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Termite Field Evaluations in Hawaii:

A Brief Review of Methods and Issues

by

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ABSTRACT

The severe termite hazard in Hawaii, principally due to the presence of the Formosan subterranean termite (*Coptotermes formosanus* Shiraki), has long required the use of preservative-treated lumber in building construction. This hazard has also favored and stimulated field research in Hawaii on methods of protection from termite attack, including evaluation of soil insecticides and treated wood under rigorous conditions. The fact that Formosan subterranean termites are not distributed randomly and homogeneously across a given field site, as with fungal spores, but forage in a rather unpredictable fashion, has lead to the use of a number of different methods of field evaluation in order to "accelerate" termite attack or simulate conditions of end use. Rationale, advantages and disadvantages are discussed in this review.

KEYWORDS: Termite control, *Coptotermes formosanus*, Rhinotermitidae, Isoptera

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This paper is intended as a starting point for discussion at the 26th Annual Meeting of the International Research Group on Wood Preservation, rather than any sort of comprehensive review. Therefore, I have avoided descriptions and comparisons of the results obtained in specific studies, and focused instead upon several general issues involved in field tests in Hawaii. For discussions of the results of such studies, and more detailed descriptions of methodology, interested readers are referred to the list of selected references.

The Formosan subterranean termite, *Coptotermes formosanus* Shiraki (Isoptera: Rhinotermitidae) is the only subterranean (or ground) termite known to be established in the Hawaiian islands, and is a severe pest worldwide in tropical and subtropical regions. This termite is considered to be the most economically important insect pest in Hawaii, with control and repair costs estimated from US $60 million to $100 million annually.

In addition to the Formosan subterranean termite, probably introduced to Hawaii around the mid-1800's, three endemic drywood termites (Kalotermitidae) are also found in Hawaii: *Cryptotermes brevis* (Walker), the West Indian drywood termite; *Incisitermes immigrans* (Snyder), the lowland tree termite; and *Neotermes connexus* Snyder, the forest tree termite. Although it is an impressively large termite, *N. connexus* is found only in stumps and dead portions of living trees, particularly haole koa (*Leucaena leucocephala* [Lam.] de Wit [Leguminosae]), in damp areas, and is not considered a structural pest. *Incisitermes immigrans* is also frequently found haole koa limbs, especially in dry areas, and has only occasionally been reported infesting structural wood. *Cryptotermes brevis*, on the other hand, is a serious structural pest in Hawaii and many other tropical and subtropical locales, since it is readily transported in wooden materials (e.g., furniture, picture frames).

Both *C. formosanus* and *C. brevis* are targets of preventative and remedial termite control measures in Hawaii. Soil insecticides have historically been the major control measure for subterranean termites, although there is increasing use of physical barriers to prevent termite penetration of the building envelope. Commercially-available physical barriers to termites in Hawaii are the Basaltic Termite Barrier (BTB), a

gravel product developed by the University of Hawaii and licensed to Ameron HC&D, and Termi-Mesh, a stainless steel wire mesh developed in Australia and marketed in Hawaii by Termi-Mesh Hawaii. This year, a system of baits employing the chitin inhibitor hexaflumuron became commercially available as a remedial method for subterranean control in Hawaii (Sentricon System, DowElanco). The plastic bait stations placed in the ground to administer the bait also function in a preventative sense as monitoring stations to intercept foraging termites.

Wood treatment is considered essential to preventing (or at least minimizing) attack by both subterranean and drywood termite species in Hawaii. Unfortunately, the extensive use of the refractory wood species Douglas-fir, *Pseudotsuga menziezii* (Mirb.) Franco, in Hawaiian construction has limited the effectiveness of such treatments. Many field evaluations of treated wood in Hawaii have focused on above-ground test methods, since structural building framing is the major target of preservative treatments in the islands.

A major difficulty in conducting field tests in Hawaii is the clumped distribution of Formosan subterranean termites within the islands, and more importantly within individual field locations. Although this species forages with great intensity, it does not appear to forage in a uniform manner or homogeneously throughout a large area. Researchers at the University of Hawaii at Manoa have dealt with this by first establishing specific feeding sites (or termite traps) within each field site, and then placing the wood samples under evaluation directly into those feeding sites. This technique has the advantage of exposing the test samples to intense termite pressure, but the disadvantage allowing fairly limited replication and small numbers of treatments at any particular field site. It is also difficult to include large-dimensioned timbers in the test design.

Researchers at Michigan Technological University and several private firms, most notably Chemical Specialties Incorporated (CSI), have developed and implemented field tests in Hawaii that are based upon more traditional test methodologies, but include a number of different variations intended to compensate for the capricious foraging behavior of *C. formosanus*. These researchers have also observed that, with the more creative test variations, inclusion of a sufficient number of replicates and uniformity of attack on all the test units is problematic.

The high rainfall experienced in many parts of Hawaii has created difficulties in designing field tests of diffusible preservatives such as disodium octaborate tetrahydrate. This led University of Hawaii researchers, in a joint project with Forintek Canada and Kyoto University, to place test samples on concrete blocks extending quite a distance further above the soil than has been customary in other field tests.

A final concern in Hawaii has been the method of evaluating (rating) the samples for relative degrees of termite damage. Dry wood weight loss is usually the most quantitative and least subjective method of evaluation, but is also generally terminal and cannot be used in long-term tests where the samples are to be evaluated periodically. On the other hand, visual ratings are extremely subjective and vary from researcher to researcher. An added complication is the use different rating scales in different tests.

Field test methodologies are constantly evolving, and hopefully improving. As the wood industry is acutely aware, standardization of test methods is frequently resisted by termite researchers on the basis of the unique characteristics of different termite species and different geographic locations. These are valid points of concern and probably best addressed by inter-laboratory cooperative tests such as those organized by the working groups within the International Research Group on Wood Preservation.

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