
Subterranean Termite Control

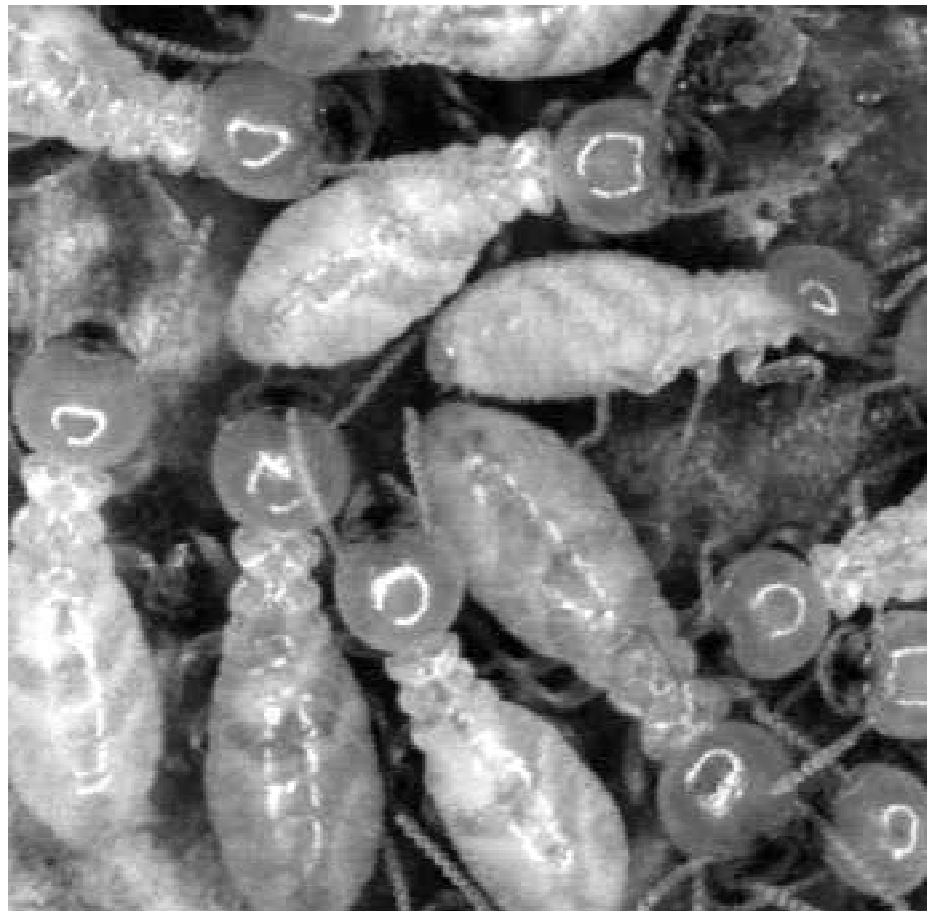


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Introduction

Subterranean termites, the most destructive wood-feeding insects in Tennessee, feed on cellulose that is usually obtained from wood. Termites are very important because they help recycle dead, fallen trees back into the soil. They do not easily distinguish between a dead pine tree and pine lumber; therefore, their food may be in the form of a dead tree or the wood in a house. They will also feed upon fence posts, paper, books and fabrics of plant origin, as well as living plants such as trees, shrubs, flowers and some crops.

Colonies of subterranean termites live in the soil and enter structures through wood or foundation walls adjacent to the soil. In cases of structures built partly or completely on concrete slabs, infestation occurs through expansion joints, cracks, and utility and sewer openings. The damage to buildings is reduced structural strength of the wood caused by the removal of part of the tissues.

Information contained in this publication is provided to inform the consumer, as well as the pest control professional, of termite biology and the techniques and materials available for termite control. In the past, the main method of termite control was to form an insecticidal barrier between the wood and soil. Specialized equipment (sprayers with large tanks, rodding tools, large drills, safety equipment and others) and special knowledge were and still are required for the proper application of termite insecticides. Currently, conventional soil treatments, as well as baiting systems, are available for termite control. Knowledge of termites' biology and behavior is even more crucial with the use of termite baits that suppress

or "eliminate" termite colonies. Experience using baits is a key component to achieving control with this method. Therefore, securing the services of a reliable pest control professional is advisable in almost all cases.

Termite Biology and Identification

Termites and termite damage are not difficult to identify; however, people often mistake winged ants for termites and become unnecessarily alarmed. Actually, the difference is quite pronounced (Figure 1). An alate or "swarmer" of the most common termites is generally black. It has a rather straight body, straight antennae and four cloudy-white wings

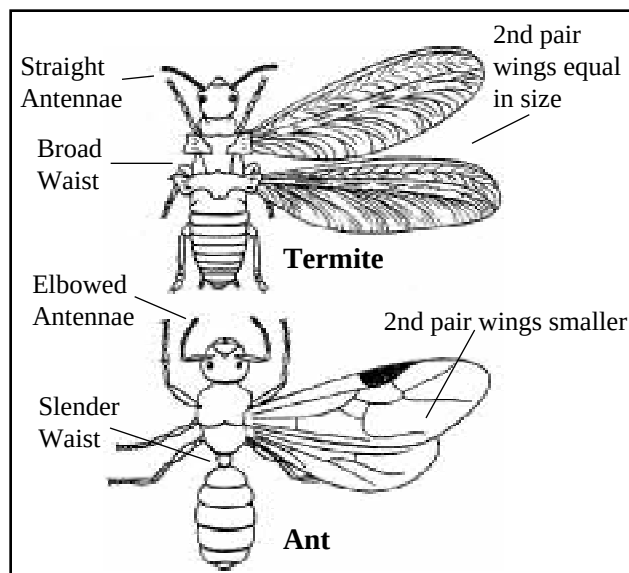


Figure 1. Comparison of a winged (alate or swarmer) termite and a winged ant.

of equal length that are twice as long as the body. The winged ant, on the other hand, may be similar in color but has a wasp-like constricted waist, elbowed or bent antennae and four clear wings. The ant's hind wings are shorter than the front pair and are not quite as long as the body.

The white, soft-bodied, wingless, worker termites, although seldom seen, are the ones that do the damage. They eat the soft grain of wood, leaving a thin shell outside and a layered effect inside. Often mud is present in the eaten layers of the wood, which helps distinguish termite damage from other wood-destroying insects.

Termites live in true social colonies with a division of labor among the different types of individuals. These different types, called castes, usually consist of reproductives, soldiers and workers (Figure 2).

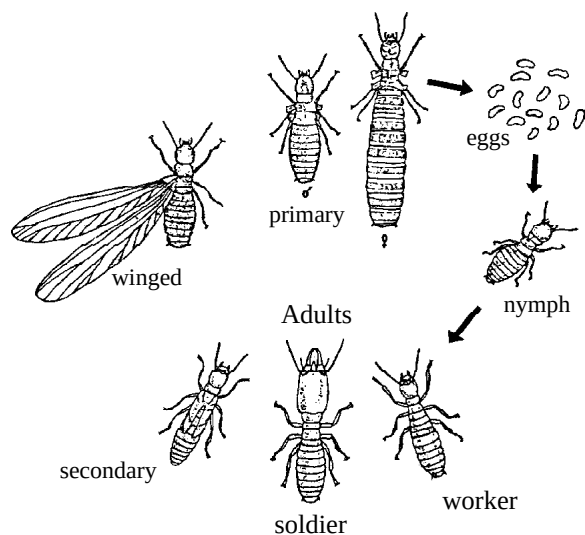


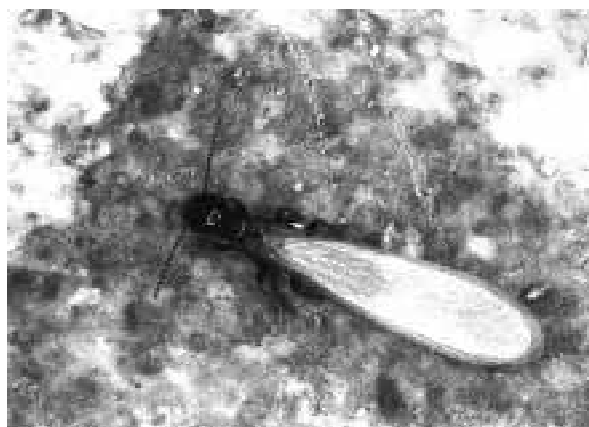
Figure 2. Termite life cycle.

The primary reproductives of the most common species in Tennessee are shiny black and are winged. They are produced in mature colonies and typically fly to find mates on a warm day after a rain. The three most common termite species in Tennessee are the eastern subterranean termite, *Reticulitermes flavipes*; the southeastern subterranean termite, *R. virginicus*; and the light southeastern subterranean termite, *R. hageni*. *R. flavipes* often flies between March and May, while *R. virginicus* flies April through June or in the fall. *R. hageni*, a pale-brown species, may fly from August to October.

Mating flights can occur during other times of the year, especially in heated structures. After the

flight, they shed their wings and pair up. Each pair attempts to start a new colony by constructing a cell adjacent to wood or other food source. Mating takes place in the cell and eggs are laid that will produce the first small group of nymphs. These nymphs are fed by the reproductive pair until the nymphs are large enough to “go to work” themselves. As the colony increases in size, soldiers and reproductives are produced. New winged swarmers (Figure 3) are seldom produced until the colony is more than 3 years old. Mating flights occurring indoors (Figure 4) are almost never successful and fallen winged individuals can be vacuumed and discarded.

The workers are creamy white (Figure 5), very soft-bodied and subject to drying out (desiccation). Thus, they need soil contact for a source of moisture. Workers build shelter or mud tubes from bits of soil and excretions as passageways from the nest to the food source. Shelter tubes are usually the width of a



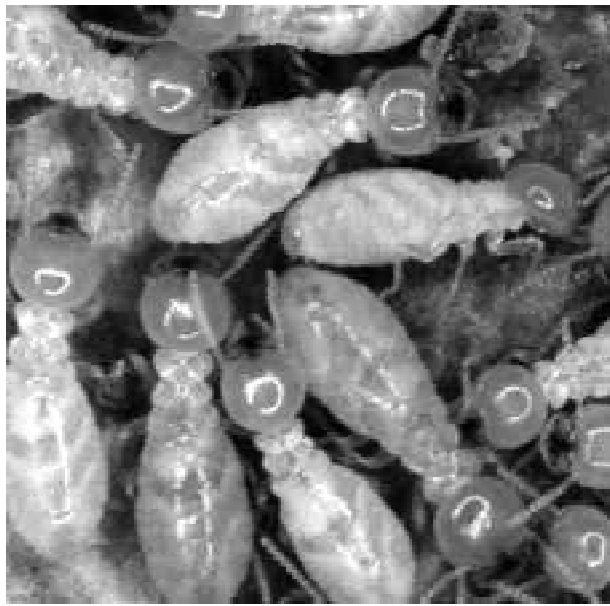
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Figure 3. Winged native subterranean termite swarmer.



Karen Yail

Figure 4. Swarmers are often found at windows.



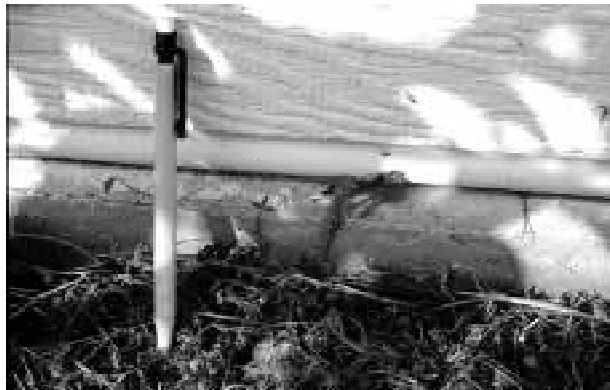
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Figure 5. Native subterranean termite worker.



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Figure 7. Native subterranean termite soldier.



Karen Voil

Figure 6. Shelter or mud tubes are usually the width of a pencil.

pencil (Figure 6), but may be wider. The soil/excretion material is also used to close any breaks in the surface of the wood the termites are infesting. Termites need this closed system to preserve the necessary high level of humidity. Shelter tubes also serve as a protective barrier against their natural enemies, particularly ants.

The soldiers are also creamy white with large, dark, reddish-brown, rectangular heads (Figure 7). The strong mandibles or jaws are also hardened and darkened. Soldiers use these strong jaws to protect the colony from invaders such as ants.

Supplemental reproductives are usually white, larger than nymphs or workers and have short wing pads. Because they may be numerous, supplemental reproductives can become an important egg source and collectively can produce more eggs than the

primary female. Supplemental reproductives are formed if the queen or king dies, or if individuals become isolated from the main colony due to application of termiticide (which separates above-ground individuals from those below ground), flooding, drought, physical disruption of the soil, such as during construction, and other causes.

The Formosan subterranean termite, *Coptotermes formosanus*, (Figure 8) is a more aggressive feeder than the native subterranean termites. It has been introduced to the Memphis area in the past, but is not established. Unlike the other subterranean termites that eat along the grain of the wood, the Formosan termite is less discriminating and will often hollow out a tree trunk or wooden beam. See Table 1 for a comparison of Formosan versus other subterranean termites. Formosan termites found in Tennessee



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Figure 8. Formosan termite soldier.

should be reported to the Tennessee Department of Agriculture, Division of Regulatory Services.

Drywood or powderpost termites are occasionally introduced into Tennessee through infested furniture or other wooden pieces. Drywood termites are easily distinguished from subterranean by the presence of their six-sided fecal pellets. These pellets are concave on the sides and often appear in piles as they are kicked out of the nest. No soil contact is

Table 1. Comparison of Formosan and native subterranean termites.		
Characteristic	Formosan subterranean	Native Subterranean
shape of soldier head	oval	rectangular
wings	hairy	nearly bare
% soldiers in colony	20-30	1-3
swarm time	dusk to midnight	day
length of alates including wings	12 - 15 mm	7 - 10.5 mm

needed, so mud is not present in the damaged wood. Also, these termites feed within and against the grain. Damage occurs slowly as compared to subterranean termites. A pest control professional is needed for control, especially if the infestation has spread to structural timbers and fumigation is required.

Collecting specimens for identification

Alates (swarmers) with wings and/or soldiers should be preserved in rubbing alcohol when submitted for identification. Submit at least 10 — 15 specimens. Swarmers without wings and workers are not useful in identification.

Prevention

Most structures are pretreated during construction with a soil termiticide (termite poison) to protect them from termite attack. The objective of the pre-treatment is to create a continuous barrier of termiticide that repels or kills termites as they attempt to cross this barrier. Few people would consider building a new house and then not insuring it against damage caused by fire or other calamities, yet many more houses are damaged each year by termites than by fire. Pre-treatment is relatively inexpensive and highly recommended.

There are four major considerations in pre-

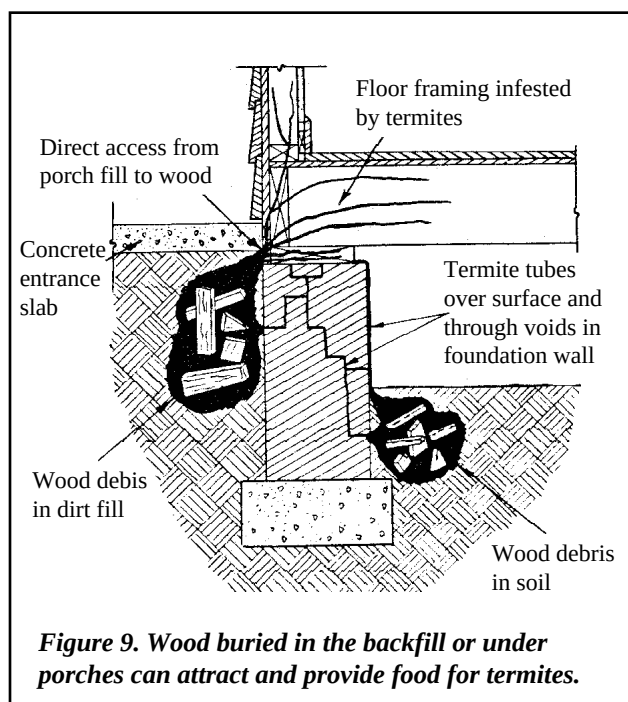
venting termites from invading a new building: (1) sanitation of the building site, (2) landscape practices, (3) structural and construction defects and (4) barriers.

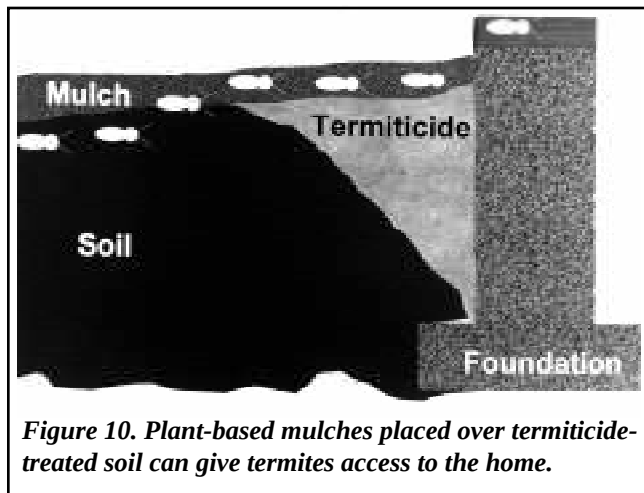
1. Sanitation — Do not bury wood in the backfill or under porches or steps, as this will attract and provide food for termites (Figure 9). Remove form boards and wood scraps from soil before filling or backfilling. Remove all tree roots and stumps from the building site before beginning construction. Remove spreader boards and grade stakes before the concrete sets.

2. Landscape Practices — Landscape practices can also determine the structure's susceptibility to termites. Cellulose mulches (wood or bark chips and others of plant origin) placed against the foundation (Figure 10) give termites access to the home without having to contact the termiticide barrier that has been applied next to the foundation. Leave a 12-18-inch plant/mulch free zone next to the foundation.

Landscape timbers or wooden decks can provide food for termites and can also become an access route into the structure if they are placed against the foundation or wood siding (Figure 11). Other landscaping materials for borders, such as concrete and vinyl, are available that will not degrade as quickly as wood and will not provide food or structural access to termites.

Irrigation systems that wet the structure's foundation can also attract termites to the structure.





Inspect irrigation systems regularly to ensure the water is being applied to the proper location in the appropriate quantities. Hard water stains on the structure's foundation could indicate an irrigation problem. Repair leaks in faucets (Figure 12) and hoses as soon as possible.

3. Structural and construction defects — Allow sufficient space (30-inch clearance) and ventilation outlets for air movement to aid in keeping soil dry beneath houses with crawlspaces, which will make the area less suitable to termites. Ventilation openings, in foundation walls and beneath buildings with crawl spaces, should be large enough and equally distributed to prevent dead air pockets from forming. Such pockets would give rise to humid conditions conducive not only to termite activity, but also to powderpost beetles, carpenter ants and wood decay. Installing fans at the vents will keep air circulating. Cover 80 percent of the soil surface in the crawl space area with a 4-6 mm polyethylene (plastic)



layer. One way to do this is to cover all of the center of the crawl space area, leaving a 1-foot-wide strip of bare soil around the foundation. (A 100 percent crawl space cover could dry hardwood flooring too much and lead to warping.) Moisture rising from the soil around the perimeter will be exhausted through the foundation vents. The plastic cover will prevent moisture rising from the soil from being absorbed by the floor joists, insulation and subfloor.



Other construction practices can reduce termite invasion. The finished grade outside the building should slope away from the foundation so water will not collect under the house. Porch supports should be separated from the building by at least 2 inches. Wooden steps should rest upon a concrete base that extends 6 inches above grade. Do not place basement partitions, posts and stair stringers until the concrete floor has been poured. They should never extend into or through the concrete.

In the final grading, allow at least 6 inches clearance between the top of the soil and the top of the foundation. Rigid board insulation, exterior insulation and finishing systems (EIFS) or synthetic stucco, stucco or other decorative materials that extend below grade (below the soil) are especially troublesome. These materials installed below grade can wick moisture into the walls of the house, creating conditions favorable to termites and wood rot. When stucco separates from the foundation

wall, termites can build a tube between the wall and stucco and enter the home undetected. Termites can chew through the insulation if it is present below grade. Although the foam board does not provide nutrition, it does provide optimal nesting and tunneling conditions. Even if the termites are detected, liquid termiticides are difficult to apply in this situation because the foam insulation resists wetting.

4. Barriers — Barriers can be classified into two major categories: mechanical and chemical.

Mechanical barriers

Foundations — A poured, reinforced, crack-free, concrete foundation hinders the movement of termites. Termites can go through a crack as small as 1/32nd of an inch. Hollow-block or brick foundations should be capped with a minimum of 4 inches of reinforced concrete. Of all foundation types, slab-on-ground construction is most susceptible to termite attack. Termites can enter the wood by going over the edge of the slab, as well as through expansion joints, openings around plumbing and cracks. The monolithic slab is least likely to be penetrated by termites, the suspended slab is intermediate and the floating type slab is most easily penetrated.

Metal termite shields — A good metal shield placed on top of a foundation and piers is a good inspection tool because it will force termites to build tubes out in the open where they can be seen when inspections are made. Metal termite shields can aid in protection of the structure if properly designed, constructed, installed and maintained. However, good shield construction, installation and maintenance are rare. Metal shields should not be relied upon solely to protect a structure from termites. They should be used in conjunction with a conventional soil treatment or other methods described in this publication.

Particle-sized barriers — Termite researchers have found that particle-sized rocks of basalt (basaltic termite barrier) or granite may provide a physical barrier to termites. The rock is ground into a specific size, which is too big for the termite's mandibles to move and too small to allow movement between the grains. Sand barriers are used in Hawaii, although they can add thousands of dollars to the cost of the home. It may be difficult to prevent tree root intrusion and other disruptions to these types of barriers. We have no data on the effectiveness of these products in Tennessee.

Stainless steel mesh — Termi-Mesh™ (Termi-Mesh™ Australia Pty Ltd., Malaga, Australia) is a

marine grade stainless steel, wire mesh that is laid down as a barrier during the preconstruction phase to prevent termites from entering the structure. Pipes, posts, foundations and trenches are also fitted. These are currently undergoing evaluation in the United States.

Chemical barriers

Treated lumber — Chemically treated lumber should be used for the foundation plate, mudsill and all lumber used as partition framing and furring strips below ground. For maximum protection, the wood should be pressure treated with an approved preservative. Brushing, spraying or soaking the lumber with the chemical usually gives only limited protection.

Borates can be used as another barrier or layer of protection when applied to wood in contact with the foundation or support piers. Several borate formulations containing disodium octaborate tetrahydrate (Tim-bor® or Bora-Care®) are available to treat unfinished wood. In a six-year USDA study, termites did not successfully tunnel over floor joists treated with Bora-Care®. Therefore, in addition to a chemical soil barrier, a 2-foot band of Bora-Care® or other similar products applied to wood where the termites may enter the structure (box sills, above piers, etc.) could deter termites from tunneling over these wood pieces into the structure.

Soil termiticides - Treatment of the soil around and under the foundation with one of the EPA(Environmental Protection Agency)-approved soil termiticides is one of the best methods of preventing termite attack. Soil treatment should be used as a supplement to good construction, NOT as a substitute for it. Treatment is needed in four areas during construction:

1. Treatment of the entire soil surface under any area to be covered with concrete, including garage floors, entrance platforms and filled porches.
2. Treatment with additional amounts of chemical to the soil beneath those areas that lie adjacent to foundation walls, beneath interior walls, around sewer and utility openings and at other possible points of entry.
3. Treatment of footings and backfill against outside foundation walls and inside walled area where there is a crawl space.
4. Treatment of empty spaces or voids in concrete blocks or similar materials.

Insecticides - EPA requires a new termiticide to show five years of field effectiveness before the agency will register it as an insecticide for conventional soil treatment. Currently registered termiticides can be grouped as “repellent” or “non-repellent” termiticides. Repellent termiticides include bifenthrin, cypermethrin, fenvalerate and permethrin. The newer non-repellent insecticides include imidacloprid and fipronil. Chlorpyrifos appears to have an intermediate level of repellency. (Over the next four years, chlorpyrifos uses are being withdrawn from the market.) Imidacloprid disrupts the social behavior (grooming) of termites and renders them more susceptible to pathogens. Fipronil’s residual activity looks very promising. Subterranean termites have not penetrated through soil or damaged wood at any of the USDA testing sites, as of this writing, when the soil was treated with labeled rates of fipronil. The newer non-repellent termiticides have become popular because they are reported to kill large numbers of termites as well as protect the structure. Expect to see other “non-repellent” termiticides enter the market.

The termiticides recommended are for use by individuals/firms certified or licensed by the Tennessee Department of Agriculture to apply termiticide products. The pest control professional must read and follow specific instructions on the container label of the pesticide concentrate. The label will also provide directions for use, list the personal protective equipment required, as well as other information. If the consumer has a questions pertaining to the use of a pesticide, he or she may ask the pest control professional for a copy of

the label. Chemicals should not be applied to water-soaked or frozen soils, because the chemicals will not be distributed appropriately and the desired control may not be obtained. Do not treat when it is raining.

Application Methods — Preconstruction.

See Table 2 for amount of diluted termiticide to be applied to each area — horizontal areas, vertical areas and hollow voids.

Monolithic slab— After grading is complete and before the slab is poured, treat all vertical critical areas such as bath traps, plumbing and electrical entries, etc. A horizontal barrier should be created by applying a termiticide to the entire area where the slab will be poured. The treated soil must not be disturbed between the time of application and laying of a vapor barrier and concrete.

Treating the soil outside the foundation

Also apply termiticide as the backfill is being replaced. If this is not possible, treat the outside foundation soil after all grading is completed by digging a trench 6 inches wide and about 12 inches (a minimum of 6 inches) deep, but do not dig below the bottom of the footing. The trench should angle towards the foundation. Where the footing is less than 6 inches below the top of the grade, the trench should extend to the top of the footing. If the top of the footing is more

Table 2. The instructions below apply to diluted insecticides:

If you are applying to:	Apply this amount:
Horizontal areas to be covered by concrete (slabs, attached entryways, garages, carports, porches and terraces)	1 gal./10 sq. ft or 1 gal./ 10 sq. ft. if soil is porous or fill is coarse gravel
Vertical critical areas (around sewer, plumbing or utility openings).	4 gal./10 linear ft/foot of depth
Other vertical areas (backfill against foundations walls; support piers; inside foundation walls if crawlspace)	4 gal./10 linear ft/foot of depth to footing
Voids in foundation blocks (If preconstruction, apply before capping.)	2 gal./10 linear ft.
Heavy, clay-type soils are often found in Tennessee and may not hold the above described amount of diluted insecticide. Most manufacturers have amended their labels so the volume may be reduced, but there must be a corresponding increase in the concentration of insecticide so the same amount of active ingredient is applied to the same area of soil. The rates given above typically apply to the lowest concentration listed. Pest control professionals must not apply pesticide at a lower or higher concentration than listed on the label.	

than 12 inches below the surface, the soil must be trenched or trenched and rodded to a minimum of 4 feet, but not to exceed the footing. Professionals use a rodding tool inserted into the trench at 6-12 inch intervals, as close to the foundation as practical (within a few inches), and inject the termiticide as the rod is forced through the soil. When the soil is replaced in the trench, it must also be treated.

Suspended (supported) and floating slabs including basement homes —

Treat the soil in the bottom of the footing trenches prior to pouring the footings. If the footing has been poured already, treat voids in the masonry elements of the foundation wall. Trench or trench and rod to treat soil with a termiticide around the interior perimeter foundation and all other interior walls within the slab (Figure 13). After grading is complete and before the slab is poured, treat all vertical critical areas such as bath traps, plumbing and electrical lines. A horizontal barrier should be created by applying a termiticide to the entire area where the slab will be poured. The treated soil must not be disturbed between the time of application and laying of vapor barrier and concrete. Also apply termiticide as the backfill is being replaced against the outside foundation as described above in **Treating the soil outside the foundation**.

Crawl space — After the grading is complete, apply termiticide to the soil in the bottom of the footing trenches prior to pouring the footing for the foundations wall, pillars, piers, chimneys, etc. If footing is already poured, then treat the voids in the masonry foundation elements. Trench or trench and rod the soil along the interior walls and outside walls of the foundation as well as other vertical critical areas such as around pipes (Figure 14). See **Treating the soil outside the foundation** for trenching instructions.

Control in Existing Structures

Inspection — A thorough inspection should be conducted at least annually by a professional to detect possible termite activity such as mudtubes, swarmers' wings or live termites in an active infestation. To inspect for termites, wood (especially the plates, header joists, ends of floor

joists and any hardwood flooring) near the foundation or soil is probed with a screwdriver or similar instrument. The pest control professional may also use a boroscope. Damaged wood will be soft, channeled, unsound and may possibly reveal the termite infestation itself. Presence of earthen "shelter tubes" on foundation walls and wood is also evidence of infestation. Termites build the tubes from bits of soil, which they also use to close up breaks in the surface of infested wood. Professionals should also use a moisture meter to help detect the presence of termites. Termite activity will increase the moisture reading relative to uninfested areas. Occasionally, moisture-damaged wood in roofs can support an aerial infestation and no mud tubes may reach to the ground. Therefore, attic inspections can be very important too. If termite damage is found, do not be pressured into purchasing pest control services without doing your homework because there are many treatment options.

Termite control — post construction —

Subterranean termites typically nest in the soil, which provides the necessary source of moisture. They feed on cellulose, which is usually obtained from wood. The correct application of an appropriate insecticide creates a barrier between the termites in the soil and the wood in the house. Baiting options for controlling termites are discussed following these directions for termiticide use.

Conventional soil treatment

Slab-on-ground houses — The control of infestations occurring beneath concrete floor slabs on the ground is difficult and sometimes hazardous. This is another reason it should generally not be done by the homeowner. This is especially true where radiant heat is installed, because pipes are apt to be buried in the concrete and may be damaged when drilling holes in the floor through which an insecticide is poured to treat the soil below.

When pipes are not present in the slab, holes 1/2 inch in diameter usually are made in the slab. Holes are placed about 12 inches apart (no more than 24 inches) and 4-6 inches from the wall (Figure 15A). The insecticide is applied with a pump and pressure less than 25 psi through a hose and rod or sub-slab injector. Drilling holes in the slab may require pulling back carpet, moving furniture, etc., or drilling through wood flooring. Intact monolithic slabs do not usually need to be drilled near the exterior walls as described above. Treatment should also be made to breaks in

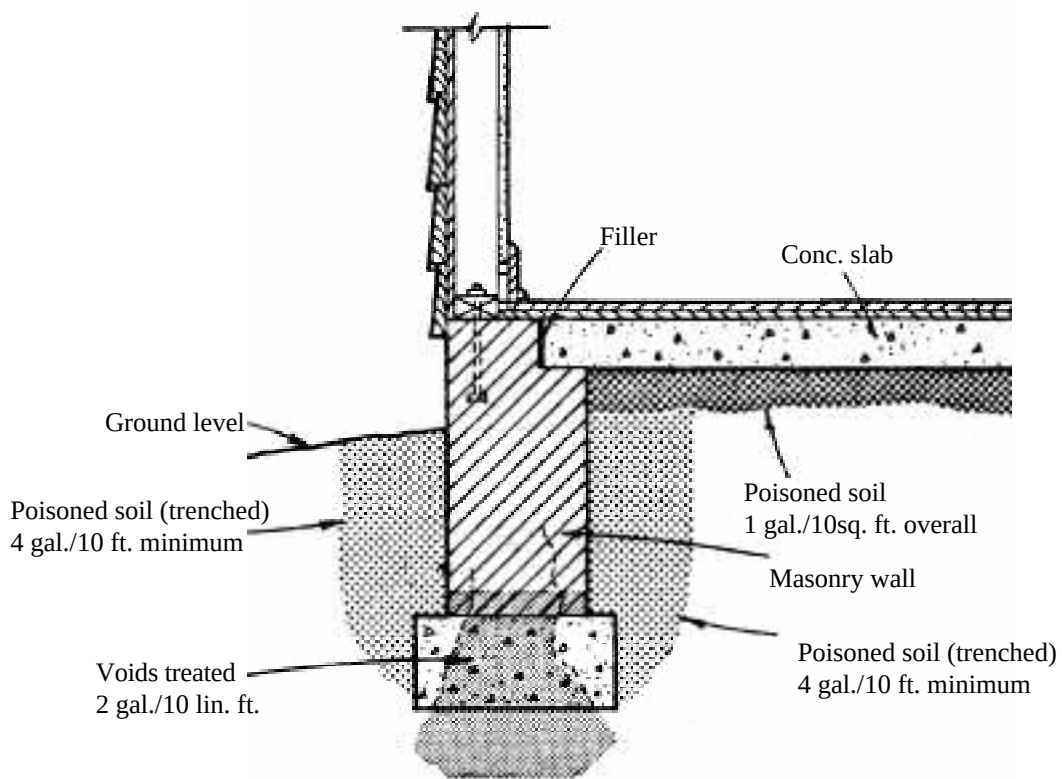


Figure 13. Application of termiticide to a supported slab foundation.

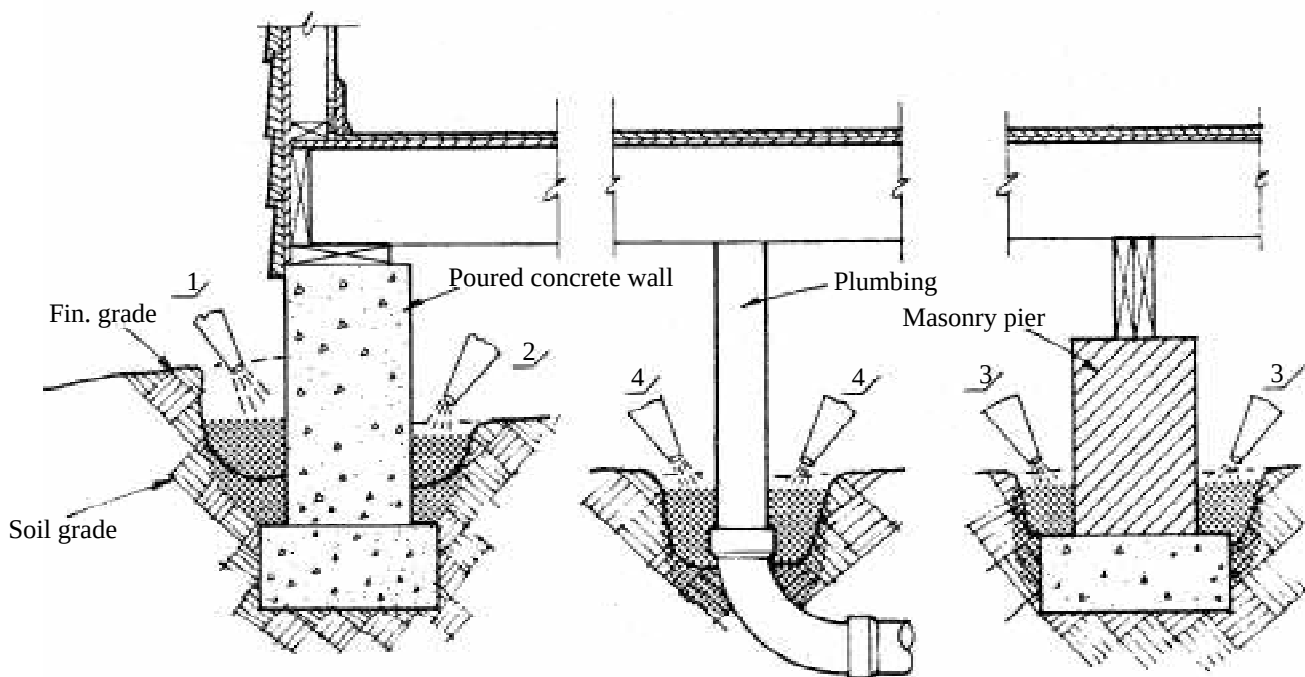


Figure 14. Application of termiticide to a crawl space foundation.

the slab including vertical critical areas such as expansion joints, bath traps, plumbing and electrical entries, and cracks often caused by settling. Construction elements such as sidewalks, patios, dirt/sand filled porches (Figure 15B), steps, and chimneys should also be drilled and termiticide injected adjacent to the foundation wall. After the treatment is finished, the holes are sealed with a non-cellulose plug.

Termiticide may also be applied as a foam to improve coverage. Foam disperses the termiticide laterally in the space between the slab and fill. Foam can also be used in wall voids of stone foundations, concrete block, behind brick veneer (Figure 15C) and other places including above-ground feeding sites.

An alternative method to drilling through the slab to treat near inside expansion joints consists of drilling the holes through the outside foundation walls so the chemical can be injected into the soil just below the slab and against the inner foundation wall. The holes are made about 6-12 inches apart and injected just a few inches beyond the inner foundation. This horizontal rodding allows the interior foundation wall, the hollow block foundation and possibly the brick veneer to be treated. Vertical drilling usually provides better coverage than horizontal drilling.

Along the exterior foundation wall, treat as described in **Treating the soil outside the foundation**. Drill and treat all voids of masonry elements extending from the structure to the soil.

Crawl space houses — Treat along interior and exterior foundation walls or around supporting piers of houses with crawl spaces, taking care not to go below the top of the footing. If the land slopes or if footing is deeper than the trench, less than 6 inches or at grade level, trench and treat as described in **Treating the soil outside the foundation**. Treat around other vertical critical areas such as pipes. Drill attached construction elements such as sidewalks, patios, dirt/sand filled porches, chimneys, slab foundations, etc. and inject termiticide adjacent to the foundation wall. All voids of masonry elements extending from the structure to the soil should be drilled and treated.

Basement houses — A basement is a special case of a floating slab. See **Slab-on-ground houses** for directions on drilling the slab near the inner foundation wall, attached slabs (patios, sidewalks, dirt/sand filled porches, steps and chimneys) and other vertical critical areas (expansion joints, bath

traps, plumbing and electrical entries, and cracks often caused by settling). Drill and treat all voids of masonry elements extending from the structure to the soil. Termites may come from beneath the concrete floor in the basement. If so, remove any wood that may extend into the ground, treat the soil and then seal cracks or holes with a dense cement mortar. In houses with full basements, it is necessary to treat the soil along the exterior foundation to a greater depth than is required for other types of houses. The trench is prepared in the same way, but termiticide is injected through the rod down to the top of the footing to aid in proper distribution of the chemical to all parts of the wall. This is especially important when masonry mortar joints are below grade and may be susceptible to termite attack. If the footing is deeper than 4 ft., industry standards allow rodding to a minimum of 4 ft.

Wood treatments

Wood can be treated after an infestation occurs as a supplement to a soil treatment, but should not be relied upon for sole control. Infested wood can be sprayed, brushed or injected into wood where termites have been detected. Small holes are drilled into suspected areas and termiticide injected at low pressure, often with an aerosol system. Wood can also be treated with a foam formulation.

More detailed explanations of termite treatments can be found in the National Pest Control Association's (Dunn Loring, VA 22027) 1998 publication of *Pest Management Library: Subterranean Termites*.

Termite baits

Termite baits use small amounts of insecticide to reduce populations of termites foraging in and around the structure. Some baits may even eradicate entire termite colonies. Termite baits include paper, cardboard or other termite food, combined with a slow-acting substance lethal to termites. If the bait kills too quickly, sick or dead termites may accumulate in the vicinity of the bait stations, increasing the chance of avoidance by other termites in the area. Delayed action also enhances transmission of the lethal agent to other termites, including those that never fed on the bait. Theoretically, entire colonies could be eliminated in this manner, although total colony elimination may not be necessary to afford structural protection. A comprehensive baiting program then seeks to maintain a termite-free condition on the customer's property.



A.



B.



C.

Figure 15. Drilling slabs in basements (A), porches (B) and brick veneer (C).

Monitoring, and rebaiting as needed, must continue after termites are no longer found in the baits because, in most cases, a traditional soil treatment was not applied to protect the structure. Regardless of which bait is used, the customer must be prepared and willing to accept the possibility of a lengthy baiting process and continued monitoring.

Some bait products are inserted below ground out in the yard, whereas others are installed above ground level on the inside of the structure. Baits are applied below ground by enticing termites to feed on wooden stakes, cardboard or some other cellulose-based material. The toxicant-laced bait can either be installed initially, or substituted after termites have

been detected in an untreated monitoring device. The more belowground baits installed, the better the chances of locating termites. Planning, patience and persistence are requisites for successfully using belowground termite baits.

Termite baits may also be installed aboveground in known areas of termite activity. Typically, the stations are installed directly in the path of active termite tunnels after the mud tubes have been broken.

The Sentricon™ System.

This method of termite baiting has been the most extensively tested of those currently on the market. The Sentricon Colony Elimination System™ was developed by DowElanco (now Dow AgroSciences, Indianapolis, IN; 800-888-5511 or <http://www.sentricon.com/>) and is sold only through authorized pest control firms. The RecruitII™ bait contains hexaflumuron, a slow-acting ingredient that disrupts the normal growth process in termites (i.e., termites die while attempting to molt). Termite control with the Sentricon System™ involves a three-step process: (1) initial monitoring to “pinpoint” termite activity, (2) delivery of the bait and (3) subsequent monitoring to provide on-going protection. Recruit AG™ is a termite bait for use as an aboveground delivery system for elimination of subterranean termite colonies. Recruit AG™ can only be used in conjunction with the Sentricon Colony Elimination System™ and is not available as a separate program.

Firstline™. Another termite bait is the FirstLine™ Termite Bait Station, manufactured by FMC Corporation (Princeton, NJ, 800-321-1FMC or <http://www.fmc-apgspec.com/firstlin.htm>). The product is intended for aboveground baiting of active termite tubes. The station includes a semi-transparent plastic housing (4x4x1inches) with open slots at the base. Contained within is corrugated cardboard treated with a slow-acting ingredient (sulfluramid) lethal to termites. Firstline™ GT™ (“GT” stands for ground treatment) was originally introduced for belowground use. The latest version is GTX™. Label directions emphasize placement of baits in areas where termite activity is known or suspected, i.e., installation may not involve insertion

of baits at fixed intervals around the entire perimeter of the building as is required with the Sentricon system. FMC suggests that homes be protected from termites using the six elements of the Systematic Termite ControlSM Program: (1) inspection, (2) moisture management, (3) food source management, (4) termiticide, (5) termiticide foam and (6) termite baits. Additional research and field experience with the product are needed to delineate effects against structural infestations.

TerminateTM is a termite bait product sold to homeowners over-the-counter in garden stores. The active ingredient is identical to the FirstLineTM product, but TerminateTM was developed completely independently of FMC and without FMC's knowledge or approval. The formulation was not tested by university researchers to determine how well it worked when applied according to label directions. On October 15, 1998 a complaint was filed in U.S. District Court in Baltimore, MD by nine attorneys general, the Federal Trade Commission and the District of Columbia, alleging that the company's claims about the product's use and effectiveness were deceptive and lacked adequate substantiation. The following is an excerpt from The Federal Trade Commission Press Release of March 18, 1999 on an United Industries Settlement (<http://www.ftc.gov/opa/1999/9903/termsetl.htm>):

As part of the settlement, United Industries will not make any claims about the effectiveness of *TERMINATE* unless it has reliable scientific evidence to support those claims. The company also will disclose in any advertisements or promotional material that claim that *TERMINATE* kills termites that the product is "Not recommended as sole protection against termites, and for active infestations, get a professional inspection." ...In addition, any consumer dissatisfied with Terminate may seek a refund within 15 months of the purchase. ...

ExterraTM Termite Interception and Baiting SystemTM is a new termite bait developed by Ensystex (888-EXTERRA or <http://www.exteris.com/>). Use of ExterraTM is a multi-step process. The first step is the placement of stations in the ground around the perimeter of the structure. The next step is inspection of the stations and baiting of active stations with LabyrinthTM (bait that contains the active ingredient). Reinspection of stations and replenishment of con-

sumed bait follows. When termite activity in the station is eliminated, the station is refurbished and the cycle of inspection and baiting begins again. The toxic bait in LabyrinthTM is diflubenzuron, a chitin synthesis inhibitor that causes termites to die while attempting to molt. The biggest advantage of ExterraTM is that stations can be monitored or refilled with bait without disturbing termites in the station.

Professionally-installed baits or barriers... which is better?

This is the most common question from homeowners trying to decide which form of treatment to purchase. The question is a difficult one, considering the industry's limited amount of experience with the new bait products. Liquid barrier treatments have been the standard method for controlling subterranean termites for decades. Performance failures and other problems have occurred with barrier treatments, but for the most part, these treatments have afforded adequate termite protection. Although baiting clearly has potential advantages (see below), the approach does not yet have as long a track record as barrier treatments on which to base its performance. Other factors to consider in the purchasing decision include:

Has the structure already been treated (unsuccessfully) using conventional methods?

Some structures have construction features that interfere with conventional soil treatment methods, e.g., wells, cisterns, plenums, subslab heating ducts, drainage systems, inaccessible crawl spaces, stone foundations, etc. Buildings with hard-to-treat construction or chronic re-treatment histories are logical candidates for termite baits. With baits, gaining access for treatment is seldom a problem since foraging termites are as likely to encounter belowground bait stations around the foundation exterior as beneath the structure.

Are you opposed to having your floors drilled, and furniture/stored items/carpeting moved?

Baiting requires fewer disruptions than does conventional barrier treatment. Installation and subsequent monitoring of bait stations generally does not even require the technician to come indoors. Noise, drill dust and similar disruptions associated with conventional treatment are avoided.

Are you strongly opposed to the use of pesticides around your home? Chemically-concerned homeowners may find the concept of baiting more attractive. With baits, the total amount of pesticide

applied is minute in comparison to the high number of gallons needed to achieve a thorough and effective soil-barrier treatment. In respect to contamination of wells, heat ducts, drainage systems, etc., baits are of negligible risk and can be used in the most sensitive treatment situations.

How much are you willing to spend for termite protection? Termite treatments are rather expensive. Along with the initial treatment fee, homeowners are advised to purchase a renewable service agreement in case the termites return. Depending upon the circumstances, a baiting program may end up costing more than a conventional treatment — the reason being that baiting programs require multiple visits to the property for ongoing monitoring of bait stations. This is especially true in respect to purchase of the renewable service agreement. Whereas conventional treatments typically entail a single annual follow-up inspection, baiting contracts may require three or more visits per year, for as long as the agreement is in effect. (Thus the annual renewal fee for baiting typically will be as much as two to three times higher than for conventional treatment). Homeowners should consider both the initial treatment price and renewal fee in making their purchasing decision.

Assuming my home will be baited, should I also request a supplemental barrier treatment? The need for supplemental soil treatment depends on the circumstances. Property owners with a serious termite problem, or those involved in a real estate transaction, may not want to wait two to six months (sometimes longer) for baits to suppress or eliminate the infestation. With comprehensive baiting programs such as Sentricon™ and Exterra™, liquid applications (when deemed necessary) are usually made as partial treatments to infested areas, rather than to the entire structure. Other bait products (e.g., FirstLine™) are more suited for spot-treatment of active tunnels, feeding galleries and localized areas in the soil. Such products are typically used in conjunction with more extensive barrier treatments.

Closing remarks on baits

The “art” and “science” of termite baiting are in an evolutionary state. The use of products in the Sentricon™, Exterra™ and FirstLine™ systems may have changed and more baits will have entered the market place since this publication was written. Ask for a current pesticide label for a product before it is

installed so you can understand the baiting system.

Many questions about baits are still without answers. One thing we do know is that the products will not perform by simply hammering a few baits into the ground and walking away. Success will require thoughtful installation and diligent monitoring by an experienced service technician, backed by a responsible pest control firm.

Choosing a Pest Control Company

One of the most important steps to obtaining control of a termite infestation is procuring the services of a trained and experienced pest control professional. Use the following items as a guide in selecting professional help:

- Ask for referrals from trusted acquaintances who were satisfied with their termite treatment. Call at least three of these pest control companies and ask for price quotes, the chemical to be used and how the company plans to treat your house.
- Ask for copies of the inspection letter and map. Keep these records.
- Read the contract carefully. Different options are available. Some companies will offer to re-treat if there is a failure, while others may provide a damage repair clause. Read both sides of a contract to understand what you are getting.
- An annual renewal fee for inspections is usually offered. It is usually a good idea to contract for this service.
- Study the bids, a description of the work to be done and details of any guarantees and then make your decision.
- Be wary of prices that seem too low. Highly specialized equipment and training is needed to control termites and a low bid may mean low quality.
- Call the Better Business Bureau to learn of complaints against a potential provider of services.
- In most cases, the materials to be used for termite control are only available to a certified applicator. The certified applicator should possess a certification card and a charter number should be present on a company's truck to indicate the Tennessee Department of Agriculture has licensed the owner.

This publication was modified from the following sources:

- Burgess, E. 1992. Pesticide Labels and Labeling. E&PP Note 300. The University of Tennessee Agricultural Extension Service
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Precautionary Statement

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label.

Disclaimer Statement

Pesticides recommended in this publication were registered for the prescribed uses when printed. Pesticide registrations are continuously being reviewed. Should registration of a recommended pesticide be canceled, it would no longer be recommended by The University of Tennessee.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others which may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product.

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