USDA Forest Service: 2024 Termiticide Report

By Dr. Thomas Shelton, Craig Bell, Shawn Cooper, Dr. Grant Kirker and Dr. Mark Mankowski | *PMP* Contributors

Before new termiticides can be marketed, sold or applied in the United States, they must be registered by the U.S. Environmental Protection Agency (EPA). Part of this registration process is the collection of efficacy data indicating the product prevents termite movement past treated soil — that the product provides a "barrier." EPA's Office of Pollution Prevention and Toxics (OPPTS) is the registration body that handles candidate termiticides.

Based on methods developed in the late 1930s and 1960s, the guidelines for these efficacy trials are codified in OPPTS 810.3600. Data that are submitted to the EPA need to come from a third party, and the USDA Forest Service (FS), Forest Products Laboratory Durability and Wood Protection unit is responsible for that work. These data are used to determine whether tested concentrations, applied in the studies as a zone of treated soil, are effective at preventing damage to test wood blocks in three field locations in the southeastern United States.

After five years of data collection, these data are reported to the cooperator, who then combines them with data from other studies — using basic toxicological studies done by other labs — in a registration package for the candidate termiticide. The registration package is then submitted to EPA OPPTS for consideration.

Efficacy data in the registration package are examined using the EPA standard (covered below). Those concentrations that pass the standard and other non-target toxicological standards are allowed to be used on the eventual label by the manufacturer. At this point, the product is registered and can be used and sold in the U.S., but individual states will get a chance to make their own decisions on the product.

This report presents the data for currently registered products at their labeled application concentrations, providing efficacy information to pest management professionals (PMPs), state regulatory agencies, and owners of homes or other wooden-framed structures. The Forest Products Laboratory takes observations at set points throughout the year, with the final group of observations taken in September. Thus, the report tables present the data collected during 2024.

The work described in this report is conducted on experimental forests (EFs), which are a subset of national forests in the southeastern U.S. While the FS manages all national forests, EFs are not open to the public. Because the products involved in these studies are not yet labeled or registered, they cannot be used on national forests, as the public could potentially contact the product-treated soil. That's why EFs are set aside for forestry research and provide FS scientists with more latitude in the types of studies performed there.

Three EFs are used for this work: the Harrison EF (HEF) near Gulfport, Miss., the Chipola EF near Panama City, Fla., and

Continued on page 30

Fig. 1. A nearly complete study on the Chipola EF. Vapor barriers still need to be cut from concrete slab plots (see Fig. 2) and blocks added, and all plots need identification stakes driven into the ground.

PHOTO: US DEPARTMENT OF AGRICULTURE FOREST SERVICE

Continued from page 29

the Calhoun EF near Clinton, S.C. The FS started candidate termiticide studies in 1938 on the HEF. On the EFs used for these studies, only native subterranean termites belonging to the genus *Reticulitermes* have been observed on infested blocks. Therefore, our test data only reflect the response of *Reticulitermes* spp. to the candidate termiticides.

Testing program status

In 2024, evaluation continued for three candidate termiticides; if year zero is the installation year, we have one product in year one, one in year two, and the final one in year eight. Tables 1 and 2 provide efficacy data for current, federally labeled termiticides in the U.S.[1] Candidate products can be withdrawn from testing at any time by their manufacturers.

Our policy is to only report data from federally registered products, and only at label rates. This prevents possible off-label concentration applications, as well as the use of agricultural products using the same active ingredients. Because of this policy, if there are products that have gone through this evaluation process but have not been submitted to the EPA for registration, those data will not appear in the tables of this report.

General methods

Manufacturer representatives request that the FS termiticide testing program provide product efficacy data as an unbiased third party. The products tested are the formulations that would eventually be made available commercially; the FS does not test active ingredients (AIs) independent of formulation (technical grade, 100 percent AI materials).

Table 1. Number of years that repellent termiticides remained effective in concrete-slab (CS) and ground-board (GB) tests on four field sites applying the EPA guideline and Florida Efficacy Rule.† Fractions of years occurred when products were installed out of cycle. Control = percentage of all untreated plots attacked over the life of the study.

% Active Ingredient	Test	Arizona		Florida		Mississippi		South Carolina		FL
		EPA	FL	EPA	FL	EPA	FL	EPA	FL	SE States
Bifenthrin – Biflex TC (study established 1986 and closed 2011)										
0.031	CS	0	9	4	11	2	5	2	4	4
0.062††	CS	16	16	22	22	7	7	10	16	10
0.125††	CS	10	15	9	25	2	7	24	25	9
0.25	CS	25	25	25	25	16	17	25	25	25
0.5	CS	6	23	25	25	18	24	25	25	25
0.031	GB	6	7	4	5	2	2	3	4	4
0.5	GB	10	11	14	21	12	15	8	11	14
Control	CS	52%		68%		51%		59%		-
Control	GB	68%		86%		74%		84%		-
Cypermethrin (study established 1982 and closed 2004)										
0.125	CS	1	4	0.5	1.5	1	3	2	2	2
0.25††	CS	4	4	10.5	12.5	3	5	4	4	4
0.5††	CS	4	5	4.5	9.5	7	14	12	12	11.5
1.0	CS	8	10	7.5	21.5	6	15	12	16	15
1.0	GB	3	6	4.5	4.5	5	5	5	6	5
Control	CS	62%		66%		50%		60%		-
Control	GB	73%		75%		85%		88%		-
Permethrin – Dragnet (study established 1978 and closed 2004)										
0.25	CS	8	10	2	2	1	2	0.5	0.5	1
0.5††	CS	13	19	4	4	5	6	4.5	4.5	4.5
1.0††	CS	15	15	15	25	5	8	10.5	11.5	10.5
1.0††	GB	9	11	6	6	2	3	0.5	3.5	3
Control	CS	50%		55%		60%		53%		-
Control	GB	43%		78%		86%		84%		-
Permethrin – Torpedo (study established 1980 and closed 2011) Controls same as cypermethrin										
0.25	CS	9	9	3	7	2	2	0.5	0.5	1.5
0.5††	CS	11	13	6	9	3	5	1.5	4.5	5
1.0††	CS	19	31	25	27	3	7	6.5	7.5	7
0.5††	GB	4	4	4	4	1	1	1.5	1.5	1.5
1.0††	GB	8	9	5	5	2	2	1.5	1.5	1.5

† **EPA:** years with no penetration through treated soil in any plot.
FL: years with no annual damage more severe than ASTM 9 to blocks or boards on 90% or more of the plots per site (each annual evaluation stands alone, not cumulative).
FL SE States: years with no annual damage more severe than ASTM 9 to blocks or boards on 90% or more of the plots across the southeastern sites (damage ratings are annual, not cumulative).
†† Registered label rates.

During the field work, cooperator personnel can observe and assist to a limited extent, such as digging holes or clearing trees from a plot area. However, cooperators are not allowed to help with mixing candidate termiticides, treating plots or determining wood block damage (evaluations). All FS personnel who

Continued on page 32

EDITOR'S NOTE:
For the charts on p. 30-31, the data for the program that can be made public at press time have remained the same since they were first printed in the March 2015 issue of *Pest Management Professional* magazine. Please note the inclusion of brand names and manufacturer names are for data purposes only, and does not imply endorsement by the USDA-USFS.

TABLES: US DEPARTMENT OF AGRICULTURE FOREST SERVICE

Table 2. Number of years that non-repellent termiticides remained effective in concrete-slab (CS) and ground-board (GB) tests on four field sites applying the EPA guideline and Florida Efficacy Rule.† Fractions of years occurred when products were installed out of cycle. Control = percentage of all untreated plots attacked over the life of the study.

% Active Ingredient	Test	Arizona		Florida		Mississippi		South Carolina		FL
		EPA	FL	EPA	FL	EPA	FL	EPA	FL	SE States
Imidacloprid – Premise 75 WSP (study established 1992 and closed 2007)										
0.025	CS	15	15	15	15	1	1	3	4	2
0.05††	CS	15	15	6	12	2	2	10	10	6
0.1††	CS	15	15	15	15	2	4	5	15	8
0.15	CS	15	15	15	15	3	4	5	15	5
0.2	CS	15	15	15	15	2	5	5	5	5
0.25	CS	15	15	12	15	2	2	8	9	8
0.3	CS	15	15	15	15	5	5	5	11	14
0.4	CS	15	15	12	15	5	9	5	14	15
0.1††	GB	3	7	2	2	1	1	2	2	2
0.2	GB	8	14	2	2	2	2	2	2	2
0.3	GB	5	6	2	2	2	2	1	2	2
0.4	GB	5	7	2	3	2	2	4	5	2
Control	CS	33%		77%		75%		36%		-
Control	GB	40%		95%		96%		70%		-
Fipronil – Termidor 80 WG (study established 1994 and closed 2010)										
Only five treated GB plots were attacked during the life of the study, but due to the low attacks at untreated control plots and multiple products in the test site, it was impossible to evaluate treatment effects. For additional information refer to the 2006 Termiticide Report (*PMP*, February 2007, page 66).										
Control	CS	14%		18%		2%		3%		-
Control	GB	9%		8%		16%		11%		-
Fipronil – Termidor SC (study established 1999 and closed 2011)										
0.06††	CS	12	12	11.5	11.5	8	12	8	8	11.5+
0.125††	CS	12	12	11.5	11.5	8	12	12	12	11.5+
0.25	CS	12	12	11.5	11.5	12	12	12	12	11.5+
0.06††	GB	10	12	9.5	11.5	9	10	5	11	10.5+
0.125††	GB	12	12	11.5	11.5	8	11	10	10	11.5+
0.25	GB	0	9	2.5	11.5	2	2	12	12	11.5+
Control	CS	1%		67%		85%		50%		-
Control	GB	50%		97%		86%		88%		-
Chlorfenapyr – Phantom (study established 1996 and closed 2011)										
0.125††	CS	15	15	1	7	1	1	6	7	1
0.25††	CS	15	15	11	11	2	5	5	15	6
0.5	CS	15	15	15	15	4	4	15	15	15
0.75	CS	15	15	1	1	5	5	15	15	15
1.0	CS	15	15	15	15	5	7	8	8	7
2.0	CS	15	15	15	15	1	9	15	15	15
0.25††	GB	9	11	0	0	2	6	5	8	6
0.5	GB	5	10	1	8	4	4	12	15	5
0.75	GB	15	15	4	7	5	12	11	15	8
1.0	GB	8	15	9	11	5	11	11	11	11
2.0	GB	6	11	15	15	12	12	8	14	12
Control	CS	19%		66%		79%		44%		-
Control	GB	54%		87%		99%		95%		-
Chlorantraniliprole – Altriset (study established 2004 and closed 2015)										
0.025	CS	3	5	1	7	2	5	11	11	7
0.05††	CS	5	6	3	11	9	11	4	4	11
0.1	CS	2	11	11	11	11	11	11	11	11
0.25	CS	4	11	11	11	11	11	11	11	11
0.025	GB	2	5	0	1	1	2	1	2	1
0.05††	GB	2	2	0	2	2	4	1	2	2
0.1	GB	4	7	1	6	4	6	2	4	4
0.25	GB	2	4	2	9	2	8	4	8	8
Control	CS	5%		63%		88%		49%		-
Control	GB	13%		82%		88%		89%		-

† **EPA:** years with no penetration through treated soil in any plot.
FL: years with no annual damage more severe than ASTM 9 to blocks or boards on 90% or more of the plots per site (each annual evaluation stands alone, not cumulative).
FL SE States: years with no annual damage more severe than ASTM 9 to blocks or boards on 90% or more of the plots across the southeastern sites (damage ratings are annual, not cumulative).
†† Registered label rates.

Continued from page 30
mix and apply candidate chemicals have current commercial pesticide applicator certificates (Category X) and many years of experience with the FS testing protocol.

The FS offers two tests for soil barrier efficacy of candidate products: the ground board and the concrete slab. The FS also provides samples of treated soil and conducts both the installation of the product and annual observations of the test wood. These methods are identical to those required by the OPPTS 810.3600 document.[2]

This document requires five years of efficacy data for candidate termiticides. As a result, these studies take a total of six years to complete. Product manufacturers are updated annually on their product's performance. The EPA and, eventually, state regulatory agencies, once the product obtains federal registration, are free to contact the FS regarding the data or methods used to obtain them.

Test methods

The ground board test and the modified ground board (or concrete slab) test are specified for efficacy testing of candidate products in OPPTS 810.3600. Ten replicates of each concentration, including water-only controls, are installed for each candidate termiticide in each of three EFs, as described above. Individual plots are laid out within rectangular areas in the forest and cannot be reused once treated (see Fig. 1, p. 29).

The methods are described in the annual termiticide report each year in *Pest Management Professional* (*PMP*) magazine. Because no procedural changes have been made, the language used to describe them remains constant.

The ground board test employs a 24-by-24-inch area that is cleared of debris, roots and rocks. Then, a 17-by-17-inch area is treated with the candidate termiticide at the concentrations requested by the manufacturer, at the sub-foundation rate of 1 gallon per 10 square feet. After drying, a 6-by-6-by-1-inch southern yellow pine (*Pinus* spp.) sapwood board, sourced from the East Mississippi Lumber Co. in Starkville, Miss., is centered on the exposed, termiticide-treated soil and held in place with a brick.

▲ **Fig. 2. A day after treatment and concrete pouring, vapor barriers from within the PVC pipes are cut and removed. A wooden block is placed directly onto the treated soil, and the pipe is capped.**

The concrete slab test is similar to the ground board test. In this test, a 24-by-24-inch area is cleared and prepped as described above. A 17-by-17-inch area is treated as in the ground board test. After treatment, the soil is covered by a polyethylene vapor barrier (6-mil black construction film, sourced from Lowe's, item #810482), and a 21-by-21-inch concrete slab is poured around a 4-inch-diameter polyvinyl chloride (PVC) pipe placed at the center of the square.

Once the concrete has set, the vapor barrier is cut out and removed from the bottom interior of the PVC pipe (see Fig. 2, above). A 3.5- by 2.5- by 1.5-inch rectangular pine sapwood block is then placed on the treated soil at the bottom of the pipe. To prevent weathering of the treated soil, a PVC cap is placed on the pipe. Completed plots are laid out in a grid pattern within the forest.

Mixed solutions of candidate termiticides are applied to the soil at the pre-construction horizontal treatment rate of 1 gallon per 10 square feet in both test configurations. Wood placed in each plot is evaluated annually for termite damage using a simple scale called the Gulfport scale (described below); the presence or absence of live termites infesting test blocks or boards is also noted.

Soil sampling

During product installations, two extra ground board and concrete slab plots per concentration are added for soil pesticide residue analysis. One 4-inch-long soil sample core per residue analysis plot is collected, measuring 1 inch in diameter, after initial installation and on each subsequent year of the study. After each soil core is taken, a 1-inch-diameter PVC spacer is placed in the sampling location to prevent the same place from being sampled again later.

The ground board and concrete slab plots designated for soil sample collection have no wood blocks in the plots and, therefore, cannot have termite feeding observations. The collected soil samples are shipped to the product manufacturer for residue analysis of their product.

Continued on page 34

PHOTO: US DEPARTMENT OF AGRICULTURE FOREST SERVICE

Continued from page 32

The Gulfport scale

Termite feeding data is assessed using the Gulfport scale: 0 = no damage, 1 = nibbles-to-surface etching; 2 = light damage with penetration; 3 = moderate damage; 4 = heavy damage; and 5 = board or block destroyed.

The Gulfport scale was developed in the late 1930s by the FS termiticide unit to give an estimate of the level of termite feeding on wood examined when the study plot is annually evaluated. The scale was first published in 1959 by Arthur F. Verrall.[3] The Gulfport scale can be compared to other termite feeding standards such as the ASTM laboratory wood damage scale in standard ASTM D 3345-22.[4] Table 3 shows a comparison of the two scales.

The damage/feeding scales described are categorical and, in nature, termite damage does not readily jump from one of these conditions to the next. Termite feeding would be more accurately represented if wood mass loss could be measured, but this is difficult to perform in the field in a short amount of time and without the ability to equilibrate the wood block to a constant weight. The rating scale system allows for the fast collection of damage data.

In the field, the block ratings are also not evenly distributed across these categories. This is partly due to the size of the categories, with Category 3 taking up both a substantial portion of the potential block damage, as well as the largest chunk of study data each year for products reaching the end-of-life date. Regardless, while it might be possible to make statistical comparisons using non-parametric methods, these are unnecessary as the standard established by the EPA is a pass/fail system. Furthermore, the categories can be important for state regulatory standards, which in some states can set percentages of allowable damage to blocks.

Table 3. Rough equivalencies between the two termite feeding scales — the Gulfport scale and the ASTM scale — for assessing termite feeding damage to wood.

Gulfport	ASTM
0	10
1	9
2	8
3	7
4	4
5	0

TABLE: US DEPARTMENT OF AGRICULTURE FOREST SERVICE

Performance standards

The EPA has a single standard for termiticide efficacy: Five years of complete control. In other words, no termite has fed on any plot's wooden block within a five-year timeline. This has been covered in previous versions of this report in *PMP* magazine. But while there is a single federal standard, all states can create their own individual standards.

The individual state lead agencies for structural pest control make decisions regarding the use or sale of a product via either a state-specific regulatory standard, such as the Florida Termiticide Efficacy Rule[5], or using their own judgment of the FS efficacy data on a product. Several state lead agencies have chosen to make these decisions collectively through the Association of Structural Pest Control Regulatory Officials (ASPCRO).

In this report, the data in Tables 1 and 2 are presented for each testing site individually, using the EPA guideline and the Florida Rule (individually by site and collectively across all sites). Discussions of the differences between the two standards have been covered in many of the past annual reports in *PMP* magazine. Both standards have remained unchanged.

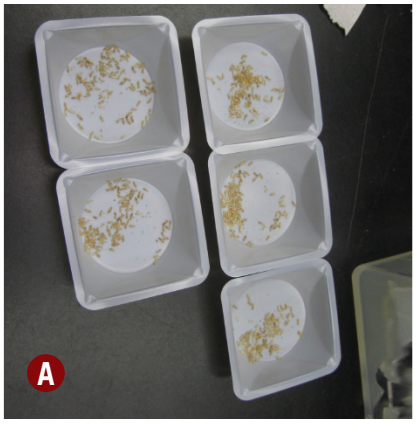
Latest test results

Data collected through 2023 for all repellent (Table 1) and non-repellent (Table 2) termiticides are available through the corresponding links. No new products entered the market in 2024, and all currently registered soil-applied termiticide products have had their studies closed at the request of their respective manufacturers. Thus, there are no new products whose data can be revealed and no additional data for currently available products in the tables.

The tables and data in this report are the same as those in the report published in the March 2015 issue of *PMP*.[1] All recently collected data are for unregistered products, which remain confidential until after EPA registration, and with an accepted label.

A comment should be made regarding the Altriset product, with the AI chlorantraniliprole. Altriset

Continued on page 36



▲ **Fig. 3.** **A** Counted termites ready to be placed in tubes. **B** Termites placed into tubes. **C** Tubes during experiment.

Continued from page 35
still appears in Table 2 because it retains its federal registration for use in the U.S. While the product is no longer being produced by its manufacturer, Syngenta Crop Protection, the remaining stock still can be sold and applied. The data are provided here, should the public need them when considering Altriset use. It is expected that the remaining stock will diminish over time, and the product eventually can be removed from the table.

New methodology

One of the key problems with the current test methods described above is that they do not have a way to predict termite activity at individual plots. We know termites are quite common in the EF locations, and control data show that even without a way to assess termite activity ahead of time, "random" plots still show termite activity. However, even if all the plots in a study are active, there is no way to know whether any given plot has the same termite pressure as any other. Thus, something aside from the field activity of the termites is needed to support our efficacy data.

Work by Grace *et al.*[6] provided a method that could be modified to fit this purpose. Their work used samples of termiticide-treated soil packed into thin glass tubes, which had fixed numbers of termites added to the bottom. The tubes were examined over several days. This provided termite mortality data, as well as termite tunneling distance through the treated soil — all while using the same known degree of termite pressure for every tube.

The FS has modified the literature methods to suit the FS field trials. Basically, starting with a simple concrete slab for all plots, soil samples are taken as described above at different time intervals. The FS uses plastic tubes that are wider than the glass tubes used by Grace *et al.*, as seen in Fig. 3, but otherwise, the method is very similar.

We do not take observations of sample wood in the plots, as there is no wood to observe, and our observations are limited to the response of known numbers of termites in the tubes. Thus, we are getting field aging of the product application, but the data come from known termite pressure, rather than by chance.

We have continued taking soil samples and running these tube tests to date. In the new method, the data are not categorical. So, both mortality and tunneling distance can eventually be analyzed through parametric means, assuming the data are normally distributed.

Continued on page 38

Recent barriers to new installations

In September 2024, a new product installation was started at the South Carolina Experimental Forest (CEF). A plot location was cleared, plots were laid out, and the digging of plots was begun. Unfortunately, an emergency weather notice caused our unit to stop work and return to Starkville, Miss., approximately two days before Hurricane Helene was scheduled to arrive at CEF.

We were able to revisit the site after a few weeks, but were unable to arrange for enough help from the National Forest to continue product installation, as National Forest personnel were busy assisting with damage from the hurricane. This installation took place in September 2025 instead.

In addition, the installation of a new product in Florida in March 2025 was held up due to a potential lack of federal funding. While these studies are funded by product manufacturers, government personnel and equipment (such as trucks) cannot be used during a shutdown of the federal government. The shutdown was averted, but not before we were forced to reschedule the work.

At press time, the federal government is under a continuing resolution until the end of the fiscal year ending Sept. 30, so this should cause no further disruptions in 2025.

PHOTOS: US DEPARTMENT OF AGRICULTURE FOREST SERVICE

For access to previous USDA Termiticide Reports, visit **MyPMP.net/tag/termiticide-testing-program.**

Continued from page 36

This year, we have made some improvements to the use of this method — mainly by changing the tube storage from vertical to horizontal. Control mortality in the tube tests has improved by doing this, although it is not apparent why our studies with *Reticulitermes* spp. (horizontal tubes) differ from those of Grace *et al*. with *Coptotermes* spp. (vertical tubes). Our 0.75-inch-diameter tubes are wider than the Grace *et al*. 0.5-inch-diameter tubes, possibly causing this increased control tube mortality with *Reticulitermes* termites in a vertical tube, but this is only speculation.

Conclusions

The USDA FS has provided unbiased candidate termiticide efficacy data for federal needs (military or regulatory) since 1938. To date, this program has provided performance data to the EPA for all federally registered soil-applied termiticides. These data are also provided to the public annually via this report. We hope that this information enables the public to make informed decisions regarding the protection of wood in service from termite feeding and assists pest management companies in making decisions about which termiticide products to offer their customers. **PMP**

Bell and **Cooper** are biological science technicians. **Dr. Kirker** is a Research Forest Products technologist, and **Drs. Mankowski** and **Shelton** are research entomologists. All are with the USDA FS Forest Products Laboratory, Durability and Wood Protection Research Unit in Madison, Wis. (Kirker), and Starkville, Miss. (all others).

REFERENCES

1. Shelton, T., D. Fye, J. Tang and M. Mankowski. 2015. "Command Performance: The UFSF presents its annual Termiticide Report for 2014." *Pest Management Professional* 83(3): 40, 42, 47, 48, 50

2. Environmental Protection Agency. 1998. EPA's Office of Pollution Prevention and Toxics. "Product performance test guidelines OPPTS 810.3600 Structural Treatments." EPA 712–C–98–424.

3. Verrall, Arthur F. 1959. "Preservative moisture-repellent treatments for wooden packing boxes." *Forest Products Journal*. 9(1): 1-22.

4. ASTM (American Society for Testing and Materials). 2022. D3345-17. "Standard test method for laboratory evaluation of wood and other cellulosic materials for resistance to termites." *ASTM Annual Book of Standards*. Vol. 04.10, West Conshohocken, Pa.

5. Florida Department of Agriculture and Consumer Services. 2003. "Performance standards and acceptable test conditions for preventive termite treatments for new construction." Florida Administrative Code 5E-2.0311.

6. Grace, K.J., J.R. Yates, M. Tamashiro and R.T. Yamamoto. 1993. "Persistence of organochlorine insecticides for Formosan subterranean termite (Isoptera: Rhinotermitidae) control in Hawaii." *J. Econ. Ent*. 86(3): 761-766.