IRG/WP 98-10255

THE INTERNATIONAL RESEARCH GROUP ON WOOD PRESERVATION
Section 1 Biology

Resistance of borate-treated lumber to subteranean termites in the field

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Paper prepared for the 29th Annual Meeting
Maastricht, Netherlands
June 14-19, 1998

IRG Secretariat
KTH
SE-100 44 Stockholm
Sweden

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ABSTRACT

Borate-treated wood samples were tested for their resistance against subterranean termites in the field. Wood samples (10.5x10.5x40cm) of western hemlock were pressure impregnated with disodium octaborate tetrahydrate (DOT) and didecyldimethylammonium chloride (DDAC), and assigned into two groups on the basis of boron contents:high retention(1.5~2.2%BAE) and low retention(0.7~1.3%BAE). Eight replicates were prepared for each retention level. Four untreated controls were also included in the field evaluation for comparison.
Each sample was placed on a concrete block 19cm above ground surface and covered with plastic box in Kagoshima, Japan on July 1, 1993. Four boxes were employed so that 5 samples (two each of treated groups and one untreated sample) were in each box. After two years of exposure, three of all the treated samples exceptionally sustained very slight attacks, while in general untreated controls were moderately to severely attacked.
Borate-treatment was proved to be satisfactorily effective in protecting lumber in above ground situations from suberranean termites. Further trials have been set up to determine the long-term efficacy of the treatment compared to chromated copper arsenate treated and naturally durable wood.

Key words:Borate-treatment, disodium octaborate tetrahydrate, subterranean termites, sill plate(dodai), above ground use, field evaluation

1.INTRODUCTION

Review of early work clearly shows that boron compounds are good wood preservatives under non-leaching conditions (Cockcroft and Levy, 1973;Bunn, 1974;Lloyd, 1997), although the efficacy of disodium octaborate tetrahydrate (DOT) against termites is not fully understood. Different test conditions have resulted in different conclusions (Preston et al. 1986, 1996;Williams et al. 1990;Grace et al. 1992, 1995;Drysdale 1994;Mauldin and Kard 1997). All these studies have recently been reviewed by Grace(1997).

An above ground field trial was conducted to test DOT-treated wood samples for their resistance against subterranean termites, simulating sill plates (dodai) of Japanese houses. A comparative one-year field test was also performed in Hawaii, as reported by Grace et al.(1995).

2.MATERIALS AND METHODS

Wood samples of Pacific silver fir(amabilis fir)(10.5x10.5x40cm) were end-sealed and presssure impregnated with DOT and 0.5%DDAC to control sapstain during storage. The treated materials were categorized on the basis of boron loadings: low retention (mean 1.0%BAE) and high retention (mean 1.8%BAE). Boron content of each sample is given in Table 1. Eight replicates were prepared for each treatment. Four untreated controls were also prepared for comparison. Each wood sample was placed on a concrete block 9cm above ground surface. An assembled set of 5 samples (two each of treated groups and one untreated control) was covered with a PVC box. Four boxes were put in place in Kagoshima, Japan on July 1, 1993. Samples were allocated as follows:Box 1=Sample Nos. 13, 28, 31 and 59 plus untreated control A, Box 2=7, 11, 20 and 21 plus untreated control B, Box 3=30, 34, 10 and 24 plus untreated control C, Box 4=25, 27, 15 and 43 plus untreated control D.

The samples were inspected three times to determine whether termite attack occurred or not, and the materials were recovered after two years exposure. The recovered samples were visually rated using the IUFRO field testing scale of 0 (sound) to 4(destroyed).

3.RESULTS AND DISCUSSION

When the wood samples were first inspected on October 22, 1993, no untreated controls had sustained termite attack. Pine feeder stakes were, therefore,

driven into the soil through each hollow of the concrete blocks to facilitate access by termites to the samples. In addition, the hollows were filled up with earth for the same purpose. A year later, heavy termite attack was found on the untreated controls B and D. Treated samples were not attacked at all.

After two years of field exposure, every untreated control was heavily or moderately attacked. Careful observation demonstrated that the samples numbered 11 in Box 2 and 30 in Box 3 of low retention and 59 in Box 1 of high retention (Table 1) were very slightly attacked. Others were free from attack. These results are very similar to those of a one-year test in Hawaii, although termite activity in general was somewhat greater at the Hawaii test site (Grace et al. 1995).

As the treated samples which were attacked did not appear to sustain much weight loss (less than 1%) and cosmetic damage of those was negligible, DOT-treatment proved to be effective in protecting lumber in an above ground covered conditons.

Boron compounds are considered to be slow-acting and to become toxic to termites when they are ingested (Tokoro and Su, 1993;Su et al., 1994). Thus, it is always possible that termites nibble and/or bite borate-treated wood even at very high retentions (Grace et al., 1992;Grace and Yamamoto, 1993). Whether this continues to occur over the long-term is still open to question. We have planned more extensive field trials to answer this question using matched test specimens in Japan and Hawaii. It is expected that comparative results of the two test sites will give us some clear image of the efficacy of DOT on termites.

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Table 1 Boron loadings (%BAE=Boric Acid Equivalent) and visual ratings of IUFRO scale after two years exposure to subterranean termites in Kagoshima, Japan.

Box No.	Sample No.	%BAE	IUFRO rating	Sample No.	%BAE	IUFRO rating	Sample No.	%BAE	IUFRO rating
1	13	1.2	0	31	2.2	0	A	0	2
	28	1.2	0	59	1.6	1			
2	7	0.7	0	20	1.6	0	B	0	3
	11	0.8	1	21	1.7	0			
3	30	1.3	1	10	1.5	0	C	0	2
	34	0.8	0	24	2.2	0			
4	25	1.0	0	15	1.5	0	D	0	2
	27	0.8	0	43	1.9	0			
Mean	Low	1.0	0.3	High	1.8	0.1	Untreated	0	2.3