# 1988

# ANNUAL REPORT
# U. S. DEPARTMENT OF AGRICULTURE

## ANIMAL AND PLANT HEALTH INSPECTION SERVICE
## SCIENCE AND TECHNOLOGY

### WHITEVILLE PLANT METHODS CENTER
### IMPORTED FIRE ANT STATION

3505 25th AVENUE
GULFPORT, MS 39501

# 1988 ANNUAL REPORT


Imported Fire Ant Station

Whiteville Plant Methods Center

Science and Technology

Animal and Plant Health Inspection Service

U.S. Department of Agriculture

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

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

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

Compiled and Edited by:

Homer L. Collins

April, 1989

CONTENTS

FY 1988 OBJECTIVES
IMPORTED FIRE ANT STATION
GULFPORT, MS

OBJECTIVE #1: Development of quarantine treatments for certification of regulated articles: Emphasis on development of in-field treatments and management systems for field grown stock. Continue screening for alternate potting soil and grass sod treatments. Registration of alternate drench treatments.

OBJECTIVE #2: Development of eradication procedures for small isolated infestations: Evaluate combinations of chemicals, dose rates, application procedures, treatment intervals, etc. to determine the most effective method of eliminating small isolated infestations before spread occurs. Based on results obtained, prepare guidelines and protocol for use by others to achieve eradication of small infestations. Cooperate with ARS on a pilot project involving aerial applications of LOGIC baits for eradication of isolated infestations.

OBJECTIVE #3: Continue testing and development of chemical bait formulations: Small plot field evaluation of new bait formulations (primarily new attractants, inert carriers, and stabilizers). Evaluation of pheromone based baits (at least in small quantities or crude form) if ARS research has advanced to the appropriate stage. Assist with registration of GX-071 bait.

OBJECTIVE #4: Preparation/distribution of technical information on control, quarantine procedures, new technology, biological hazards, etc. to state agencies, the media, and the public.

## SUMMARY

Dose Rate Trials with Triumph 1G in Nursery Potting Media (Page 1): Dose rates of 5.6, 11.2, 22.4 and 44.8 g. AI/cu. yd. of potting media provided residual activity for 7 to over 31 months, depending upon dose rate.

Persistence of Triumph 1G in Various Types of Potting Media (Page 3): 16 months of residual activity was obtained after blending Triumph 1G into either milled pine bark, or a high vermiculite soil mix at 11.2 g. AI/cu. yd.

Rate of Degradation of Dursban 2.5G, 4EC, Triumph 1G and 2EC in Potting Soil (Page 6): GLC analysis was used to generate degradation curves for two formulations of both Dursban and Triumph. Results indicated that both products degraded rapidly. However, both Dursban formulations provided end point residues of 1.78 and 3.81 ppm for 2.5G and 4EC respectively.

Evaluation of New Potting Soil Toxicants (Page 14): Phosphorodithioate provided 9 months of residual activity. Several synthetic pyrethroids provided very encouraging results in the initial bioassays.

Toxicity of Triumph and Dursban in Topsoil to IFA Workers and Alate Queens (Page 19): The $LD_{99}$ of Triumph in a sandy loam topsoil was .372 ppm for queens and .035 ppm for workers. The $LD_{99}$ of Dursban was 1.75 ppm for queens and .35 ppm for workers.

Evaluation of Various Rates of Topically Applied Granular Dursban and Triumph for Quarantine Treatment of Containerized Nursery Plants (Page 27): Triumph 2G applied "over-the-top" at rates 1.0 or 2.0 lb. formulated material per cubic yeads of media effectively eliminated colonies infesting pots at the time of treatment and provided residual activity against queens for 4 months. Inconsistent results were achieved with Dursban. The results with Dursban were somewhat predictable since it is relatively insoluable in water and did not leach throughout treated pots. Ant colonies therefore were able to survive in the bottom of treated containers.

Pesticide Avoidance by IFA Workers (Page 38): Foraging workers readily crossed pesticide contaminated surfaces in order to reach a food source. Therefore, an avoidance behavior was not induced by the presence of either Dursban, Triumph, or Orthene.

Evaluation of In-field Spot Treatments with Dursban for Certification of Field Grown Nursery Stock (Page 44): Based on very preliminary data, spot treatment with granular Dursban shows promise as a means of certification of field grown nursery stock.

Evaluation of Various Insecticide Coating and Paint Additives for Residual Control of Foraging Workers on Painted Surfaces (Page 51): Three paint additives containing chlorpyrifos gave quick knockdown and up to 120 days residual control against workers.

Evaluation of Chlorpyrifos 2.5G for Phytotoxic Effects on Nursery Stock (Page 55): Dursban was not phytotoxic at either 1X or 3X dose rates when tested against eighteen different plant species. Both succulents and woody ornamentals were included in the test.

Evaluation of Various Candidate Insecticides for Quarantine Treatment of Grass Sod,1988 (Page 60): A severe drought and lack of an irrigation system prevented completion of a trial with 10 candidate sod treatments in 1988. However, under severe drought conditions, both Dursban 10G and Turcam 2.5G remained effective for 60 days post-treatment at which time the trial was cancelled.

Topical Application of Various Insecticides to Containerized Plants for Quarantine Certification (Page 64): Dursban, Triumph, Oftanol, and Orthene were tested as an "over-the-top" treatment for containerized plants. Orthene provided 100% nest mortality and 1 week residual activity against alate queens. Variable results were obtained with other products tested.

Toxicity of Dursban to IFA Workers and Alate Queens in Nursery Potting Media (Page 69): The $LD_{99}$ for technical chlorpyrifos in nursery potting media was 4.26 ppm for alate queens. This value is more than two fold the $LD_{99}$ in local sandy loam topsoil. $LD_{99}$ for workers was 1.98 ppm.

Evaluation of Commercially Available Fumigants for Control of Foraging Workers (Page 74): Six commercially available insect foggers were tested against IFA workers. All products were 100% effective on surface foraging worker ants. Simulated IFA nests (infested pots containing potting media and a "fragmented" IFA colony) were not affected by the fumigant.

Rate of Degradation of Dursban 2EC in a Typical Nursery Potting Soil Environment (Page 77): Two separate trials conducted between April 5, 1988 and July 15, 1988 indicated that the Dursban drench specified in M301.81 provided 100% mortality up to the 90 day certification period given, but not beyond 90 days.

Effects of Irrigation on Residual Activity of Dursban Drenches for Certification of Containerized Plants (Page 79): Varying amounts of irrigation water (up to 53.95 inches cumulative) did not influence residual activity of Dursban drenches at approved rates of application.

Examination and Possible Treatment of Grass Sod for the Presence of IFA Queens in an Area Known to be Infested with Polygynous Colonies (Page 82): Current treatments for grass sod are based on data and assumptions for monogynous colonies. Since polygynous populations represent a totally different pest risks, treatment procedures should be developed specifically for polygynous populations.

Evaluation of Jobe's® Insecticide Spikes as a Method for Certification of Containerized Plants (Page 86): Jobe's® Plant Spikes containing Furadan and Disyston were determined to have no potential for use as a quarantine treatment for containerized plants.

Lateral Movement of Dursban Emulsion through Various Soil Types (Page 91): Dursban emulsion laterally translocated 26 inches in a typical nursery soil, 72 inches or more in masonary sand and 14 inches in a local sandy loam.

Population Dynamics of IFA Colonies (Page 96): A long term study to compare rates of reinfestation, time required for incipient colonies to attain various colony classes, etc. at two sites (Gulfport, MS and Whiteville, NC) was initiated.

Eradication of Isolated Infestations: Comparison of Methods of Treatment Page 103): Test plots which were first baited with Logic, then drenched with Dursban reached 100% control sooner than did plots treated in reverse order.

Evaluation of Beauveria biassiana (Page 108): Although colonies were not eliminated in several laboratory trials, very low levels of infection were achieved with the Abbott Laboratories strain of B. bassiana.

Field Tests with Neoplectana carpocapsae Nematodes for Control of IFA (Page 115): Two trials with an entomogeneous nematode under commercial development by Biosis Company were conducted. An acceptable level of IFA control was not achieved in either trial.

Strip Treatment vs. Broadcast Treatment with Logic Bait (Page 122): IFA control in "strip-treated" plots was inferior to "broadcast-treated" plots.

Shelf Life of GX-071 Bait (Page 127): Feeding acceptance of GX-071 bait stored at elevated temperatures deteriorated rapidly.

Provide Training to State Nursery Inspectors on All Phases of the Federal IFA Quarantine Program (Page 133): A one day workshop was provided to 300 inspectors in 10 states.

PROJECT NO: FA02G036

PROJECT TITLE: Dose Rate Trials with Triumph 1G in Nursery Potting Media

TYPE REPORT: Interim

LEADER/ PARTICIPANT: Avel Ladner

INTRODUCTION/METHODS & MATERIALS:

A long term dose rate study with Triumph 1G was initiated in January 1986 and continued throughout 1988. Dose rates of 5.6, 11.2, 22.4, and 44.8 grams AI per cubic yard of potting media (Baccto Brand, Michigan Peat Co., Houston, Texas) were thoroughly blended into the media with a portable cement mixer on January 30, 1986. Treated media was then weathered outdoors under natural conditions (no irrigation water, natural rainfall only) in 1 gallon plastic pots to simulate actual nursery conditions. Bioassays with alate queens were periodically conducted according to procedures described elsewhere in this report (see Project FA02G037).

RESULTS:

As shown in Table 1, 5.6 grams AI/cu. yd provided 7 months residual activity, and 11.2 gms. AI/cu. yd. remained active for approximately 14 months. All other rates continued to provide 100% mortality for 27 months or longer. This trial will be continued until all rates become ineffective. .

Table 1. Residual Effectiveness of TRIUMPH 1G in Nursery Potting Soil. 1/

| DOSE RATE (Gm AI/Cu. Yd) | Mean % Mortality to alate queens confined to treated soil after 7 days continuous exposure | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Age of treated soil (months) | | | | | | | | | | | | | | | | |
| | (1) | (3) | (7) | (9) | (12) | (13) | (14) | (18) | (19 | (20) | (21) | (23) | (25) | (27) | (29) | (31) | (34) |
| 5.6 | 100 | 100 | 100 | 60 | 55 | 30 | 10 | 65 | 35 | 5 | 5 | 0 | 5 | 0 | 0 | 0 | 5 |
| 11.2 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 80 | 90 | 45 | 70 | 80 | 35 | 60 | 15 | 0 | 0 |
| 22.4 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 85 | 100 | 65 | 45 | 100 |
| 44.8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Check | 5 | 10 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 5 | 5 | 10 | 0 | 10 | 5 | 10 |

1/ Test initiated January 30, 1986.

PROJECT NO: FA02G046

PROJECT TITLE: Persistence of Triumph 1G Insecticide in Various Types of Potting Media

TYPE REPORT: Final

LEADER/PARTICIPANT: Avel Ladner

INTRODUCTION:

All available evidence indicates that Triumph 1G is an effective IFA quarantine treatment for potting soil. However, all prior trials with Triumph involved a single type of potting soil (Baccto®), (Michigan Peat Co., Houston, Texas). Since potting soils vary greatly in composition, % organic matter, pH, density, and numerous other factors which could affect residual activity of insecticides, more information on the performance of Triumph in various types of potting media was needed.

METHODS AND MATERIALS:

The performance of Triumph 1G in two types of potting media was compared to Dursban 2.5G applied at equivalent rates of application (11.2 gms. AI/Cu. yard of media). One potting mix consisted of milled pine bark (Forest Gardens, Inc.) the other was a high vermiculite mix containing bark, vermiculite, peat and pearlite (Ball Growing Mix, Ball Seed Co.). Each insecticide was blended into the mixes with a portable cement mixer on September 25, 1986 and then weathered outdoors under natural conditions (no irrigation water added) in

plastic 1 gallon pots and bioassayed periodically utilizing procedures described in Project FA02G037 of this report.

RESULTS AND DISCUSSION:

As shown in Table 2, both Triumph 1G and Dursban 2.5G were highly effective in both types of potting media for about 16 months.

Table 2. Residual Activity of Triumph 1G in Two Different Types of Nursery Potting Media.

| Type of Media | Insecticidal Treatment | Mean % Mortality of Alate Queens after 7 Days Exposure to Media Treated and Aged as Indicated 1/ Age of Treated Media (Months) 2/ (1) | (3) | (6) | (9) | (10) | (12) | (14) | (16) | (18) | (22) | (24) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Milled pine bark | TRIUMPH 1G, 11.2 Gm AI/cu yd | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 25 | 0 | 0 |
| Milled pine bark | DURSBAN 2.5G, 11.2 Gm AI/cu yd | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 85 | 100 | 25 | 35 |
| Milled pine bark | Untreated | 15 | 0 | 5 | 0 | 0 | 20 | 0 | 10 | 0 | 0 | 0 |
| Grow Mix 3/ | TRIUMPH 1G, 11.2 Gm AI/cu yd | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 70 | 0 | 0 |
| Grow Mix 3/ | DURSBAN 2.5G, 11.2 Gm AI/cu yd | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 | 0 | 0 |
| Grow Mix 3/ | Untreated | 35 | 0 | 0 | 0 | 0 | 15 | 0 | 10 | -- | -- | -- |

1/ Average based on 4 replicates/treatment with 5 queens/replicate.

2/ Test initiated September 25, 1986.

3/ A high vermiculite media available from Ball Seed Company.

PROJECT NO: FA02G017

PROJECT TITLE: Rate of Degradation of Dursban 2.5G, 4EC, Triumph 2G and 2EC in a Typical Nursery Potting Soil Environment.

TYPE REPORT: Final

LEADER/PARTICIPANTS: Homer Collins, Avel Ladner, and J.C. Hawthorne (NMRAL)

INTRODUCTION:

Dursban 2.5G applied as a preplant incorporated treatment is approved for certification of nursery potting soil under the IFA quarantine. Dursban 4EC is also an approved treatment for containerized nursery plants, but is applied as a drench (4 fl. oz./100 gals. $H_2O$). A certification period of 24 months is listed in M301.81 for the 2.5G formulation and 90 days for the drench treatment. Triumph (CGA-12223) is a relatively new product from Ciba-Geigy that has shown promise as a potting soil toxicant. A study employing gas chromatography analysis was initiated on April 23, 1987 to determine degradation curves for each of these insecticide treatments in a typical potting soil environment. Initial dose rates for each of the 4 insecticide treatments are shown in Table 3.

METHODS AND MATERIALS:

Granular formulations (Dursban 2.5G and Triumph 2G) were blended into potting soil (Grow-Mix@, Ball Seed Co., 493 lb./ cu. yd. bulk density) with a cement mixer at a rate of 11.2 grams AI/cubic yard of soil (equivalent to 10 lbs. AI/3" acre). EC formulations were applied at a rate of 4 fl. oz. 4E/100

TABLE 3. Dose Rates for Triumph/Dursban Degradation Study.

| TREATMENT | DOSE RATES | | | | |
|---|---|---|---|---|---|
| | GRANULAR FORMULATIONS | | | EC FORMULATIONS | |
| | Gms. AI/YD$^3$ | Lbs. Formulated Material per Cubic Yard | Grams formulated material per cubic foot | Fluid oz./100 gal. $H_2O$ | Ml./Gal. $H_2O$ |
| DURSBAN 2.5G | 11.2 | 1.0 | 16.8 | — | — |
| TRIUMPH 2G | 11.2 | 1.25 | 21.0 | — | — |
| DURSBAN 4EC | — | — | — | 4 | 1.2 |
| TRIUMPH 4 EC | — | — | — | 4 | 1.2 |

gallons of water to potting soil contained in 6" x 6" plastic pots. (13 fl. oz. finished solution/pot). Following treatment, all pots were weathered outdoors under natural conditions. No irrigation water was added. At monthly intervals, 3 pots from each treatment were composited and uniformly blended. From the composite sample, a 150 gram sub-sample was taken for GLC analysis by the National Monitoring Residue Analysis Laboratory (NMRAL). Samples were stored in a food freezer until analyses were conducted by NMRAL. Extraction and analysis procedures are published elsewhere (NMRAL Procedure PR0047).

RESULTS:

As depicted in Figures 1 and 2, initial and end point concentrations of the 4 treatments as determined by GLC analyses were as follows:

| Treatment | Initial Concentration (ppm) | End Point Concentration 18 months Post-treatment (ppm) |
|---|---|---|
| Dursban 2.5G | 167.23 | 1.78 |
| Dursban 4EC | 288.90 | 3.81 |
| Triumph 2G | 77.38 | 0.14 |
| Triumph 4EC | 104.63 | 0.14 |

The theoretical initial rate for 2.5% granular Dursban was 50 ppm (i.e., 11.2 grams AI incorporated into 1 cu. yd. of potting soil with a bulk density of 493 lbs./cu. yd. = 50 ppm). The reason for the three-fold discrepancy in actual and theoretical dose rates is not known. Non-homogeneous blending of the insecticide into the media is often a factor. However, in this case, media treated with Dursban 2.5 remained well above the theoretical initial

dose rate for the first 5 consecutive months after treatment.

Results with the Dursban 4EC were also quite unexpected. Data from the present study indicate that residues remained above 2.0 ppm for the duration of the 18 month study.

Dosage mortality tests with technical Dursban have shown the $LD_{99}$ to be about 2.0 ppm for large major workers in nursery potting media (see Project Report FA01G088). However, bioassays of Dursban 4E samples from the last 3 months of this study (i.e., 16, 17, and 18 months post-treatment provided 51 to 80% mortality to IFA major workers (Table 4). Only 3.7 to 10% mortality was achieved in the bioassay of Dursban granular treatments, although GC analysis ranged from 1.42 to 1.78 ppm.

One possible explanation for IFA survival in potting media containing Dursban residues is that part of the Dursban was in a "bound" state and therefore unavailable as a pesticide. This phenomenon of pesticide binding (adsorption) was well documented for chlordane and other organochlorine pesticides (Harris, 1972; Fleming, 1948; and Lilly, 1956). Other studies (Sharome et al. 1980) have shown that Dursban also adsorbs to organic soil particles.

Table 4. Bioassays of Selected Soil Samples from GLC Degradation Study.

| TREATMENT | % Mortality of IFA Major Workers Confined to Soil Samples Collected at Indicated Post-Treatment Intervals (months) 1/ (16) | (17) | (18) |
|---|---|---|---|
| Dursban 2.5G | 10 2/ | 8.7 | 3.7 |
| Dursban 4EC | 77.5 | 80.0 3/ | 51.2 |
| Untreated Check | 10 | 10 | 10 |



1/ Bioassays initiated 3/8/89. Average of 4 replicates/sample; except as otherwise noted, 20 field collected major workers/replicate. 7 days continuous exposure.

2/ 1 replicate only due to insufficient retention sample

3/ Average of 2 replicates only due to insufficient retention sample.

Fig. 1. Degradation Curves for Dursban & Triumph EC Formulations in Potting Media.

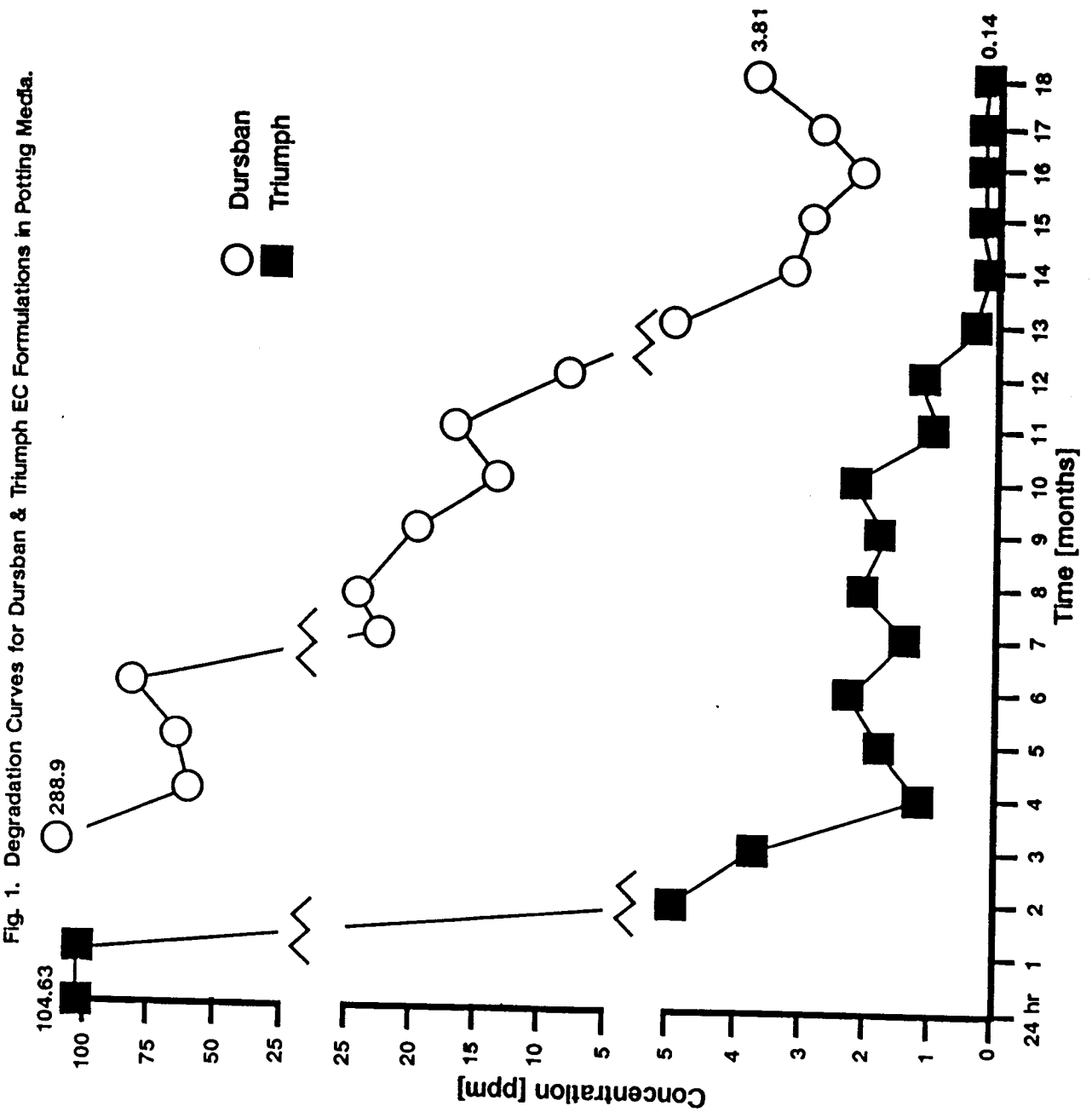
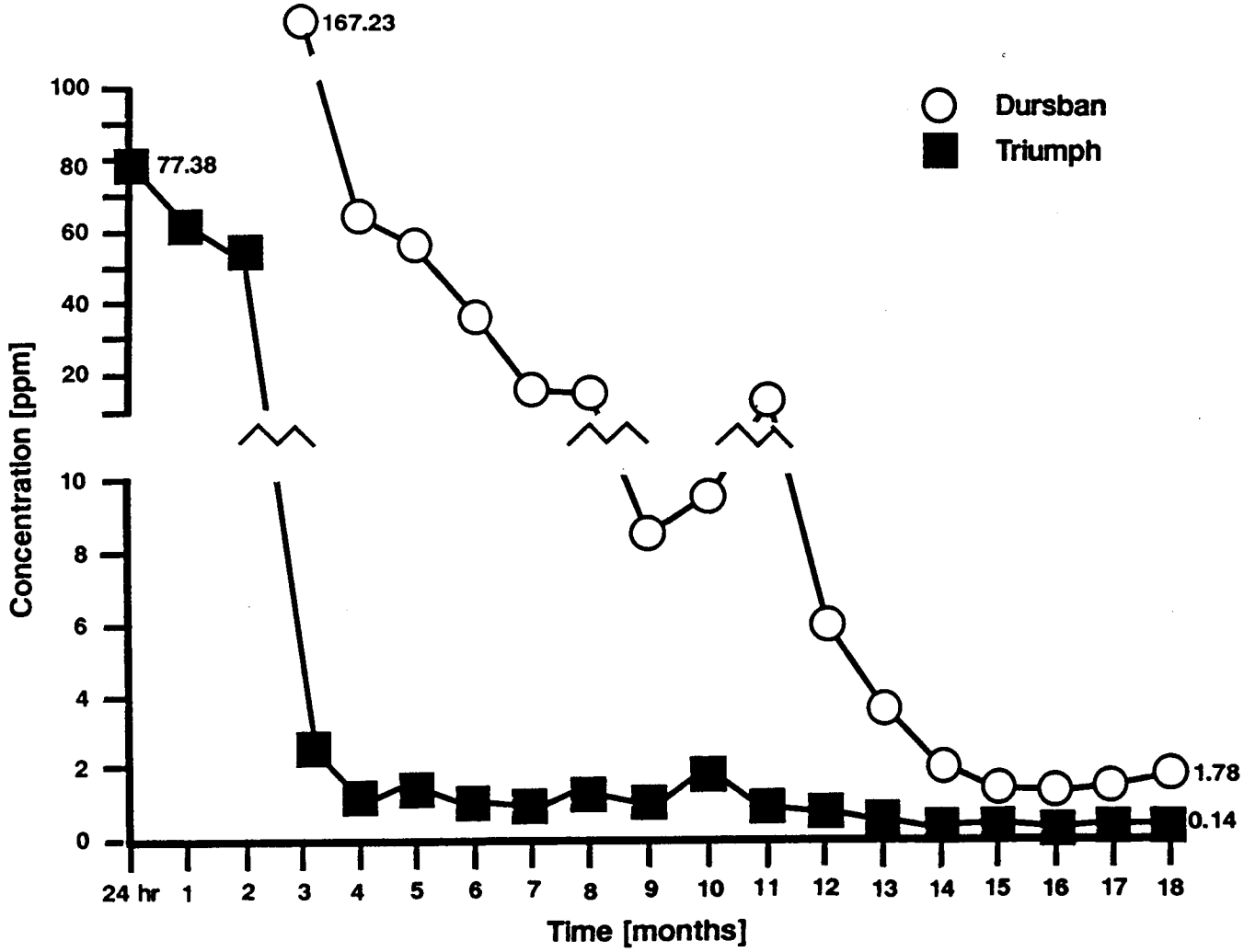


Fig. 2. Degradation Curves for Dursban & Triumph Granular Formulations in Potting Media.



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Fleming, W.E. 1948. Chlordane for control of Japanese beetle larvae. Jour. Econ. Ent. 41:905-912.

Harris, C.R. 1972. Factors influencing the biological activity of technical chlordane and some related components in soil. Ibid. 65:341-374.

Lilly, J.H. 1956. Soil insects and their control. Ann. Review Ent. 1:203-222.

Sharom, M.S., J.R.W. Miles, C.R. Harris and F.L. McEwen. 1980. Behavior of 12 insecticides in soil and aqueous suspensions of soil and sediment. Water Research. 14:1095-1100.

PROJECT NO: FA02G037

PROJECT TITLE: Evaluation of New Potting Soil Toxicants

TYPE REPORT: Interim

LEADER/PARTICIPANT: Tim Lockley and Avel Ladner

INTRODUCTION:

Chlordane applied at a rate of 4 ounces of 5% per cubic yard of potting soil was used as a quarantine treatment for containerized nursery stock until cancellation of registration in December 1979. An on-going screening program to evaluate insecticides applied as a pre-plant incorporated treatment for nursery potting soils has been conducted by the PPQ IFA Station since 1974. The most effective treatment thus far is chlorpyrifos(Collins et al. 1980). In January 1980, Dow Chemical Company obtained registration of a 5% chlorpyrifos granule which was marketed under the trade name FA-5. This product was applied at a rate of 0.5 lbs. FA-5 per cubic yard of potting media. Several cases of possible FA-5 related phytotoxicity to greenhouse grown succulent plants in Central Florida prompted the registrant to withdraw this product from the market in the fall of 1981. Registration of a second chlorpyrifos formulation(a 2.5% granule) for treatment of potting soil was obtained in July 1984 by Ford's Chemical and Service, Inc., Pasadena, Texas. At the current time this is the only registered product for this use pattern.

A limited number of candidate potting soil toxicants were evaluated in 1988 in

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

METHODS AND MATERIALS:

Test procedures used to evaluate all candidate toxicants were as follows: Granular or dust formulations of each product tested were blended into nursery potting soil, (Baccto®, 818 pounds per cubic yard) at an initial rate of 10 lbs. AI per three-inch acre (equivalent to 11.2 grams AI per cu. yd. of media). A portable cement mixer (2 cu. ft. capacity) was used to blend the toxicants into the potting media, and was operated for one hour per batch to insure thorough blending. Treated media was then poured into two-quart plastic pots and weathered outdoors under natural conditions for one month prior to the first bioassay. No additional irrigation water was added.

Bioassays were conducted in the laboratory by confining alate queens to treated soil placed in 2" x 2" plastic flower pots equipped with a Labstone® bottom. The labstone absorbed moisture from an underlying bed of damp peat moss. There were four replicates per treatment in each bioassay. Each pot (replicate) contained 20 cc. of treated soil and five alate queens. Queen mortality was assessed after seven days of continuous confinement to the treated soil. Treatments which were effective at the first bioassay interval were aged and retested periodically to measure and compare residual activity

with chlorpyrifos. Several granular formulations of chlorpyrifos have provided up to 24 months residual activity under these conditions.

RESULTS:

As shown in Table 5, Stauffer SC-056-10G (Phosphorodithioate) demonstrated excellent residual activity for nine months. Several termiticides were included in these trials. These compounds demonstrated excellent results during preliminary bioassays (1 month after incorporation). Bioassays will continue until activity ceases.

Table 5. Residual Activity of Candidate Potting Soil Toxicants, 1988. 1/

| TOXICANT | Rate (Gm. AI/yd. | Mean % Mortality of Alate Queens Confined to Treated Soil for 7 Days<br>Age of Treated Soil (Months) (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stauffer SC-056-10G (Phosphorodithioate) | 11.3 | 100 | 100 | 100 | | 90 | | 95 | 100 | 100 | 75 | 15 |
| Advantage 5G | 14.8 | 45 | | | | | | | | | | |
| Ammo 0.25G | 14.8 | 100 | | | | | | | | | | |
| Capture 0.30G | 12.4 | 100 | | | | | | | | | | |
| Dursban 2.5G | 14.8 | 100 | | | | | | | | | | |
| Force 1.5G | 14.8 | 100 | | | | | | | | | | |
| Furadan 5G | 14.8 | 25 | | | | | | | | | | |
| Oftanol 5G | 14.8 | 0 | | | | | | | | | | |
| Pounce 1.5G | 14.8 | 100 | | | | | | | | | | |
| Turcam 2.5G | 14.8 | 100 | | | | | | | | | | |

1/ Tests with Stauffer SC-056-10G initiated September, 1987. All other toxicants initiated December 14, 1988.

## REFERENCES CITED:

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

PROJECT NO: FA02G077

PROJECT TITLE: Toxicity of Triumph and Dursban in Topsoil to IFA Workers and Alate Queens

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott, Rebecca Norris, Linda Ward, and Gilbert Nance

INTRODUCTION:

Triumph is a relatively new organophosphate insecticide from Ciba-Geigy that has shown promise as a quarantine treatment for nursery potting media. Triumph's efficacy when incorporated into soil, used as a single topical application for containerized plants and its residual activity are currently being tested. Because of promising results thus far, a study to establish initial toxicity and $LD_{99}$ of technical Triumph insecticide against IFA workers and alate queens was initiated. The worker ant study was done in Whiteville, North Carolina by Rebecca Norris, et al., and the alate queen study in Gulfport, Mississippi, by Anne-Marie Callcott.

A study of toxicity of Dursban to IFA workers, conducted in 1979,(Annual Report, USDA, APHIS, PPQ, IFA Station), showed the $LD_{50}$ approximately .18 ppm and $LD_{99}$ to be .28 ppm. This study was repeated because of recent interest in the minimum dose rate required for IFA control in potting media.

METHODS AND MATERIALS:

Procedures described elsewhere were slightly modified to meet the criteria here (Banks et al. 1964, Collins and Ladner 1981, Collins et al. 1982). Stock solutions of technical Triumph (94.4%), and technical Dursban (99%), were mixed in acetone. Serial dilutions of the stocks were added to 150 g. local sandy loam top soil to obtain various dosage rates. Additional acetone, to bring total liquid to 40 ml., was added to acquire a thoroughly saturated soil mixture. The solvent was evaporated by drying under a hood for 1 hour (Dobbs 1985). Bioassays, using 20 workers or 5 alate queens per replicate, and four replicates per soil sample (treated or check), were performed. Check soil was treated with 40 ml. acetone and dried under the hood. PPM dosage rates showing 10% to 90% mortality were bioassayed three times and percent mortality of each rate recorded at 7 days post-treatment.

RESULTS:

Toxicity of Triumph to alate queens shows a $LD_{99}$ of .372 ppm and $LD_{50}$ of .172 ppm (Fig. 3). The results of toxicity tests on IFA workers indicates a $LD_{99}$ of .035 ppm and $LD_{50}$ of .015 ppm (Fig. 4). These results confirm the findings of Dobbs (1985) who used a different procedure to show that Triumph is highly toxic to the IFA. Dursban's toxicity to alate queens showed $LD_{99}$ to be approximately 1.75 ppm and $LD_{50}$ about 1.39 ppm (Fig. 5). The results of

the toxicity of Dursban to IFA workers in topsoil showed a $LD_{99}$ of .35 ppm and a $LD_{50}$ of .20 ppm (Fig. 6).

The averages of the four replicates in each trial were used as data points in constructing the dosage mortality curves (Figs. 3, 5, & 6)). Individual replicates were used in the Triumph worker dosage mortality curve (Fig. 4), since only one trial was performed.

Fig. 3 Dosage Mortality Curve - Toxicity of Triumph to IFA Alate Queens in Sandy Loam Topsoil.

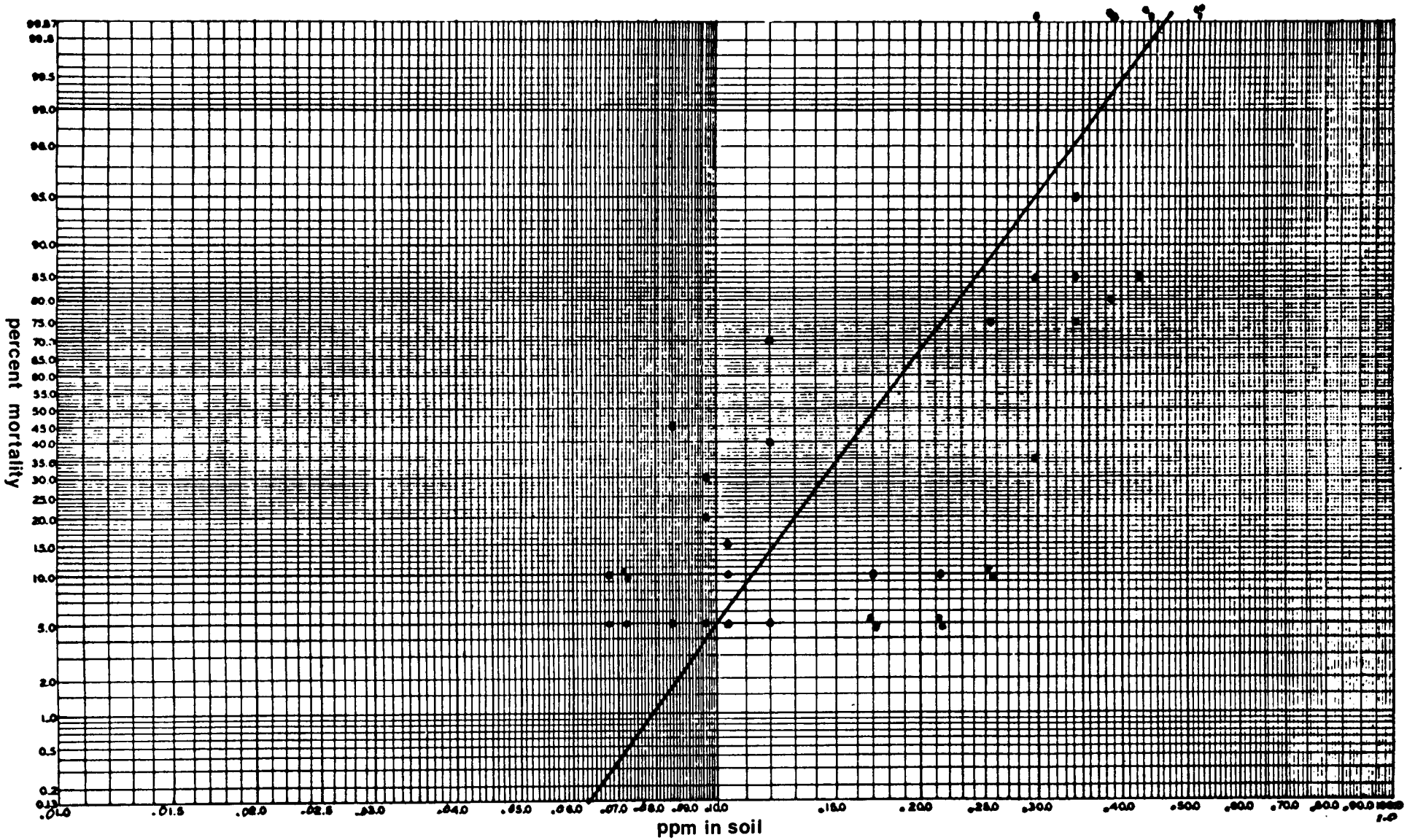


Fig. 4. Dosage Mortality Curve - Toxicity of Triumph to IFA Workers in Sandy Loam Topsoil.

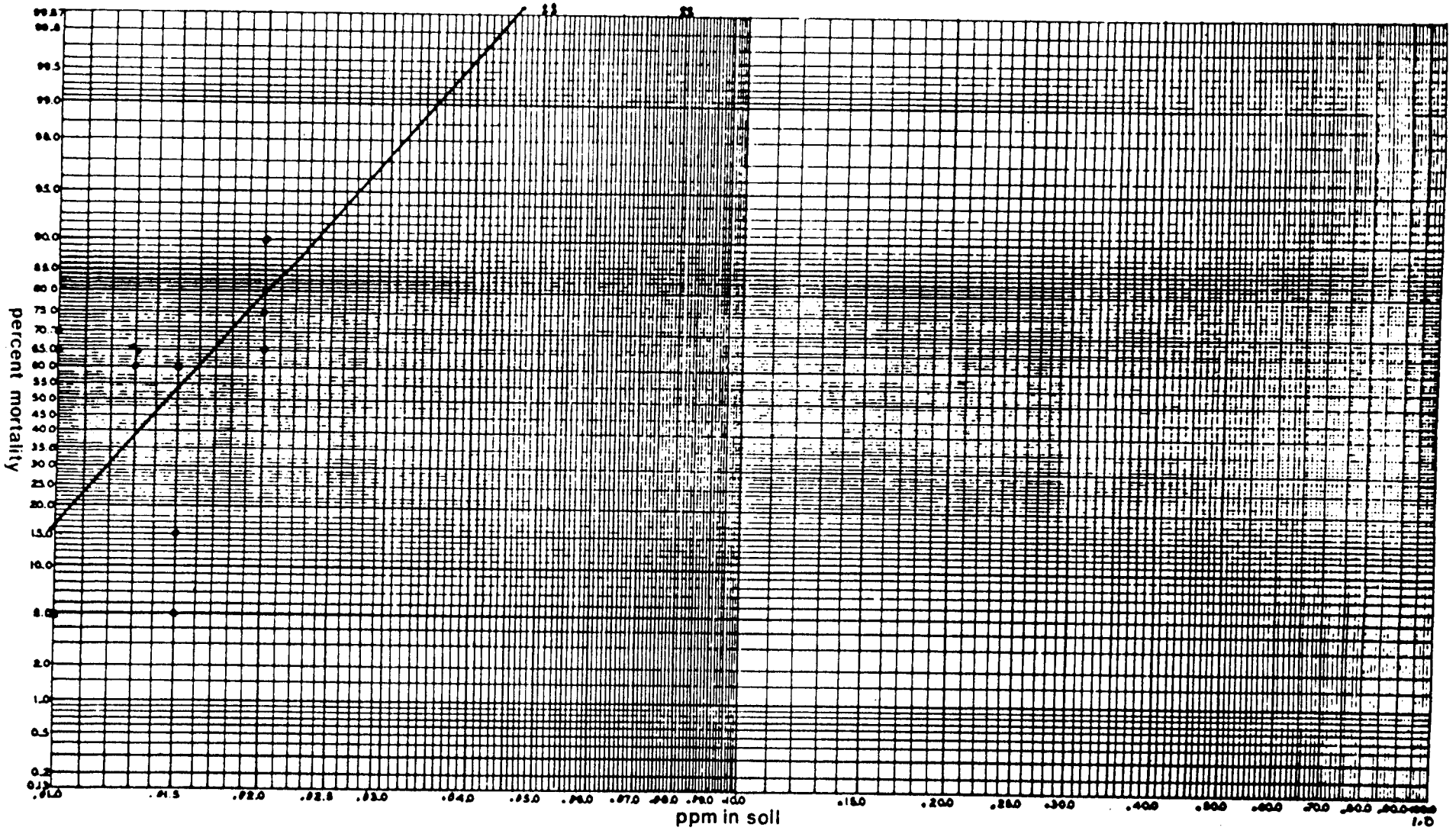


**Fig. 5. Dosage Mortality Curve - Toxicity of Dursban to IFA Alate Queens in Sandy Loam Topsoil.**

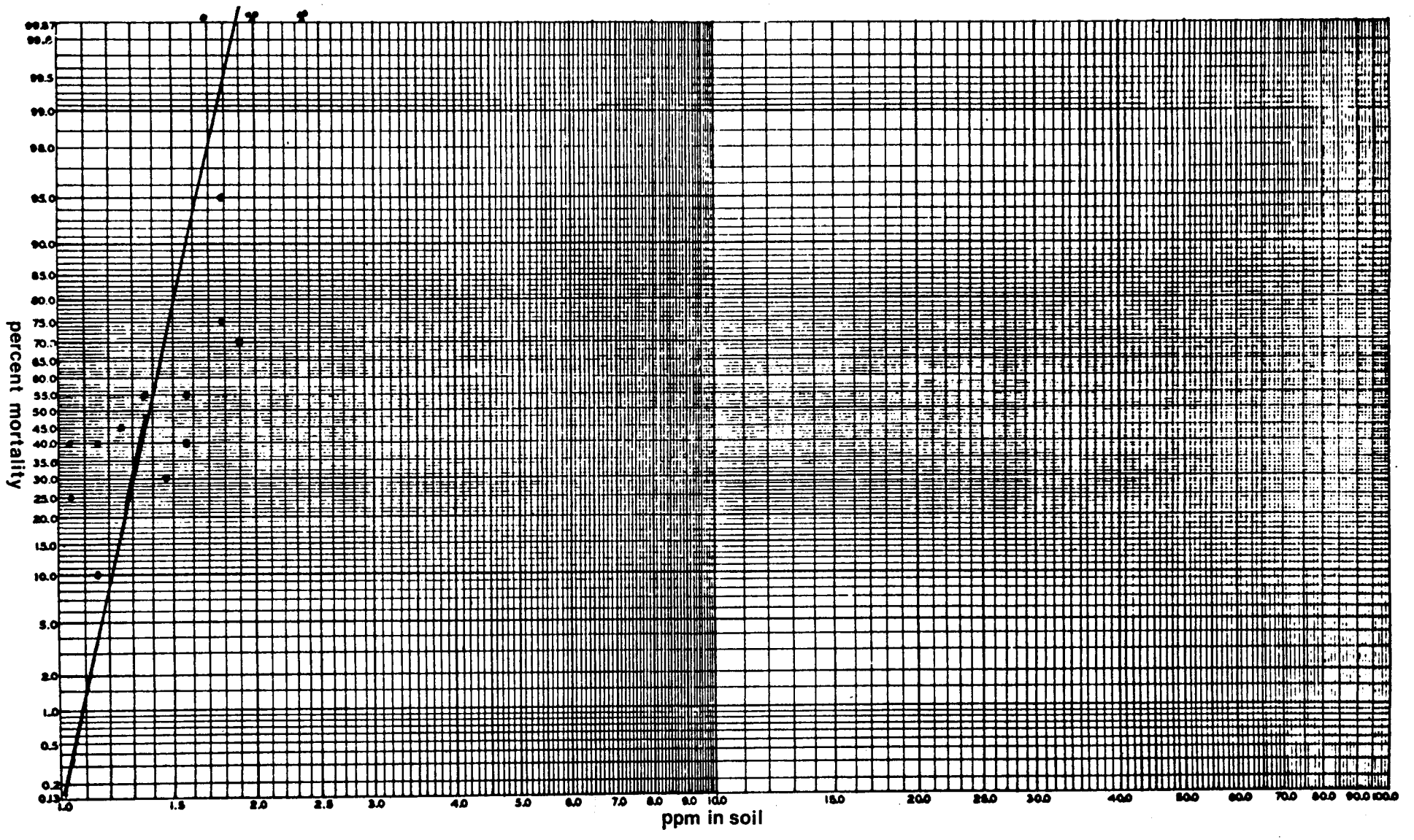
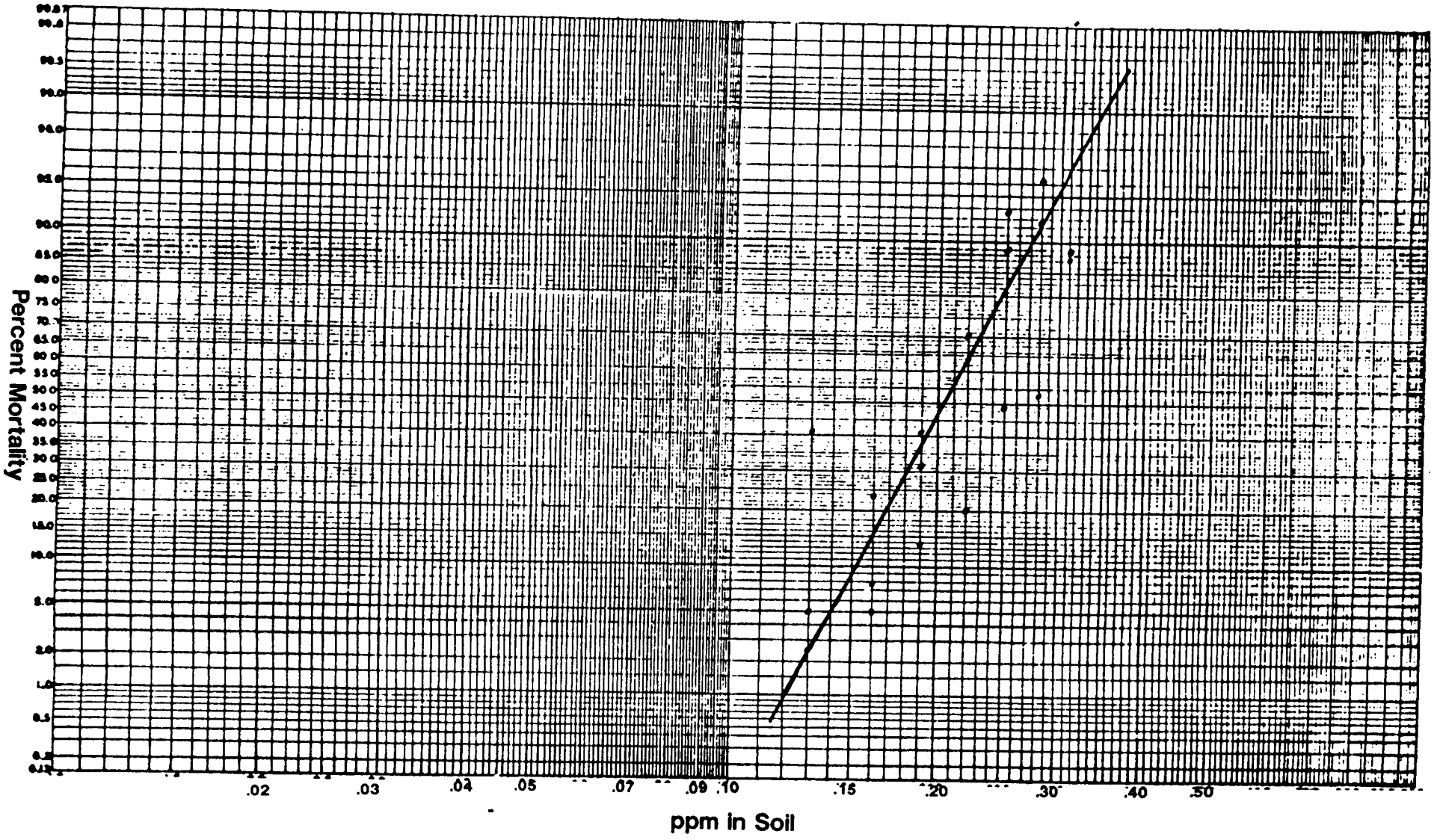


Fig. 6. Dosage Mortality Curve - Toxicity of Dursban to IFA Major Workers in Sandy Loam Topsoil



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PROJECT NO: FA02G087

PROJECT TITLE: Evaluation of Various Rates of Topically Applied Granular Dursban and Triumph for IFA Quarantine Treatment of Containerized Nursery Plants

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott

## INTRODUCTION:

PPQ Manual 301.81 (January 1985) states that soil (potting and bench) treatments shall consist of granular Dursban (chlorpyrifos) incorporated into the potting media to control IFA. Triumph is a relatively new organophosphate insecticide from Ciba-Geigy that has shown promise as a potting soil toxicant. A topical application of granular Dursban or Triumph to containerized plants would be an additional means of certification for nurserymen who did not incorporate chlorpyrifos into the soil mixture prior to potting. The objective of this study was to determine if various rates of chlorpyrifos (Dursban 2.5G) and Triumph 2G applied as single topical applications would eliminate existing colonies and also provide effective residual activity to prevent alate queen infestation of containerized plants.

## METHODS AND MATERIALS:

I. Colony infested pot study (kill of existing colonies):

STRONG-LITE® potting media (Strong-Lite Products, P.O. Box 8029, Pine Bluff,

Arkansas), consists of a blend of pine bark, peat moss, and vermiculite, and was used to three-quarters fill twenty-one (21) 6" x 6" standard plastic nursery pots. A field collected fragmented colony (queen status unknown) of 50 cc. was then introduced into each pot. The pots were divided into seven groups of three pots and treated after five days acclimation by the ants. The groups were topically treated as follows:

0.5 lb. Dursban 2.5G/cu. yd. media,
1.0 lb. Dursban 2.5G/cu. yd. media,
2.0 lb. Dursban 2.5G/cu. yd. media,
0.5 lb. Triumph 2.0G/cu. yd. media,
1.0 lb. Triumph 2.0G/cu. yd. media,
2.0 lb. Triumph 2.0G/cu. yd. media,
untreated check.

In order to simulate a nursery watering schedule, 0.65 inches of water were applied to each pot weekly. Sustenance for the treated colonies consisted of one teaspoon of peanut butter per week. Pots were disturbed daily for three weeks then weekly and evaluated for survival. Colonies were rated as active if 25 or more workers were observed after disturbing the treated pots.

II. Alate queen bioassay:

Residual activity of each treatment was determined by bioassaying treated media with alate queens. The commercial potting media used was Dodd's Potting

Soil which consists of equal parts of bark and peat combined with 5% airlite, 1 1/2 lbs. per cubic yard of minor nutrients and 8 lbs. per cubic yard of lime (George Dodd Nursery Supply, P.O. Box 86, Semmes, Alabama). The standard treatment was 1.0 lb. Dursban 2.5G incorporated into one cubic yard of potting media (PPQ Manual 301.81). Ninety (90) standard treatment (incorporated Dursban) pots were used; and four-hundred ninety-five (495) 6"x 6" pots three-quarters filled with Dodd's Potting Soil were topically treated in the following manner:

90 pots treated with 0.5 lb. Dursban 2.5G/cu. yd.,
90 pots treated with 1.0 lb. Dursban 2.5G/cu. yd.,
90 pots treated with 2.0 lb. Dursban 2.5G/cu. yd.,
45 pots treated with 0.5 lb. Triumph 2.0G/cu. yd.,
45 pots treated with 1.0 lb. Triumph 2.0G/cu. yd.,
45 pots treated with 2.0 lb. Triumph 2.0G/cu. yd.,

From each respective treatment an 80-100 cc. composite sample of potting media was collected monthly from the top two inches of media from three pots. The pots were exposed to outdoor weather conditions and watered artificially to maintain a minimum of 0.5 inches water per week in the absence of sufficient rainfall. Samples were subjected to standard alate queen bioassay procedure described elsewhere in this Annual Report.

RESULTS:

I. TRIUMPH

A. Nest Mortality:

Three trials to evaluate the effects of Triumph on colonies infesting pots at the time of treatment (i.e. nest mortality) have been performed. The first trial was initiated September 28, 1987 and continued through November 30, 1987. The higher rate of Triumph (2.0 lbs./cu. yd.) was effective against IFA colonies within 3 weeks (Table 6). In two of the 2.0 lb. replicates, the ants (including brood) formed a "ball" on the outer surface of the plastic pot. The colony remained "clustered" on the exterior of both pots for 10 days prior to moving back into the pots. This may have been an avoidance reaction to the insecticide and probably accounts for the longer survival of these colonies. The 1.0 lb. rate also showed good control, being effective within 10 days or less of treatment. At the 0.5 lb. rate, two of three replicates showed mortality within 3 weeks. The third replicate was still active when the test was discontinued 2 months post-treatment.

A second trial was begun December 7, 1987. After the 5 day acclimation period, and before treatment, a number of workers of the fragmented

Table 6. Triumph Nest Mortality: Days Required to Produce Total colony Mortality Following Topical Application of Triumph 2G at Indicated Treatment Rates.

| Treatment Rate (lb./cu. yd.) | Replicate No. | TRIAL 1 | TRIAL 2 | TRIAL 3 |
|---|---|---|---|---|
| 0.5 | 1 | 15 | 16 | 1 |
| | 2 | 18 | 7 | 1 |
| | 3 | * | * | 3 |
| 1.0 | 1 | 2 | 2 | 8 |
| | 2 | 8 | 11 | 1 |
| | 3 | 10 | 4 | 3 |
| 2.0 | 1 | 21** | 2 | 1 |
| | 2 | 16** | 4 | 8 |
| | 3 | 4 | 2 | 1 |
| Check | 1 | * | * | * |
| | 2 | * | * | * |
| | 3 | * | * | * |

* Colony still active when test discontinued 60 days post-treatment
** extended "ball" of ants formed on outside of pot day 5 after treatment; ants moved back into pot day 15

colonies were dead. The cause of this mortality is not known and the checks sustained as many deaths as the treated colonies. The two higher rates of application were effective in less than 2 weeks and two of the three 0.5 lb. replicates were also effective within 2 weeks (Table 6). The third replicate was still active when the test was discontinued 2 months post-treatment. However, these results are questionable due to the mortality seen prior to treatment.

A third trial was initiated on December 22, 1987. The 0.5 lb. rate was effective in all three replicates in 3 days as were two of three replicates in both the 1.0 lb. and 2.0 lb. rates (Table 6). The third replicate in both higher rates showed 100% mortality in 8 days.

These 3 trials show varying degrees of control in the 0.5 lb. rate. The first 2 trials are comparable, with 2 of the 3 replicates in each trial providing 100% mortality in 7 to 18 days. The third trial was effective in all replicates in 3 days. The reason for this inconsistency is not known.

The 1.0 lb. rate was effective in all replicates and trials in 1 to 11 days. The 2.0 lb. rate was also effective in all cases in 1 to 21 days. This range was affected by the number of days the ants in 2 of the trial 1 replicates clung to the outer surface of the plastic pot.

B. Residual activity against alate queens:

The first four monthly bioassays showed 100% mortality of alate queens in all Triumph rates tested (Table 7). By five months post-treatment, odd results occurred. While the 0.5 and 1.0 lb./cu. yd. rates still showed 100% mortality, the 2.0 lb. rate showed only 5% alate queen mortality. From six months post-treatment on, all rates showed less than 30% mortality.

C. Discussion:

The efficacy of Triumph at 1.0 and 2.0 lb./cu. yd. are at acceptable levels for control of established IFA colonies. Residual activity of Triumph against infestation of potted soil by alate queens was effective up to four months post-treatment. This "over-the-top" application may be a new method of short term treatment for nurserymen who need to treat containerized plants.

II. DURSBAN

A. Nest Mortality:

After four trials of Dursban sprinkled "over-the-top", inconsistent results have occurred with existing rates and water schedules (Table 8). The insecticide treatments appear to stimulate an avoidance behavior; namely, the workers relocate to the bottom one-third of the soil and under the pot. Occasionally, workers will form an amorphous mass (i.e.,

Table 7. Dursban Nest Mortality: Days Required to Provide Total Colony Mortality Following Topical Application of Dursban 2.5G at Indicated Treatment Rates.

| Treatment Rate (lbs/cu. yd.) | Replicate No. | TRIAL 1 (Treated 9/28/87) | TRIAL 2 (Treated 12/7/87) | TRIAL 3 (Treated 12/22/87) | TRIAL 4 (Treated 1/12/88) |
|---|---|---|---|---|---|
| 0.5 | 1 | 9 | * | * | -- |
| | 2 | * | * | 19 | -- |
| | 3 | * | * | * | -- |
| 1.0 | 1 | * | 49 | 5 | * |
| | 2 | * | 2 | 9 | 4 |
| | 3 | * | 2 | 5 | * |
| 2.0 | 1 | 4 | 7 | * | * |
| | 2 | 2 | 15 | 43 | * |
| | 3 | 4 | 4 | * | 6 |
| 3.0 | 1 | — | — | — | 2 |
| | 2 | — | — | — | * |
| | 3 | — | — | — | * |
| Untreated Ck. | 1 | * | * | * | * |
| | 2 | * | * | * | * |
| | 3 | * | * | * | * |

* Colony still active when test discontinued 60 days post-treatment.

Table 8. Residual Activity of Topically Applied Triumph Against Alate IFA Queens.

| Rate of Application | Months Post-Treatment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 24 Hr. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0.5 lb./cu. yd. | 100 | 100 | 100 | 100 | 100 | 100 | 30 | 30 | 30 |
| 1.0 lb./cu. yd. | 100 | 100 | 100 | 100 | 100 | 100 | 10 | 30 | 10 |
| 2.0 lb./cu. yd. | 100 | 100 | 100 | 100 | 100 | 5 | 15 | 30 | 5 |
| Check | 0 | 15 | 5 | 0 | 0 | 5 | 5 | 20 | 10 |
| Rainfall (in inches) | 0 | 2.26 | 4.0 | 2.72 | 5.6 | 11.92 | 5.56 | 10.92 | 6.02 |

"cluster") on the outside of the pot. Soil working (colony maintenance) and feeding was greatly diminished. Although colony vigor is greatly decreased, some workers continue to survive and to infest treated pots.

B. Residual Activity against Alate Queens:

Dursban also showed 100% mortality against alate queens up to four months post-treatment (Table 9). Like the Triumph results, the 0.5 lb./cu. yd. treatment of Dursban remained effective for 6 months while the 1.0 lb. and 2.0 lb. rates fell drastically from the fifth month on. The standard incorporated Dursban also became less effective by seven months post-treatment.

C. Discussion:

Although IFA colonies were not effectively controlled by the Dursban "over-the-top" method of treatment, the residual activity against alate queens was effective up to four months. While this treatment would not kill existing colonies or prevent the movement of an established colony into the pot, it would provide a temporary, short term method for prevention of reinfestation by an alate queen.

Table 9. Residual Activity of Topically Applied Dursban Against Alate IFA Queens.

| Rate of Application | Months Post-Treatment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 24 Hr. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0.5 lb./cu. yd. | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 50 | 5 |
| 1.0 lb./cu. yd. | 90 | 100 | 100 | 100 | 100 | 20 | 10 | 40 | 20 |
| 2.0 lb./cu. yd. | 100 | 100 | 100 | 100 | 100 | 5 | 15 | 25 | 20 |
| Incorporated Dursban | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 50 | 10 |
| Rainfall (in inches) | 0 | 2.26 | 4.0 | 2.72 | 5.6 | 11.92 | 5.56 | 10.92 | 6.02 |

PROJECT NO: FA01G018

TITLE: Pesticide Avoidance by IFA Workers

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott

INTRODUCTION:

Colony relocation or movement following insecticidal treatment is a well documented phenomenon (Hillman 1977, Bass and Hays 1982, Williams and Lofgren 1983). Casual observations in this laboratory have indicated that IFA workers seem to avoid contact with chlorpyrifos treated potting media. If more were known about insecticide induced avoidance, it might be possible to utilize this behavorial trait in some manner to enhance or develop quarantine treatments. Therefore, a study was initiated to determine if the avoidance behavior can be induced, and to compare the effectiveness of three different insecticides in eliciting this response. The overall objectives of the study were to determine whether IFA workers would follow an established foraging trail to a food source by crossing an area contaminated with an insecticide, or whether workers would avoid all contact with surfaces treated with Triumph, Dursban, or Oftanol. Also, to compare the pesticides in relation to degree of avoidance by IFA foragers.

METHODS AND MATERIALS:

IFA workers forage for food sources at varying distances from the nest. When

a food source is located, the worker returns to the nest leaving a pheromone trail for other foragers to follow to the food. Only workers who have contacted and examined the food lay a pheromone trail as they travel back to the nest (Wilson 1962). This study compared behavior of foraging workers after exposure to Dursban, Triumph, and Oftanol. Three separate trials were conducted on different dates by the following procedures.

A large IFA colony was collected from the field and held in a 30 quart plastic tub, talced on the sides to prevent escape. The colony was starved for two to three weeks prior to testing since hungry ants should respond more quickly and in greater numbers to a food source. At the end of this period, four pieces of electric cable (Romex 12-2, 26-30 inches long, 1/2 inch width) were extended from the nest, each to a separate test arena. A petri dish containing food (tunafish) was placed at the terminal end of each piece of cable. Workers were allowed to establish a foraging trail along each piece of electrical cable to each of the dishes (food sources).

After the trails had been established (approximately 1/2 - 1 hour), three of the petri dishes were exchanged for dishes contaminated with technical Triumph, Dursban, or Oftanol. The pesticide was applied to the petri dish according to procedures described by Dobbs (1985). A stock solution of each insecticide, at a rate equivalent to a 1 lb. AI per acre, was prepared by dissolving technical material in acetone (approximately 0.8g/1000 milliliters). One milliliter of each stock solution was then applied to a 71.22 square centimeter glass petri dish and allowed to air dry for two hours before

adding a determined amount of the food source and placing the dish at the end of the foraging trail. The check dish was treated with 1 milliliter of acetone and handled in the same manner. A cable was placed in each dish so that the foragers had to cross 0.5 to 1.0 inches of the contaminated surface to reach the food source. At the end of each trial, the amount of food removed by the foragers from each dish was determined. Avoidance of pesticide contaminated surfaces was quantified by counting the number of ants feeding in each dish at various intervals after the food source was introducted into each respective petri dish.

RESULTS:

By two hours post-treatment, in all the trials, there was very little trail activity or feeding in the Dursban or Triumph dishes (Table 10). In constrast, the Oftanol and untreated check dishes were still very active with foragers feeding and on the trail.

By 4 hours post-treatment, there was no trail activity or feeding in the Dursban or Triumph dishes. The Oftanol dishes, at this time, were still active, but contained a number of dead ants (250-600). At the end of each trial (24 hrs. post-treatment), 100% of the food in check dishes had been removed, at least 60% of the Oftanol food removed, and less than 52% of the Dursban and Triumph food removed.

Table 10. Effect of Pesticide Contaminated Surfaces on Foraging Activity.

| Treatments | Grams Food Offered | Grams Food Taken 1/ | No. ants Observed Feeding, on Trail, or Dead, at Indicated Time after Introducing Pesticide Contaminated Dishes 2/ | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 30 min. | | | 1 Hr. | | | 2 Hr. | | | 3 Hr. | | | 4 Hr. | | | 6 Hr. | | | 24 Hr. | | |
| | | | OT | F | D | OT | F | D | OT | F | D | OT | F | D | OT | F | D | OT | F | D | OT | F | D |
| TRIAL I | | | | | | | | | | | | | | | | | | | | | | |
| Dursban | 8.9 | 1.5 | 15 | 25 | 40 | 5 | 7 | 60 | 0 | 2 | 200 | 0 | 0 | 200 | 0 | 0 | 200 | ----- | | | 0 | 0 | 200 |
| Triumph | 8.3 | 1.1 | 5 | 10 | 100 | 5 | 5 | 100 | 0 | 3 | 300 | 0 | 0 | 300 | 0 | 0 | 300 | ----- | | | 0 | 0 | 300 |
| Oftanol | 7.5 | 7.5 | 75 | 300 | 0 | 125 | 300 | 15 | 50 | 200 | 100 | 50 | 200 | 200 | 20 | 200 | 600 | ----- | | | 0 | 0 | 1000 |
| Check | 10.7 | 10.7 | 50 | 100 | 0 | 100 | 200 | 0 | 200 | 500 | 0 | 250 | 500 | 50 3/ | 300 | 500 | 100 3/ | ----- | | | 0 | 0 | 700 3/ |
| TRIAL II | | | | | | | | | | | | | | | | | | | | | | |
| Dursban | 10.95 | 5.7 | 20 | 30 | 40 | 6 | 5 | 80 | 2 | 3 | 150 | 1 | 8 | 170 | 0 | 0 | 200 | 0 | 0 | 200 | 0 | 0 | 200 |
| Triumph | 12.4 | 5.9 | 2 | 3 | 70 | 2 | 0 | 100 | 0 | 0 | 150 | 0 | 0 | 175 | 0 | 0 | 200 | 0 | 0 | 200 | 0 | 0 | 200 |
| Oftanol | 12.3 | 10.0 | 30 | 80 | 0 | 15 | 80 | 5 | 30 | 100 | 100 | 20 | 200 | 250 | 20 | 150 | 350 | 40 | 150 | 700 | 0 | 0 | 700 |
| Check | 10.5 | 10.5 | 40 | 100 | 0 | 40 | 100 | 0 | 150 | 500 | 0 | 250 | 750 | 0 | 250 | 700 | 0 | 250 | 700 | 100 3/ | 0 | 0 | 800 3/ |
| TRIAL III | | | | | | | | | | | | | | | | | | | | | | |
| Dursban | 10.9 | 5.14 | 15 | 5 | 30 | 10 | 0 | 80 | 5 | 0 | 80 | 8 | 1 | 100 | 4 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 |
| Triumph | 10.7 | 5.0 | 10 | 2 | 30 | 3 | 0 | 50 | 1 | 0 | 50 | 1 | 0 | 50 | 2 | 0 | 70 | 0 | 0 | 70 | 0 | 0 | 70 |
| Oftanol | 11.0 | 6.7 | 20 | 30 | 10 | 30 | 30 | 50 | 20 | 20 | 100 | 20 | 20 | 125 | 40 | 40 | 150 | 50 | 100 | 250 | 4 | 5 | 600 |
| Check | 10.1 | 9.5 | 200 | 400 | 0 | 200 | 400 | 3 | 250 | 500 | 3 | 300 | 500 | 5 | 300 | 500 | 5 | 250 | 200 | 50 3/ | 1 | 0 | 400 3/ |

1/ 24 hours after introduction
2/ abbreviations used: OT = number ants on trail; F = number ants feeding; D = number ants dead.
3/ probably came in contact with insecticide treated dishes

DISCUSSION:

In none of the trials did the foragers immediately refuse to cross the insecticide contaminated area in order to reach the food source. However, in all trials, within 30 minutes of introducing the pesticide contaminated dishes, trail activity and the number of ants feeding (less than 25) was reduced dramatically in the Dursban and Triumph dishes. The Oftanol and check dishes, at this time, were very active. These results indicate that both Triumph and Dursban are more toxic, or act faster than Oftanol and prevent re-establishment of the foraging trail by workers which succumb while feeding or returning to the nest. These results are in agreement with the findings of Dobb's (1985) which showed that Triumph is 5 times more toxic to IFA workers than Dursban which is 6 times more toxic than Oftanol. The large number of dead workers which appeared in the checks of all trials probably came in contact with one of the insecticides before foraging to the check dishes and dying.

While none of the insecticides instantly repelled the foragers from the contaminated area, Dursban and Triumph did in essence act as a feeding deterent within 2 hours of introduction. Neither did Oftanol seem to repel the ants; although it also caused a high rate of mortality, but at a slower rate.

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PROJECT NO: FA01G028

PROJECT TITLE: Evaluation of In-Field Spot Treatments with Dursban for Certification of Field Grown Nursery Stock

TYPE REPORT: Interim

LEADER/PARTICPANTS: Tim Lockley, Lee McAnally, and Avel Ladner

INTRODUCTION:

Currently, the only approved treatment procedures for certification of field grown nursery plants (ball and burlap) involve either a chlorpyrifos root-dip treatment or broadcast application of baits in combination with granular chlorpyrifos. Root dips are not only highly labor intensive and costly, but are quite disruptive to the root system of plants grown in lighter, sandy soils. The cost of a broadcast application of chlorpyrifos and the difficulty of making such an application in situations where the stock is relatively large makes this method prohibitive. A simpler, relatively inexpensive in-field treatment for these plants is among the highest priorities in IFA quarantine. As an alternative, we have begun a test using "low tech" approach that would allow the grower to treat each plant individually prior to its excavation without having to waste expensive chemical on plants that may or may not be harvested for shipment outside the regulated area.

Although the residual activity associated with surface application of chlorpyrifos is relatively short (4 weeks at 4 lbs. AI/acre for granular formulations), it does provide protection against invasion by newly mated queens. Large mature colonies are weakened, but not killed by this treatment.

However, a behavioral trait consistently manifest by IFA colonies treated with almost any insecticide is to abandon the treated mound and establish a new nest some distance away (Hillman 1977, Bass and Hays 1982, Williams and Lofgren 1983). A simple surface application of chlorpyrifos applied to the root zone of field grown plants intended for harvest and shipment within a short time (4 to 6 weeks) might prove to be a successful (though not necessarily lethal) quarantine treatment if it would force mature colonies in the treated area (i.e., 36" band around the row of plants to be harvested) to evacuate the area and provide a 4 to 6 week residual barrier against re-invasion by newly mated queens. Theoretically, IFA colonies forced to evacuate the treatment area would relocate in the area between rows (the middles), turnrows, or field borders where they would not be subject to movement from the nursery via root balls of plants. Extensive in-field trials are needed in order to confirm this hypothesis.

METHODS AND MATERIALS:

An initial evaluation was carried out in a heavily infested field of commercially grown coastal bermuda grass at the Pearl River Sod Farm 10 km. east of Wiggins, Stone County, Mississippi on September 8, 1988. One hundred sixty-three mounds were marked with numbered survey flags, and treated with chlorpyrifos (Dursban 2.5G) at the rate equivalent to 6 lbs. AI/acre (17.4 g. total compound per 1 yd. diameter circle [7.04 sq. ft.]). The mounds were treated by hand application within a 1.5 ft. radius of the flag. After 14 days, on September 22, the mounds were excavated to determine if the ants were

forced to abandon their position.

RESULTS:

Of the 163 mounds treated, only 157 could be located. Of these, all had been evacuated. In 93 of the 157 located mounds, new mound of an equivalent or slightly smaller size were located outside of a radius of 6 to 10 feet from the original mound. No new mounds were found within a 6 foot radius of any of the original mounds. In 41 of the treatments, the new mounds were located in excess of 10 feet from the originally treated mound. In the remaining 23 sites, no new mounds could be located within a reasonable distance (25 feet) from the original mound.

Having shown that chlorpyrifos repels established IFA colonies, two other tests were initiated to determine: (1) How rapidly IFA colonies abandon a treated site given differing climatological situations and (2) What degree of residual activity is offered by chlorpyrifos at the 6 lb. AI/acre equivalent rate in a field grown nursery stock situation.

With regards to the rate of evacuation, tests were begun on November 28, 1988, at a Christmas tree farm approximately 9 km. NNW of Gulfport, Harrison County, Mississippi. The site was selected because of its ability to simulate a field grown nursery situation (even though the trees were to be cut and not balled and burlapped) and because of its convenient location to the IFA lab. Thirty-two mounds were located and marked with survey flags. The area within

the drip line of the tree canopy was treated at the per acre equivalent of 6 lbs. AI. The treatment area ranged from a minimum radius of 0.5 yds. to 2.0 yds. The trees themselves ranged in height from 4 to 11 feet. Results can be seen in Table 11.

During the test, temperatures ranged from 30°F. (on two successive nights) for the low temperature to 63°F. on two separate days within the study. No rainfall occurred nor was irrigation applied to the site. Further evaluations will be carried out during the coming year (1989) to determine the effects varying climatological factors have on the time required to force evacuation of IFA mounds from chlorpyrifos treated sites.

In the second test undertaken to determine the long-term residual activity of chlorpyrifos using the "low tech" method, an area was prepared by discing up a site 20' x 100'. Ten sites were selected at random within the plot and marked and treated using the techniques for the tests as described above. Samples of the treated soil were collected weekly and bioassays were carried out using alate IFA queens. Results for this test are listed in Table 12.

forced to abandon their position.

RESULTS:

Of the 163 mounds treated, only 157 could be located. Of these, all had been evacuated. In 93 of the 157 located mounds, new mound of an equivalent or slightly smaller size were located outside of a radius of 6 to 10 feet from the original mound. No new mounds were found within a 6 foot radius of any of the original mounds. In 41 of the treatments, the new mounds were located in excess of 10 feet from the originally treated mound. In the remaining 23 sites, no new mounds could be located within a reasonable distance (25 feet) from the original mound.

Having shown that chlorpyrifos repels established IFA colonies, two other tests were initiated to determine: (1) How rapidly IFA colonies abandon a treated site given differing climatological situations and (2) What degree of residual activity is offered by chlorpyrifos at the 6 lb. AI/acre equivalent rate in a field grown nursery stock situation.

With regards to the rate of evacuation, tests were begun on November 28, 1988, at a Christmas tree farm approximately 9 km. NNW of Gulfport, Harrison County, Mississippi. The site was selected because of its ability to simulate a field grown nursery situation (even though the trees were to be cut and not balled and burlapped) and because of its convenient location to the IFA lab. Thirty-two mounds were located and marked with survey flags. The area within

the drip line of the tree canopy was treated at the per acre equivalent of 6 lbs. AI. The treatment area ranged from a minimum radius of 0.5 yds. to 2.0 yds. The trees themselves ranged in height from 4 to 11 feet. Results can be seen in Table 11.

During the test, temperatures ranged from 30°F. (on two successive nights) for the low temperature to 63°F. on two separate days within the study. No rainfall occurred nor was irrigation applied to the site. Further evaluations will be carried out during the coming year (1989) to determine the effects varying climatological factors have on the time required to force evacuation of IFA mounds from chlorpyrifos treated sites.

In the second test undertaken to determine the long-term residual activity of chlorpyrifos using the "low tech" method, an area was prepared by discing up a site 20' x 100'. Ten sites were selected at random within the plot and marked and treated using the techniques for the tests as described above. Samples of the treated soil were collected weekly and bioassays were carried out using alate IFA queens. Results for this test are listed in Table 12.

Table 11. Rate of Evacuation of IFA Mounds Following Spot Treatment with Granular Dursban (6# AI/Acre).

| DAY | Number Evacuated 1/ |
|---|---|
| 0 | 0 |
| 1 | 6 |
| 2 | 11 |
| 3 | 15 |
| 4 | 17 |
| 7 | 23 |
| 8 | 24 |
| 9 | 25 |
| 10 | 29 |
| 11 | 31 2/ |
| 14 | 32 |

1/ Total number of mounds treated was 32.

2/ Small number of workers reamining in 1 nest; no brood present.

Table 12. Residual Activity of 2.5% Granular Chlorpyrifos applied as a Spot Treatment.

| WEEK | % Mortality to Alate Queens 1/ |
|---|---|
| 0 | 100 |
| 1 | 100 |
| 2 | 100 |
| 3 | 100 |
| 4 | 100 |
| 5 | 100 |
| 6 | 100 |
| 7 | 100 |
| 8 | 100 |
| 9 | 100 |
| 10 | 100 |

1/ Average of 4 replicates; 5 queens/replicated in standard laboratory bioassay.

## REFERENCES CITED:

Bass, J.A. and S.B. Hays. 1982. Imported fire ant control-individual mound treatment, 1981. Insecticide and Acaracide Tests. 7:262-264.

Hillman, R.C. 1977. RIFA control with conventional insecticides, 1975, 1976. Insecticide and Acaracide Tests 2:135.

Williams, D.F. and C.S. Lofgren. 1983. IFA Control: Evaluation of several chemicals for individual mound treatments. Jour. Econ. Ent. 76:1201-1205.

PROJECT NO: FA01G048

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

TYPE REPORT: Interim

**LEADER/PARTICIPANTS:** Tim Lockley, Homer Collins, and Avel Ladner

INTRODUCTION:

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

We initiated a study in late September 1988, to test the relative effectiveness and residual activity of three products against the IFA workers: Di-A11 Brand Paint Insecticide; CPF Insecticide (both paint additives), and Super IQ Insecticide Coating. The potential use of chlorpyrifos impregnated paints or coatings could minimize the problem of foraging IFA workers which occasionally enter non-hazardous cargoes on tractor-trailers. They may also have some utility in the control of IFA in outdoor or subterranean electrical circuitry. The Texas Department of Agriculture (TDA) experienced a

significant number of documented incidences in which IFA infestations have caused failure of diversified electrical systems.

METHODS AND MATERIALS:

A one-half inch, exterior grade, pine plywood board was sectioned into 1 x 1 foot test boards and given a coating of primer (Exterior Latex) on September 27, 1988. Three boards (replicates) were then painted with each of the following treatments on September 28:

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

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

3. Super IQ Insecticide Coating (pre-mixed). Manufactured by Biochemical Dynamic Corp., Indianapolis, Indiana. AI=0.90%.

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

Untreated paint was applied to three boards as a painted check and three boards were left unpainted as a control. The boards were then stored in the bed of a small pickup truck covered with an aluminum camper shell. The shell had plexiglass windows on all four sides. The boards were aged under natural conditions of temperature and humidity but were protected from precipitation by the shell. Bioassays were carried out at monthly intervals starting on November 21, 1988. Bioassays were conducted by confining 100 carbon dioxide anesthesized IFA workers under an inverted petri dish placed on a test board surface. The surface of the test board was prepared by moistening the surface with a damp sponge then sealing the inverted petri dish with malleable caulking strip. Moistening the surface of tests boards was necessary to prevent lethal dessication of the ants. Mortality was assessed hourly.

RESULTS:

Results are incomplete at this time, however, some data are available and are summarized in Table 13. Initial evaluations show that all three products effectively control foraging workers within the 8 hour exposure period. However, the pre-mixed Super IQ Insecticide Coating shows a significantly quicker "knockdown" of foraging IFA than the other two candidates.

Table 13. Relative Efficacy of Various Candidate Insecticide Coatings or Paint Additives against IFA Workers.

| Additive or Coating | Days Post-Application | % Mortality to IFA workers confined to treated surfaces for indicated time (hours) 1/ (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (24) |
|---|---|---|---|---|---|---|---|---|---|---|
| Super IQ | 60 | 0 | 22 | 87 | 98 | 99 | | | | 100 |
| CPF | 60 | 0 | 0 | 10 | 29 | 92 | | | | 100 |
| Di-All | 60 | 0 | 0 | 6 | 27 | 80 | | | | 100 |
| Painted Ck. | 60 | 0 | 1 | 2 | 2 | 2 | | | | 2 |
| Unpainted Ck. | 60 | 0 | 0 | 0 | 0 | 1 | | | | 1 |
| Super IQ | 90 | 97 | 100 | | | | | | | |
| CPF | 90 | 50 | 77 | 100 | | | | | | |
| Di-All | 90 | 5 | 17 | 88 | 99 | 100 | | | | |
| Painted Ck. | 90 | 0 | 0 | 1 | 2 | 2 | 3 | | | |
| Unpainted Ck. | 90 | 0 | 0 | 1 | 2 | 2 | 2 | | | |
| Super IQ | 120 | 100 | -- | -- | | | | | | |
| CPF | 120 | 3 | 68 | 100 | | | | | | |
| Di-All | 120 | 4 | 20 | 100 | | | | | | |
| Painted Ck. | 120 | 0 | 0 | 0 | 8 | | | | | |
| Unpainted Ck. | 120 | 0 | 0 | 0 | 4 | | | | | |

1/ Average based on 3 replicates; 100 IFA workers/replicate.

PROJECT NO: FA01G058

PROJECT TITLE: Evaluation of Chlorpyrifos 2.5G for Phytotoxic Effects on Nursery Stock

TYPE REPORT: Interim

**LEADER/PARTICIPANT:** Timothy Lockley, Lee McAnally, and Adolph J. Laiche [Mississippi Agriculture and Forestry Experiment Station]

INTRODUCTION:

One of the approved procedures for IFA quarantine certification of containerized plants is the use of Dursban 2.5G incorporated into the potting medium. A rate of 11.3 grams AI per cu. yd. is specified. The only currently available formulation of chlorpyrifos was registered for this use pattern by Ford's and Speciality Company in July of 1984. However, it is restricted to woody landscape (ornamental) plants. This restriction came about due to complaints of possible phytotoxic effects by chlorpyrifos to succulents (foliage plants). Because of this restriction, succelents must be grown under complete cover to meet certification requirements. This restricts the number of plants that can be grown due to limited glasshouse space. Those succulents grown outdoors and exposed to possible IFA infestation cannot be certified under the present quarantine regulations.

METHODS AND MATERIALS:

This experiment was carried out in cooperation with the Mississippi Agriculture and Forestry Experiment Station (MAFES), (South Mississippi Branch) at Poplarville, Mississippi.

The following eighteen species of plants were acquired as seedlings:

| Common Name | Scientific Name | Variety |
|---|---|---|
| Begonia | Bigonia sp. | |
| Pansy | Viola odorta | |
| Flowering Kale | Brassica sp. | Emperor |
| Philodendron | Philodendron oxycardium | |
| Devil's Ivy | Scindapsus areus | |
| Snapdragon | Antirrhinum majus | |
| Pinks | Dainthus sp. | |
| African Violet | Seintpaulia ionantha | Miniature |
| Holly | Ilex cornuta | Needlepoint |
| Holly | Ilex x | Nellie Stevens |
| Holly | Ilex x | William Cargill |
| American Holly | Ilex opaca | Green Leaf |
| Japanese Holly | Ilex crenata | Compacta |
| Dwarf Yaupon | Ilex vomitoria | Straughns Dwarf |
| Privet | Ligustrum lucidum | Variegata |
| Privet | Ligustrum sinensis | Variegata |
| Indian Hawthorn | Raphiolepis indica | |
| Juniper | Juniperus pfitzeriana | Nick's Compacta |

All plants were transplanted into 1 gallon containers on October 18, 1988. The plants were divided into 3 groups: 1X (treated at 14.2 g. AI/cu. yd.); 3X

(treated at 42.6g AI/cu. yd.) and check (untreated). The plants were then transferred into a glasshouse and subjected to normal agronomic practices throughout the remainder of the test. Evaluations were made biweekly on the relative effects of chlorpyrifos to the plants. A visual examination of the foliage of each plant was made using the following criteria: Catagory 1- healthy; Catagory 2 - slight yellowing; Catagory 3 - symptoms more severe, leaf drop necrosis; Catagory 4 - severe stunting, abnormal leaf drop or necrosis; Catagory 5 - dead. At week 20, half of the replicates were sacrificed and a more thorough evaluation was made. All plant structure above the oil line was weighed and a visual observation of the root structure was undertaken. The root structure examination was made using the following criteria: Catagory 1 - roots healthy; Catagory 2- root structure slightly less complex or slightly stunted; Catagory 3 - symptoms more severe, moderate stunting or necrosis; Catagory 4 - severe stunting; Catagory 5 - dead.

RESULTS AND DISCUSSION:

As shown in Tables 14 and 15, no adverse effects were noted for any of the plant species tested. Two test plants were removed from the study due to excessive leaf drop caused by a faulty gas heater leaking fumes into the test area (*Ilex* x Nellie Stevens and *Ilex* x William Cargill).

Table 14. Phytotoxicity Ratings for Various Containerized Plants Treated with Incorporated Dursban (chlorpyrifos) 2.5G at 1X and 3X Dose Rates.

| PLANT | Week 2 | | | Week 4 | | | Week 6 | | | Week 8 | | | Week 10 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ck | 1X | 3X | Ck | 1X | 3X | Ck | 1X | 3X | Ck | 1X | 3X | Ck | 1X | 3X |
| Ilex cornuta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ilex x Nellie Stevens | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | na | | |
| Ilex x William Cargill | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ilex opaca | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ilex crenata | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ilex vomitoria | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ligustrum lucidum | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ligustrum sinensis | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Raphiolepsis indica | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Juniperus pfitzeriana | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Begonia sp. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Viola odorata | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Brassica sp. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Philodendron oxycardium | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Scindapus areus | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Dianthsu sp. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Antirrhinum majus | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Saintpaulia ionantha | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

1 = Average rating of 14 plants (replicates) per dose rate

Table 15. Results of Whole Plant Evaluation for Phytotoxic Effects of Chlorpyrifos.

| Plant | Foliage Weight (g) | | | Root Structure Category | | |
|---|---|---|---|---|---|---|
| | Ck | 1X | 3X | Ck | 1X | 3X |
| Ilex cornuta | 20.0 | 21.4 | 21.3 | 1 | 1 | 1 |
| Ilex opaca | 16.3 | 17.2 | 16.7 | 1 | a | a |
| Ilex crenata | 18.0 | 15.6 | 14.9 | 1 | 1 | 1 |
| Ilex vomitoria | 14.3 | 13.7 | 13.3 | 1 | 1 | 1 |
| Ligustrum lucidum | 12.9 | 12.4 | 11.9 | 1 | 1 | 1 |
| Ligustrum sinensis | 4.1 | 6.1 | 5.3 | 1 | 1 | 1 |
| Raphiolepsis indica | 18.7 | 17.4 | 18.1 | 1 | 1 | a |
| Juniperus pfitzeriana | 16.4 | 17.7 | 18.1 | 1 | 1 | 1 |
| Begonia sp. | 188.3 | 187.5 | 168.7 | 1 | 1 | 1 |
| Viola odarata | 38.0 | 36.2 | 32.6 | 1 | 1 | 1 |
| Brassica sp. | 156.5 | 164.7 | 137.8 | 1 | 1 | 1 |
| Philodendron oxycardium | 44.3 | 40.9 | 50.1 | 1 | a | a |
| Antirrhinum majus | 87.6 | 86.7 | 64.2 | 1 | a | a |
| Dianthsu sp. | 36.0 | 41.8 | 57.2 | 1 | a | b |
| Scindapsus areus | 48.7 | 63.9 | 55.0 | 1 | a | a |

a = root structure enhanced when compared to check
b = root structure SIGNIFICANTLY enchanced when compared to check

PROJECT NO: FA01G068

PROJECT TITLE: Evaluation of Various Candidate Insecticides for Quarantine Treatment of Grass Sod, 1988

TYPE REPORT: Final

LEADER/ PARTICIPANTS: Tim Lockley and Avel Ladner

INTRODUCTION:

Commercial shipments of grass sod have been associated with the introduction of imported fire ants (IFA) into previously uninfested areas since 1953 (Culpepper, 1953). Initially, chlorinated hydrocarbons were utilized as effective quarantine treatments. However, in 1978 the EPA issued a cancellation order eliminating the last chlorinated hydrocarbon (chlordane) for this use. Currently, there exists but a single registration (chlorpyrifos 10G) for this use pattern (4.0 and 6.0 lbs. AI/acre).

METHODS AND MATERIALS:

This study was conducted in Centipede turf grass at the Pearl River Grass Farm 9 km. east of Wiggins, Stone County, Mississippi beginning on April 22, 1988. Eleven candidate insecticides/formulations were applied to 20' x 50' plots each replicated three times.

Granular formulations were applied using a cyclone type seeder. Liquid applications were made using a Solo® back-pack sprayer. All materials were

applied uniformily within each plot.

Soil samples were taken on May 25, and on June 23 with a modified core sampler. The cores were composited for each formulation assuring sufficient amounts for subsequent bioassay. Samples were screened to remove plant material and debris, placed in marked cans, sealed and returned to the laboratory. Collection of samples, handling and storage was done in a manner to assure that no cross-contamination occurred.

Bioassays of the soil for efficacy and residual activity were conducted using alate IFA queens. Twenty cc. of test soil was placed in 2" square plastic flower pots. Dental labstone was used to seal the bottom of each pot and to retain moisture. Five alate queens were placed in each pot which was then covered with an inverted petri dish to prevent escape or cross-contamination. Bioassays were carried out at approximately 30 day intervals.

RESULTS:

During this study, the test plots received no rainfall nor was any irrigation applied. As indicated in Table 16, Turcam 2.5G at 4.0 lbs. AI achieved the same results as Dursban 10G at the same rate 30 and 60 DAT. The test was discontinued at 60 days due to the extreme drought conditions. Turcam 2.5G is already registered for use on grass sod and may prove to be a viable alternative to Dursban applications. Additional trials with Turcam and other products will be conducted in 1989.

Table 16. Residual Activity of Candidate Grass Sod Insecticides, 1988.

| Candidate | AI/Acre | % Mortality to Alate Queens at Indicated Post-Treatment Intervals | |
|---|---|---|---|
| | | 30-Day | 60-Day |
| Dursban 10G | 4.0 lbs. | 100 | 100 |
| Oftanol 5G | 3.0 lbs. | 50 | na |
| Oftanol 5G | 2.0 lbs. | 5 | na |
| Furadan 5G | 4.0 lbs. | 85 | na |
| Advantage 5G | 4.0 lbs. | 25 | na |
| Pounce 1.5G | 1.5 lbs. | 85 | na |
| Turcam 2.5G | 4.0 lbs. | 100 | 100 |
| Tempo 20WP | 1.5 lbs. | 70 | na |
| Tempo 2EC | 1.5 lbs. | 95 | na |
| Oftanol 2I | 2.0 lbs. | 100 | 85 |
| Dursban 50W | 4.0 lbs. | 60 | na |
| Control | -- | 5 | 10 |

na = No activity

## REFERENCES CITED:

Culpepper, G.H. 1953. Status of the imported fire ant in the southern states in July 1953. Bureau Ent. Plant Quarantine, U.S. Dept. Agric., Special Report E-867.

PROJECT NO: FA01G078

PROJECT TITLE: Topical Application of Various Insecticides to Containerized Plants for Quarantine Certification

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott and Lee McAnally

INTRODUCTION:

Results of a preliminary study (Project FA026087, this report) with topically applied granular insecticides to containerized plants indicated potential for this use pattern. In an effort to obtain more and varied treatments for nursery owners to use for compliance with the IFA quarantine, a study with topical applications (i.e., "over-the-top") of various insecticides was initiated. A topical application of an insecticide would be an alternate treatment for a grower who had not incorporated chlorpyrifos into the potting media previous to planting. Two types of woody ornamentals were used in the current study; one with a fiberous root system and another with a non-fiberous system, since the different root systems may affect leaching of the insecticides through the potting media and root systems,

METHODS AND MATERIALS:

Fifteen azaleas (Rhododendron spp. 'Judge Solomon'), representing the fiberous root system, and fifteen red tips (Photinia 'Fraseri'), representing the non-fiberous system, were purchased in trade gallon containers at a local nursery. Each plant was placed on a brick in a 8 x 12 x 6" plastic tray. The

trays were filled with water, with a drainage hole 1 1/2 inches from the bottom. Water placed in the bottom of the tray provided a moat-like effect to keep the ants from escaping. Each plant was infested with 50 cc. of ants (brood present) from a field collected fragmented colony. After a 5 day acclimation period, the plants were topically treated as follows:

3 azaleas and 3 red tips - Dursban 2.5G
11.3g AI/cu. yd.(2.48 gms./pot)

3 azaleas and 3 red tips - Triumph 1G
11.3g AI/cu. yd.(6.2 gms./pot)

3 azaleas and 3 red tips - Oftanol 5G
11.3g AI/cu. yd.(1.24 gms./pot)

3 azaleas and 3 red tips - Orthene 75S
1/4 tsp./plant (.78 gms./pot)

3 azaleas and 3 red tips - untreated checks

After treatment, the plants were watered, and a standard nursery watering schedule followed for the remainder of the study.

The plants were checked daily for colony mortality. After a colony died, soil

from the top 2 inches of the pot was collected for an alate queen bioassay using procedures described elsewhere in this report. Bioassays were conducted at one week and then monthly to determine what residual effect the insecticides had against infestation by alate queens.

RESULTS:

Orthene was totally effective against colonies within one week of application (Table 17), but residual activity against alate queens was greatly diminished by one month post colony mortality (Table 18).

Both Dursban and Triumph eliminated five of six treated colonies (Table 17). Triumph provided colony mortality in less than one week to the 5 colonies which succumbed. Dursban results occurred over a longer time span, since Dursban binds to the soil and does not leach, allowing the IFA to live in the bottom of the pot (Annual Report, USDA, APHIS, PPQ, IFA Station 1987, pp. 45-53). However, both insecticides showed 100% residual efficacy against alate queens up to one month after colony mortality.

Oftanol showed varied results with three of six colonies dying within eight days and a fourth colony dead after 33 days (Table 17). Soil bioassayed from pots where colonies were eliminated, showed residual activity greatly reduced by one week post colony mortality. (Table 18).

Table 17. Time Required to Provide Total Colony Mortality Following Topical Application of Various Insecticides to Infested Containerized Plants.

| Treatment | | | Time Required for Nest Mortality to Occur (Days) | |
|---|---|---|---|---|
| Insecticide & Formulation | Application Rate/ 6" Pot (gms) | Replicate | Photinia | Azalea |
| Dursban 2.5G | 2.48 | 1 | 15 | 39 |
| | | 2 | 1/ | 2 |
| | | 3 | 3 | 33 |
| Triumph 1G | 6.20 | 1 | 6 | 1 |
| | | 2 | 1/ | 3 |
| | | 3 | 4 | 4 |
| Oftanol 5G | 1.24 | 1 | 8 | 4 |
| | | 2 | 1/ | 33 |
| | | 3 | 7 | 1/ |
| Orthene 75S | 0.78 | 1 | 1 | 3 |
| | | 2 | 3 | 3 |
| | | 3 | 6 | 3 |
| Check (Untreated) | ---- | 1 | 16 | 1/ |
| | | 2 | 1/ | 1/ |
| | | 3 | 1/ | 1/ |

1/ More than 25 workers surviving at termination of test (60 days).

Table 18. Results of Alate Queen Bioassays Conducted 24 Hours, 1 Week, and 1 Month after Nest Mortality Occurred for each Treatment and Plant Species Listed.

| Insecticide & Formulation | Replicate | Time After Nest Mortality Occurred | | | | | |
|---|---|---|---|---|---|---|---|
| | | 24 Hours | | 1 Week | | 1 Month | |
| | | Photinia | Azalea | Photinia | Azalea | Photinia | Azalea |
| Dursban 2.5G | 1 | 100 | nb | 100 | 100 | 100 | nb |
| | 2 | * | 100 | * | 100 | * | 100 |
| | 3 | 100 | nb | 100 | 100 | 100 | nb |
| Triumph 1G | 1 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 2 | * | 100 | * | 100 | * | 100 |
| | 3 | 100 | 100 | 100 | 100 | 100 | 100 |
| Oftanol 5G | 1 | 100 | 100 | 65 | 100 | nb | 25 |
| | 2 | * | nb | * | 40 | * | nb |
| | 3 | 100 | * | 35 | * | nb | * |
| Orthene 75S | 1 | 100 | 70 | 100 | 100 | 10 | 10 |
| | 2 | 100 | 45 | 100 | 100 | 60 | 20 |
| | 3 | 100 | 75 | 100 | 100 | 25 | 25 |
| Check | 1 | 20 | * | nb | * | 10 | * |
| | 2 | * | * | * | * | * | * |
| | 3 | * | * | * | * | * | * |

nb - no bioassay performed
* - more than 25 workers surviving after 60 days

PROJECT NO: FA01G088

PROJECT TITLE: Toxicity of Dursban to IFA Workers and Alate Queens in Nursery Potting Media

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott and Lee McAnally

INTRODUCTION:

A study of toxicity of Dursban to IFA workers, conducted in 1979, (Annual Report, USDA, APHIS, PPQ, IFA Station), showed the $LD_{50}$ to be approximately .18 ppm and $LD_{99}$ to be .28 ppm. This study was conducted using technical Dursban in local sandy topsoil. More recent studies, also using technical Dursban in local sandy topsoil show $LD_{99}$ to workers at .35 ppm and $LD_{99}$ to alate queens at 1.75 ppm (see FA02G077, this report). Studies have not been conducted using technical Dursban in nursery potting media. This study was done in order to establish initial toxicity and $LD_{99}$ of technical Dursban in potting media to IFA workers and alate queens.

METHODS AND MATERIALS:

Procedures described elsewhere were slightly modified (Banks et al. 1964, Collins and Ladner 1981, Collins et al. 1982). Stock solutions of technical Dursban (99%) were mixed in acetone. Serial dilutions of the stocks were added to 100 g. Strong-Lite® Potting Soil (a blend of composted pine bark, peat moss, vermiculite and perlite, Strong-Lite Products Corp., P.O. Box 8029, Pinebluff, Arkansas) to obtain various dosage rates. Additional acetone, to

bring total liquid to 70 ml., was added to acquire a thoroughly saturated soil mixture. The solvent was evaporated by drying under a hood for 2-3 hours (Dobbs 1985). Bioassays, using 20 major workers or 5 alate queens per replicate, and four replicates per soil sample (treated or check), were performed. Check soil was treated with 60 ml. acetone and dried under the hood. PPM dosage rates showing 10% to 90% mortality were bioassayed three times and percent mortality of each rate recorded at 7 days post-treatment.

RESULTS:

Toxicity of Dursban in nursery potting media to alate queens shows a $LD_{99}$ of of 4.00 ppm and a $LD_{50}$ of 2.85 ppm (Fig. 7). This is more than two-fold the LD rates of Dursban to alate queens in sandy loam top soil. The dosage mortality curve for IFA workers (Fig. 8), shows the $LD_{99}$ of Dursban to workers is about 1.98 ppm and $LD_{50}$ is 1.25 ppm.

Fig. 7. Dosage Mortality Curve - Toxicity of Dursban to IFA Alate Queens in Potting Media.

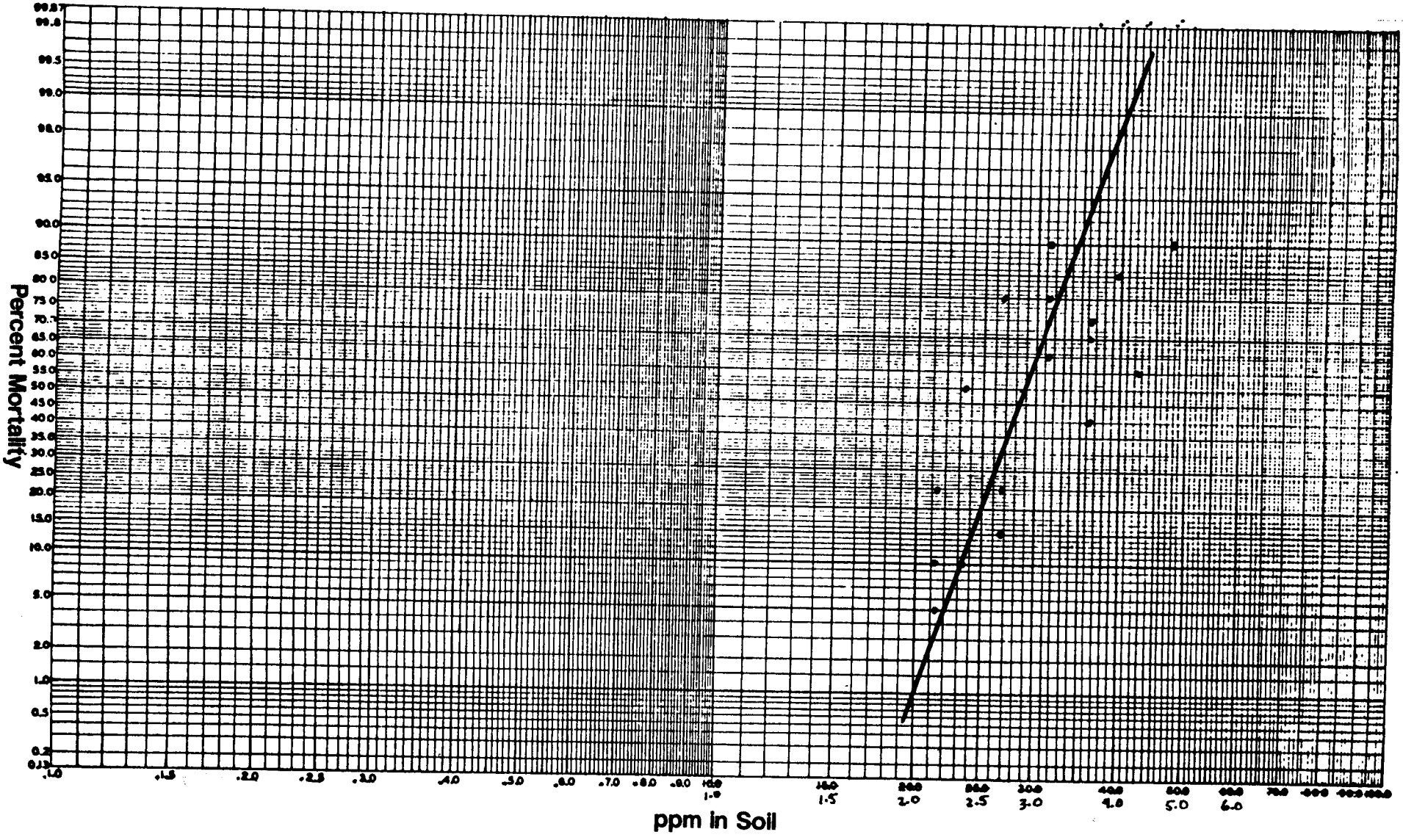
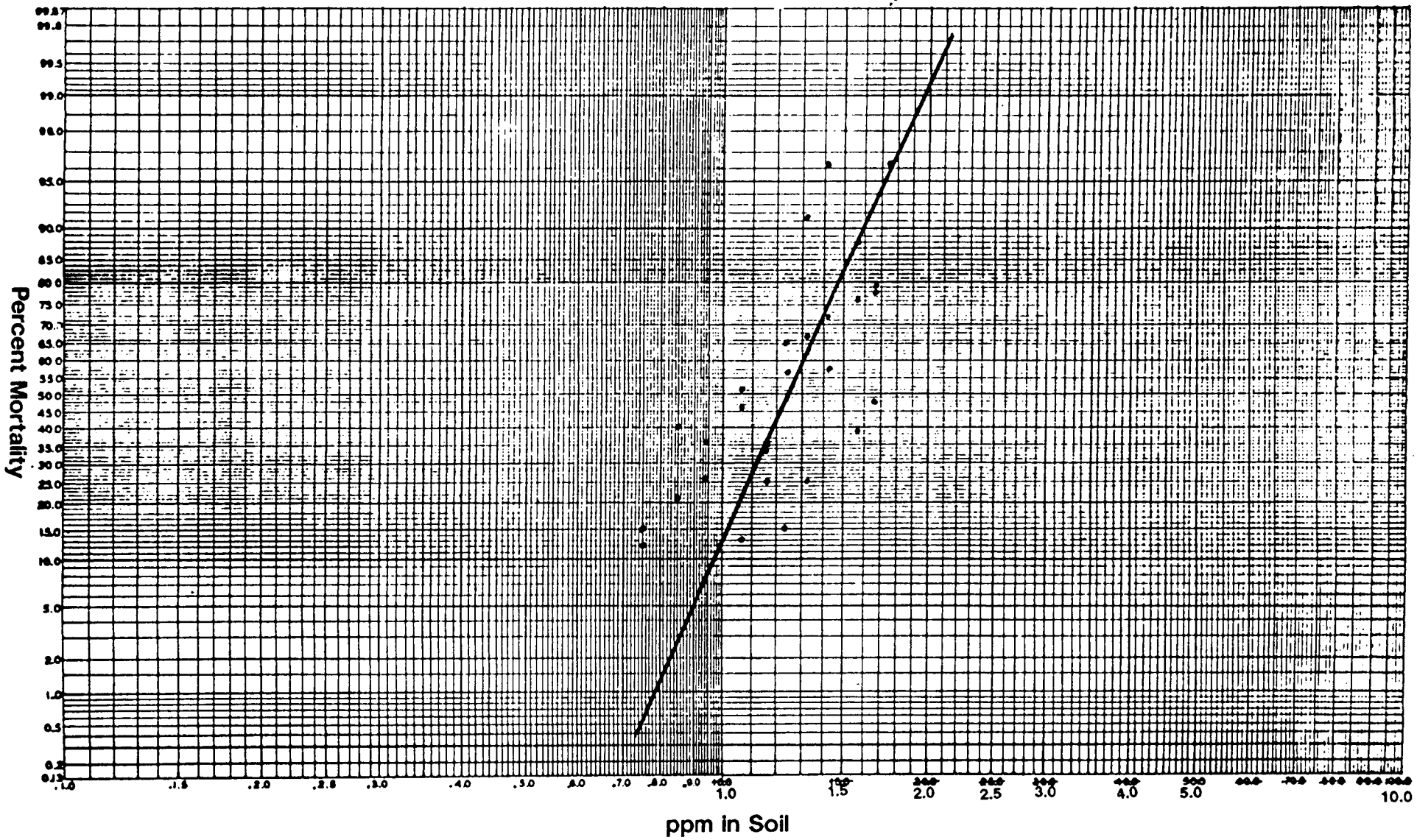


Fig. 8. Dosage Mortality Curve - Toxicity of Dursban to IFA Major Workers in Potting Media.



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PROJECT NO: FA01G098

PROJECT TITLE: Evaluation of Commercially Available Fumigants for Control of Foraging IFA Workers on Public Carriers

TYPE REPORT: Final

LEADER/PARTICIPANTS: Tim Lockley, Lee McAnally, and Avel Ladner

INTRODUCTION:

Even though IFA workers are sterile and are, therefore, incapable of causing a viable infestation, their presence on non-hazardous cargo constitutes a rationale for disallowance of entry into non-infested states. The only recourse for interstate carriers is either to return to their point of origin or go through a lengthy and costly methyl bromide fumigation. Recently, it has come to our attention that commercial carriers were using the widely available foggers currently on the market for control of household pests as a means to control for foraging IFA workers on general interstate cargo. Whether or not this practice is widespread cannot be determined, however, the use of these products by tractor-trailer operators constitutes an interesting application for which they are not currently labelled, one which may have some utility in the control of IFA workers on general cargo.

METHODS AND MATERIALS:

An enclosed truck (capacity 1,152 cu. ft.) was used to test six commercially available foggers. Three 18"x20"x2" plastic trays containing 1 gallon nursery pots with potting soil and a simulated nest of IFA were placed within the

trailer area of the truck along with three 1000 ml. glass beakers containing 25 foraging workers. Controls were placed within the cab of the truck. Upon discharge of the fumigant, the trailer was closed and sealed and not opened for two hours. Afterwards, the trailer was evacuated for 30 minutes, and the pots and glass containers were examined for mortality of the test insects. Fumigation was carried out following labelled instructions for each product.

Six separate fumigants were tested:

1. Raid Fogger. Manufactured by S.C. Johnson, Inc., Racine, WI 53403. AI 0.5% pyrethrins.

2. Security Indoor Insect Fogger. The Security Products Co. of Delaware, Inc. City of Commerce, CA. 90040. Fort Valley, GA 31030. AI 0.5% pyrethrins.

3. Holiday Household Insect Fogger. Boyle-Midway, Inc., New York City, NY 10017. AI 0.5% Fenvalerate.

4. Starbar Fogasect Plus Fogger with Precor Insect Growth Regulator. Starbar, A Division of Zoecon Corp. 12200 Denton Drive, Dallas, TX 75234. AI 0.5% Permethrin; 0.75% Insect Growth Regulator (Precor).

5. Raid Fumigator, S.C. Johnson and Son, Inc., Racine, WI 53404. AI 12.6% Permethrin.

6. Starbar Roach Ban Fogger with Gencor Insect Growth Regulator. Starbar, A division of Zoecon Corp., 12200 Denton Drive, Dallas, TX 75234. AI 0.25% Permethrin; 0.60% Hydroprene (IGR).

RESULTS AND DISCUSSION:

All tests indicated 100% mortality of foraging IFA workers. Simulated nests (infested pots), were not affected by the fumigants. Only those ants near or on the surface were killed; the remainder were unharmed. In all of the fumigant tests (with the exception of Test 5 [Raid Fumigator] ants would vacate the top layer (ca. 2.5 - 3.5 cm.) of soil in the treated pots. Examination of the untreated checks showed ants approximately 1.0 cm. below the surface of the soil. In Test 5, the ants were within 0.5 cm. of the surface. In both the treated and the check pots, the top 2.5 - 3.5 cm. were dry. The moisture level began at the 2.5 - 3.5 cm. depth. Ants found below this point were active and unharmed. Those above this level in the treated pots were either dead or displayed neurological dysfunction.

PROJECT NO: FA01G108

PROJECT TITLE: Rate of Degradation of Dursban 2EC in a Typical Nursery Potting Soil Environment

TYPE REWRT: FINAL

LEADER/PARTICIPANTS: Timothy Lockley

INTRODUCTION:

Dursban 2EC used as a drench treatment is approved for certification of containerized plants under the IFA quarantine. A certification of 90 days is listed for this method in PPQ Manual M301.81. The 90 day time frame was an arbitrarily period selected because of the belief that nurseries would not keep treated stock beyond this period without shipment. No further evaluation of this treatment was considered necessary and, as such, no attempt was made to determine the maximum residual activity of chlorpyrifos applied as a drench. A study was initiated to determine the maximum period of residual activity for Dursban 2EC applied as a drench to potting soil at rates of 1X and 2X (8 and 16 fl. oz./100 gal, water respectively).

METHODS AND MATERIALS:

Dursban 2EC was applied at a rate of 4.0 fl. oz./100 gals. water (.5X) and 8.0 fl. oz./100 gals. water (1X) to potting soil contained in 1 gallon plastic pots. Each pot received 24.0 oz. of the solution. Following treatment, all pots were weathered outdoors under natural conditions. No irrigation water was added. At 30 day intervals, 3 pots from each treatment were composited

and uniformily mixed together. From the composite sample, a 100 g. sub-sample was taken for bioassay. Two separate tests were carried out. Test 1 was begun on April 5, 1988, and Test 2 was initiated on July 15, 1988.

RESULTS:

In both tests, the results were the same. Both the .5X and the 1X rates failed to exceed the 90 day mark in residual activity (i.e., 100% mortality in bioassay).

Table 19. Influence of Irrigation on Residual Activity of Dursban Drench.

| Time Post-Treatment (Days) | Irrigation water (inches/week) | Cumulative water received (inches) | % Mortality to Alate Queens 1/ |
|---|---|---|---|
| 30 | 1 | 4.95 | 100 |
| | 2 | 8.95 | 100 |
| | 4 | 16.95 | 100 |
| | rain only | .95 | 100 |
| 60 | 1 | 12.15 | 100 |
| | 2 | 20.15 | 100 |
| | 4 | 36.15 | 100 |
| | rain only | 4.15 | 100 |
| 90 | 1 | 17.95 | 100 |
| | 2 | 29.95 | 100 |
| | 4 | 53.95 | 100 |
| | rain only | 5.95 | 100 |
| 120 | 1 | 23.70 | 95 |
| | 2 | 38.70 | 50 |
| | 4 | 70.70 | 5 |
| | rain only | 6.70 | 100 |

1/ As determined by standard laboratory bioassays described elsewhere in this report; average based on 4 replicates/treatment with 5 alate queens/replicate.

PROJECT NO: FA01G128

PROJECT TITLE: Examination and Possible Treatment of Grass Sod for the Presence of Imported Fire Ant Queens in an Area Known to be Infested with Polygynous Colonies

TYPE REPORT: Final

LEADER/PARTICPANTS: Timothy Lockley and Mark Trostle [Texas Department of Agriculture, Austin, Texas]

INTRODUCTION:

The current registration of chlorpyrifos (Dursban 10G) for certification of grass sod is designed as a preventive treatment to eliminate newly mated (alate) queens (but not mature colonies). However, isolated infestations of IFA have been discovered in Texas outside of the quarantine area that were thought to be caused by transport of treated sod. The current treatment requirements are based upon the assumption that an established colony poses little or no pest risk because it is thought that the approach of the sod cutting machinery would cause an alarm response among the workers. Among these responses is the removal of the queen from the threatened area i.e, the queen retreats as deeply as possible into the mound well away from the area to be cut. However, the presence of polygynous colonies in sod growing areas of Texas has posed new, and potentially dangerous problem. The presence of possibly hundred of queens in a single mound may alter the alarm response in at least three different ways each of which may in and of itself circumvent current treatment procedures: (1) the alarm response may be diluted causing the workers to react less actively, thus the removal of endangered queens may be slowed or they may not be removed as far from the threat area; (2) if an

attempt is made to move all of the queens to the deepest part of the mound, their numbers may preclude their being moved quickly and effectively and (3) workers may selectively remove only a certain number of the threatened queens sacrificing some for the good of the mound. Any of these hypothetical reactions can result in one or more fertile queens being removed from the nest with the cut sod and transported to a new, previously unifested site. A field test was designed and carried out to determine if, indeed, a fertile queen could be removed from a multiple-queen mound with conventional sod harvesting equipment.

METHODS AND MATERIALS:

On May 24, an examination of a site at the Milberger Grass Farm near Bay City, Texas revealed an infestation of polygynous colonies in a field of centipede grass. A sod cutting machine was directed to cut through a mound beginning approximately 3.0 m. from the mound and proceeding 1.0 m. beyond. The sod section containing the mound was removed and emersed in water in a large, galvanized tub. The section was separated and each piece agitated to loosen all ants from the attached dirt and grass. The surface of the water was then examined for the presence of de-alate queens.

RESULTS:

The first two mounds examined failed to reveal the presence of any non-winged queens. However, the third mound yielded four de-alate queens. Following the

discovery of de-alate queens in cut sod, a trial was undertaken to examine the possibility of utilizing baits in combination with chlorpyrifos to control IFA on commercial sod. Quarter acre plots were set up in a field heavily infested with polygynous colonies. Five applications each were applied at 1 lb. of formulation per acre of Amdro and Logic. These applications were followed 24 hours later by a broadcast of Dursban at a rate of 4 lbs. AI/acre. An examination of the field was made 30 days post-treatment. Results of this test are shown in Table 20. The current registration is ineffective against established colonies and it is these colonies that pose the greatest threat in polygynous situations. Additional studies employing combinations of baits plus chlorpyrifos will be conducted in 1989.

Table 20. Effectiveness of Baits used in Combination with Granular Chlorpyrifos for Eliminating IFA Infestations from Grass Sod.

| Treatment | Population Index at Indicated Treatment Intervals (Days) 1/ ( 0 ) | ( 30 ) |
|---|---|---|
| Amdro and chlorpyrifos | 163.0 | 3.6 |
| Logic and chlorpyrifos | 182.0 | 24.0 |
| Untreated check | 460.0 | 553.0 |

1/ Mean based on 5 1/4 acre subplots/treatment

PROJECT NO: FA01G138

PROJECT TITLE: Evaluation of Jobe's Insecticide Spikes as a Method for Certification of Containerized Plants

TYPE REPORT: Final

LEADER/PARTICIPANT: Timothy Lockley

INTRODUCTION:

The Imported Fire Ant Quarantine, (7 CFR 301.81) sets forth conditions governing the movement of regulated articles. PPQ Manual 301.81 (January 1985) authorizes the use of chlorpyrifos drenches, or granular chlorpyrifos may also be blended into the potting media for certification of containerized plants. A study was undertaken to evaluate the efficacy of two insecticides spikes as a possible adjunct treatment for certification of containerized plants.

METHODS AND MATERIALS:

Evaluations were made on Jobe's Furadan 1% and Di-Syston 1% spikes (6g) [International Spike Inc., Lexington, KY) beginning on April 18, 1988. A single spike was placed in a six inch plastic pot (50 replicates) containing a standard potting mixture. Each spike was inserted approximately 3.0 cm. below the surface of the soil in the center of the pot. The pots were then drenched to capacity (approximately 24 fl. oz.) then left out of doors exposed to normal weathering. Subsequent waterings were made weekly with 0.5 inches of water applied to each pot. Bioassays with alate queens were carried out at

30 day intervals.

Further evaluations of these spikes were made beginning July 1, 1988, following the same procedures as before with the exception of the inclusion of living plants to the study. Jobe's spikes are designed as systemic, time-released insecticides. Consideration had to be made as regards to the possible adsorption of the insecticide into the plant. If a significant amount of the chemical was taken up into the plant system, a significant decrease in the efficacy of the insecticide would occur. Two species of Begonia were used, a fibrous-rooted species and a tuberous-rooted species. Though closely related taxonomically, the two species each had disparate watering requirements and were expected to take up the chemical at differing rates.

RESULTS:

TEST I:

In the initial evaluation, both the Furadan and Di-Syston spikes displayed residual activity to cause 100% mortality in the bioassays at day 30. (Table 21). Mortality in this test was complete within 24 hours post-exposure. Bioassays conducted at 60 day post-treatment showed a decrease in efficacy. Both products caused 90% mortality but only after a 7 day bioassay (exposure) period.

Table 21. Efficacy of Jobe's Insecticide Impregnated Spikes Against IFA Alate Queens.

| Treatment [1/] | % Mortality to Alate Queens at Indicated Post-Treat Interval (Days) (30) | (60) |
|---|---|---|
| Furadan Spikes | 100 | 90 |
| Di-Syston Spikes | 100 | 90 |
| Check | 5 | 5 |

1/ Plants not present in treated pots

TEST II:

When the evaluation was carried out in association with living plants, a significant difference was noted. In the 30 day post-treatment bioassay, the fibrous-rooted Begonia treatments showed only an average mortality of 5% (Di-Syston) and 10% (Furadan). While the tuberous-rooted Begonia treatments each had a 100% mortality. By the 60th day post-treatment, the tuberous-rooted Begonia treatment's efficacy had decreased to 10% each (Table 22).

These data would seem to indicate that the efficiency of Jobe's Spikes against IFA is dependent upon the plant type. The fibrous-rooted Begonia species was able to take up the insecticide more efficiently than the tuberous-rooted species and, as a result, the effects of the insecticide was negated. Whether this phenomenon is consistent with root type will need to be evaluated on a species basis. An evaluation that, under circumstances, would not seem to be warranteed either on a basis of residual activity or cost-effectiveness.

Table 22. Impact of Plant Root System on Residual Activity of Insecticide Impregnated Plant Spikes.

| Treatment | Root System | % Mortality to Alate Queens at Indicated Post-Treat Interval (Days) (30) | (60) |
|---|---|---|---|
| Jobe's Furadan Spikes | tuberous | 100 | 10 |
| | fibrous | 10 | 0 |
| Jobes's Di-Syston Spikes | tuberous | 100 | 10 |
| | fibrous | 5 | 0 |
| Untreated Check | tuberous | 0 | 5 |
| | fibrous | 5 | 0 |

PROJECT NO: FA01G148

PROJECT TITLE: Lateral Movement of Dursban Emulsion through Various Soil Types

TYPE REPORT: Final

LEADER/PARTICIPANTS: Anne-Marie Callcott

INTRODUCTION:

Dursban is currently used for a variety of IFA quarantine treatments. Use patterns include drench treatment of containerized plants, incorporation of granular formulations into potting media, and soil surface applications to grass sod and field grown nursery stock. Another potential method of application would be the use of chemigration for certification of large containerized plants (i.e., those plants grown in 20 to 50 gallon containers). Since both overhead sprinklers and drip irrigation lines are used in the nursery industry, a study was initiated to gain additional basic information about the dispersion of Dursban in various types of soil.

METHODS AND MATERIALS:

A 7 ft. long PVC pipe (4 inches i.d.) was cut lengthwise to form a trough (Fig. 9). The ends were sealed and a fiberglass screen placed 12 inches from one end of the pipe to form a reservoir. Soil was placed in the remaining 6 feet of the pipe to within 1/4 - 1/2 inch of the top. Dursban 2E, mixed per label instructions for drench treatment of containerized plants (8 fl. oz./ 100 gal. water), was poured into the 12 inch reservoir and the solution

allowed to move laterally into the soil. A total of 1 gallon of Dursban drench was added to the reservoir over a 5 day period. One week after the trial began the first 2 inches of every 6 inch interval was removed and bioassayed using alate queens. The three soils used were Strong-Lite® potting media, masonry sand and local sandy loam topsoil. Strong-Lite potting media is a typical potting mix consisting of a blend of composted pine bark, peat moss, vermiculite and perlite (Strong-Lite Products, Pine Bluff, Arkansas).

RESULTS:

Dursban translocated 26 inches from the pesticide reservoir in Strong-Lite potting media (Fig. 10). In a local sandy loam topsoil, the Dursban translocated 14 inches. When masonry sand was used, the Dursban moved through the entire 6 ft. section, showing 100% mortality of alate queens up to 72 inches from the souce of the pesticide. The pesticide moved more freely and further in the sand as expected, since high organic matter encourages the adsorption of pesticides by the soil (Brady 1974).

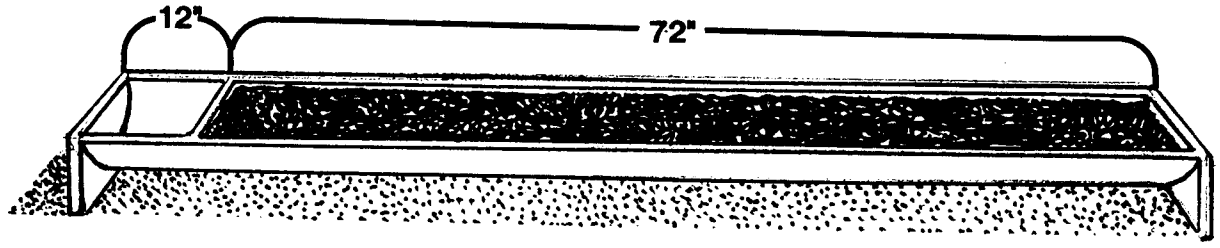


**Figure 9. PVC Trough Used in Testing Lateral Movement of Dursban Through Various Soil Types.**

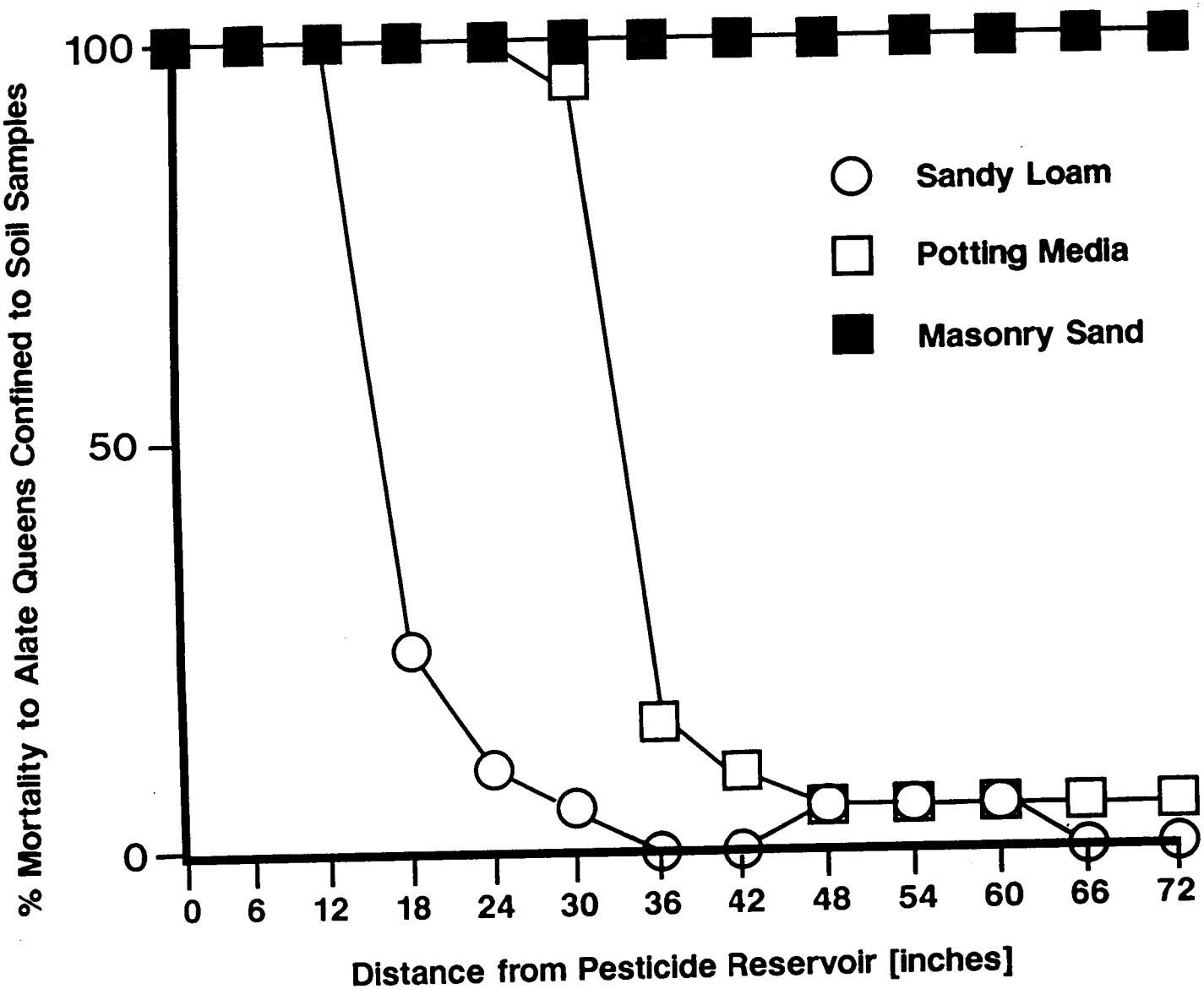


Fig. 10. Lateral Translocation of Dursban Emulsion Through Various Soil Types.

## REFERENCES CITED:

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PROJECT NO: FA02G018

PROJECT TITLE: Population Dynamics of Imported Fire Ant Colonies

TYPE REPORT: Interim

LEADER/PARTICIPANTS: Anne-Marie Callcott and Rebecca Norris

INTRODUCTION:

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

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

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

METHODS AND MATERIALS:

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

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

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

RESULTS:

South Mississippi Site:

The South Mississippi site was located in Forest County, Mississippi approximately 40 miles north of Gulfport, Mississippi. However, the site was not ideal due to its small size (about 10 acres) and the number of trees in the area. The trees made even broadcast of the bait difficult. Some of the efficacy plots were located close to the edge of the treated area, resulting in a possible "edge effect" i.e., colonies outside the 10 acre treated area moving into the outer edges of an efficacy plot. This "edge effect" was very evident in Plot 1, thus this plot was removed from the study.

A theoretical population of zero was reached at about 5 months (23 weeks) post-treatment. At this time, 5 of the plots had 100% colony mortality (Table 23), while the remaining 4 plots had 5 surviving colonies between them. Good control was still being observed 9 months post-treatment and reinfestation had not occurred. This study will continue with quarterly counts until a mature, stable population is reached, with most colonies present rated as class 20 or 25.

North Carolina Site:

A theoretical population of zero was reached at about 6 months (24 weeks) post-treatment. At this time, 5 of the plots had 100% mortality (Table 23), while the remaining 5 plots ranged from 91 to 95% mortality.

Table 23. Population Dynamics of IFA following a Broadcast Application of Logic Bait.

| Plot Number | Pretreat Population Colonies/ Subplot | Pop. Index | Status of Population at Indicated Months Post-Treatment: % Colony Mortality (1) | (2) | (3) | (4) | (5) | (6) | (9) | % Change in Pre-Treatment Population Index (1) | (2) | (3) | (4) | (5) | (6) | (9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOUTH MISSISSIPPI SITE | | | | | | | | | | | | | | | | |
| 2 | 15 | 260 | - | 40 | 80 | 100 | 93.3 | - | 100 | - | -85.8 | -96.9 | -100 | - 93.3 | - | -100 |
| 3 | 8 | 136 | - | 0 | 37.5 | 75 | 87.5 | - | 87.5 | - | -69.9 | -77.2 | - 74.3 | - 87.5 | - | - 89 |
| 4 | 21 | 380 | - | 28.6 | 57.1 | 95.2 | 95.2 | - | 100 | - | -86.1 | -90 | - 99.2 | - 95.2 | - | -100 |
| 5 | 17 | 316 | - | 47.1 | 76.5 | 100 | 100 | - | 100 | - | -85.8 | -96.8 | -100 | -100 | - | -100 |
| 6 | 23 | 455 | - | 52.2 | 73.9 | 100 | 100 | - | 95.6 | - | -91.4 | -97.8 | -100 | -100 | - | - 95.6 |
| 7 | 17 | 356 | - | 52.9 | 82.3 | 82.4 | 100 | - | 88.2 | - | -91.3 | -97.5 | - 93 | -100 | - | - 92.4 |
| 8 | 19 | 385 | - | 42 | 84.2 | 100 | 100 | - | 100 | - | -89.1 | -97.7 | -100 | -100 | - | -100 |
| 9 | 19 | 348 | - | 41 | 73.7 | 89.5 | 100 | - | 100 | - | -88.2 | -96.3 | - 94.3 | -100 | - | -100 |
| 10 | 18 | 325 | - | 27.8 | 83.3 | 100 | 88.9 | - | 88.9 | - | -86.8 | -97.5 | -100 | - 96.3 | - | - 89.2 |
| NORTH CAROLINA SITE | | | | | | | | | | | | | | | | |
| 1 | 27 | 286 | 0 | 14.8 | 29.6 | 63 | - | 100 | - | -58 | -73.8 | -77.3 | - 88.1 | - | -100 | - |
| 2 | 22 | 251 | 0 | 18.2 | 22.7 | 81.8 | - | 100 | - | -49.4 | -74.1 | -79.7 | - 97.2 | - | -100 | - |
| 3 | 32 | 302 | 3.1 | 4.4 | 46.9 | 90.6 | - | 100 | - | -63.9 | -69.5 | -82.8 | - 97.7 | - | -100 | - |
| 4 | 23 | 234 | 8.7 | 4.3 | 21.7 | 65.2 | - | 91.3 | - | -52.7 | -57.5 | -66.7 | - 85 | - | - 91.5 | - |
| 5 | 13 | 162 | 0 | 15.4 | 15.4 | 84.6 | - | 92.3 | - | -58 | -72.8 | -79.6 | - 96.3 | - | - 96.9 | - |
| 6 | 19 | 184 | 0 | 21.1 | 52.6 | 84.2 | - | 94.7 | - | -46.2 | -57.1 | -72.8 | - 93.5 | - | - 94.6 | - |
| 7 | 19 | 184 | 26.3 | 10.5 | 68.4 | 100 | - | 94.7 | - | -50.5 | -50.5 | -79.3 | -100 | - | - 94.6 | - |
| 8 | 7 | 65 | 0 | 28.6 | 85.7 | 85.7 | - | 100 | - | -40 | -73.8 | -95.4 | - 98.5 | - | -100 | - |
| 9 | 10 | 90 | 0 | 0 | 50 | 100 | - | 90 | - | -53.3 | -61.1 | -84.4 | -100 | - | - 94.4 | - |
| 10 | 24 | 208 | 0 | 4.2 | 29.2 | 75 | - | 100 | - | -47.6 | -56.7 | -64.9 | - 80.9 | - | -100 | - |

Table 24. Decline and Resurgance of IFA Colonies by Colony Class following a Broadcast Application of Logic Bait.

| Colony Class | Pretreat | % of Total Colonies in each Colony Class at Indicated Post-Treatment Interval (Months) (1) | (2) | (3) | (4) | (5) | (6) | (9) | (12) | (14) |
|---|---|---|---|---|---|---|---|---|---|---|
| SOUTH MISSISSIPPI SITE | | | | | | | | | | |
| 1 | 1.9 | - | 1.9 | 9.8 | 0 | 0 | - | 0 | | |
| 2 | 0 | - | 12.7 | 39 | 0 | 40 | - | 16.7 | | |
| 3 | 0.6 | - | 30.4 | 41.5 | 22.2 | 20 | - | 0 | | |
| 4 | 0 | - | 38.2 | 2.4 | 0 | 0 | - | 0 | | |
| 5 | 0 | - | 15.7 | 0 | 11.1 | 0 | - | 0 | | |
| 5 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | | |
| 10 | 7 | - | 0 | 2.4 | 44.4 | 20 | - | 0 | | |
| 15 | 26.1 | - | 1 | 2.4 | 11.1 | 0 | - | 33.3 | | |
| 20 | 37.6 | - | 0 | 2.4 | 11.1* | 20* | - | 33.3* | | |
| 25 | 26.6 | - | 0 | 0 | 0 | 0 | - | 16.7 | | |
| NORTH CAROLINA SITE | | | | | | | | | | |
| 1 | 1.6 | 8.2 | 2.3 | 12.5 | 24.3 | 0 | - | | | |
| 2 | 7.2 | 14.6 | 12.2 | 29.2 | 18.9 | 0 | - | | | |
| 3 | 5.7 | 27.6 | 35.5 | 26.7 | 29.8 | 0 | - | | | |
| 4 | 6.7 | 18.5 | 34.3 | 15.8 | 13.5 | 0 | - | | | |
| 5 | 15 | 20.9 | 9.9 | 2.5 | 2.7 | 0 | - | | | |
| 5 | 8.3 | 0 | 0.6 | 1.7 | 2.7 | 33.3 | - | | | |
| 10 | 19 | 4.4 | 2.3 | 6.6 | 5.4 | 66.7 | - | | | |
| 15 | 23.2 | 2.9 | 1.2 | 4.2 | 2.7 | 0 | - | | | |
| 20 | 10.3 | 2.9 | 1.7 | 0.8 | 0 | 0 | - | | | |
| 25 | 3 | 0 | 0 | 0 | 0 | 0 | - | | | |

* Possible "Edge Effect"

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PROJECT NO: **FA02G028**

PROJECT TITLE: Eradication of Isolated Infestations: Comparison of Methods of Treatment

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

TYPE REPORT: Final

INTRODUCTION:

The eradication of IFA in isolated areas of infestation is a growing concern. In 1988, isolated infestations were detected in California, Arizona, and St. Croix, U.S. Virgin Islands. While both baits and insecticidal drenches are effective for individual mound control, a combination of these two treatments may be the best method of eradication of IFA in relatively small isolated areas.

Several state regulatory agencies have used the dual application method in the past, These agencies usually first drench all detectable mounds and then follow with a "mop up" treatment using broadcast bait. However, Lofgren and Stringer (1964) observed that even a few hours after treatment with a granular insecticide, few to no foraging workers were active. Apparently not only the direct effect of the insecticide keeps worker ants from foraging, but also the insecticidal vapors are somehow detected, and the foragers remain in their nests. Decreased foraging activity would theoretically decrease the expected level of control.

Logic® bait, which is labelled for use on non-agricultural land, non-bearing

citrus and nurseries, has been shown to be effective against IFA (Banks et al. 1983, Banks et al. 1988) and was used in this study. Many different insecticides including acephate, carbaryl, diazinon and Dursban are labelled for use as mound drenches. While no one product has been shown conclusively more effective than the others, Dursban has shown fairly consistent results in a number of tests (Bass and Hays 1982, Francke 1983, Hillman 1977, Lemke and Kissam 1977, Williams and Lofgren 1983), and was chosen as the drench treatment in this project.

METHODS AND MATERIALS:

Nine 1-acre plots were set up in an infested field in Forest County, Mississippi, and a 1/4 acre efficacy plot marked in the center of each. All mounds in each plot were marked with an orange surveyor's flag and its colony size (population) rated according to the procedure described by Lofgren and Williams (1982) before treatment. Three of the plots were treated with bait and 48 hours later by drenching whereas three other plots were treated by drenching and then with bait. The last three plots remained as untreated checks. The bait was applied at 1 1/2 lb./acre (maximum labelled rate) by the APHIS Bait Spreader (1987 Annual Report) attached to a tractor. The Dursban 2E drench was applied at a rate of 1 fl. oz./2 gal. water, using 1 gal. per individual mound as specified on the product label. The plots were checked at weekly intervals to determine colony mortality.

RESULTS:

Because of a lack of rainfall and shortage of time and manpower, these plots were not counted until seven weeks post-treatment. At this time, the plots which received the bait first and then drenched, had 100% colony mortality and reduction in population index. The plots which were drenched and then baited had greater than 92% reduction in population index, but some surviving colonies were present (Table 25). By 13 weeks post-treatment, both sets of plots had reached 100% colony mortality and no reinfestation had occurred in either set of plots. While these results are based on a small number of observations, they do tend to indicate that for small isolated infestations, it would probably be best to apply a bait prior to drenching all detectable IFA colonies.

Table 25. Influence of Sequence of Treatments with Baits and Drenches on IFA Control.

| Plot No. | Treatment Sequence 1/ | Pre-Treat Population | | Results at Indicated Weeks Post-Treatment | | | |
|---|---|---|---|---|---|---|---|
| | | No. Colonies | Pop. Index | % Colony Mortality (7) | % Colony Mortality (13) | % Change in Pre-Treat Pop. Index (7) | % Change in Pre-Treat Pop. Index (13) |
| 1A | bait/drench | 17 | 295 | 100 | 100 | - 100 | - 100 |
| 1B | bait/drench | 14 | 270 | 100 | 100 | - 100 | - 100 |
| 1C | bait/drench | 9 | 160 | 100 | 100 | - 100 | - 100 |
| 2A | drench/bait | 15 | 285 | 100 | 100 | - 100 | - 100 |
| 2B | drench/bait | 9 | 160 | 55.5 | 100 | - 92.5 | - 100 |
| 2C | drench/bait | 12 | 265 | 91.6 | 100 | - 98.9 | - 100 |
| Ck1 | untreated | 25 | 455 | 12 | 32 | - 26.4 | - 40.7 |
| Ck2 | untreated | 16 | 385 | 15.8 | 21.1 | - 31.2 | - 38.9 |
| Ck3 | untreated | 29 | 575 | 6.9 | 41.4 | - 42.6 | - 56.5 |

1/ Logic bait applied at 1 1/2 lb./acre. Dursban drench applied at 0.5 fl.oz 2EC/gal. water/mound.

## REFERENCES CITED:


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PROJECT NO: FA03G018

PROJECT TITLE: Evaluation of Beauveria bassiana (Abbot t Laboratories Strain)

TYPE REPORT: Final

**LEADER/PARTICIPANTS:** Anne-Marie Callcott, Homer Collins and Steve Jaronski [Abbott Laboratories, Chicago, Illinois]

INTRODUCTION:

Recent interest in the pathogenicity of various strains of the fungus Beauveria bassiana prompted Abbott Labs (14th & Sheridan, Chicago, Illinois 60064) to investigate this organism as a possible biocontrol agent for IFA. We were contacted by Abbott and asked to conduct laboratory tests using various formulations of B. bassiana spores prepared by them. Stimac et al. (1988) concluded that various isolates of the fungus B. bassiana, when applied as a spray, were pathogenic to Solenopsis invicta and S. saevissma. The objective of these tests was to determine whether B. bassiana (Abbott Lab Strain) is pathogenic to S. invicta (IFA) in laboratory tests.

METHODS AND MATERIALS:

Two methods of exposure, either by contact or per os, were used in these trials. IFA nests were collected from the field, placed in plastic trays and the ants allowed to rebuild their nests in the laboratory before treatment. Several methods of treatment were instigated using the two methods of exposure.

A. Exposure by contact:

1. On July 22, 1988 twenty-four colonies were collected and allowed to acclimate. Twelve of the colonies were drenched with B. bassiana spores at a rate of 2.0E11 spores/liter of water/nest (6.5 g. of 3.2E10 spores/g.). The 12 check colonies were treated with 1 liter of water/nest.

2. Another 24 colonies were collected and allowed to acclimate in the laboratory. Of these colonies, 12 were treated with 3.4 E10 viable spores/35 ml. of water/nest (0.5 g. of 6.8E10 viable spores g.) using a plant sprayer attached to a 40 ml. glass jar.

3. One colony with brood was collected, brought to the lab and the ants separated from their nest tumulus by dessication. The nest tumulus was spread in a metal tray (2' x 8') and a plaster of paris artificial nest placed in the middle (Markin 1968). After 16-24 hours, the ants, including brood, moved into the artificial nest. The entire nest was moved to a bucket and the ants anesthetized with carbon dioxide. Two hundred cc. of ants were obtained by this method. The ants were then dipped in a spore suspension of 0.5 g. of 6.8 E10 viable spores/g. in 400 ml. of water. This entire suspension (including ants) was poured over the original nest tumulus, which was retrieved from the metal tray and placed in a plastic tray.

B. Exposure per os:

1. Five colonies were provided 0.5 g. of 6.8E10 viable spores/g. mixed into 20 ml. honey-water solution (50:50 v/v). The solution was put into a petri dish and placed in the tray for the IFA colony to feed on.

2. In the final trial, a bait using B. bassiana spores was prepared (1.25 g. of 6.8E10 viable spores/g. mixed into 15 g. of peanut oil). This mixture was added to 35 g. defatted corn grits to make an attractive IFA bait. Five colonies were then offered 10 g. each of the bait in a petri dish and allowed to feed ad lib (1.7 E10 viable spores/nest). Five check colonies were provided with a bait made with defatted corn grits and peanut oil.

RESULTS AND DISCUSSION:

A. Exposure by contact:

1. Four days post-treatment, the treated colonies seemed disturbed and showed excessive activity; possibly trying to relocate the nest. By contrast, check colonies showed normal activity. By 1 week post-treatment, all but 2 of the treated colonies had large "bone piles" (2" dia. and stacked), while the check colonies showed normal attrition (1/2" - 1" dia. bone piles which were not stacked).

All colonies were watered and fed weekly while under observation. All colonies were observed to feed normally. After the observations recorded during the first week post-treatment, no significant changes occurred and the test was concluded 5 weeks post-treatment.

2. Twenty-four mature IFA colonies with brood were collected October 7, 1988 and allowed to rebuild their nests in the lab. Twelve colonies were treated with 3.4E10 viable spores/35 ml. water/nest (0.5 g. of 6.8E10 viable spores/g.) using a plant sprayer attached to a 40 ml. glass jar. After 2 weeks, no significant changes were observed. The ants were active and feeding normally. This test was discontinued on November 1, at which time no significant mortality had occurred.

3. One colony with brood was collected and brought to the lab and the ants separated from their nest tumulus by dessication. The nest tumulus was spread in a metal tray (2' x 8') and a plaster of paris artificial nest placed in the middle (G.P. Markin 1968). After 16-24 hrs. the ants, including brood, had moved into the artificial nest. The entire nest was moved to a bucket and the ants anesthetized with CO2. Two hundred cc. of ants were obtained by this method. The ants were then dipped in a spore suspension of 0.5g. of 6.8E10 viable spores/g. in 400 ml. water. This entire suspension (including ants) was then pored over the original nest tumulus, which had been retrieved from the metal tray and placed in a plastic tray. At 5 days post-treatment, a fairly large "bone-pile" had appeared (2"-3" dia. and stacked), and the ants were agitated. The colony had a great number of alate queens present when

collected, and by 6 days post-treatment approximately 80% of these alate queens were dead. At 2 weeks post-treatment, a large number of ants were dead, but the survivors (approximately 70% of population) were active.

B. Exposure per os:

1. Five colonies were treated with 0.5 g. of 6.8E10 viable spores/g. mixed into a 20 ml. honey-water solution (50:50 v/v) on October 18, 1988. This solution was put in a petri dish and placed in the colony for the ants to feed on. All colonies eagerly partook. By 2 weeks post-treatment, no significant mortality was observed and the test discontinued.

2. 1.25 g. of 6.8E10 viable spores/g. were mixed into 15 g. peanut oil. This mixture was then added to 35 g. defatted corn grits to make an attractive IFA bait. Defatted corn grits is the inert carrier used in all registered IFA baits at the current time. Five colonies were then given 10 g. each of the bait in a petri dish and allowed to feed ad lib (1.7E10 viable spores/nest). One day post-treatment, 3 colonies had removed 100% of the bait. By day 4, colony number 4 removed 100% of the bait. At this time, the last colony had not moved much of the bait, but had obviously fed on it (little oil left). This test discontinued 2 weeks post-treatment at which time no significant mortality was observed.

In summary, five different small laboratory trials with B. bassiana have been initiated. In three of these trials, the method of exposure was through

contact whereas the last two trials involved exposure per os.

Results to date seem to indicate that B. bassiana does cause low levels of infection in the laboratory. However, in these tests, no colony has been effectively controlled or eliminated.

Recommendations:

Work should continue with B. bassiana using a strain that has been selected for pathogenicity using live IFA. This strain(s) should be tested in a bait or a drench, as these are the most practical methods of application.

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PROJECT NO: FA03G028

PROJECT TITLE: Field Tests with Neoplectana carpocapsae Nematodes for Control of IFA

TYPE REPORT: Final

LEADER/PARTICIPANTS: Homer Collins, Timothy Lockley, Anne-Marie Callcott, Avel Ladner, Lee McAnally and Richard Miller [Biosis Co., Palo Alto, California]

INTRODUCTION:

N. carpocapsae, an entomogeneous nematode under commercial development by Biosis Co. (1057 East Meadow Circle, Palo Alto, California), was evaluated for control of IFA colonies in two separate trials during 1988.

METHODS AND MATERIALS:

A. Spring Trial - The first trial was initiated on April 7, 1988 using a dessicated nematode product. All active IFA colonies in 3 test plots (approximately 0.5 acres each) were flagged, enumerated, and rated on the population index scale described by Lofgren and Williams (1982). All colonies in one plot were treated with Amdro bait at 5T/colony. A second plot was treated with nematodes (2 million infective juvenile nematodes/colony in a 1 gallon drench). Soil moisture was at or near field capacity at time of treatment, The third plot served as an untreated check. All IFA colonies in the nematode plot were re-treated 3 weeks after the original application.

A chronological record of events including irrigation, rainfall, etc. is as

follows:

Spring Nematode Trial - Chronological Record

| DATE | EVENT(S) |
|---|---|
| 4/6/88 | Nematodes received 9:15 a.m. |
| 4/7/88 | (1) Subsamples of nematodes re-hydrated and activity confirmed under magnification. |
| | (2) Plots rated and treated. |
| 4/9/88 | Approximately 0.3cm. irrigation water added by pulsating sprinkler. (nematode plot only) |
| 4/16-17/88 | All plots mowed, ca. 1.0 cm. irrigation water added to nematode plot only. |
| 4/19 | Rainfall 2.8 cm. in 24 hr. period ending at 6:00 pm. on 4/19. |
| 4/23 | Trace ppt. All plots mowed. |
| 4/29 | Second shipment of nematodes received 8:45 am. Nematode plots retreated (37 nests). |
| 5/10 | Rainfall .8 cm. in 24 hour period ending 6:00pm on 5/10. |
| 5/19 | 6 Week evaluation conducted; test terminated. |

Evaluations were conducted at 3 and 6 weeks after the initial application.

B. Fall trial - A much larger field trial was initiated on November 2, 1988. Nine test plots 1 acre in size, (210' x 210') were established at the Pearl River Sod Farm near Wiggins, Mississippi. All active ant colonies in each 1 acre plot were flagged for subsequent treatment by either nematodes, Dursban drench, or plain water. A 1/4 acre efficacy subplot was established in the

center of each test plot and all ant colonies counted and rated on the population index scale described by Lofgren and Williams (1982). Treatments (3 replicates each) were as follows:

1. Nematodes

   Day 0: 800,000 IJ's in half gallon water/nest

   Day 14: 200,000 IJ's in half gallon water/nest

   Day 28: 200,000 IJ's in half gallon water/nest

   Applied to all active IFA nests in entire 1 acre plots

2. Dursban drench - (15 cc 2EC/gal water/nest) applied to all active nests in entire 1 acre plots at Day 0, 14, and 28.

3. Control Mounds - Drenched with 1/2 gallon water/nest at Day 0, 14 and 28.

Live nematodes were shipped from California via Federal Express overnite delivery prior to each application. All plots were evaluated on Days 0, 14, 28 and 42.

Rainfall/irrigation during the trial was as follows:

| Date | Inches of water | Cumulative |
|---|---|---|
| 11/9 | 1.0 | — |
| 11/14 | .8 | 1.8 |
| 11/16 | .6 | 2.4 |
| 11/19 | 2.0 | 4.4 |
| 11/28 | Heavy frost; light freeze | |
| 11/29 | 1.5 | 5.9 |
| 12/6 | .6 | 6.5 |
| 12/13 | 2.9 | 9.4 |
| 12/20 | .3 | 9.7 |

RESULTS:

An acceptable level of IFA control was not achieved in either trial (Tables 26 and 27).

Table 26. Results of Spring 1988 Field Tests with N. carpocapsae.

| Treatment | Pre-Treat Population | | Results at Indicated Weeks after Initial Treatment | | | |
|---|---|---|---|---|---|---|
| | Total No. Colonies | Pop. Index | % Colony Mortality (3) | % Colony Mortality (6) | % Change in Pre-treat Pop. Index (3) | % Change in Pre-treat Pop. Index (6) |
| Amdro bait, 5T/Colony Day 0 | 39 | 544 | 23 | 46 | - 30 | - 67 |
| 2,000,000 IJ nematodes/colony Day 0 and 22 (2 nematode applications) | 29 | 497 | 0 | 0 | - 17 | - 20 |
| Untreated Check | 15 | 197 | 0 | 0 | + 51 | + 9 |

Table 27. Results of Fall 1988 Field Tests with N. carpocapsae.

| Treatment | Pre-Treat Population 1/ | | Results at Indicated Weeks after Initial Treatment 1/ | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | % Colony Mortality | | | % Change in pre-treat Pop. Index | | |
| | Number of Colonies | Population Index | (14) | (28) | (42) | (14) | (28) | (42) |
| Dursban Drench | 11.6 | 174.3 | 73.0 | 89.6 | 97.2 | - 74.5 | - 94.3 | - 98.1 |
| Nematode Drench | 12.6 | 177.6 | 24.7 | 18.1 | 28.4 | - 7.2 | - 46.2 | - 59.2 |
| Plain Water (Check) | 15.3 | 218.6 | 10.1 | 5.6 | 2.7 | - 18.0 | - 13.9 | - 18 |

1/ Average based on three 1/4 acre plots/treatment

## REFERENCES CITED:

Lofgren, C.S. and D.F. Williams. 1982. Avermectin Bla: A highly potent inhibitor of reproduction by queens of the red imoprted fire ant (Hymenoptera: Formicidae). J. Econ. Ent. 75(5):798-803.

PROJECT NO: FA03G038

PROJECT TITLE: Strip Treatment vs. Broadcast Treatment with Logic® Bait

TYPE REPORT: Final

LEADER/PARTICIPANTS: Homer Collins, Anne-Marie Callcott, Avel Ladner
Tim Lockley, and Dr. J. Thomas Bridges [Maag Agrochemical Co., Vero Beach, Florida]

INTRODUCTION:

Due to ultra low volume rates of application, few commercially available bait distribution systems are capable of applying labelled rates of IFA baits. One possible solution to this problem would be the application of a bait to alternative swaths, or a "strip" treatment. This procedure would enable the equipment to be calibrated for heavier rates of application for which they were originally designed. By "skipping" alternating swaths, the per acre rate of application would be halved. Since ants forage a considerable distance from the nest (Wilson, et al. 1971) it was hypothesized that ants would forage into the treated portion of the "strip treated plots." In coordination with Maag Agrochemicals, a field test using Logic bait in a strip treatment was conducted in the summer of 1988. The objective of this trial was to compare effectiveness of Logic bait as a strip treatment versus complete coverage (broadcast application).

METHODS AND MATERIALS:

Twelve one-acre plots were laid out in grazed pastureland near Brooklyn, Mississippi. Treatments (3 replicates each) were as follows:

- Logic strip treatment 1.0 lb./acre
- Logic complete coverage 1.0 lb./acre
- Amdro complete coverage 1.0 lb./acre
- Untreated check

All baits were applied using a shop-built spreader (USDA, APHIS, PPQ, IFA Annual Report 1987) attached to a farm tractor. For application of the Amdro and Logic complete coverage plots, the spreader was calibrated to deliver 1.0 lb./acre. For the Logic strip treatment, the spreader was calibrated to deliver 2.0 lb./acre, allowing twice as much bait to be applied to the alternate swaths, but resulting in 1.0 lb./acre actual application.

Within each one-acre plot, a 1/4 acre efficacy plot was established. Mounds within each efficacy plot were counted and rated on the population index scale described by Lofgren and Williams (1982) before treatment and 6, 12, and 18 weeks post-treatment.

RESULTS:

As shown in Table 28, Amdro (broadcast applied) provided 91.4% colony mortality 7 weeks post-treatment versus 49.2 and 38.1% for Logic "strip" treatment and Logic broadcast respectivefully. By 13 weeks after treatment, results were comparable for all treatments (85 to 93% colony mortality), but by 19 weeks post-treatment, the Amdro plots and the Logic strip treated plots

Table 28. Broadcast versus "Strip" Treatment with Logic Bait.

| Treatment | Application Rate (lb. bait/acre) | Pretreat Pop.* Colonies/ Sub-Plot | Pretreat Pop.* Pop. Index | Results at Weeks Post-Treatment* % Colony Mortality (7) | % Colony Mortality (13) | % Colony Mortality (19) | % Change in Pretreat Pop. Index (7) | % Change in Pretreat Pop. Index (13) | % Change in Pretreat Pop. Index (19) |
|---|---|---|---|---|---|---|---|---|---|
| Logic Broadcast | 1.0 | 11.5 | 204.3 | 38.1 | 93.3 | 98.1 | - 87.5 | - 96.7 | - 98.3 |
| Logic "Strip" | 1.0 | 14.0 | 213.0 | 49.2 | 93.8 | 57.5** | - 89.8 | - 97.6 | - 71.4** |
| Amdro Broadcast | 1.0 | 12.6 | 186 | 91.4 | 85.1 | 37.8** | - 92.5 | - 90.9 | - 43.1** |
| Untreated Check | -- | 24.3 | 471.6 | 11.5 | 31.5 | 29.5 | - 33.4 | - 45.3 | - 44.0 |

* Average based on three 1/4 acre efficacy plots/treatment

** Reinfestation by small incipient colonies

PROJECT NO: FA03G048

PROJECT TITLE: Shelf Life of GX-071 Bait

TYPE REPORT: Final

PROJECT LEADER/PARTICIPANT: Avel Ladner

INTRODUCTION:

Storage of shelf life of any IFA bait formulation is an important consideration because all baits eventually oxidize and become rancid. Since rancid baits are not actively accepted and fed upon by foraging workers (Lofgren et al. 1964), poor control may result from field applications of rancid baits. All commercialized baits contain soybean oil as a feeding attractant, and it is this component of the formulation rather than the inert carrier or active ingredient that becomes unacceptable to foraging workers. The shelf life of GX-071, a fluronated sulfone bait toxicant under development of Griffin Corp., Valdosta, Georgia was investigated in the study reported here.

METHODS AND MATERIALS:

A 10 lb. batch of GX-071 formulated by Griffin Corp. on November 13, 1987 was sub-divided into 3 groups of approximately 3.3 lbs. each, placed into plastic zip-lock bags and stored under 3 different temperature regimes: (1) in the laboratory at ambient conditions (21-23 degrees C.), (2) in a constant temperature chamber at 38 degrees C., and (3) in a second chamber at a constant temperature of 50 degrees C. The study was initiated on November 16,

1987. Samples were removed from storage 1, 2, 5, and 6 months after the test was initiated and subjected to the following bioassay procedures:

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

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

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

4. Candidate bait: The candidate bait is any potentially attractive oil, experimental bait formulation, or formulated bait which may have

deteriorated due to storage, etc. Each candidate bait is tested on five different colonies, and the results reported as an average response of all colonies.

5. Bioassay: Four grams of a candidate bait contained in a plastic petri dish are placed on the surface of each of the five test colonies. Simultaneously, four grams of the the freshly prepared standard bait in an identical container 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 by each test colony is determined by weighing the amount remaining in each petri dish.

6. Computation of acceptance ratio: An acceptance ratio for each candidate bait is computed as follows:

gm candidate consumed divided by gm std. consumed = Acceptance ratio

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

Lofgren et al. (1961) reported on the evaluation of 222 different food materials and provided a list of those which gave an acceptance ratio of 0.75

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

RESULTS:

As indicated in Table 29, bait acceptance declined rapidly when GX-071 was stored at elevated temperatures.

Table 29. Shelf Life of GX-071 Bait.

| Storage Temperature | Mean Acceptance Ratio after Storage for Indicated Time (Months) 1/ (0) | (1) | (2) | (5) | (6) |
|---|---|---|---|---|---|
| Ambient Laboratory (20-23 C.) | .89 | .50 | .61 | .25 | .20 |
| 38 C. (Constant) | | .27 | .05 | .05 | 0 |
| 50 C. (Constant) | | .06 | .14 | .07 | 0 |

1/ Mean based on laboratory bioassay with 5 field collected colonies at each sampling interval. Acceptance ratios computed after a 24 hour feeding period. Test initiated on November 30, 1987.

## REFERENCES CITED:

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

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

PROJECT NO: FA04G018

PROJECT TITLE: Provide Training to State Nursery Inspectors on all Aspects of the Federal IFA Quarantine Program

TYPE REPORT: Final

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

INTRODUCTION:

The United States Congress first provided funds for a fire ant eradication program in 1957. Responsibility for administering and enforcing a supporting quarantine was assigned to the Plant Pest Control Division of USDA's Agricultural Research service. Although numerous reorganizations and name changes occurred over the years, this group continued in the lead role of enforcing Federal Quarantine 81 until 1988. At that time, a series of cooperative agreements between USDA, APHIS, PPQ and the various states relegated virtually all enforcement and inspection activities to the states.

In many cases, new personnel were hired by the states to conduct this program. Due to numerous changes in treatments, etc., the Imported Fire Ant Station was asked to provide training on all aspects of the quarantine program. A one day workshop was developed (Appendix I), and presented to 300 inspectors in 10 states (Appendix II) in 1988.

## APPENDIX I

### AGENDA
### IMPORTED FIRE ANT QUARANTINE WORKSHOP

8:00A Biology of IFA - H.L. Collins

9:00 Taxonomy, Field Identification and Survey - Tim Lockley

10:30 Break

10:45 Federal Quarantine Document - H.L. Collins
- Background
- Definition of fire ant
- Regulated articles
- Pending revisions
- Map of regulated area

11:15 PPQ Treatment Manual - H.L. Collins
- List of approved chemicals
- Treatments
- Grass Sod
- Greenhouse grown plants
- Containerized plants
- Field grown stock

12:00 Lunch

1:00P Pesticide labels, distributors, and price list - Anne-Marie Callcott
- Dursban 10G (grass sod)
- Dursban 2.5G (potting media)
- Dursban 2E and 4E (drench)

1:30 Compliance Agreements - local PPQ Officer-in-Charge

2:00 Nursery Sampling Procedures - Anne-Marie Callcott
- Monitoring Plan
- Sample collection/handling/shipping
- Preparation/distribution of PPQ Form 602
- Practice exercise; completion of 602

2:45 Break

3:00 Videotape (Produced by the University of Georgia)

3:30 Application Equipment - H.L. Collins
- Sod
- Field grown stock

3:45 Pending Registrations and Treatments - H.L. Collins
- Diazinon drench for containerized blueberries
- Triumph for potting media
- "Over-the-top" for containerized plants

4:00 - General Discussion

## APPENDIX II

### IFA QUARANTINE WORKSHOPS, 1988

| LOCATION | DATE | NO. ATTENDEES |
|---|---|---|
| FLORIDA | | |
| Winterhaven | 3/22 | 47 |
| Ft. Lauderdale | 4/12 | 49 |
| Gainesville | 4/14 | 24 |
| OKLAHOMA | | |
| Durant | 6/21 | 11 |
| ARKANSAS | | |
| Little Rock | 6/23 | 13 |
| MISSISSIPPI | | |
| Gulfport | 8/18 | 15 |
| GEORGIA | | |
| Tifton | 8/23 | 12 |
| Atlanta | 8/25 | 7 |
| TEXAS | | |
| Austin | 9/13 | 48 |
| NEW MEXICO | | |
| Las Cruces | 9/15 | 15 |
| LOUISIANA | | |
| Baton Rouge | 9/21 | 29 |
| TENNESSEE | | |
| Nashville | 10/4 | 22 |
| ALABAMA | 11/15 | 18 |
| Montgomery | | |
| | TOTAL NO. ATTENDEES: | 300 |

## APPENDIX III

### Size and Scope of the Plant Nursery Industry within the IFA Infested Area

The Grass Turf and Nursery Industries are an important, dynamic component of American agriculture and represent a unique segment of the total agricultural economy. These data presented here are an attempt to assess the impact of these industries within the IFA quarantine and, indirectly, the potential market(s) for control of IFA within these industries. No attempt has been made to assess the market for IFA control in such areas as landscaping, household use, golf courses and parks, et cetera.

FIELD GROWN AND CONTAINERIZED WOODY ORNAMENTALS:

| | x $ MILLION | Census Year |
|---|---|---|
| Alabama | 200.0 | 87 |
| Arkansas | 14.9 | 85 |
| Florida* | 298.0 | 87 |
| Georgia | 100.0 | 87 |
| Louisiana | 40.0 | 87 |
| Mississippi | 7.0 | 82 |
| North Carolina | 100.0 | 87 |
| South Carolina | 73.3 | 86 |
| Tennessee | 180.0 | 87 |
| Texas** | 357.0 | 87 |
| Puerto Rico | 17.0 | 87 |
| Virgin Islands | 0.2 | 87 |
| Total Value | 1387.7 | |

*Florida is currently rated as the number one producer of field grown and containerized nursery stock.
**Texas is currently rated third.

Relative acreage of commercially grown grass sod in thousands of acres:

| | | | |
|---|---|---|---|
| Alabama | 14.0 | North Carolina | 1.9 |
| Arkansas | 2.0 | South Carolina | 2.3 |
| Florida | 75.0 | Tennessee | 3.2 |
| Georgia | 10.0 | Texas | 50.0 |
| Louisiana | 3.3 | Puerto Rico | 2.0 |
| Mississippi | 2.5 | Virgin Islands | 0.0* |
| | | Total Acreage | 166.2 |

*Grass sod sold in VI is grown in PR.

Data Sources:

| | FG and Cont. | Grass Turf | Telephone Number |
|---|---|---|---|
| Alabama | Charles Gilliam a | *Coleman Ward c | (205) 826-4862 *4985 |
| Arkansas | Carter Price b | C. Price | (501) 575-6839 |
| Florida | Robert Strain b | *Burt McCarty a | (904) 392-1881 *1829 |
| Georgia | Steve Turner b | *Gill Landrey c | (404) 542-0852 *5350 |
| Louisiana | Roger Hinson b | *Tom Koske c | (504) 388-2752 *2222 |
| Mississippi | Travis Phillips b | T. Phillips | (601) 325-2750 |
| North Carolina | Stewart Warren a | *Art Bruneau b | (919) 737-3133 *2326 |
| South Carolina | Larry Bauer b | L. Bauer | (803) 656-3223 |
| Tennessee | Ken Tilt a | K. Tilt | (615) 974-7324 |
| Texas | Charles Hall b | C. Hall | (409) 845-1772 |
| Puerto Rico | Ms. Carrillo b | Carrillo | (809) 721-2120 |
| Virgin Islands | Chris Ramcharan a | C. Ramcharan | (809) 778-0288 |

a Horticulturist b Agricultural Economist c Extension Service