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LOW-INSECTICIDE INPUT APPLICATION STRATEGIES FOR MANAGING SUBTERRANEAN TERMITE (ISOPTERA: RHINOTERMITIDAE) INFESTATIONS

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Abstract Twenty-six treatments were conducted using an integrated management approach to removing subterranean termite infestations from structures on the University of Georgia, Athens, GA, USA campus. Termite infestations were identified by building occupants followed by an inspection, development of an action plan, treatment, and verification of treatment success by call-backs from occupants. Treatments consisted of soil applications of termiticide solution at labeled application rates and liquid or foam solutions injected into wood or wall voids at various rates inlcuding less than labeled rates. Success was achieved in all but one infestation indicating the feasibility of a spot treatment program built on inspections aimed at identifying termite entry points as a means of controlling subterranean termites.
Key Words Termite control, spot treatment, wood injection

INTRODUCTION

Termite management in the United States moved from an integrated approach in the early part of the 20th century to a methodology that relied on the paradigm of a soil termiticide barrier (Kofoid, 1934; Potter, 1997). The barrier concept was even codified in certain State regulatory satutes to encompass the entire soil-foundation interface introducing the term "whole house" treatment. This emphasis on termiticide soil barriers and whole house treatments has resulted in applying 15 liters of termiticide solution per 3 linear meters of foundation. Introduction of termite baits to the professional pest control market in 1996 highlighted the amounts of termiticides applied to structures. The use of baits, combined with discussions of IPM in termite management and the 'Green Movement' are encouraging a reevaluation of termiticide use patterns toward a spot-treatment approach (Robinson, 1996; Su and Scheffrhan, 1998; Forschler et al., 2007).

The Household and Structural Entomology Research Program (HSERP) at the University of Georgia formed a partnership with the University Physical Plant Division to treat all termite infestations on the campus in Athens, Georgia. This program initiated in early 2002 involved a multi-step process that included: 1) inspections by HSERP staff, 2) development and enaction of an action plan, and 3) monitoring of termite activity following action plan implementation. The HSERP has used this program to examine the efficacy of a variety of 'spot treatment' application technologies for termite control. This manuscript reports efficacy results from that program using the ideological method of efficacy measurement: complaints by building occupants.

MATERIALS AND METHODS

Residents of buildings and employees (custodial, carpenters, maintenance) of the University of Georgia Physcial Plant Division (UGA PPD) report any termite activity to the main office of UGA PPD, in turn this information, with details of the location and contact person(s), is sent to the HSERP. The Termite Response Team from HSERP go to the site, perform an inspection aimed at collecting any termites (live or dead), locating the extent of an infestation and potential entry points into the structure. This team uses visual inspection, digitial camera records, interviews with building occupants, moisture meters, and/or acoustic emissions detectors to conduct the inspection. From the collected data a plan of action is developed, which is relevant to the unique features of each site and infestation. Treatment action plans are developed and aimed to involve treatment of the entry point(s) used by the offending termite population to gain access to the structure.

Liquid and foam treatments were performed using a B&G Wood Treatment System® (WTS) that allows application of liquid or foam solutions. Wood injection treatments were made to infested wood or wall voids around structural elements such as window and door frames, baseboards, or moulding by drilling a 3-mm diameter hole and using the WTS applicator tip with a rubber stopper attached to prevent backflow on the interior structural feature being treated. Liquid termiticide solutions applied using the trench and treat technique that were in excess of 11 liters were mixed in a 20 liter plastic bucket and applied by pouring into the trench. Termite baiting was conducted using manufacturer label directions. Treatment success was monitored by an inspection 2-8 months after treatment using the aforementioned inspection protocol and by calls from the residents or UGA PPD.

RESULTS AND DISCUSSION

A total of 26 treatments were conducted over a 5 year period with 25 using a liquid termiticide and one bait system installation. The 25 liquid treatments employed on average 20.4 ± 11.1 liters of termiticide (Table 1, 2). All treatments with one exception were deemed successful using complaint or re-treatment calls as a measurement: no calls from the residents would indicate a return of the termites. A 96% success rate for intitial treatments is a noteworthy achievement given the low volumes of insecticide used in this program.

Wood-Injection. The treatments involving wood injection only (N=14) used on average 1.1 ± 0.8 liters of final dilution of insecticide per treatment.

Trench-and-Rodding. The standard trenching and rodding applications (N=8) used on average 24.6 ± 29.7 liters (by excluding one 95 liter treatment, the average was 14.6 ± 9.3 liters).

Wood-Injection / Trench-and-Rodding. The combination wood injection procedures and trenching and rodding treatments (N=3) averaged 16.4 ± 15.2 liters per treatment.

Retreatment. The one treatment failure was determined to be the result of an incomplete initial inspection. A call was received in March of 2006 concerning the appearance of a few alate termites in Room 124 Milledge Hall. The second inspection found an extensive termite infestation in form boards left after a concrete support wall, in what is a crawlspace off of the basement, was poured under the hallway and room next to where the swarm was noted. Termites swarmed from flight castles under an exterior window several meters distance from the infested form boards. The intitial inspection, conducted in the basement under Room 124, did not identify the termite entry point because the concrete wall and triple-course brick construction did not reveal any obvious termite activity. It was assumed termites entered the room from beneath the window containing the flight castles and the resulting action plan did not address the true nature of the infestation. The revised action plan called for removal of the form boards and a trenching/rodding application along the foundation of the concrete wall in the crawlspace.

Table 1. Summary of Household and Structural Entomology Research Program termite treatments on the University of Georgia Athens Campus from 2002 through 2004 by date, building, and site.

Treatment Date	Building	Location	Treatment Method	Amount and Chemistry	Treatment Site
02-02	Milledge Hall	Learning Center	Liquid Wood injection	500 ml, 0.06%, Fipronil EC	Window Sill
6/10/2002	Clark Howell Hall	Front and Back Doors	Trench/Rod	95 L, 0.06%, Fipronil EC	Around front and back door
7/23/2002	Brooks Hall	369	Liquid Wood injection	1 L, 0.06%, Fipronil EC	Window and baseboard
11/2002	Dawson Hall	Stairwell outside 101B	Liquid Wood injection	500 ml, 0.06%, Fipronil EC	baseboard
1/7/2003	Botanical Gardens	Visitor Center	Foam Wood injection	941 ml, 0.125%, Fipronil EC	Wall void around door
3/14/2003	Dance Hall	Hallway locker room	Liquid Wood injection	941 ml, 0.06%, Fipronil EC	Baseboard.

3/17/2003	Dawson Hall	Window that faces Soule Hall	Trench	15 L, 0.06%, Fipronil EC	Below window
5/1/2003	Brooks Hall	Outside 289C	Bait Stations	Whitmire Advance, 0.25%, Diflubenzuron	Outside 289C
9/2003	Fine Arts	111	Liquid Wood injection	941 ml, 0.06%, Fipronil EC	baseboard
3/19/2004	Geology-Geography Building	Hallway and outside wall	Liquid Wood injection and trench	941 ml, 0.06%, Fipronil EC	baseboard and exterior wall
3/22/2004	LeConte Hall	135	Liquid Wood injection	588 ml, 0.06%, Fipronil EC	Baseboard
3/2004	Fermentation	113	Liquid Wood injection	941 ml, 0.06%, Fipronil EC	Inside lab cabinet space
9/2004	Ecology Annex	Graduate Office	Foam Wood injection	941 ml, 0.125%, Fipronil EC	Baseboard outer wall

Table 2. Summary of Household and Structural Entomology Research Program termite treatments on the University of Georgia Athens Campus from 2005 through 2006 by date, building, and site.

Treatment Date	Building	Location	Treatment Method	Amount and Chemistry	Treatment Site
2/23/2005	Visual Arts	112A	Foam Wood injection and rodding	7.6 L, 0.03%, Fipronil EC	Inside cupboard, rod by door
3/2/2005	Old Print Shop		Liquid rodding	30 L, 0.06%, Fipronil EC	Interior expansion joint
4/6/2005	PDRC	108	Foam rodding	23 L, 0.06%, Fipronil EC	Expansion joint on exterior wall
4/13/2005	Bamboo Station	Window and exterior wall	Foam Wood injection	11 L, 0.03%, Fipronil EC	Baseboard and window frame
			Trench	23 L, 0.06%, Fipronil EC	Below window
5/6/2005	Dawson Hall	123A	Foam Wood injection	3.8 L, 0.006%, Fipronil EC	Window casing
6/21/2005	Dawson Hall	123A	Trench	7.6 L, 0.03%, Fipronil EC	Exterior wall
6/21/2005	Park Hall	Door near custodian's office	Foam Wood injection	588 ml, 0.03%, Fipronil EC	Doorframe
8/05	Demosthenian Hall	Handicap door area	Rodding	5.7 L, 0.03%, Fipronil EC	Expansion joint
8/05	LeConte Hall	135	Rodding	15 L, 0.03%, Fipronil EC	Slab outside
10/12/2005	Peabody Hall	9	Liquid Wood injection	3.8 L, 0.03%, Fipronil EC	Window sill
			Trench	3.8 L, 0.06%, Fipronil EC	Below window
4/5/2006	BioScience	402	Foam Wood injection	1 L, 0.006% Fipronil EC	Window sill

4/10/2006	Vet Diagnostics	Outside wall and doors	Foam rodding	2 L, 0.03%, Fipronil EC	Slab at doors
8/30/2006	Milledge Hall (call-back in March 2006)	124	Trench	5.7 L, 0.06%, Fipronil EC	Beneath window

Termite management has been termed a process to highlight the ongoing nature of maintaining structures free of infestation. The one 'failure' in this program highlights the vicarious nature of termite management and the importance of a thorough intitial inspection. This ongoing project is in the process of reviewing all treatments using follow-up inspections that employ visual, acoustic, moisture meters and an infrared camera in an attempt to provide a methodological measure to compare to the ideological measure of success reported in this manuscript. The goal is to provide evidence enabling the urban entomology practioner and regulatory communities to embrace reduced insecticide input strategies for subterranean termite management.

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