212	3	727	4.30
C. lineolata		1	49								50	0.30
C. missouriensis	2	1	7			3	2		10	1	26	0.15
Forelius sp. A.	8	2006	105	268	496	74	206	663	646		4472	26.43
F. sp. B.							1	1	1		3	0.02
F. sp. C.							58				58	0.34
F. pruinosus				63		2800	38	16	3027	251	6195	36.62
Formica sp. A.											0	0.00
F. sp. B.											0	0.00
F. dolosa		4									4	0.02
Labidus sp. A.				36			137		2		175	1.03
Lasuis sp. A.							1				1	0.01
L. neoniger											0	0.00
Leptothorax sp. A.		13							2		15	0.09
L. pergandei			14			1	5		1		21	0.12
Monomorium sp. A.		2									2	0.01
M. minimum		257	1			58	35	2	5	10	368	2.18
Paratrechina sp. A.			1	2					1		4	0.02
P. faisonensis			51	9		8	9	1	23	3	104	0.61
P. parvula			1								1	0.01
P. terricola	5	1	66	1	1	28	13	1	76	121	313	1.85
Pheidole sp. A.	4						1	1			6	0.04
P. dentata	3			1		8	129	39	85	104	369	2.18
P. tysoni		16	6	14		4	18		2	7	67	0.40
P. vinelandica	5	3	36	12	2	96	63	128	116	194	655	3.87
Proceratium silaceum				1		2		2			5	0.03
Tapinoma sessile									1		1	0.01
Trachyomyrmex sp. A.											0	0.00
S. molesta	3		185	13		237	29		65		532	3.14
S. invicta	984	18	152	128	10	558	395	374	68	2	2689	15.89
S. richteri											0	0.00
TOTAL	1014	2335	676	548	554	4309	1206	1237	4343	696	16918	

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

Table 35. Mean no. of ants trapped in bait and pitfall traps seasonally in NON-INFESTED plots.

Species name	1993	1994			1995			1995			TOTAL	PERCENT OF TOTAL
	Fall	Spr	Summ	Fall	Spr	Summ	Fall	Spr	Summ	Fall		
Aphaenogaster sp. A.		1						1	1		3	0.04
A. lamellidens		1	27								28	0.39
A. treatae	11		6	14	1	38	9		14	15	108	1.52
Crematogaster sp. A.		27		1			2		1		31	0.44
C. ashmeadi				2	85				3		90	1.27
C. clara	3	235	7			616	12	39	321	6	1239	17.44
C. lineolata		265	99								364	5.12
C. missouriensis	1	2	3	1			6		38		51	0.72
Forelius sp. A.		518	836	5	4	47	86	1	4		1501	21.13
F. sp. B.						43		1	2		46	0.65
F. sp. C.								1			1	0.01
F. pruinosus	2					299	6	12	518		837	11.78
Formica sp. A.		14				1			1		16	0.23
F. sp. B.		4									4	0.06
F. dolosa	2	22	23			19	8		12	1	87	1.22
Labidus sp. A.											0	0.00
Lasuis sp. A.			9								9	0.13
L. neoniger		6	19								25	0.35
Leptothorax sp. A.		15	2				4		45		66	0.93
L. pergandei	8	39	24	4	1	53	12	13	24	6	184	2.59
Monomorium sp. A.		1									1	0.01
M. minimum	1	3	502	7	3	504	9	4	383		1416	19.93
Paratrechina sp. A.					2	3					5	0.07
P. faisonensis	4			1		2	2		6		15	0.21
P. parvula											0	0.00
P. terricola				1					3		4	0.06
Pheidole sp. A.	10	2				2	1				15	0.21
P. dentata	53	5	7	5		112	44	2	16		244	3.43
P. tysoni	10		70	3		57	35		78		253	3.56
P. vinelandica	15		144	3		54	13	4	203		436	6.14
Proceratium silaceum								1			1	0.01
Tapinoma sessile				1							1	0.01
Trachyomyrmex sp. A.						1					1	0.01
S. molesta			1			16	3		2		22	0.31
S. invicta											0	0.00
S. richteri											0	0.00
TOTAL	120	1160	1779	48	94	1866	255	79	1675	28	7104	

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APPENDIX I

1996 PUBLICATIONS AND PRESENTATIONS

PUBLICATIONS:

Callcott, A.M. and H.L. Collins. 1996. Invasion and range expansion of imported fire ants (Hymenoptera: Formicidae) in North America from 1918 - 1995. Fla. Entomol. 79: 240-251.

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APPENDIX II - LABORATORY BIOASSAY PROCEDURE

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

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

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

collect as many ants as possible while minimizing the collection of adjacent soil which will contain few ants. Collected colonies are then transported to the laboratory for a 3-5 day acclimation period. The addition of food or water during this short acclimation period is not necessary. Alate queens are collected with forceps after placing a 1-2 liter aliquot of the nest tumulus in a shallow laboratory pan. Again, the use of talc on the sides of containers prevents escape while talced rubber gloves minimizes the number of stings experienced by the collector. The forceps should be used to grasp the queens by the wings in order to prevent mechanical injury. An experienced collector can collect 2-300 queens per hour. It is generally advisable to place collected queens in a 500 cc beaker or other suitable vessel containing moist paper towels prior to being introduced into the test chamber.

Test chambers: Test chambers are 2.5" x 2.5" plastic flower pots which have been equipped with a labstone bottom. Labstone is generally available through dental supply firms such as Patterson Dental Co., 2323 Edenborn Ave., Metairie, Louisiana. The labstone bottom prevents the queens from escaping through the drain holes in the bottom of the pot and also serves as a wick to absorb moisture from an underlying bed of wet peat moss (see Figure 1). Ants are susceptible to desiccation so humidity/moisture levels must be optimized. Pots should be soaked in water to moisten the labstone prior to placing potting media in the pots. Plastic petri dishes are inverted over the tops of the pots to prevent escape from the top of the test chambers. Prior to placing queens in the test chamber, 50 cc of treated potting media is placed in the bottom of each pot. Due to possible pesticide contamination, test chambers are discarded after use.

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

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

Recording of data: Results of each bioassay are entered on the attached data

form. Conclusions regarding efficacy and residual activity of the candidate treatments are drawn from this raw data.

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

1) Availability of queens; supply is primarily influenced by season. More time will be spent collecting queens in winter or during extreme droughts.
2) Number of treatments to be evaluated; e.g., if only a single treatment and an untreated check are to be evaluated only 40 queens/month are needed. Conversely, a test involving 4 insecticides at 3 rates of application (12 treatments + untreated check) will require 260 queens monthly for the duration of the test.

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

APPENDIX III

PROTOCOL FOR CONDUCTING BAIT ACCEPTANCE STUDIES

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

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

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.

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

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

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

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

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

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

APPENDIX IV

IFA INTERCEPTIONS, 1996

Nursery stock shipped out of the imported fire ant quarantine area is routinely inspected for presence of live IFA upon arrival at its destination, or at some check point in route. The state of Arizona is especially diligent in this endeavor. An informal system has evolved whereby, if live IFA are found in a non-quarantined state on incoming nursery stock from a quarantined area, the ants are usually sent to the state laboratory for taxonomic verification. Media from the suspect nursery stock is collected and sent to the USDA. APHIS, PPQ, National Monitoring and Residue Analysis Laboratory (NMRAL) in Gulfport. MS for chemical analysis. NMRAL routinely analyzes these samples for certain program chemicals; chlorpyrifos (Dursban), diazinon, and bifenthrin. A portion of the collected media sent to NMRAL is shared with the Gulfport Plant Protection Station where IFA worker bioassays are performed (Appendix II; modified to use 20 major workers in lieu of 5 alate females per replicate). Results from both testing procedures are forwarded to Joe Vorgetts (USDA, APHIS, PPQ, TSS, Riverdale, MD; formerly BBEP, TSS) for reporting to the collecting agency.

Trials conducted in our laboratory have shown that residual activity of chlorpyrifos (Dursban) is affected by media type; some media requires more chlorpyrifos than others to be effective against IFA (Callcott et al. 1995. Proc. of Southern Nurserymen's Assoc. pp. 158-177). In a prior trial, we tested three types of media treated with chlorpyrifos against IFA alate females and found that a minimum of 10 ppm of chlorpyrifos is necessary to insure adequate activity against IFA (FA01G024; 1995 Annual Report). This same report indicates that a minimum of 5.0 ppm of bifenthrin is necessary for adequate control. We have no data at this time on rates of diazinon needed to obtain 100% kill in most medias.

In 1996, 14 media samples from nursery stock originating within the IFA quarantined area were submitted to NMRAL for testing. All of these interceptions were detected in Arizona. Of these 14, 10 were from nurseries

in Florida, and 4 were from Texas. There may have been additional interceptions in other states that we have no record of. Results of chemical analyses and bioassays that were conducted in 1996 are shown in Table 36.

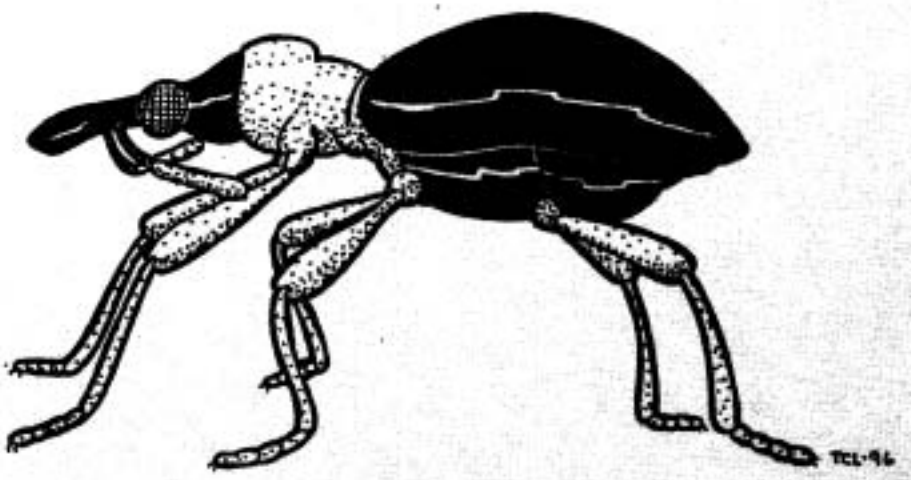
Table 36. Results of all IFA Quarantine Violations Which Have Passed Through the IFA Laboratory in 1996.

NMRAL Lab Number	Plant Material Origin	Plant Material Sampled At . . . (Destination)	Collect-ion Date	IFA Lab Bioassay Results (% mortality)	NMRAL Results (ppm)			Comments
					Dursban	Diazinon	Bifenthrin	
AB54699	Meristem Nursery Gould, FL	Whitfill Nursery Phoenix, AZ	2/8/96	12.5	0.038	ND	*	live IFA found
AB54935 AB54942	Flory Tree Farm Grand Prairie, TX	Shiloh Flats Chandler, AZ	2/16/96	100	8.83	0.019	*	
AB54936 AB45943	Altex Nursery Co. Alvin, TX	Whitfill Nursery Phoenix, AZ	2/16/96	100	12.4	ND	*	
AB56524	Golden Gate Nursery & Sod, Inc (palms) Golden Gate, FL	Pacific Palms Phoenix, AZ	3/29/96	100	215.4	1.05	*	7 IFA identified by AZ. lab; copy of investigation in IFA lab folder (no nest found only a few ants)
AB57613	Palm trees from Donna, TX	Sam Simon border AZ	6/20/96	10	ND	ND	*	2060 states they found tropical fire ant ??
AB58673	East Marsh Nursery Pompano Beach, FL	Nab Nursery Phoenix, AZ	8/9/96	27.5	trace <0.012	ND	*	
AB58902	Delray Beach, FL	San Simon border AZ	8/18/96	100	45.0	pending	*	live IFA found and confirmed by AZ
AB59784	Exotic Collectors Delray Beach, FL	Whitfill Nursery Phoenix, AZ	9/28/96	100	4.37	0.026	*	
AB59970	Altman Specialty Plants Lake Worth, FL	Altman Specialty Phoenix, AZ	10/28/96	100	0.878	trace <0.04	*	media from infested pots
AB59971	Altman Specialty Plants Lake Worth, FL	Altman Specialty Phoenix, AZ	10/28/96	100	2.43	0.704	*	media from non-infested pots on same load as previous sample
AB60071	Altman Specialty Plants Lake Worth, FL	Altman Specialty Phoenix, AZ	11/6/96	100	33.9	1.73	*	
AB60072	Kerry's Bromeliad Nursery Homestead, FL	Altman Specialty Phoenix, AZ	11/6/96	not enough media to bioassay	19.9	0.599	*	

NMRAL Lab Number	Plant Material Origin	Plant Material Sampled At . . . (Destination)	Collect-ion Date	IFA Lab Bioassay Results (% mortality)	NMRAL Results (ppm)			Comments
					Dursban	Diazinon	Bifenthrin	
AB60246	Horticultural Consultants Houston, TX	Phoenix Zoo Phoenix, AZ	11/25/96	5	ND	ND	*	
AB60301	B & L Farms, Inc Lake Worth, FL	Plant stand-28th St Phoenix, AZ	11/96	100	6.88	4.23	*	no date on 2060 - to NMRAL 12/2/96

* NMRAL does not have a workable procedure for detecting bifenthrin
ND - not detected; detection limits: chlorpyrifos = 0.0119 ppm; diazinon = 0.04-0.01 ppm

SWEETPOTATO WEEVIL



FY 1996 SWEET POTATO WEEVIL OBJECTIVES

GULFPORT PLANT PROTECTION STATION
GULFPORT, MS

The Sweet Potato Weevil (SPW), *Cylas formicarius elegantulus* (Summers) is one of the most devastating pests of sweet potatoes worldwide. It occurs in southern parts of Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Texas. Recent advances in the development of pheromone traps and other issues have spawned renewed interest in this old program pest.

At the request of several members of the Souther Plant Board we initiated a small project to test and develop improved trapping techniques for use in storage facilities and growing fields. Short term goals for 1996 were as follows:

- Establish a reprint file of selected scientific papers and become familiarized with the biology, rearing, and trapping of SPW.
- Establish a laboratory culture of SPW using standardized rearing techniques.[6]
- Establish a field planting of sweet potatoes on USDA farm property in Harrison County, MS[7]; artificially infest this field in early season with SPW in anticipation of conducting late season trapping studies.
- Conduct trapping studies on alternate hosts in Harrison County, MS
- Establish working relationships with Louisiana State University research and extension personnel so that expanded trapping studies can be expedited.
- Establish working relationships with State Regulatory Agencies in Louisiana and Mississippi in order to foster future cooperative efforts on SPW.

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[6] Physical Location: Gulfport Plant Protection Station, USDA, APHIS, PPQ, 3505 25th Ave., Gulfport, MS 39501

[7] Physical Location: Harrison County Farm, County Farm Road, Gulfport, MS.

SPW CONTENTS

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PROJECT NUMBER: 96SPW001

PROJECT TITLE: Population Fluctuations of the Sweetpotato Weevil on Wild Host Plants in South Mississippi.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Timothy C. Lockley and Homer Collins

INTRODUCTION:

The sweet potato weevil, *Cylas* formicarius e*legantulus* (Summers) (Coleoptera: Curculionidae), has been known for decades to breed on a number of wild host plants in the family Convolvulaceae. Information on these wild host plants (eg. local species and their abundance, host preference, etc.) is lacking from the literature.

To increase the knowledge of sweetpotato weevil (SPW) and the role wild host plants play in population levels of this pest, a survey was begun in Hancock and Harrison Counties, Mississippi.

MATERIALS AND METHODS:

Beginning in June 1996, screen-cone boll weevil traps (Dickerson et al. 1981) containing a SPW pheromone were deployed throughout Hancock and Harrison Counties Mississippi. Traps were placed at two week intervals among stands of ten different species of the Convolvulaceae (*Ipomoea* batatas-a 1.17 acre planting, *I*. coccinea, *I*. imperati, *I*. x. *leucantha, I*. pandurata, *I*. *purpurea, I*. sagittata, [redacted] trichocarpa and Merremia *dissecta*). Traps remained in place for 24 hours and were then retrieved. Kill strips were not utilized in this study because we did not want to impact the natural population levels. Counts were made in the field and weevils were then released at the point of capture. Monitoring of these sites is continuing and will proceed throughout the foreseeable future.

RESULTS:

Initial numbers of SPW captured in early June averaged 6.8 weevils per trap from 11 sites (Figure 1). Populations peaked in mid July at 31.9 weevils per

trap at 16 sites and began a precipitous decline from that point. More weevils were caught on *I. trichocarpa* than any other alternate host, while fewer weevils were caught on sweet potatoes than any other host except *I. leucantha* (Figure 2). These data are preliminary. Because of the late start in sampling, no data exists for the overwintering population of SPW or for the probable F_1 generation. Monitoring of these sites and future sites will continue. It is anticipated that three years of monitoring will be needed to determine the "normal" fluctuations of SPW populations in south Mississippi.

Figure 1. Sweet Potato Weevil Populations on Wild Hosts along the Mississippi Gulf Coast.

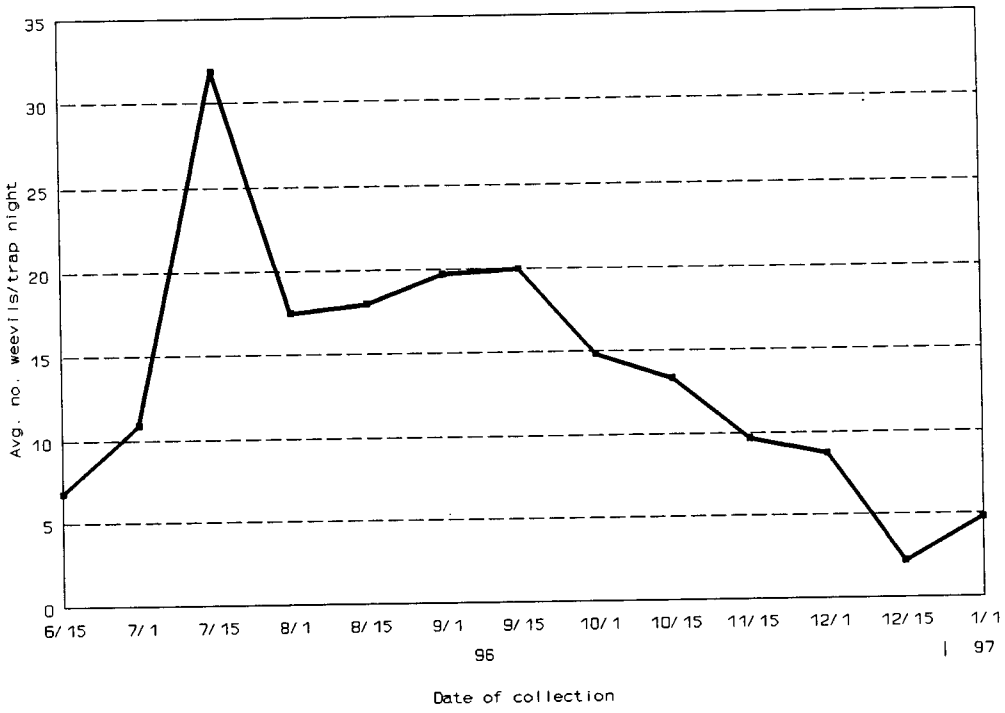
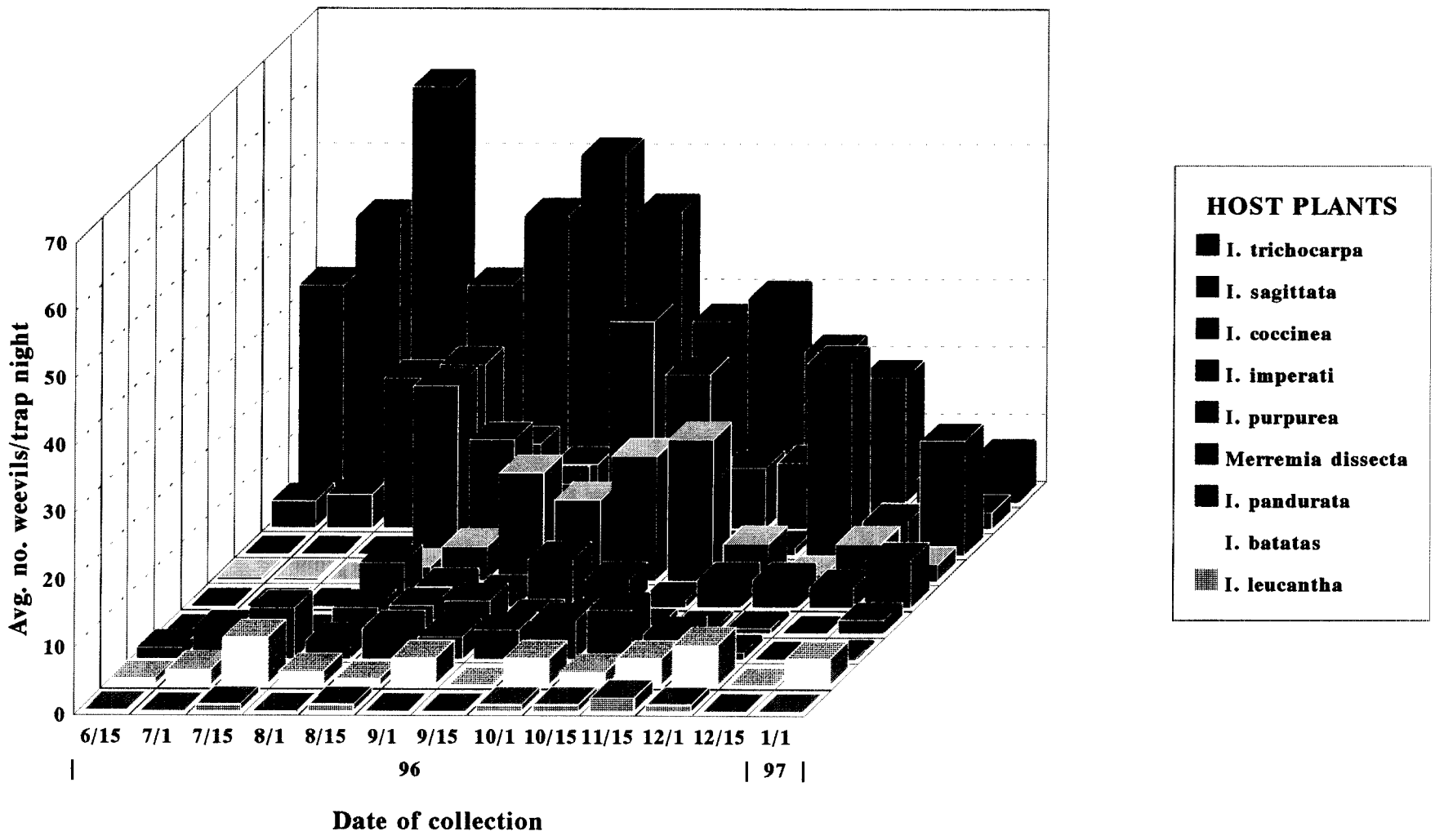


Figure 2. Sweet Potato Weevil Populations on Wild Hosts along the Mississippi Gulf Coast.



PROJECT NUMBER: 96SPW002

PROJECT TITLE: A Simplified Key to the Morning Glory Species Native to the State of Mississippi.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Timothy C. Lockley

INTRODUCTION:

Morningglories are common throughout the state of Mississippi. Within the agricultural community, they are of increasing economic importance as weeds. They are known to reduce yields, increase difficulty in harvesting, reduce quality of the crop harvested and harbor pest species of insects and mites (Elmore & McDaniel 1983). Morningglories have been known for decades as reservoirs for populations of the sweet potato weevil, *Cylas formicarius elegantulus* (Summers). Control of sweetpotato weevils (SPW) require knowledge of the biology of the pest on its hosts, and this requires accurate identification of the host species.

MATERIALS AND METHODS:

Dr. Sidney McDaniels of Mississippi State University supplied me with a listing of the known Convolvulaceae from Mississippi. From this list, and various taxonomic texts on vascular flora in North America, the dichotomous key shown below was developed. No attempt was made to develop the key beyond the true morningglories (*Ipomoea* spp.). Other Convolvulaceae will be added to the key as more data on wild host plants is gathered.

RESULTS:

Key to the *Ipomoea spp.* of Mississippi

1. Corolla tube-like and **SCARLET**; stamen and style extending beyond the corolla tube.

   2. Leaves divided, comb-like..... *I. quamoclit*
   2. Leaves unlobed or 3-lobed..... *I. coccinea*

1. Corolla funnel- or bell-shaped, **NOT SCARLET**; stamen and style within corolla tube.
   3. Leaves palmate; corolla **PINK**..... *I. wrightii*
   3. Leaves not palmate
      4. Sepals firm, pubescent with apex sharp or toothed.

         5. Pedicel or its stem with spreading hairs or with an uneven bumpy surface; sepals with shaggy hairs.

            6. Corolla 3-4 cm long, **LAVENDER** with a **DARK THROAT**...*I. trichocarpa*
            6. Corolla 1.5-2.0 cm long

               7. Corolla **WHITE**.....*I. lacunosa*
               7. Corolla **PINK**.....*I. x leucantha*

         5. Pedicel and its stem with strongly reflexed hairs.

            8. Leaves mostly heart-shaped; sepals oblong or elliptic with hairs ca. 2 mm long; corolla usually **PURPLE**....*I. purpurea*
            8. Leaves mostly 3-lobed; sepals long, narrow and sharp; corolla usually **BLUE** .....*I. hederaceae*

               9. Leaves 3-lobed.....var. *hederaceae*
               9. Leaves unlobed.....var. *intergriuscula*

      4. Sepals leathery, hairless or hairy; apex broadly rounded.

10. Leaves fleshy, leathery; creeping vine rooting at nodes.

11. Corolla **WHITE** with **YELLOW THROAT** (occasionally purple-throated).....*I. imperati*
11. Corolla **LAVENDER**.....*I. pes-caprae*

10. Leaves membranous; stems trailing or twining.

12. Corolla uniformly **LAVENDER** or **PURPLE**; leaves very narrow to lance-shaped.....*I. sagittata*
12. Leaves broader, heart-shaped near base.

13. Stems with soft "spines"; corolla **PURPLE**.....*I. turbinata*
13. Stem smooth; corolla **CREAM**-colored with a **PURPLE THROAT**.....*I. pandurata*

MISSISSIPPI MORNINGGLORIES

TAXON	COMMON NAME	TYPE	DISTRIBUTION
*I. batatas**	Sweet Potato	annual	
*I. coccinea**	Red Morningglory	annual	
*I. hederaceae** var. *hederaceae*	Ivy Leaf Morningglory	annual	
I. hederaceae var. *integriuscula**	Entire Leaf Morningglory	annual	
*I. imperati**	Railroad Vine	perennial	
*I. lacunosa**	Pitted Morningglory	annual	
*I. macrorhiza**		perennial	
*I. pandurata**	Bigroot Morningglory	perennial	
*I. pes-caprae**	Beach Morningglory		
I. purpurea	Tall Morningglory	annual	
*I. quamoclit**	Cypress Vine	annual	
*I. sagittata**	Glades Morningglory	perennial	
*I. trichocarpa**	Sharppod Morningglory	perennial	
*I. turbinata**	Purple Moonflower	annual	
*I. wrightii**	Palmleaf Morningglory	annual	
I. x leucantha		annual	
*Merremia dissecta**	Miniature Woodrose	perennial	

*Previously reported as a host

Austin et al. 1991

PROJECT NUMBER: 96SPW009

PROJECT TITLE: Dispersal of Marked Male Sweetpotato Weevils from a Central Release Site

LEADERS/PARTICIPANTS: Homer Collins. Tim Lockley, Anne-Marie Callcott, and Avel Ladner

TYPE REPORT: Interim

INTRODUCTION:

A number of studies on dispersal of sweetpotato weevils (SPW) have been conducted. Early mark-release-recapture studies in Louisiana indicated that SPW can disperse over considerable distances. Deen (1940) collected one dyed weevil in a light trap 880 yards from the release site. Sweet potato trap patches planted 1/4, 1/2, 3/4, and 1 mile from a release site all became infested with SPW over a growing season. Cockerham et al. (1954) marked both males and females with an aniline dye and captured 25 males and 3 females in a light trap 1 mile from the release site. One marked male and one female weevil were caught 1¼ miles from the release site. However the authors did not specify the time intervals involved in these catches.

More recent studies on SPW dispersal have included time frames in the data. Mason et al. (1990) found that male SPW are capable of travelling to a pheromone source 280 m from the release site in less than 16 hr. Sugimoto et al. (1994) marked and released 4,000 males after placing pheromone traps 10, 50, 100, and 1000 m away along 4 compass headings. The majority of males caught after 24 hr were at 10 or 50 m from the release site. Only three weevils were captured at 500 m and none were caught at 1000 m.

Information on dispersal distances of SPW is of particular interest to regulatory officials who must make decisions on quarantine boundaries, etc. We initiated a series of trials to gather additional information on dispersal of SPW.

MATERIALS AND METHODS:

Replicate Number I - July 24, 1996: The study site was located in Harrison

County, MS, and consisted of a variable habitat comprised of pecan groves, open grassy areas, and fallow fields. A 1.17 acre planting of sweet potatoes was located in the southwest quadrant of the test site. Several species of morningglories in relatively light stands were growing throughout the area. A central release site was located in a pecan grove. Screen-cone bollweevil traps (Dickerson et al. 1981) baited with pheromone septa were deployed on the cardinal and half points of the compass at distances of 50, 100, 200, and 400 yards from the central release site. A kill strip was not utilized. Weevils for release were collected in bollweevil traps placed along dense stands of *Ipomoea trichocarpa* along the CSX railroad in Gulfport, MS. Captured weevils were returned to the laboratory where they were marked on the elytra with a paint marker pen. Two hundred and sixty marked weevils were released on July 24, 1996. The number of marked weevils captured in each trap at 24, 48, and 120h after release was recorded. Air temperature and wind speed were recorded at the time of the release.

Replicate Number II - October 1, 1996: Procedures described above were repeated except traps were not placed at 100, 200, 400, and 500 yards. One-hundred ten marked weevils were released on October 1, 1996.

RESULTS:

Replicate Number I: Weevils were released at 9:00AM; air temperature was 82°F, and the wind was from the west at 0.6mph. As shown in Figure 3 and Table 1, 32.7% of the released weevils were recaptured 50 yards from the release site. Rate of recapture was 6.2, 3.1, and 0.4% at 100, 200, and 400 yards respectively.

Replicate Number II: Weevils were released at 3:00PM; air temperature was 78°F, and the wind was east at 6mph. Results were similar to the first replicate (Figure 4 & Table 1). No weevils were caught at 500 yards; and only 0.9% were captured at 400 yards. At 100 yards the recapture rate was 10.9%, and at 200 yards, 4.5%.

DISCUSSION:

These very preliminary data do not allow us to generalize much about weevil

dispersion except that it appears to be minimal over a relatively short time frame. These results are in general agreement with most other published studies. More intensive studies are needed to determine distance travelled over a longer period of time such as weeks or an entire growing season.

Figure 3. Percent of Released Marked SPW Males Recaptured at 50, 100, 200, and 400 Yards from the Center Release Point along Cardinal and Half Points of the Compass.

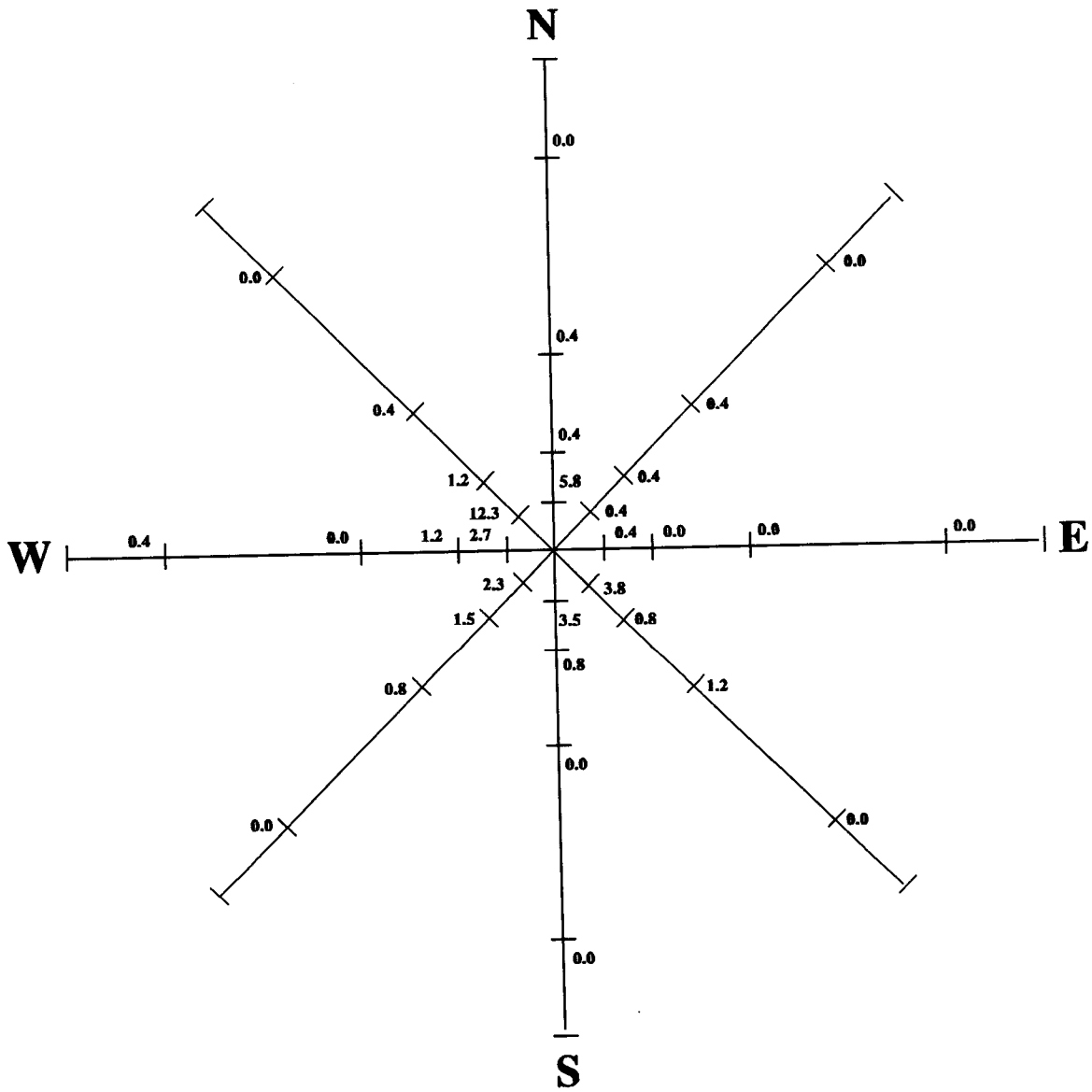


Figure 4. Percent of Released Marked SPW Males Recaptured at 100, 200, 400, and 500 Yards from the Center Release Point along Cardinal and Half Points of the Compass.

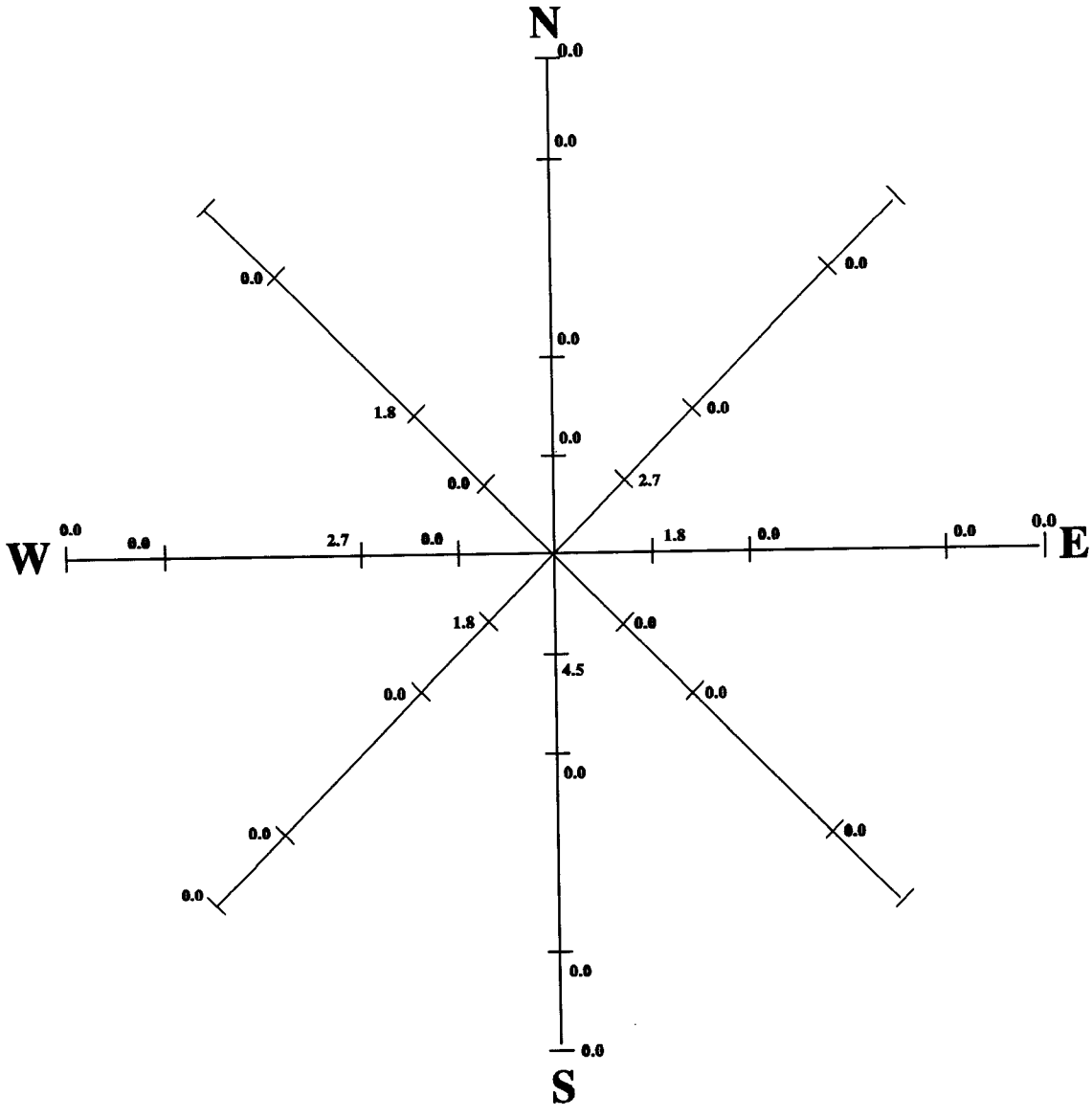


Table 1. Number of marked male SPW recaptured by pheromone traps located varying distances from the release site.

Date of release - 7/24/96; 260 marked males released

	Number of released male SPW captured at indicated direction, distance and time after release															
	50 yds				100 yds				200 yds				400 yds			
Direction	24h	48h	120h	Total	24h	48h	120h	Total	24h	48h	120h	Total	24h	48h	120h	Total
N	5	10	5	15	0	0	1	1	0	1	0	1	0	0	0	0
NE	0	0	1	1	0	0	1	1	0	1	0	1	0	0	0	0
E	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SE	5	0	5	10	1	1	0	2	2	1	0	3	0	0	0	0
S	8	0	1	9	2	0	0	2	0	0	0	0	0	0	0	0
SW	3	3	0	6	2	1	1	4	2	0	0	2	0	0	0	0
W	6	1	0	7	0	1	2	3	0	0	0	0	0	0	1	1
NW	26	6	0	32	2	1	0	3	1	0	0	1	0	0	0	0
Total all directions (%)				85 (32.7)				16 (6.2)				8 (3.1)				1 (0.4)

Table 1. Cont.

Date of release - 10/1/96; 110 marked males released

	% of released male SPW captured at indicated direction, distance and time after release																							
	100 yds						200 yds						400 yds						500 yds					
Direction	24h	48h	72h	144h	264h	Total	24h	48h	72h	144h	264h	Total	24h	48h	72h	144h	264h	Total	24h	48h	72h	144h	264h	Total
N	0	0	0	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	3	0	0	--	--	3	0	0	0	0	0	0	0	0	1	0	0	1	--	--	--	--	--	--
E	1	0	1	--	--	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	--	--	--	--
S	4	1	0	--	--	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	1	1	0	--	--	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	0	0	0	--	--	0	0	0	--	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	--	--	0	0	0	1	0	1	2	0	0	0	0	0	0	--	--	--	--	--	--
Total all directions (%)						12 (10.9)						5 (4.5)						1 (0.9)						0 (0)

PROJECT NO: 96SPW006

PROJECT TITLE: A Method for Internally Marking Sweetpotato Weevils (Coleoptera: Curculionidae) for Release-Recapture Studies

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott, Homer Collins, Charlene Hebert, Tim Lockley

INTRODUCTION:

Internal dyes have been used to mark or label a variety of insects including fire ants, weevils, fruit flies, moths, and others (Bartlett & Lofgren 1961, Gast & Landin 1966, Steiner 1965, Lloyd et al. 1968, Hendricks & Graham 1970, Graham & Mangum 1971). Several studies on dispersal of sweetpotato weevils (SPW), *Cylas formicarius elegantulus* (Summers), have employed release and recapture of marked weevils (Mason et al. 1990, Jansson et al. 1992, Sugimoto et al. 1994). These studies were all conducted by externally marking the elytras with a paint marking pen or enamel paint. However, marking large numbers of weevils is a very tedious task, and care must be taken to avoid sticking the elytras together so that flight is not impaired or prevented. We attempted to develop a system for internally marking SPW that is rapid, simple, and highly effective.

MATERIALS AND METHODS:

Field collection of wi7d adult SPW: Mason et al. (1990) determined that pre-exposure to pheromone had no influence on SPW recapture. Wild adult SPW were col1ected from various morningglory populated sites around the Mississippi Gulf Coast area. Male weevils were captured using a screen-cone boll weevil type trap baited with sweetpotato weevil pheromone septa (AgriSense. Palo Alto. CA 94303). Wild adult female weevils were captured using a coffee can baited with sweet potato roots and placed within patches of *Ipomoea trichocarpa,* sharppod morningglory. All traps were placed out in the afternoon and collected early in the morning of the following day.

Media preparation: Kays et al. (1993) developed a semiartificial diet for SPW as part of a study on the feeding response of the weevil to various components in the potato tubers. We slightly modified their procedure by adding 0.1% water soluble blue dye (Pylam Products Co., Inc., Garden City, NY).

Commercially available (grocery store) sweet potato roots were dipped in a 0.5% chlorine solution for 15 minutes followed by rinsing with sterile water. The exterior portion of the root (external to the vascular cambium) was peeled off. These peelings were chopped into small pieces and dried in an oven at 60°C for 24 hrs. Using a chlorine treated jar and blade assembly, the dried peelings were blended into a puree with sterile water. The artificial media was then composed of 94.4% sweet potato puree, 3.5% agar flake, 2.0% sucrose, and 0.1% Pylam water soluble blue dye. This mixture was then heated in a water bath until liquified. The liquid mixture was poured into chlorine treated Petri dishes, covered, and allowed to solidify prior to use.

Percentage of internally marked individuals: Using agar plates prepared as described above, 5 wild adult male SPW were introduced onto each agar plate. There were 5 replicates per trial and 5 trials were performed (125 weevils). Adult weevils were allowed to feed *ad libitum* for 48 hours. After this time period, weevils were removed from the agar plates, placed between 2 sheets of 8½ x 11" bond paper, and then crushed using a photographic roller. Presence of dye in alimentary tract was easily determined visually on the white paper. The percentage of adult weevils marked by this process was then calculated.

Effect of dye on longevity of marked weevils: Blue dyed semiartificial diet agar plates were prepared as described above. Undyed agar plates were prepared using the above methods, but without the addition of the blue dye (94.5% puree, 3.5% agar flake, 2.0% sucrose). After agar had solidified, 5 adult weevils, sex not determined, were introduced onto each agar plate type (dyed and undyed). There were 5 replicates of each agar type per trial, and 5 trials were performed. Weevils were allowed to feed *ad libitum* for 48 hours. At the end of the 48 hour feeding period, weevils were removed and placed in glass containers with screen tops according to their treatment and replicate number. A new piece of sweet potato was placed in the jar as a food source. Mortality was recorded twice weekly for 4 weeks.

Longevity of blue dye in alimentary tract: Wild collected adult male weevils were introduced onto the above described artificial agar diet with the blue dye. Ten weevils were used per agar plate. After the 48 hour feeding period, the weevils from each replicate were placed in a mason jar (screen top) with a section of sweet potato for a food source. On a daily basis, weevils from one replicate were removed from the jars, placed between 2 sheets of 8½ x 11" bond paper, and then crushed using a photographic roller. Presence of dye in alimentary tract was easily determined visually on the white paper. The percentage of adult weevils marked by this process was then calculated. Presence of dye was followed for 2 weeks.

RESULTS:

Percentage of internally marked individuals: Using this method of internally marking SPW, 98.4% of the weevils were marked internally. Only 2 of the 125 weevils exposed to the dyed diet did not pick up the dye. Thus this method of marking SPW is a viable alternative to externally marking the weevils with a paint marker.

Effect of dye on longevity of marked weevils: Two weeks after feeding on artificial diet, the weevils which fed on the dyed diet showed an average of 4.0% mortality, while those that fed on the undyed diet showed no mortality. At the end of 4 weeks, there was no significant mortality in either treatment: 36.0% mean mortality in both treatments. This indicates that the dye has no adverse effect on SPW.

Longevity of blue dye in alimentary tract: Presence of dye was 100% immediately following removal from agar diet. One day after feeding on sweet potatoes showed a 30% presence of dye. Ten percent of weevils showed indication of dye two days after feeding. No trace of blue dye was found in alimentary tract following three days after feeding, indicating that this method of marking SPW is not a viable alternative to external marking.

PROJECT NUMBER: 96SPW008

PROJECT TITLE: Trap Efficiency of the Screen-Cone Boll Weevil Trap Baited with Pheromone Septa

LEADERS/PARTICIPANTS: Homer Collins and Tim Lockley

TYPE REPORT: Interim

INTRODUCTION:

Screen-cone boll weevil traps devised by Dickerson et al. (1981) baited with a synthesized sex pheromone (Agrisense, Palo Alto, CA 94303) are used to survey for sweetpotato weevils (SPW) throughout the infested area. Jansson et al. (1992) compared trap efficiencies of the screen-cone boll weevil trap, Universal moth trap (Uni-trap, Great Lakes IPM, Vestaburg, Mich.), and a plastic funnel trap described by Jansson et al. (1989). They found that plastic funnel traps and Uni-traps were more efficacious than screen-cone boll weevil traps. However, the plastic funnel traps are not commercially available, whereas the boll weevi1 traps are readily available and far less expensive than the Uni-trap.

Under Option 1 of the National Sweetpotato Weevil Survey Plan, one screen-cone bollweevil trap is placed for every 10 acres of sweet potatoes. Traps are left in place for three weeks. Potatoes grown in SPW infested areas may only be shipped under limited permit ("pink tagged").

We attempted to determine sensitivity of the National Survey Plan by marking. releasing, and recapturing weevils with screen-cone boll weevil traps.

MATERIALS AND METHODS:

Test I - 20 Acre Fallow Field Infested with Morningglories: The site for our first release was a 20 acre fallow field in Harrison County, Mississippi. Several species of morningglories including *Ipomoea quamoclit, I. hederaceae, I. trichocarpa* and numerous other forbs such as broom sedge, *Crotalaria,* and many others were in various stages of growth. Weevils for release were collected in screen-cone bollweevil traps from dense stands of *I. trichocarpa* located along the CSX railroad in Gulfport, MS. Captured weevils were returned to the

laboratory and marked on the elytra with a quick drying paint pen (The Personalizer Paint Marker, Raz Imports, Inc.). Five-hundred and thirty-two marked weevils were transported to the fallow field on August 15, 1996 and released in the center of the field. At each corner of the field one pheromone baited screen-cone boll weevil trap was installed (Figure 5). The number of weevils captured at 24, 48, and 96 hours after release was recorded.

Test II - 1.17 acre Sweet Potato Planting: A second trial was conducted in a 1.17 acre planting of sweet potatoes (mixed varieties) in Harrison County, Mississippi. Weevils were captured and marked as above and released in the center of the field on August 22, 1996. A total of 100 marked weevils were released. A single trap was placed on the south side (prevailing wind) of the field (Figure 6). The number of weevils captured at 24, 48, and 96 hours after release was recorded.

RESULTS:

Test I - Fallow field: As shown in Table 2 the recapture rate was extremely low, 1.7, 0.7, and 0.5% of the released weevils were recaptured at 24, 48, and 96 hours after release. The cumulative recapture rate was only 2.9%. Small numbers (less than 10) of unmarked weevils were also captured indicating that an indigenous population of SPW was present during the study. Therefore, presence of alternate host plants for food and wild weevils for mating probably very closely simulated what would be expected had this study been conducted in commercial sweet potato fields. The rate of trap deployment in this trial (4 traps per 20 acres) was twice that specified in the National SPW Survey, and yet the recapture rate was less than 3%.

Test II - 1.17 acre sweet potato field: The results of the release of 100 marked weevils into a small planting of sweet potatoes are also shown in Table 2. No weevils were caught at either 24 or 96 hours after release, but 1 weevil (1%) was caught at 48 hours.

DISCUSSION:

The extremely low recapture rates we obtained in these trials are in general agreement with most other studies in which marked weevils were released and recaptured. For example, Mason et al. (1990) using plastic funnel traps obtained 50-70% recovery of marked males over short distances (10-60 meters). At 200-280 meters they captured <10% which supports our data because the distance from our release site to the traps was 190-210 meters. Sugimoto et al. (1994) reported 8.5% recapture rate at 100 meters, but plastic box traps loaded with 100μg of pheromone were used in that study. Therefore, three different studies have shown relatively low recapture rates of marked male SPW at distances over 100 meters from the release site.

Since our studies were conducted with the same trapping system used in the National Survey in an area with alternate hosts and wild weevils present, we feel that our data closely represents what could be expected under actual program conditions. Assuming that the 3% recovery of marked males that we obtained is representative of program conditions, we can predict actual population levels based on trap catches. For example, if two males are caught in a trap, we predict that 66.7 other males could be in a 200 meter radius (ca. 15 acres) of the trap (Figure 7). Assuming a sex ratio of 1:1 (Mullen 1981), capture of 2 males means that a total of 133.4 adult weevils could theoretically be within a 200 meter radius of the trap.

Figure 5. Plot Design - SPW Trap Efficiency in 20-acre Fallow Field Infested with Several Spp. of Morningglory.

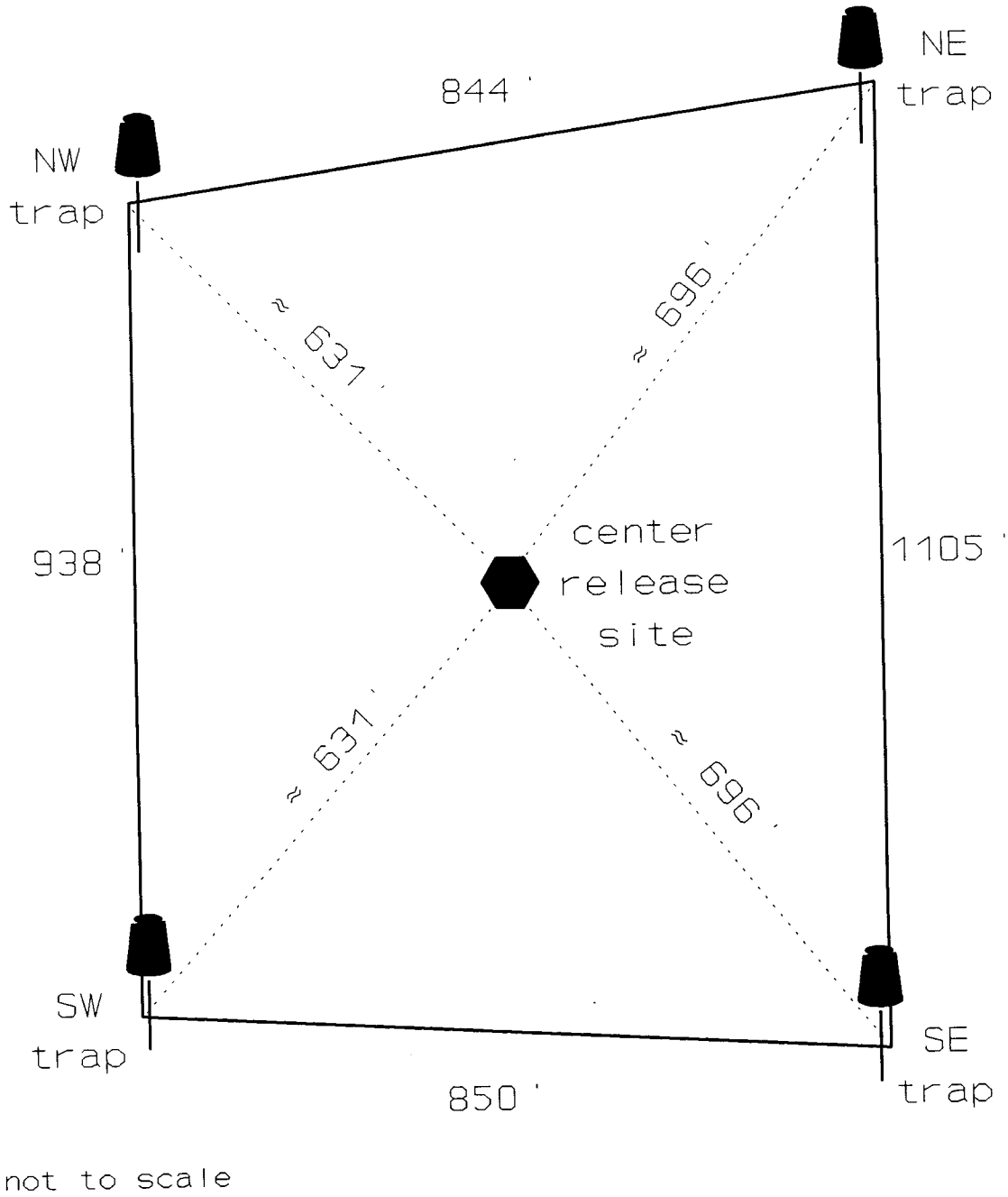


Figure 6. Plot Design - 1.17-acre Sweet Potato Field

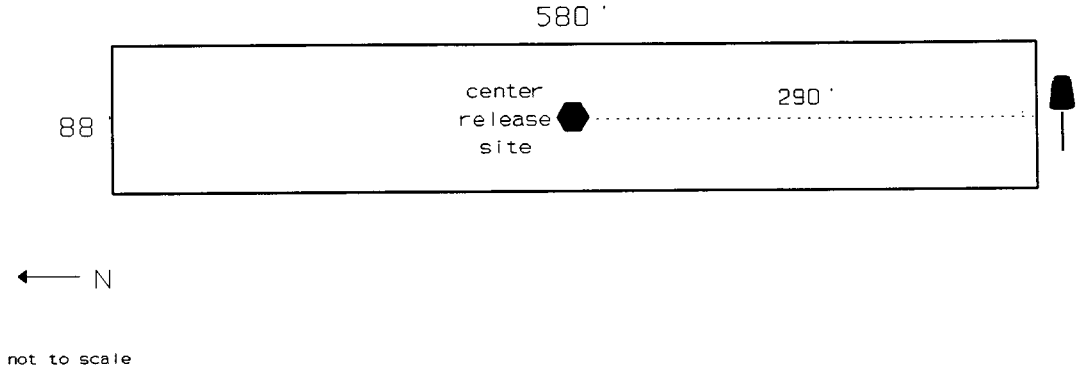
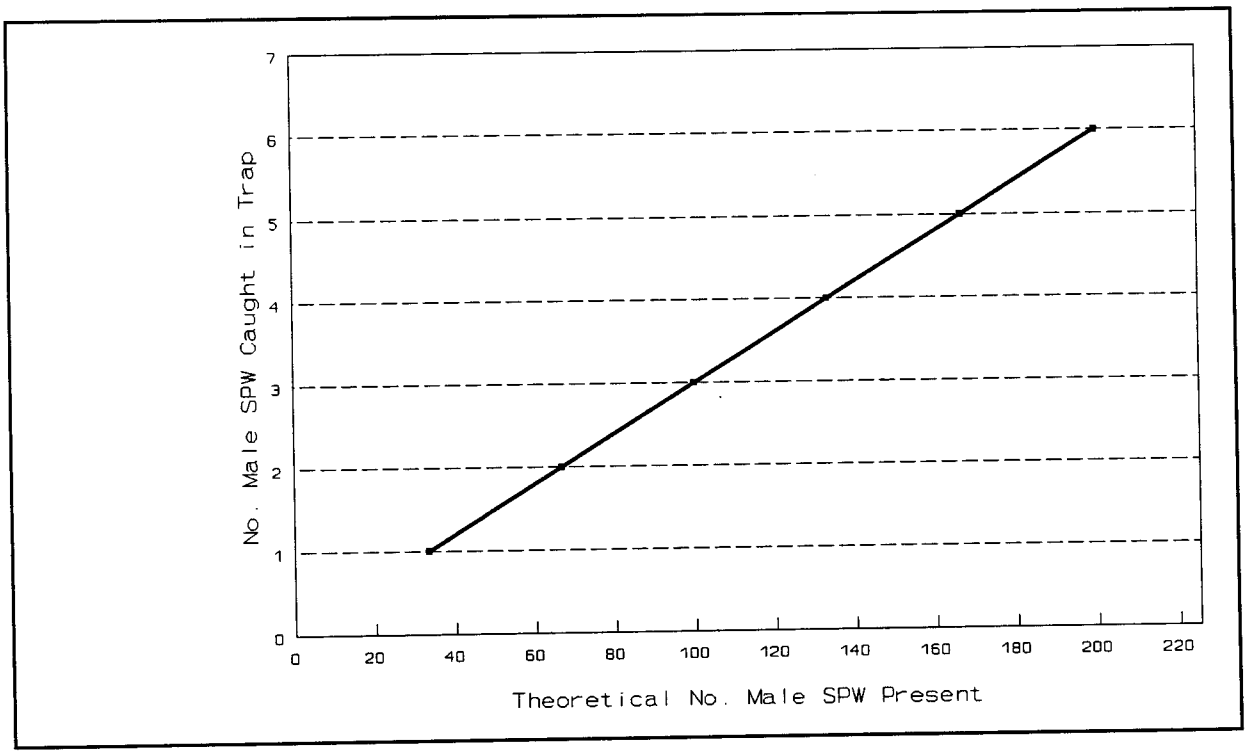


Table 2. SPW Trap Efficiency Results (Boll Weevil Type Trap)

Date of release	Number released	Habitat	% recaptured at indicated interval			
			24h	48h	96h	TOTAL
8/15/96	532	20-acre fallow field	1.7	0.7	0.5	2.9
8/22/96	100	1.17-acre sweet potato field	0.0	1.0	0.0	1.0

Figure 7. Theoretical Population Levels of Male SPW Based on 3% Trap Efficiency.



PROJECT NUMBER: 96SPW003

PROJECT TITLE: Feeding of Sweet Potato Weevils on Non-convolvulaceae Hosts

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Timothy C. Lockley and Charlene Hebert

INTRODUCTION:

Although it has been shown that the preferred host plant of the sweet potato weevil is *Ipomoea batatas* (Cockerham 1943), several other species in the family Convolvulaceae also serve as alternate hosts. Some attempts to use these alternate hosts as trap crops have been attempted in tropical areas with mixed results (Kemner 1924). Although few details are given, Jayaramaiah (1976) under laboratory conditions, succeeded in breeding SPW on carrot, *Dacus carota* (Umbelliferae); cassava, *Manihot esculenta (ultissima)* (Euphorbiaceae); and *I. campanulata* (Convolvulaceae). Das (1992) listed fourteen plants from nine families as alterative hosts for SPW. The author indicated that SPW could survive on these alternate hosts when Convolvulaceae (specifically the sweet potato) was unavailable. Many authors consider the presence of alternate hosts as potentials for major infestations and recommend their removal as a cultural control measure.

MATERIALS AND METHODS:

Investigations on the root preferences of SPW were conducted in the laboratory. Whole and sectioned roots of ten species of plants in 8 families were placed in 1-pint capacity jars. Tops were covered with insect screen. Five male and five female SPW were introduced into each jar (three replicates per species) where they remained throughout the study. Observations were made under magnification at one hour intervals for eight continuous hours each day over a three day period. One replicate per species of root stock was dissected every seven days under a binocular microscope to determine the presence of immature stages of SPW. Root stocks were maintained in the laboratory. Temperatures ranged from 20 - 25°C. Weevils used in the test were reared from sweet potato cultivars.

RESULTS:

Observations during the first day indicated feeding activity on Ginger roots (*Zingiber officinale*). During the second day of observations, feeding continued on ginger. Some signs of feeding were also noted in two of the three replicates of Chinese yam (*Discorea batatas*) and in one of the replicates of Taro (*Colocasia esculenta*). On the third day of the study, feeding continued on ginger. All three replicates of Taro and Chinese yam showed feeding activity by SPW; as did the three replicates of carrot (*Dacus carota*). In one replicate, SPW were seen feeding on the roots of collards (*Brassica oleraceae* var. *acephala*).

Although previously reported as alternate hosts (Muruvanda et al. 1986.), radishes showed no sign of feeding damage and neither radishes nor carrots housed any immature stages of SPW when dissected and examined under magnification. None of the other root stocks tested contained larval stages.

PROJECT NUMBER: 96SPW004

PROJECT TITLE: Laboratory Evaluations of *Ipomoea* Species as Host Plants for the Sweetpotato Weevil.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Timothy C. Lockley

INTRODUCTION:

Although it has been known for many years that the sweet potato weevil, *Cylas formicarius elegantulus*, breeds on a number of wild host plants within the family Convolvulaceae, no study has been undertaken to determine the efficacy of these alternate hosts in contributing to overall weevil populations.

Tests were initiated to determine (1) if wild and cultivated morningglories can support SPW and (2) how many weevils can be generated by one plant.

MATERIALS AND METHODS:

With notable exceptions, all experimental plants were grown from seed in standard industry two-gallon containers. At maturity, three plants from each species were discarded and 15 cm of stem and 15 cm of root were collected. Each severed section of plant was placed on a moistened filter paper in a 100mm petri dish with one female and one male SPW. After 72 hours, stems and roots were examined under a binocular microscope for signs of feeding damage.

In a second study, plants were placed in screened cages with two male and two female SPW to determine the potential number of SPW each species of morning glory is capable of producing as a seedling plant. Plants were watered through a drip irrigation system on an as-needed basis. Plants were removed at 40 days post introduction and the top 33 cm of stem and major root trunks were excised, dissected and examined under magnification for the presence of SPW immatures.

RESULTS:

In the first trial, all species of morning glory showed signs of feeding activity. Feeding punctures for both stems and roots seemed to be concentrated

near the crown line (soil level) in most of the tests (Table 3).

The greatest feeding activity was in *Ipomoea trichocarpa*, sharppod morningglory, with an average of 7.3 feeding punctures along the root and 4.3 punctures along the stem. *I. batatas*, sweet potato, ranked second with an average of 5.7 feeding punctures along the root and 3.0 along the stem. The commercially grown morning glory, *I. aquatica* (water spinach), had all of its stem feeding punctures located within the hollow portion. No punctures were found on the exterior surface of the stem.

In the second study, three commercial varieties of morningglory have been examined to date for their efficacy in SPW production. Each cultivar had latter instar SPW immatures within stems and roots (Table 4).

Table 3. Feeding activity of Sweet Potato Weevils on Alternate Host Plants.

Species	ROOTS		STEMS	
	Average number of punctures	Primary location of punctures	Average number of punctures	Primary location of punctures
Convolvulus tricolor	2.3	Crown	1.3	Crown
Ipomoea sp. "Pearly Gates"	3.0	Throughout	1.3	Crown
I. alba	3.0	Crown	2.0	Crown
I. aquatica	3.3	Throughout	7.3	Interior
I. batatas	5.7	Throughout	3.0	Crown
I. coccinea	2.0	Crown	1.7	Crown
I. hederaceae	3.7	Crown	1.7	Crown
I. hederaceae var. *intergriuscula*	3.0	Crown	2.3	Crown
I. lacunosa	1.7	Crown	1.0	Crown
I. nil	3.7	Throughout	2.0	Crown
I. pandurata	4.3	Throughout	1.7	Crown
I. purpurea	2.0	Crown	2.0	Crown
I. quamoclit	2.0	Crown	1.7	Crown
I. rubrocaerulea	3.7	Throughout	2.7	Crown
I. trichocarpa	7.3	Throughout	4.3	Throughout
I. wrightii	4.3	Throughout	2.3	Crown
I. x leucantha	1.3	Crown	1.7	Crown
I. x multifida	1.0	Crown	0.7	Crown
Jacquemontia tamnifolia	1.7	Crown	1.0	Crown
Merremia dissecta	3.7	Throughout	2.0	Crown

Table 4. Relative Efficacy of Differing Species of Alternate Host Plants in the Production of the Sweetpotato Weevil.

SPECIES	Date SPW introduced	Date examined	Mean no. larvae	Mean number larvae present	
				stem	root
Convolvulus tricolor "Pink Ensign"	25 IX 96	5 XI 96	0.7	0.3	0.3
Ipomoea tricolor "Pearly Gates"	6 XI 96	18 XII 96	0.7	0.3	0.3
I. alba Moon Flower	6 XI 96	18 XII 96	1.7	1.3	0.3
I. aquatica Water Spinach	25 IX 96	5 XI 96	21.3	0.3	21.0
I. batatas Sweet Potato					
I. coccinea Scarlet M.G.					
I. hederaceae Blue M.G.					
I. hederaceae var. *integriuscula* Ivyleaf M.G.					
I. imperati Beach M.G.					
I. lacunosa Pitted M.G.					
I. x multifida "Cardinal Climber"	25 IX 96	5 XI 96	0.7	0.7	0.0
I. nil "Scarlet O'Hara"					
I. pandurata Bigroot M.G.					
I. purpurea Tall M.G.	6 XI 96	18 XII 96	0.0	0.0	0.0
I. quamoclit Cypressvine M.G.	25 IX 96	5 XI 96	1.7	1.0	0.7
I. tricolor "Heavenly Blue"					
I. cordato-triloba Sharppod M.G.	6 XI 96	18 XII 96	0.7	0.7	0.0
I. turbinata Purple Moonflower					
I. wrightii Palmleaf M.G.					
I. x leucantha	6 XI 96	18 XII 96	0.0	0.0	0.0
Jacquemontia tamnifolia Smallflower M.G.					
Merremia dissecta					

PROJECT NO: 96SPW007

PROJECT TITLE: Attraction of Variously Configured Light Traps to Adult Male Sweetpotato Weevils.

LEADERS/PARTICIPANTS: Homer Collins and Tim Lockley

TYPE REPORT: Interim

INTRODUCTION:

The sweetpotato weevil, *Cylas formicarius elegantulus* (Summers) is a destructive pest of sweet potatoes under cultivation and in storage. Heath et. al. (1986) isolated, identified, and synthesized a female produced sex pheromone which is attractive to only male sweetpotato weevils. This pheromone loaded onto rubber septa is now commercially available from AgriSense, Palo Alto. CA 94303. Jansson et al. (1992) compared trap efficiencies of the modified screen-cone boll weevil trap (Dickerson et al. 1981), Universal moth trap (Uni-trap, Great Lakes IPM, Vestaburg, Mich.), and a plastic funnel trap described by Jansson et al. (1989). In this study the plastic funnel traps and Uni-traps were more efficacious than screen-cone boll weevil traps. However, the plastic funnel traps are not commercially available, and the boll weevil traps are readily available and far less expensive than the Uni-trap. Screen cone boll weevil traps are currently used to monitor weevil populations in all infested states (Dickerson, W. A., personal communication). Several preliminary mark/release/recapture studies conducted by us in 1996 confirmed that trap efficiency of the screen cone boll weevil trap is very low (See project report number 96SPW008). In addition to pheromone traps, adults have been collected in light traps (Deen 1940, Cockerham et al. 1954, Proshold et al. 1986).

We modified a commercial light trap by adding a pheromone loaded rubber septa and compared efficiency of the modified light trap to a screen-cone boll weevi1 trap which was also baited with a pheromone loaded rubber septa. We also attempted to determine attraction of weevils to incandescent bulbs as well as circular black lights.

MATERIALS AND METHODS:

Addition of pheromone loaded rubber septa to a commercial black light trap: A collecting light trap (Model 2851M, BioQuip Products Co., Gardenia, CA 90248) equipped with a 12 volt DC 22 watt circular blacklight was modified by gluing a map tack to the apex of the plexiglass vanes. The pin was then used to secure the pheromone rubber septa in place directly above the aluminum funnel of the collecting light (Figure 8).

A series of trials were conducted over a two month period beginning in August 1996. Alternate host sites (morningglories of various species) were trapped nightly for two consecutive nights. The modified light trap was placed directly on the ground on one side of the site. A bollweevil screen cone trap was placed 100-200 yards on the other side of the site. Pheromone septa were ca. 15" from the soil surface in each type of trap. Trap positions were switched on the second night of each test series to compensate for variations in wind direction, relative concentrations of weevils, etc. A kill strip, 1" square piece of Vaportape® II (10% DDVP, Hercon, Emingsville, PA 17318), was placed in each trap to prevent escape of captured weevils. Species of morningglories at each site were recorded as were the number of weevils collected per night in each respective trap.

Influence of the blacklight on efficiency of the light trap: Since it was not known whether trap catch of the pheromone baited light trap was due to the attraction of both the light and the pheromone or simply the pheromone alone, a series of trials were conducted to answer this question. In these studies a pheromone baited light trap described above was compared to a non-baited light trap which was identical except for the absence of a pheromone septa. Alternate host sites (morningglories) were trapped as above, and the number of weevils captured by each type of trap were compared.

Attraction of weevils to 12 volt 50 watt incandescent bulb: A collecting light trap (Model 2851M, BioQuip Products Co., Gardenia, CA 90248) equipped with a 12 volt DC 22 watt circular blacklight was modified by replacing the circular blacklight with a 12 volt 50 watt incandescent bulb (Figure 9). Alternate host sites (morningglories) were trapped as above and the number of weevils captured by each type of trap were compared.

RESULTS:

Addition of pheromone loaded rubber septa to a commercial black light trap: As shown in Table 5, the pheromone enhanced light trap caught over twice as many males as the screen cone bollweevil trap (438 versus 918).

Influence of the pheromone on efficiency of the standard black light trap: Weevils were not responsive to the standard unbaited blacklight trap. The pheromone baited light trap caught large numbers of weevils as shown in Table 6.

Attraction of weevils to 12 volt 50 watt incandescent bulb: As shown in Table 7 weevils were not attracted to 50 watt incandescent bulb light traps.

DISCUSSION:

These results clearly demonstrate that the pheromone baited black light trap caught more weevils than did the screen cone bollweevil trap. However, based on very preliminary data, the enhanced capture of the pheromone baited black light trap was not due to the weevils response to the black light. The black light trap was much larger in size than the bollweevil trap and may have been easier for the weevils to climb up the sides prior to being trapped by what is essentially a funnel trap.

Substitution of a 12 volt 50 watt bulb for the 22 watt blacklight did not enhance capture rate of an unbaited light trap. However, additional work is needed to clarify whether or not trap efficiency can be improved by combining light (proper wave length to be determined), with pheromone septa. This project will be continued next season.

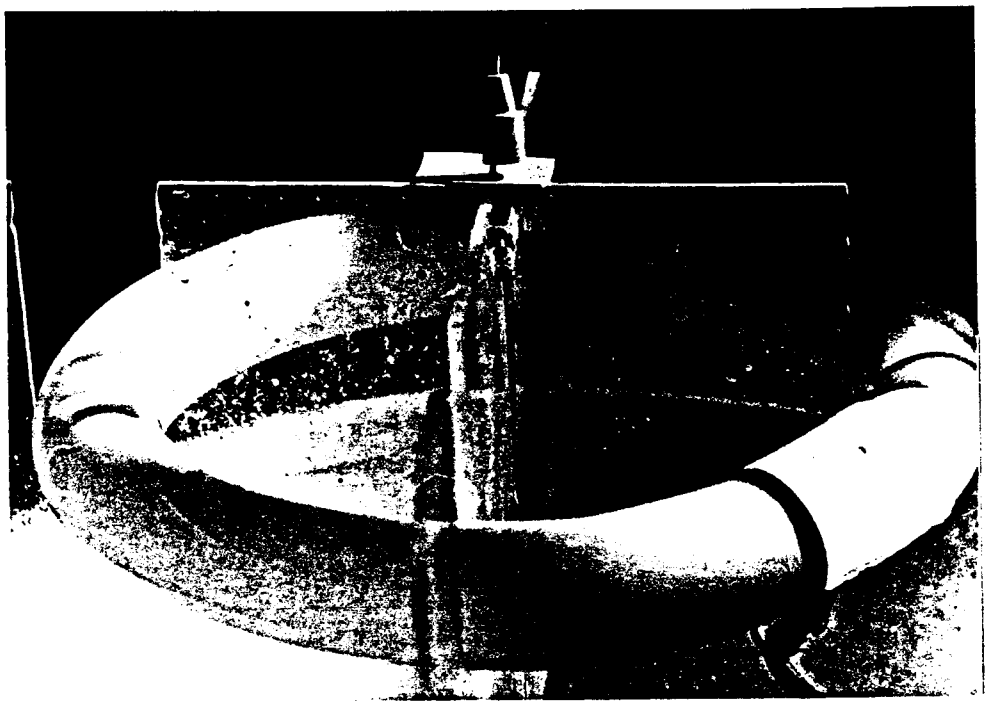


Figure 8. Light trap modified with SPW pheromone septa.

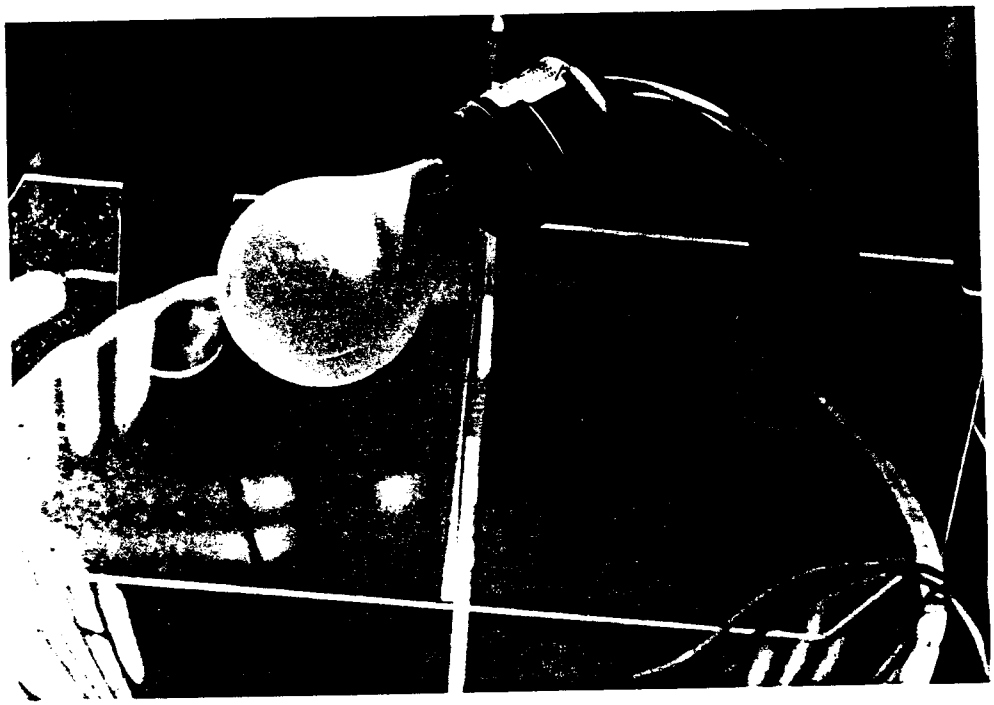


Figure 9. Light trap with incandescent bulb.

Table 5. Relative trap efficiency of a pheromone enhanced light trap versus a screen cone bollweevil trap.

DATE	SITE NO.	HOST(S)	RELATIVE TRAP PLACEMENT	NO. SPW CAUGHT	
				BW TRAP	LIGHT TRAP
8/26	1	Essentially pure stand of *Trichocarpa*	LT east of BW on railroad	187	278
9/10	2	Mixed stand; *trichocarpa, hederacea, & coccinea*	LT east of BW trap; Co. farm	27	97
9/11	2	" "	LT west of BW trap; Co. farm	2	29
9/12	1	Essentially pure stand of *trichocarpa*	LT east of BW trap on RR	131	306
9/13	1	" "	LT west of BW trap " "	91	208
			TOTALS:	438	918

Table 6. Relative trap efficiency of a pheromone baited black lighttrap versus a standard unbaited black light trap.

DATE	HOST PLANT/SITE DESCRIPTN	NO. MALE WEEVILS CAUGHT	
		STANDARD LT	PHEROMONE LT
9/17/96	*Trichocarpa* on CSX railroad	0	250
10/3/96	" "	28*	97

* Possible contamination of light trap by researchers after handling pheromone septa.

Table 7. Weevil captures with 50 watt incandescent bulb light traps.

DATE	HOST PLANT/SITE DESCRIPTN	NO. MALE WEEVILS CAUGHT	
		INCAN. BULB	BOLLWEEVIL TRP.
10/11/96	*Trichocarpa* on CSX railroad	0	45
10/24/96	*Trichocarpa* on vacant lot	0	36

PROJECT NUMBER: 96SPW005

PROJECT TITLE: Directional Survey for Population Distribution of the Sweetpotato Weevil in Harrison County, Mississippi.

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Timothy C. Lockley & Homer Collins

INTRODUCTION:

Recent surveys of sweet potato weevil, *Cylas formicarius elegantulus*, populations in south Mississippi have shown significantly high levels of the pest on native wild host plants within the Convolvulaceae family. Numbers captured in Hancock and Harrison counties are largely out of proportion with numbers collected by other researchers (pers. comm.). To better understand the distribution of the sweet potato weevil (SPW) within the area used for our researches, a directional transect survey of Harrison County MS was undertaken in July of 1996.

MATERIALS AND METHODS:

Screen-cone bollweevil traps (Dickerson et al. 1981) equipped with a SPW sex pheromone were placed at ca. 1 mile intervals along the rights-of-way of the Illinois Central Gulf Railroad (ICG) and the CSX Railroad (CSX). ICG railroad runs ca. south to north through the approximate center of Harrison County roughly paralleling U.S. Highway 49. For most of its length, ICG runs through rural areas bordered by widely varying habitats ranging from urban-industrial to single family housing to mixed deciduous/pine woods. The CSX railway runs ca. east to west through the southernmost part of Harrison County; 1.0 mile to 100 yards from the waters of the Gulf of Mexico passing along most of its length through predominantly urban areas. The traps were placed along the sides of the railway ca. 5.0 to 10.0 yards from the center of the rail within adjacent plants communities. If morningglory was located at the site, the trap was placed within the densest stand of the dominant species identified at the site. Traps remained in place for 24 hours at which time they were collected and numbers of SPW were counted at the site and released.

RESULTS:

Although the survey encompassed only a single 24 hour period in mid-summer, some rather striking differences can be seen in the data (Fig. 10). Major distinctions in the four quadrants seem to exist. The CSX survey shows a linear decline in numbers of SPW along an east to west axis. This is distinctly puzzling because of the homogeneity of the adjacent habitats along the CSX survey transect. The sharppod morning glory, *Ipomoea trichocarpa*, was found in significant numbers at all but one of the sample sites. Only two other morningglory species, *I. pandurata* and *Merremia dissecta*, were found at any of the sites; representing less than 4% of the total morningglories at the single sites where each was found. Sharppod morningglory formed the remaining 96% at those sites. The CSX transect had the greatest site diversity in both morning glory species and adjacent habitats (Table 8). At the CSX site, *I. trichocarpa*, was the predominant morning glory occurring at 96.4% of the sites. At the ICG site (north to south), *I. trichocarpa* was identified from only 52.4% of the sites surveyed. *I. purpurea* was observed at 19.1% of the ICG sites. Unidentified morningglory species represented one third of the sites sampled, with 19.1% having no morningglory species within 100 yards of the sampling site. Compared with 7.1% of the CSX sites, 42.9% of the ICG sites had mixed stands of morningglories.

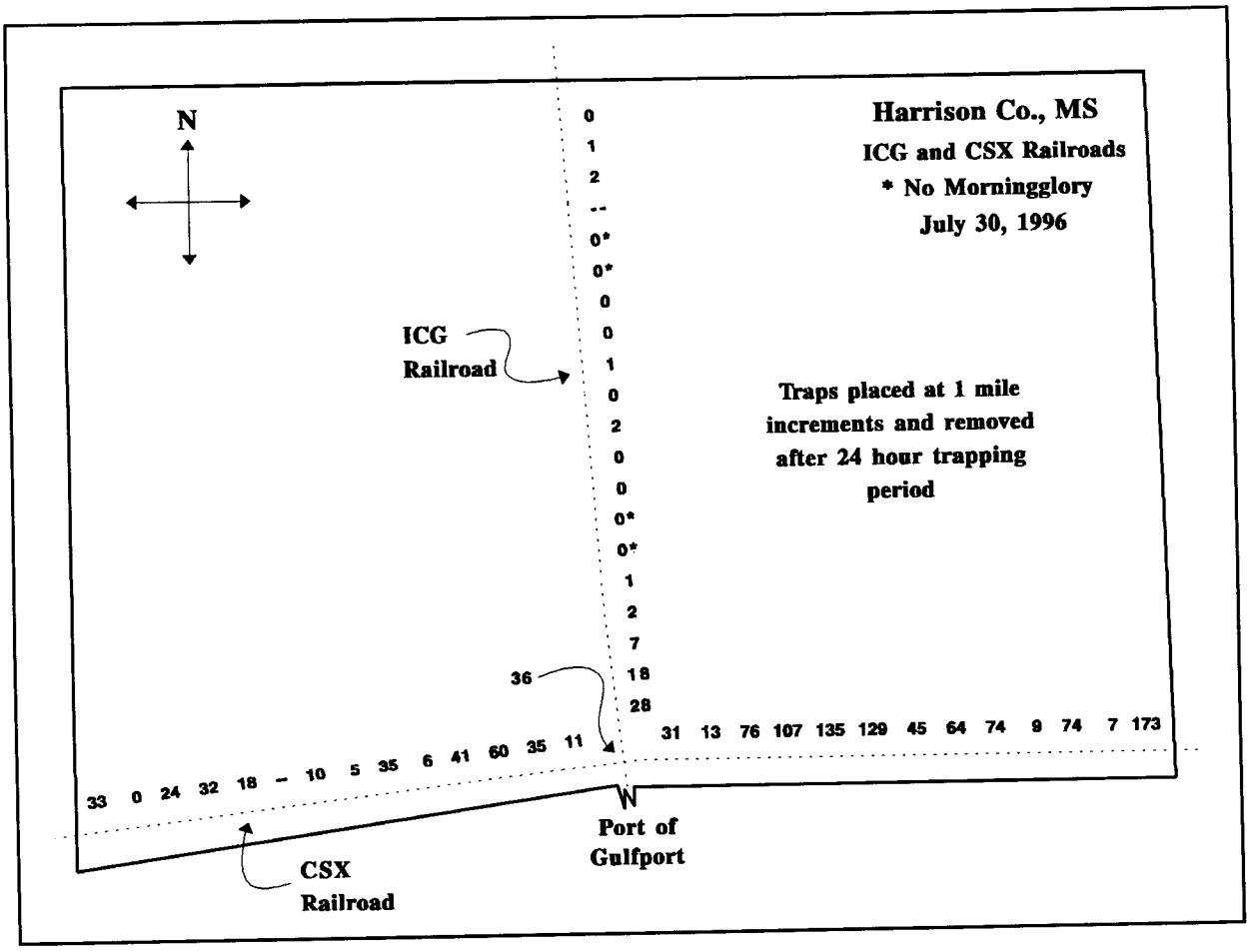
At the CSX site, all SPW (n=1283) were collected from sites having a moderate to heavy population of *I. trichocarpa*. At the ICG site, 96% of all SPW collected (n=98) were taken from sites with a dominant *I. trichocarpa* population with densities of morningglory ranging from heavy to zero.

These preliminary data would seem to indicate that *I. trichocarpa* is the preferred host of the SPW within Harrison County, Mississippi and that populations of SPW are concentrated primarily along the southernmost portion of the survey area. Whether these numbers are because of the predominance of the preferred host or because of the ameliorating affect the Gulf of Mexico has on the climatic conditions of the adjacent land area has not yet been determined.

Table 8. Occurrence of Wild Host Plants of the Sweet Potato Weevil Along the ICG and CSX Rail Roads in Harrison County, Mississippi.

Taxon	Percent of total sites	
	CSX	ICG
Ipomoea spp.		33.3
I. coccinea		4.8
I. lacunosa		4.8
I. pandurata	3.6	
I. purpurea		19.1
I. quamoclit		9.5
I. trichocarpa	96.4	52.4
Merremia dissecta	3.6	
Mixed *Ipomoea spp.*	7.1	42.9
No Morning Glory		19.1

Figure 10. SPW Capture Numbers along the ICG and CSX Railroads in Harrison Co., Mississippi



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APPENDIX I

SWEET POTATO WEEVIL ALTERNATE HOST PLANTS

An extensive list of the host plants of SPW is presented in Austin et al.1991. In that publication, the SPW was reported on 35 species of Convolvulaceae among seven genera in six tribes. These six tribes consist of Argyreieae, Convolvuleae, Cuscuteae, Dichondreae, Ipomoeae and Merremieae. Of these, Ipomoeae is considered the most important. Austin hypothesized that the SPW, a recent arrival to the New World, may have evolved with some of the Old World members of the Ipomoeae (section Erpipomoea) and later shifted to the introduced sweet potato.

World Wide Genera -

Aniseia	Cressa	Merremia	Turbina
Argyreia	Cuscuta	Operculina	Xenostegia
Bonamia	Dichondra	Poranopsis	
Calonyction	Evolvulus	Stichocardia	
Calystegia	Ipomoea	Stylisma	
Convolvulus	Jacquemontia	Thunbergia	

United States Identified Hosts -

Calystegia sepium	(Hedge Bindweed)
Cuscuta sp.	(Dodder)
Dichondra carolinensis	(Dichondra)
Ipomoea alba syn. *I. bona-nox x hederaceae*	(Moon Flower)
I. aquatica	(Water Spinach)
I. batatas	(Sweet Potato)
I. coccinea	(Red Morning Glory)
I. hederaceae	(Blue Morning Glory)
I. h. x intergruiscula	(Ivy-leaf Morning Glory)
I. imperati	(Beach Morning Glory)
I. lacunosa	(Pitted Morning Glory)
I. macrorhiza	
I. nil	(Scarlet O'Hara)
I. pandurata	(Man-Root)
I. pes-caprae	(Railroad Vine)
I. purpurea	(Tall Morning Glory)
I. quamoclit	(Cypress Vine)
I. sagittata	(Swamp Morning Glory)
I. setosa	
I. trichocarpa	(Sharp Pod Morning Glory)
I. triloba	(Three-lobed Morning Glory)
I. turbinata	(Purple Moonflower)
I. wrightii	(Palmleaf Morning Glory)
Jacquemontia curtissii	
J. tamnifolia	(Small-flowered Morning Glory)
Merremia dissecta	(Miniature Wood Rose)

Other Potential U.S. Wild Host Plants -

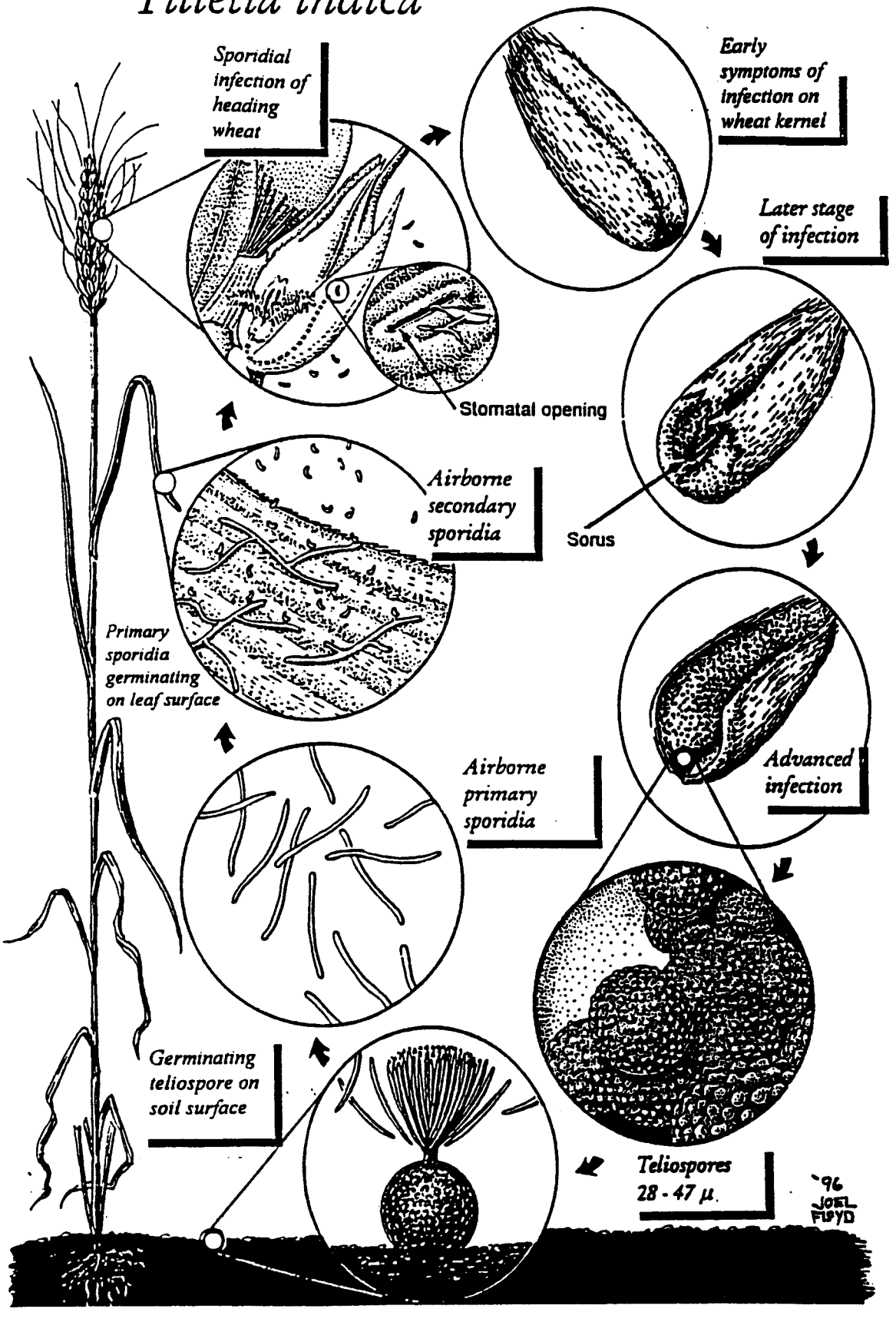
Argyreia nervosa	(Wooly Morning Glory)
Calystegia spithamaea	
Convolvulus arvensis	(Field Bindweed)
C. cneorum	(Silver-bush)
Cressa truxillensis	(Alkali-weed)
Cuscuta approximata	(Small-seeded Alfalfa Dodder)
C. campestris	(Western Flax Dodder)
C. coryli	(Hazel Dodder)
C. epilinum	(Devil's Hair)
C. epithymum	(Clover Dodder)
C. gronovii	(Gold-thread Vine)
C. indecora	(Large-seeded Dodder)
C. obscuriflora	(Australian Dodder)
C. pentagona	(Love-vine)
C. planiflora	(Small-seeded Dodder)
C. polygonorum	(Smartweed Dodder)
C. sandwichiana	(Sandwich's Dodder)
C. suaveolens	(Alfalfa Dodder)
C. umbellata	(Umbrella Dodder)
C. umbrosa	(Large-fruit Dodder)
I. cordato-triloba var. *torreyana*	(Cotton Morning Glory)
I. indica	(Blue Dawn-flower)
I. leptophylla	(Bush Morning Glory
I. x. leucantha	
Stylisma humistrata	
S. patens	
S. pickeringii	

Identified** & Possible Commercial Host Plants -

Convolvulus althaeoides	(Silverbush Morning Glory)
C. cneorum	(Ground Morning Glory)
C. mauritanicus syn. *C. sabatius*	(Dwarf Morning Glory)
C. tricolor	(Pearly Gates)
Ipomoea sp.	(Moon Flower)
I. alba **	(Water Spinach)
I. aquatica	
I. horsfalliae **	(Cardinal Climber)
I. x multifida	(Scarlet O'Hara)
I. nil **	(Railroad Vine)
I. pes-caprae **	(Heavenly Blue)
I. rubrocaerulea	(Fiddle-leaf Morning Glory)
I. imperati **	(Yellow Morning Glory)
Merremia tuberosa	
Mina lobata	(Black-eyed Susan Vine)
Thunbergia alata	(Bengal Clock Vine)
T. fragrans	(Orange Clock Vine)
T. gregorii	

Karnal Bunt Life Cycle

Tilletia indica



ARIZONA KARNAL BUNT TASK FORCE ACTIVITIES

Homer Collins and Anne-Marie Callcott were in Phoenix for a 3-week TDY assignment with the Treatment Section of the Arizona Karnal Bunt Task Force in April/May, 1996. As members of the Treatment Section, we wrote/revised many treatment protocols and guidelines regarding sodium hypochlorite treatments, storage of the product, transportation requirements, effect on T&E species, etc. One of our important contributions was the testing kit acquired from Hach Corp. with which we were able to accurately determine the percent decrease in active ingredient of sodium hypochlorite stored for any length of time under conditions of high temperature and direct sunlight. Degradation of the sodium hypochlorite is well documented in the literature and the rate of degradation, and possible solutions to the problem were outlined to the appropriate Karnal Bunt personnel before our tour was over. Work plans for other methods trials were left for the next group to initiate; efficacy of 1.5% sodium hypochlorite solution on infected wheat in actual or simulate storage facility, amount of wheatltrash remaining after sanitizing a combine with 1.5% sodium hypochlorite solution, viability of teliospores remaining on/in the wheatltrash, etc.

Tim Lockley was in Arizona for a 4-week TDY assignment in May 1996 as a "slide reader" in the Maricopa (Big Mac) Laboratory.

ALABAMA KARNAL BUNT PROGRAM ACTIVITIES

On September 27, Glen Comeaux, PPQ, SPHD, requested assistance with the Alabama Karnal Bunt situation. On September 30, Anne-Marie Callcott reported to Alabama to act as a temporary field coordinator and help field questions from the affected parties (farmers, seed dealers, storage facility operators, etc.). Anne-Marie then spent 6 weeks in the Summerdale, AL, Karnal Bunt office coordinating intensive sample collection throughout the state, compiling results as they became available, writing compliance agreements, and directing the issuing of Emergency Action Notices on those locations with positive or suspect sample results. As of November 12, Larry Herbaugh became the acting Alabama state coordinator and Gary Carpenter, the regional coordinator. After finishing up a few details, Anne-Marie was no longer involved on a day to day basis with the Karnal Bunt program. Although this work was not directly related to Methods-type activities, it was completed under the auspices of the "One APHIS" vision.