Pest Control

Termiticides— The Gulfport Report

Here are the latest findings taken from the USDA Forest Service field tests in Arizona, Florida, Mississippi and South Carolina.

BY BRAD KARD

Termiticide treatments to soil are the most widely used and successful method to protect wooden structures from attack by subterranean termites, and potentially new termiticides continue to be placed in Forest Service field tests each year (Kard 1998a). These tests continue to be installed and maintained in the primary termite biology and research sites in Arizona, Florida, Mississippi (Gulfport) and South Carolina.

A site has been established in Puerto Rico for future tests in the tropics, and specialized tests with non-chemical physical barriers are being conducted in the Republic of Panama, as well as at our Formosan subterranean research site on Midway Island. Continuing Forest Service field testing with existing and candidate termiticides, non-chemical barriers, non-repellent termiticides and baits will continue to provide vital information to the pest control industry for the foreseeable future.

Several termiticides are currently registered by the Environmental Protection Agency (EPA) for use under and around wooden structures, and will continue to play an important role in termite management. Additionally, cylluthrin and deltamethrin have been effective in field tests for more than five years, but are not yet available to pest control operators (PCOs).

Premise completed five years of field tests in 1997, with results reported in the April 1998 issue of *Pest Control* magazine (Kard 1998b). Six-year Premise results will be provided in a separate *Pest Control* article during 1999.

Termiticides are evaluated in field applications using several different concentrations. These Forest Service tests determine the years-of-effectiveness of currently marketed and potentially new termiticides as treatments to soil under long-term field conditions. Results are provided to the EPA as part of the registration process.

The ability of subterranean termites to penetrate termiticide-treated soil to attack pine blocks or boards is evaluated for at least five years, but tests often last much longer. Yearly evaluations continue for as long as a termiticide remains an effective barrier. However, when termites penetrate treated soil and attack the wood in 50 percent or more of the replicates of a particular treatment, that treatment is no longer evaluated at that test site. Results of field tests through the end of 1998 are provided in the accompanying table.

In standard grotmd-board and concrete-slab tests in the United States, termiticides provided varying years of subterranean termite control, depending on concentrations applied to the soil and test site location. Years of 100 percent control (as of November 1998) provided by each currently marketed termiticide active ingredient, applied at highest label rates under concrete slabs in the four primary test sites, include the following.

- chlorpyrifos 1 .O percent (Dursban TC, Equity, Tenure, Cyrene, Navigator), six to 12 years (197 1 four-site test), 2 1 years (1967 Mississippi test);
- cypermethrin 0.5 percent (Demon TC, Prevail FT), four to 12 years;
- permethrin 1 .0 percent (Dragnet FT), five to

Number of years that termiticides have been effective against native United States subterranean termites in concrete-slab (CS) and ground-board (GB) field tests through 1998

Termiticide & percent [AI]**	Test Method	Arizona 100	90	80	70	60	50	Florida 100	90	80	70	60	50	Mississippi 100	90	80	70	60	50	South Carolina 100	90	80	70	60	50
		Years of Control at each Percent																							
Chlorpyrifos (1971)†																									
0.5	CS	4	2	→	→	2	→	7	→	1	1	1	→	3	→	4	→	→	1*	7	1	1	→	→	1*
1.0	CS	6	→	2	→	→	→	9	4	4	1	→	1*	11	4	→	1	→	→	12	→	→	2	→	1*
0.5	GB	3	→	→	→	1	→	3	→	1	→	1	→	2	1	→	1	→	→	6	→	→	→	→	→
1.0	GB	2	2	→	1	→	1*	7	→	→	→	→	→	4	→	2	→	1	→	8	1	→	→	→	1*
1.0	GB‡	—	—	—	—	—	—	—	—	—	—	—	—	5	→	1	→	1	→	—	—	—	—	—	—
1.0	CS‡	—	—	—	—	—	—	—	—	—	—	—	—	21	3	2	→	5+	—	—	—	—	—	—	—
Cypermethrin (1982)†																									
0.125	CS	1	3	1	2	→	1*	1	1	1	2	1	1*	1	2	→	1	→	→	2	→	1	1	→	→
0.25	CS	4	→	1	→	→	1*	11	2	1	2+	—	—	3	2	1	→	→	1*	4	→	→	→	→	1*
0.5	CS	4	1	→	1	→	1*	5	5	2	4+	—	—	7	7	1	→	→	1*	12	→	→	3	→	1*
1.0	CS	8	2	→	3	3+	—	8	8+	—	—	—	—	6	9	1+	—	—	—	12	4+	—	—	—	—
1.0	GB	5	1	→	→	→	→	5	→	2	→	1	1*	5	→	1	→	1	→	5	1	→	1	2	1*
Fenvalerate (1978)†																									
0.25	CS	8	2	1	4	→	1*	1	1	3	1	→	1*	2	1	→	1	→	1*	3	2	1	1	1	1*
0.5	CS	12	1	2	→	1	→	3	4	1	7	1	1*	7	→	2	→	1	1*	4	4	4	2	2	1*
1.0	CS	12	→	→	1	7+	—	6	14+	—	—	—	—	10	1	→	2	2	1*	6	7	→	1	6+	—
1.0	GB	7	1	1	→	→	1*	4	1	3	→	1	→	4	→	→	1	1	→	6	1	→	→	1	→
Permethrin - Dragnet FT (1978)†																									
0.25	CS	8	2	3	2	→	→	2	→	2	→	1	2	1	1	→	→	1	→	→	→	→	2	1	→
0.5	CS	13	6	→	1+	—	—	4	→	2	13	1+	—	5	1	→	→	1	→	5	3	1	→	→	1*
1.0	CS	15	→	5+	—	—	—	15	5+	—	—	—	—	5	3	2	1	→	1*	10	1	5	1	→	1*
1.0	GB	9	2	→	3	1	1*	6	→	3	→	→	→	2	1	→	→	→	→	1	3	→	→	1	→
Permethrin - Torpedo (1980)†																									
0.25	CS	9	→	1	2	→	1*	3	4	2	2	2	→	2	→	→	1	→	1*	→	→	→	1	1	1*
0.5	CS	11	2	3	2+	—	—	6	3	4	→	4	1*	4	1	→	→	1	→	1	3	3	→	1	→
1.0	CS	18+	—	—	—	—	—	18+	—	—	—	—	—	3	4	1	1	2	→	6	1	2	1	2	1*
0.5	GB	4	→	1	→	→	1*	4	→	→	1	→	→	1	→	1	→	→	→	1	→	→	→	→	→
1.0	GB	8	1	→	→	→	→	5	→	1	1	→	1*	2	→	→	→	1	1*	1	→	→	→	→	→
Bifenthrin (1986)†																									
0.031	CS	→	9	2	→	1+	—	4	7	1+	—	—	—	2	3	1	5	1+	—	2	2	3	5+	—	—
0.062	CS	12+	—	—	—	—	—	12+	—	—	—	—	—	7	→	2	1	2+	—	10	2+	—	—	—	—
0.125	CS	10	2+	—	—	—	—	9	3+	—	—	—	—	2	5	5+	—	—	—	12+	—	—	—	—	—
0.25	CS	12+	—	—	—	—	—	12+	—	—	—	—	—	12+	—	—	—	—	—	12+	—	—	—	—	—
0.5	CS	6	6+	—	—	—	—	12+	—	—	—	—	—	12+	—	—	—	—	—	12+	—	—	—	—	—
0.5	GB	10	1	1+	—	—	—	12+	—	—	—	—	—	12+	—	—	—	—	—	8	3	1+	—	—	—
Cyfluthrin (1987)†																									
0.125	CS	4	2	→	→	3	→	9	2+	—	—	—	—	2	2	5	1	1+	—	4	3	4+	—	—	—
0.25	CS	10	1+	—	—	—	—	11+	—	—	—	—	—	6	2	2	1+	—	—	11+	—	—	—	—	—
0.5	CS	11+	—	—	—	—	—	11+	—	—	—	—	—	11+	—	—	—	—	—	11+	—	—	—	—	—
1.0	CS	11+	—	—	—	—	—	11+	—	—	—	—	—	11+	—	—	—	—	—	11+	—	—	—	—	—
0.5	GB	5	1	1	→	→	1*	6	1	→	2	2+	—	5	→	1	1	→	1*	6	3	→	→	1	1*
1.0	GB	5	2	→	1	→	→	7	4+	—	—	—	—	4	2	4	→	1+	—	7	4+	—	—	—	—
Deltamethrin (EC formulation, 1988)†																									
0.05	CS	1	→	1	3	→	→	3	1	3	3+	—	—	3	→	1	→	→	1*	2	2	→	→	1	1*
0.125	CS	5	→	→	3	→	1*	10+	—	—	—	—	—	4	→	2	1	1+	—	7	2	1+	—	—	—
0.5	CS	9	1+	—	—	—	—	10+	—	—	—	—	—	10+	—	—	—	—	—	10+	—	—	—	—	—
1.0	CS	10+	—	—	—	—	—	10+	—	—	—	—	—	10+	—	—	—	—	—	10+	—	—	—	—	—
0.5	GB	2	5	1	1	1+	—	10+	—	—	—	—	—	2	4	→	2	1	1*	10+	—	—	—	—	—
1.0	GB	9	1+	—	—	—	—	10+	—	—	—	—	—	2	7	1+	—	—	—	10+	—	—	—	—	—
Non-treated monitoring plots (See note below)																									
Percent attack on wooden blocks and boards in plots without termiticide treatments																									
	CS	40 to 90 percent						80 to 100 percent						50 to 80 percent						60 to 100 percent					
	GB	40 to 100 percent						80 to 100 percent						80 to 100 percent						80 to 100 percent					

* Evaluations stopped after one year at 50 percent effectiveness.
** The active ingredient [AI] concentration in the termiticide dilution applied to the soil.
† Year test initiated.
‡ Initial 1967 test in Mississippi only.

NOTE: An arrow indicates a greater than 10 percent loss in termite control since the preceding evaluation.
Dashes represent termite control percentages not yet observed.
A "+" after a number indicates that control did not decline below the indicated percent as of the most recent evaluation.
Percent attack on wood in non-treated monitoring plots is for 1996 through 1998. Wood in all original non-treated control plots has been destroyed, thus, non-treated monitoring plots are used to assess continuing termite activity.

Mention of a trade name does not imply Forest Service endorsement of any specific brand of termiticide over another.

15 years, (Torpedo, Prelude), three to more than 18 years;

- fenvalerate 1.0 percent (Tribute), six to 12 years; and
- bifenthrin 0.125 percent (Talstar, Biflex TC), two to more than 12years.

Cyfluthrin (Tempo 2 TC) at 0.5 percent has been 100 percent effective for more than 11 years, the length of this test to date. Deltamethrin EC at 0.125 percent (DeltaGard TC) has provided four to more than 10 years of 100 percent control, and should last longer at the 0.25 percent concentration. AgrEvo Environmental Health plans to market DeltaGard TC as a suspension concentrate with a planned general use rate of 0.125 percent, and at 0.25 percent for use in difficult-to-treat situations.

A termiticide reported as 100 percent effective for a specific number of years is not necessarily less successful than one reported as 100 percent effective for a longer period.

Methods

When installing termiticide field tests, an experimental area is established that contains 10 blocks of land (each 35 feet by 35 feet), with each block subdivided into 49 plots (each five feet by five feet). Each termiticide treatment is replicated once in each block (one treatment per plot) in a randomized complete-block design.

Termiticides are evaluated using both ground-board and concrete-slab methods (Beal 1980; Beal et al. 1994). Standard water mixtures of termiticides are applied to the soil at several active ingredient concentrations, usually ranging from 0.00 percent (water-only controls) to 1 .O percent by weight, at pre-construction volumes. Each block of land contains at least one concrete-slab and one ground-board application of each concentration, for a minimum of 10 replicates of each treatment at each test site.

The concrete-slab method simulates a poured concrete foundation. To establish a test plot, leaves and debris are removed to expose soil in a square area 24 inches on a side. A 2 l-inch-square wooden frame constructed of one-inch-by-one-inch spruce strips is placed in the center of the cleared area, and a triangular trench two inches deep and two inches wide at the top is dug around the inside of and adjacent to the frame.

A square metal frame, 17 inches on a side by four inches high, is then centered within the wooden frame, and termiticide is applied evenly to the soil surface within the metal frame. The metal frame is removed, and a vapor barrier (six-m&thick, 2 1 -inch-square plastic sheet) is placed over the treated area. A seven-inch-tall PVC plastic pipe, four inches in diameter, is placed upright at the center of the vapor barrier, and concrete is poured over the vapor barrier until it reaches the top of the wooden frame. The concrete is finished with a trowel, resulting in a smooth-surfaced slab.

After the concrete hardens, the vapor barrier at the bottom of the PVC pipe is cut out to expose treated soil. Care is taken not to disturb the treated soil when removing the circular piece of vapor barrier. A two-by-three-by-four-inch pine-sapwood block is placed inside the pipe and directly on the treated soil. The PVC pipe is capped to reduce loss of moisture and to preclude rain and sunlight from affecting the termiticide.

The ground-board method is similar to the concrete-slab method, except that no concrete slab or vapor barrier is used. A one-by-six-by-six-inch pine-sapwood board is placed on the termiticide-treated soil and weighted down with a brick. The treated area remains exposed to weathering. Decayed blocks and boards are replaced during annual evaluations.

Interpreting the Table

The following examples help interpret the table.

In Mississippi, 1 .O percent fenvalerate placed under concrete slabs in 1978 provided 100 percent control of subterranean termites for 10 years. Control then declined to 90 percent during the 1 lth year, where it remained for one year before declining further to 70 percent. It remained at 70 percent for two years before falling to 60 percent effectiveness, where it remained for two more years. By the next year, it declined to 50 percent.

In South Carolina, 1 .O percent permethrin (Torpedo) under concrete slabs was 100 percent effective in preventing penetration of subterranean termites through treated soil for six years. Control then declined to 90 percent during the seventh year, where it remained for one year before declining further to 80 percent. It remained at 80 percent for two years before declining to 70 percent, where it remained for one year. The next year, it declined to 60 percent, where it remained for two years before declining to 50 percent, where it remained for at least one year.

The asterisk (*) after the "1" indicates that evaluation of this treatment stopped after one year at 50 percent. Thus, the total number of years that 1 .O percent permethrin (Torpedo) remained at 50 percent

control was not recorded. Other asterisks found in the table indicate the same situation. Arrows between different percentage-of-effectiveness levels represent a greater-than-lo-percent loss in termite control since the previous evaluation. A dash in the table represents termite control percentages not yet observed.

The table indicates that termiticide field tests are installed during different years. Thus, a termiticide reported as 100 percent effective for a specific number of years is not necessarily less successful than one reported as 100 percent effective for a longer period. The periods of testing are simply different.

It should be recognized that, to achieve termite control for the number of years indicated by research results using currently marketed termiticides, there is a narrow margin of safety for creating an effective barrier in the soil. For termiticides to be effective for as long as possible, they must be applied as a continuous barrier in the soil, preferably at their highest label rates. PCOs will need to invest more time with clients to explain the important benefits and actual costs of providing a quality termiticide service. PC

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References

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