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Termiticide Field Tests—1989 Update

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SUMMARY

For several years, organophosphate and pyrethroid termiticides have undergone field evaluation as treatments to soil for control of subterranean termites. These termiticides remained effective at some application rates for 5 or more years. Field data are reported for ground-board and concrete slab tests at sites in the continental United States. Generally, pyrethroids have remained effective longer than organophosphates under concrete slabs in the hot, dry climate of Arizona, whereas the reverse was true in the test sites in the southeastern States.

INTRODUCTION

The Environmental Protection Agency (EPA) requires efficacy from USDA Forest Service field tests for determining registration of soil termiticides. Following a 2-year laboratory screening program currently conducted by Susan C. Jones, an entomologist with the USDA Forest Service, Southern Forest Experiment Station, in Gulfport, MS, the most promising termiticides are selected for field testing. Data are required showing that a termiticide remained 100-percent effective for a minimum of 5 years in at least three field sites in the continental United States. After efficacy is determined, the manufacturer decides whether or not to apply for EPA registration and labeling, and if successful, whether to market the product as a termiticide. The manufacturer and EPA decide the labeled rate of application. Chlorpyrifos (Dursban®TC), cypermethrin (Demon®TC; Prevail®FT), fenvalerate (Tribute®), isofenphos (Pryfon®6), and permethrin (Dragnet®; Torpedo®) are presently registered and labeled as soil termiticides by the EPA for subterranean termite prevention and control. These termiticides generally provided 100-percent control for 5 years when applied at the highest labeled rates, but were not as effective when applied at lower rates (Kard and others 1989). To achieve termite control, it is essential that termiticides be applied at rates required by the label.

The pest control industry, chemical manufacturers, EPA, and private citizens and organizations depend on results from current termiticide research. Therefore, this update provides 1989 results of long-term field studies of currently marketed termiticides. Because climate, soil type, and termite species differ among geographic locations, results are provided for several field sites.

MATERIALS AND METHODS

Field Sites

Termiticides are tested in Arizona (Pima County), Florida (Calhoun County), Mississippi (Harrison County), and South Carolina (Union County). These locations are representative of semiarid, subtropical, and temperate climates. *Reticulitermes* species predominate at these locations except in Arizona, where *Heterotermes aureus* (Snyder) is the primary pest. Climatic conditions, soil characteristics, and termites found at each site are described in detail by Beal (1980, 1986).

Field Tests

Ground-board and concrete slab test methods are currently used in the United States (Beal 1986, Kard 1989). Termiticides in these tests were applied at a volume of

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1.0 pt/ft^2 through 1987; however, termiticides were applied at 0.8 pt/ft^2 in 1988 and 1989. The latter rate equals 1.0 gal/10 ft^2, which generally is the recommended application rate for termiticide treatments to soil under concrete slabs and will be used in future field tests. Soil in control plots received water at the same volume as termiticide treatments.

RESULTS AND DISCUSSION

Data Interpretation

Data on the length of time that termiticides have provided control of subterranean termites and the levels of effectiveness are given in tables 1 through 3. For example, in table 1, 0.5-percent isofenphos under concrete slabs in Florida provided 100-percent control for 7 years, then declined to 90-percent control after 8 years and to 70-percent control after 9 years. In table 3, 0.5-percent permethrin (Dragnet®) provided 100-percent control for more than 11 years in Arizona, but at the same concentration in Florida, control remained at 100-percent for 4 years and then declined to 80 percent after 5 years and to 70 percent after 7 years, at which level it currently remains.

Because most chemicals were not installed in the field at the same time, a termiticide reported in the tables as continuing to be 100-percent effective for more than a certain number of years is not necessarily less successful than one listed as 100-percent effective for a longer period. The termiticides simply have not been evaluated for an equal period. For example, table 2 shows that under concrete slabs in Arizona 1.0-percent fenvalerate has been effective for more than 11 years while 1.0-percent cypermethrin has been effective for more than 7 years. However, fenvalerate tests began in 1978 and cypermethrin tests began in 1982, which accounts for differences in the number of years of effectiveness reported.

Untreated Controls

The average annual percentage of wood attacked by termites in control plots during the past 5 years is given in table 4. Note that table 4 provides percentages of wood attacked in control plots, whereas tables 1 through 3 give percentages of wood that was not attacked in treated plots.

Organophosphate Termiticides

Data for chlorpyrifos and isofenphos are provided in table 1. Chlorpyrifos (1.0 percent) and isofenphos (0.75 percent) are registered by the EPA for subterranean termite prevention and control. Isofenphos applied as a 0.5- or 1.0-percent emulsion under concrete slabs was 100 percent effective for at least 5 years in three test sites. It was registered for use at 0.75 percent although it was not tested at this specific rate.

Generally, organophosphates placed under concrete slabs were not effective as long in Arizona as at other test sites. Relatively high soil surface temperatures and low soil moisture conditions in Arizona may increase degradation rates of these termiticides. Under concrete slabs, chlorpyrifos and isofenphos have lasted much longer than in the exposed conditions of ground-board tests.

Initially, chlorpyrifos was placed in a concrete slab test in Mississippi in 1967 (table 1). In this test, at the labeled concentration of 1.0 percent, chlorpyrifos provided 100-percent control of subterranean termites for 21 years.

Pyrethroid Termiticides

The number of years that cypermethrin, fenvalerate, and permethrin provided control of subterranean termites is given in tables 2 and 3. Cypermethrin is registered at concentrations of 0.25 to 0.6 percent, and fenvalerate and permethrin are registered at 0.5 to 1.0 percent. Except for cypermethrin, these termiticides generally have remained effective in Arizona for longer periods of time than at the other test sites. It should be noted that cypermethrin has been tested for more than 7 years, whereas fenvalerate and one formulation of permethrin have been tested for more than 11 years. Prevail®FT (cypermethrin) was registered in 1990 and is included in table 2. Its performance would be expected to be similar to Demon®TC.

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Mention of a company or trade name is for identification purposes only and does not imply endorsement by the U.S. Department of Agriculture. The pesticides reported herein are registered as termiticides and others may be registered in the future. Since registration of pesticides is under constant review by State and Federal authorities, a responsible State agency should be consulted as to the current status of these pesticides.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

Table 1.—*Number of years that chlorpyrifos and isofenphos have controlled subterranean termites in concrete slab (CS) and ground-board (GB) tests (1989 data)*

Chemical and percent [AI]*	Test method	Location and percent control																							
		Arizona						Florida						Mississippi						South Carolina					
		100	90	80	70	60	≤50	100	90	80	70	60	≤50	100	90	80	70	60	≤50	100	90	80	70	60	≤50
		Number of years																							
Chlorpyrifos (Dursban®)																									
0.5	CS†	4	5	–	–	7	8	7	–	8	9	10	11	3	–	4	–	–	8	7	8	9	–	–	10
1.0	CS†	6	–	7	–	–	8	9	10	14	18	–	–	11	12	–	16	–	17	12	–	–	13	–	15
0.5	GB†	3	–	–	–	4	5	3	–	4	–	5	7	2	3	–	4	–	5	6	–	–	–	–	7
1.0	GB†	2	3	–	5	–	6	7	–	–	–	–	8	4	–	5	–	7	8	8	9	–	–	–	10
1.0	CS‡	–	–	–	–	–	–	–	–	–	–	–	–	21	22	–	–	–	–	–	–	–	–	–	–
2.0	CS‡	–	–	–	–	–	–	–	–	–	–	–	–	>22	–	–	–	–	–	–	–	–	–	–	–
Isofenphos (Pryfon®)§																									
0.5	CS	5	6	–	–	–	7	7	8	–	9	10	11	5	–	–	–	6	8	–	–	–	–	–	–
1.0	CS	7	8	12	13	14	15	14	15	–	–	–	–	12	13	14	–	–	15	–	–	–	–	–	–
0.5	GB	1	2	–	3	–	4	1	–	–	2	–	4	1	–	–	–	–	2	1	–	2	–	–	3
1.0	GB	3	–	–	4	5	6	4	–	–	–	–	5	1	2	–	3	–	4	2	–	3	–	–	4

* AI is the active ingredient concentration in the chemical emulsion applied to the soil.
† Tests initiated in 1971.
‡ Initial 1967 test in Mississippi. Not initially installed in Arizona, Florida, or South Carolina.
§ Tests initiated in 1974; CS tests not installed in South Carolina.
Note: Dashes *between* numbers represent a greater than 10-percent loss in control during the preceding year.
Dashes *after* a number and continuing to ≤50 percent represent losses in control not yet reached.

Table 2.—*Number of years that cypermethrin and fenvalerate have controlled subterranean termites in concrete slab (CS) and ground-board (GB) tests (1989 data)*

Chemical and percent [AI]*	Test method	Location and percent control																							
		Arizona						Florida						Mississippi						South Carolina					
		100	90	80	70	60	≤50	100	90	80	70	60	≤50	100	90	80	70	60	≤50	100	90	80	70	60	≤50
		Number of years																							
Cypermethrin (1982)† (Demon®; Prevail®)																									
0.125	CS	1	2	5	6	–	–	1	2	3	4	6	–	1	2	–	4	–	5	2	–	3	4	–	5
0.25	CS	4	–	5	–	–	6	>7	–	–	–	–	–	3	4	6	–	–	–	4	–	–	–	–	5
0.5	CS	4	5	–	6	–	–	5	6	–	–	–	–	>7	–	–	–	–	–	>7	–	–	–	–	–
1.0	CS	>7	–	–	–	–	–	>7	–	–	–	–	–	6	7	–	–	–	–	>7	–	–	–	–	–
1.0	GB	5	6	–	–	–	7	5	–	6	–	–	–	5	–	6	–	7	–	5	6	–	7	–	–
Fenvalerate (1978)† (Tribute®)																									
0.125	CS	8	–	–	9	10	–	1	2	–	3	7	9	1	–	–	2	–	3	1	2	–	3	–	5
0.25	CS	8	9	11	–	–	–	1	2	3	6	–	7	2	3	–	4	–	5	4	5	7	8	9	10
0.5	CS	>11	–	–	–	–	–	3	4	8	9	–	–	7	–	8	–	10	11	4	5	10	–	–	–
1.0	CS	>11	–	–	–	–	–	6	7	–	–	–	–	10	11	–	–	–	–	6	7	–	–	–	–
1.0	GB	7	8	9	–	–	10	4	5	6	–	9	11	4	–	–	5	6	7	6	7	–	–	8	9

* AI is the active ingredient concentration in the chemical emulsion applied to the soil.
† Year tests initiated.
Note: Dashes *between* numbers represent a greater than 10-percent loss in control during the preceding year.
Dashes *after* a number and continuing to ≤50 percent represent losses in control not yet reached.

Table 3.—*Number of years that two formulations of permethrin have controlled subterranean termites in concrete slab (CS) and ground-board (GB) tests (1989 data)*

Chemical and percent [AI]*	Test method	Location and percent control																											
		Arizona						Florida						Mississippi						South Carolina					
		100	90	80	70	60	≤50	100	90	80	70	60	≤50	100	90	80	70	60	≤50	100	90	80	70	60	≤50
		Number of years																							
Dragnet® (1978)†																									
0.125	CS	7	8	–	–	9	–	1	2	–	3	–	6	1	–	–	–	–	2	-	1	–	2	–	3
0.25	CS	8	9	11	–	–	–	2	–	3	–	5	6	1	2	–	–	3	4	1	–	–	2	4	5
0.5	CS	>11	–	–	–	–	–	4	–	5	7	–	–	5	6	–	–	7	8	5	6	9	–	–	10
1.0	CS	>11	–	–	–	–	–	>11	–	–	–	–	–	5	6	9	11	–	–	10	11	–	–	–	–
1.0	GB	9	10	–	–	–	–	6	–	7	–	–	10	2	3	–	–	–	4	1	2	–	–	5	6
Torpedo® (1980)†																									
0.125	CS	5	6	8	–	–	–	2	–	–	–	3	5	–	–	–	–	1	2	–	–	–	–	–	1
0.25	CS	>9	–	–	–	–	–	3	4	8	–	–	–	2	–	–	3	–	4	–	–	–	1	2	3
0.5	CS	>9	–	–	–	–	–	6	7	–	–	–	–	4	5	–	–	6	7	1	2	5	–	8	9
1.0	CS	>9	–	–	–	–	–	>9	–	–	–	–	–	3	4	8	9	–	–	6	7	8	–	–	–
1.0	GB	8	9	–	–	–	–	5	–	6	7	–	8	2	–	–	–	3	4	1	–	–	–	–	2

* AI is the active ingredient concentration in the chemical emulsion applied to the soil.
† Year tests initiated.
Note: Dashes *between* numbers represent a greater than 10-percent loss in control during the preceding year.
Dashes *after* a number and continuing to ≤50 percent represent losses in control not yet reached.

Table 4.—*Average annual termite attack (percent) on wood in untreated control plots for ground-board (GB) and concrete slab (CS) tests (1985–1989)*

Test method	Location			
	Arizona	Florida	Mississippi	South Carolina
	Percent			
GB	47	76	90	87
CS	54	70	73	75

CONCLUSIONS

Organophosphate and pyrethroid termiticides are effective for 5 or more years at some rates of application. New insecticides are being evaluated in field tests on a continuing basis. Alternative formulations of currently registered termiticides, which may provide greater long-term control of subterranean termites, are also undergoing field tests. Results of these tests will be made available as new insecticides or formulations prove effective.

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