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Feasibility Study for Eradication of *Reticulitermes flavipes* from Endeavor, Wisconsin

Rachel A. Arango and Frederick Green, III

Abstract

Establishment of the Eastern subterranean termite, *Reticulitermes flavipes* in Endeavor, Wisconsin, in the early 1980s has caused significant damage to homes, businesses, and village properties over the years. Though precise reasons for successful establishment of the colony are still to be determined, we believe that the nearby lake and low-lying sandy soils have created conditions sufficient to sustain over-wintering of the colony. Previous successes of termite baiting in and around individual structures have prompted the hypothesis that treatment of this sort can also be applied on a larger scale with the goal of community-wide termite eradication. A spatial distribution pattern of the colony has emerged as a result of resident response to a written survey. Placement of in-ground bait stations to identify the scope and location of the colony will commence this spring.

Introduction

In addition to reducing property values in affected areas, termite damage in the United States has been estimated at \$11 billion US annually (Culliney and Grace 2000, Su 2002). Historically, the two primary termite treatments have been termite baiting systems or physical-chemical barriers. Baiting systems involve installing and monitoring interval stations followed by subsequent treatment in areas where termites are present. The effectiveness of the baiting systems relies heavily on locating the colony and having the termites consume sufficient

bait. Monitoring, inspection, and maintenance are critical components of successful baiting (Grace and Su 2000). Chemical barrier treatments involve the use of high toxicity termiticides that are applied to the soil surrounding a structure to prevent termites from gaining entry into the building. Though soil-barrier treatments can be effective, this method is often costly and is not a permanent solution to termite infestation. It can also contribute to environmental contamination in the surrounding substrate. The labor-intensive nature of these methods supports justification for complete elimination of a termite colony whenever possible as opposed to continuous chemical treatment. Therefore, strategically placed baiting stations may provide an effective elimination strategy when the area of treatment can be clearly defined.

Only a small number of projects address community-wide termite elimination. Three of the projects mentioned in this paper deal with the Formosan subterranean termite and two with the subterranean termite genus *Reticulitermes*. In northern California, baiting elimination trials for the genus *Reticulitermes* were conducted using the Sentricon system on a small scale with single-family residences. In these areas, baiting was successful in termite elimination, which supports the idea that a community-wide treatment would be feasible on a larger scale (Kistner and Sbragia 2000). Overall, area-wide baiting of Formosan termites has not succeeded in complete elimination of infestation, partly because of the extensive nature of the colony. For that reason, reducing the population size of the Formosan colony tends to be the main goal as opposed to complete eradication. A trial conducted by Su and others in the town of Golden Beach, Florida, however, did make an attempt to eradicate *Coptotermes fimosanus* from an area approximately 2 km by

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600 m. Elimination of the colony was not achieved, but a reduction in population was noted (Su et al. 2004).

The most publicized Formosan termite project is known as “Operation Full Stop” in New Orleans, Louisiana. This community-wide termite management project was established in the French Quarter of New Orleans in 1999. Termite damage in excess of \$350 million in the New Orleans area alone provided incentive for development of a project promoting a reduction in the Formosan termite population and a comprehensive study of the effectiveness of an area-wide management program (Ring et al. 2000). A total of 229 in-ground monitoring stations were positioned in and around a 15-block area bordered by Bourbon, Conti, Decatur, and Dumaine streets. The low concentration of exposed soil, however, made baiting a difficult process, and the sheer size of the colony, as well as its geographical location, made eradication nearly impossible with re-infestation an almost inevitable outcome. The goal of reducing the Formosan population’s density was achieved, as a marked decrease of approximately 50 percent of termite alates was recorded in the test area (Morgan et al. 2004).

Endeavor, a small village in central Wisconsin with a population of about 450 people, first noticed termite activity in the mid-1980s. Infestation was probably the result of accidental relocation of infected wood, as the town is located 100 miles north of the predicted range for *Reticulitermes flavipes*, which is along the Wisconsin–Illinois border in Janesville, Wisconsin (Esenther 1969). We hypothesize that nearby Buffalo Lake and low-lying sandy soil in this region moderate temperatures and conditions enough to allow over-wintering and establishment of the colony. These climactic conditions may be quite similar to those found in La Crosse, Wisconsin, along the Mississippi River and Sheboygan, Wisconsin, on Lake Michigan. Proximity to a large body of water may contribute significantly to the ability of *Reticulitermes* to survive in all three locations at about or around the same latitude (**Fig. 1**). Because little evidence suggests swarming behavior, we believe that colony expansion is due to budding of existing colonies (personal communication, Phil Pellitteri, University of Wisconsin-Madison 2006). To date, control efforts in Endeavor have largely focused on treatment of single-family homes and a few businesses with little attention given to complete eradication. In 2001, Dow AgroSciences (Dow AgroSciences, LLC, Indianapolis, IN) conducted a small Sentricon bait trial in the village, similar to the one done in northern California, with some success, but the project was not continued. Dow AgroSciences conducted a small Sentricon bait trail in the village beginning in June of 1995, similar to the one done in Northern California. Monitoring of the believed infestation area was done for a year before treated baiting matrices were installed. The structure was baited from June 1996 to October 1996 af-



Figure 1. – Map of Wisconsin showing the centralized location of the Village of Endeavor at latitude 43.72N and longitude 89.47W. La Crosse and Sheboygan, which are located at the same latitude, have previously reported active *R. flavipes* colonies.

ter which there were no more signs of active infestation. Monitoring of the stations was done the following spring showing no termite activity, but the project was not continued further (DeMark and Thomas 2000).

The relatively isolated location and confined nature of the colony makes Endeavor an ideal candidate for complete termite eradication efforts through baiting, especially because traditional treatment methods would not be advisable due to possible contamination of the town’s shallow water supply and adjoining river basin. Termite baiting systems demonstrate significantly less leaching of chemicals overall into the surrounding environment compared with other conventional treatment methods and are often used in sensitive environments (Jones 2000). This treatment method is based on the knowledge that termites will share food (trophallaxis), feed their young, groom each other, and cannibalize their dead, thereby spreading the termiticide to the entire colony (Verkerk and Bravery 2004). Therefore, termite baits need to be nonrepellent and slow acting, as well as toxic.

In 1998, a similar eradication project was undertaken to remove *Reticulitermes grassei* from a rural area in North Devon, England (Verkerk and Bravery 2004). As in Endeavor, termites were probably introduced accidentally, and conditions were favorable for establishment of a colony. A traditional liquid barrier treatment was attempted but was not successful in preventing re-infestation. Initial survey data showed the area of active infestation to be about 75 by 35 m, and an ‘eradication zone’ was estimated. The zone encompassed 29 properties

within a 500-m radius and was subdivided into three sub-areas:

- treatment zone,
- intensive monitoring area, and
- buffer zone.

After 2 years of treatment, activity was no longer detected in any of the baiting stations. Although monitoring the area will continue until 2010, the project appears to have completely eliminated the termite colony (Verkerk and Bravery 2004).

Proposed Methods

The Forest Products Laboratory, in conjunction with Alternative Pest Solutions, LLC (Madison, WI), has developed a three-stage proposal with the definitive goal of eliminating *R. flavipes* from Endeavor, Wisconsin. In step one, a mail survey of homeowners was conducted to ascertain the extent of in-home damage and whether treatment had been completed. The survey also requested permission to inspect homes to determine current termite infestations (Appendix). Based on responses from the mail survey, step two involves identifying the scope and location of the termite colony or colonies by placement of in-ground monitoring bait stations. Step three is development of a comprehensive, cost-effective in-ground bait treatment program, which will include procedures for continued monitoring after the termites have been eliminated.

After all of the written surveys are compiled, home inspections will be scheduled for those households expressing an interest. To determine the perimeter of the colony, simultaneous monitoring of untreated baiting systems will also be conducted on public properties and parks. Once the area of treatment is defined, plastic cylindrical bait stations containing an untreated cellulose material will be positioned (8 by 18 cm deep). As termites infest the stations, untreated material will be replaced with a diflubenzuron-treated cellulose matrix (Advance, Whitmeyer Micro-Gen, St. Louis, MO). This compound acts as a chitin synthesis inhibitor, which disrupts the termites' molting process leading to their eventual death. Alternative Pest Solutions, LLC, selected this compound because it has been shown to be effective in baiting small-scale infestations. Stations will be monitored monthly, and treated baits will be replaced with untreated cellulose material once termites are no longer observed at that station. Post-treatment monitoring will be conducted for several years, as long as baits are available.

In addition to producing treated baits containing diflubenzuron, Whitmire Micro-Gen also manufactures termite inspection cartridges containing no active ingredients. These cartridges will be used in the majority of baiting station monitoring. In addition, a few untreated baiting stations will contain experimental substances to determine which untreated monitoring cellulose mate-

rial works best compared with the material produced by Whitmire Micro-Gen. Some bait stations will contain all of the variables to differentiate variability in termite attraction. For example, recent observations have shown *Ailanthus altissima* (Tree of Heaven) wood to be a termite feeding attractant since the wood is high in cellulose, mostly sapwood, and nondurable (Gurney 1987). Native to Asia, this tree has become an invasive species in most of North America because of its rapid growth and prolific seed production. Because this wood species is potentially attractive to termites, we predict it will improve the success of the monitoring baiting stations project. The experimental termiticide and recently patented termite bait, N'N-naphthaloylhydroxylamine (NHA) will also be tested in certain stations (Rojas et al. 2004).

Various decay fungi have also been shown to serve as an effective termite attractant. For instance, wood decayed by the brown-rot fungus *Gloeophyllum trabeum* Mad-617 Mum has been shown to lure termites and may increase consumption of treated bait material (Esenther and Beal 1979). In our study, both *G. trabeum* and a white-rot fungus will be grown on southern yellow pine blocks and used in some untreated monitoring stations with the expectation that a greater number of termites will be drawn into those locations, thereby increasing effectiveness of chemical treatment.

Results and Discussion

To date, we have received responses from about 20 to 25 percent of residents who received the written survey data. Although responses to the survey were lower than anticipated, an isolated spatial distribution pattern of the colony has emerged. When Su et al. (2004) requested collaboration from residences in the Florida study, they received a 35 percent response rate but were still able to define the treatment area. Of the responses we received, 19 percent reported termite activity in their homes, 14 percent had treated or are currently in the process of treatment, 40 percent claimed to be able to recognize termite infestation, and 93 percent of people said they would be willing to accept a free, in-home, inspection.

Numerous trials have proven effectiveness of baiting in successfully eradicating termites from a single structure. Baiting on a larger scale should produce the same result if the entire termite colony can be clearly defined. The additional use of *G. trabeum* and a white-rot fungus as well as *A. altissima* wood should create ideal conditions for attracting termites to the baiting matrix, thereby significantly improving the effect of termiticides. The success of Verkerk and Bravery in eradicating termites from North Devon, England, using the baiting system leads us to conclude that complete elimination of the termite colony in Endeavor, Wisconsin, can potentially be achieved through strategically placed baiting stations and vigilant monitoring.

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Appendix

Village of Endeavor termite survey questionnaire sent out by the village board along with the semi-annual sewage bills (December 2005).

Village of Endeavor Termite Survey

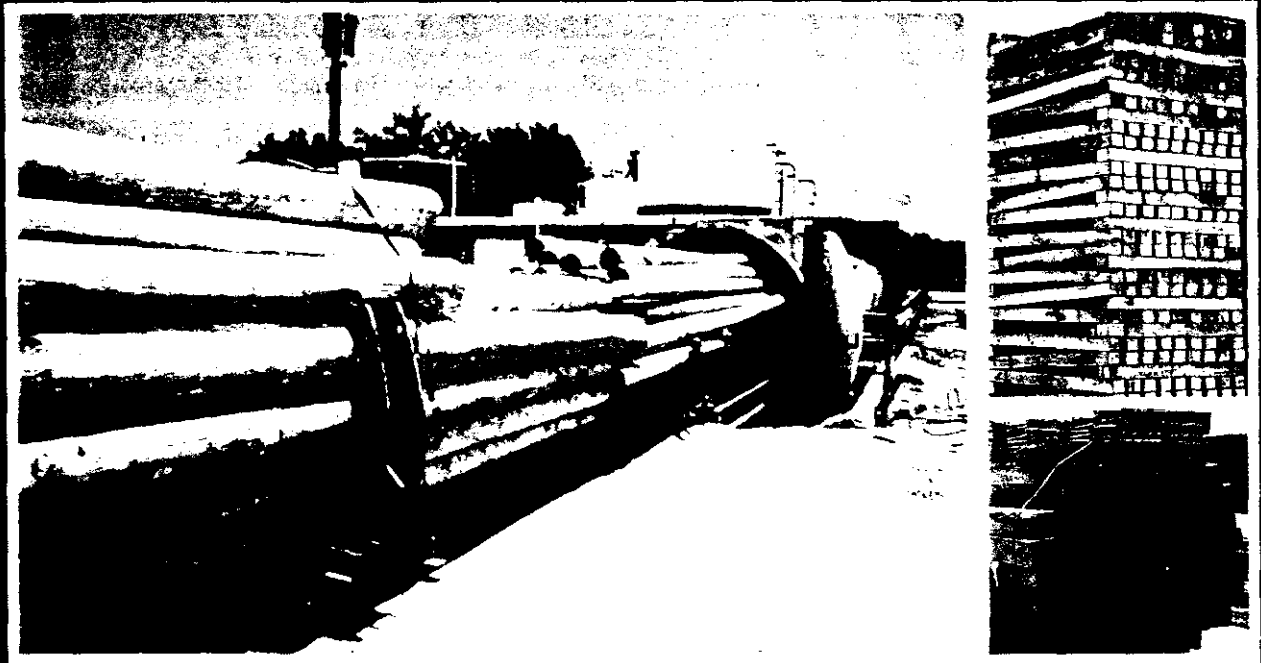
1. Are you aware of any termite activity in your home or business in the last 20 years?
__ Yes __ No
2. Was your house or business ever treated for termites?
__ Yes __ No
3. Do you know how to recognize termite damage in your home or business?
__ Yes __ No
4. The best way to assess the extent of the termite colony in Endeavor is to inspect as many homes as possible and develop a picture of where the colony ends. Would you be willing to let us come out for a free consultation?
__ Yes __ No
5. In order to determine eligibility for State grants: Is your total household income under \$30,450 a year?
__ Yes __ No

Name: _____ Lot Number: _____

What is the best way to contact you?

Thank you!

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