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PB1739-Managing Fire Ants in Urban Areas

The University of Tennessee Agricultural Extension Service

UT Extension
PB1739

Managing Fire Ants
in Urban Areas

THE UNIVERSITY of TENNESSEE

The red imported fire ant,
Solenopsis invicta Buren,
the black imported fire ant,
Solenopsis richteri Forel,
and their hybrid

are nuisance insects and their stings can cause serious medical problems. Imported fire ants interfere with outdoor activities and harm wildlife throughout the southern United States. Ant mounds are unsightly and may reduce land values. In some cases, imported fire ants are considered to be beneficial because they prey upon other arthropod pests. In urban areas, fire ants prey on flea larvae, chinch bugs, cockroach eggs, ticks and other pests. In many infested areas, the problems outweigh the benefits and controlling fire ants is highly desirable. However, eradication of these species is not currently feasible (see History of Control Efforts). When deciding whether or not to control fire ants, one must weigh the benefits of fire ant control against the cost and environmental impact of control methods. The biological control of fire ants may not be compatible with some types of insecticide use. Insecticides are not always 100 percent effective, nor are most approved for use everywhere that ants occur. Insecticides are also expensive and potentially hazardous to the environment and other animals. Chemicals provide only temporary control of fire ants and must be reapplied periodically. Where applicable, you should select programs (for urban or agricultural areas) that use a combination of non-chemical and chemical methods that are effective, economical and least harmful to the environment.

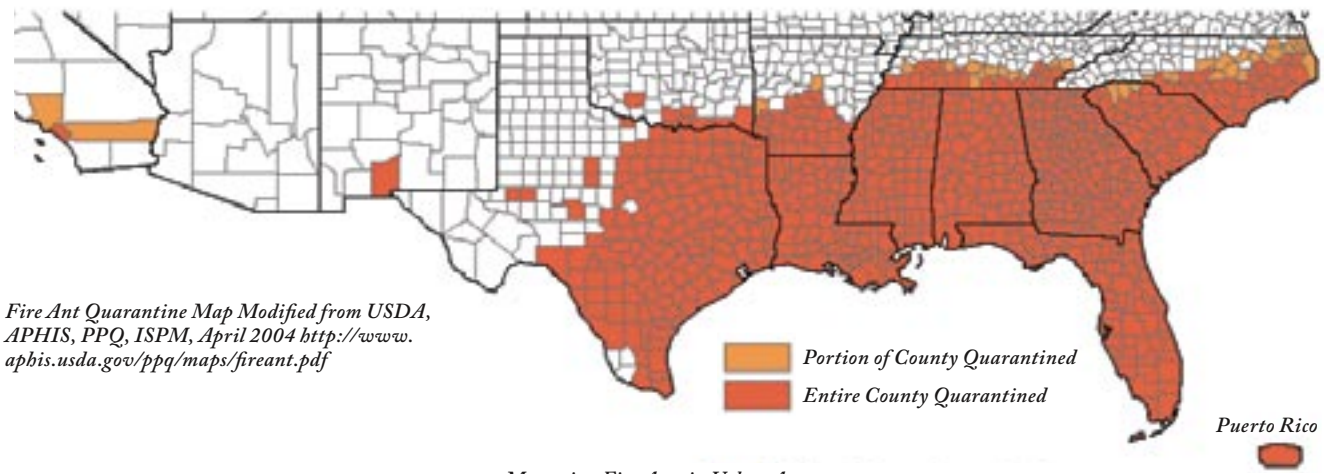
Integrated Pest Management (IPM)

Integrated Pest Management, or IPM, is a systems approach to managing insect, mite, disease and weed pests. It uses a combination of the most compatible and ecologically sound pest suppression tactics to keep pest populations below levels that cause problems. IPM uses cultural, biological and chemical methods. This bulletin describes site-specific, goal-oriented management programs for urban sites where fire ants occur. The goal of IPM is to prevent the problems caused by unacceptably large numbers of fire ants, rather than eliminating all ants from the ecosystem.

USDA Quarantine Program

Because fire ants are easily transported in nursery stock and soil, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA, APHIS) developed a quarantine program for this pest in the 1950s. The USDA Imported Fire Ant Quarantine program is administered by state regulatory agencies (e.g., Alabama Department of Agriculture and Industries, Arkansas State Plant Board, Georgia Department of Agriculture, Louisiana Department of Agriculture and Forestry, Oklahoma Department of Agriculture, Tennessee Department of Agriculture, Clemson University Department of Plant Industry, Texas Department of Agriculture). The purpose of the quarantine program is to minimize the spread of imported fire ants by requiring proper inspection and treatment of all nursery stock, turfgrass, hay and other articles shipped out of quarantined areas (see map). Inspectors also survey non-quarantined counties for fire ants and occasionally treat small, isolated infestations. The public should do its part to avoid spreading the ants by not transporting or not purchasing fire ant infested articles.

IMPORTED FIRE ANT QUARANTINE



Fire Ant Quarantine Map Modified from USDA, APHIS, PPQ, ISPM, April 2004 http://www.aphis.usda.gov/ppq/maps/fireant.pdf

Management Options

Properly identifying the ant species is the first step in determining whether and how to control them (see Fire Ant Biology and Identification). No management is an option that should be considered in areas where imported fire ants are not present or are present in very low numbers and do not pose a problem. Most management options require repeated treatments to maintain control, requiring a commitment to continued labor and expense. In the following sections are options for managing various kinds of imported fire ant problems. There may be other effective methods not mentioned. There is rarely a single best method of control.

Note: See Fire Ant Treatment Methods for information about biological control, home remedies, and insecticide products and their proper use. Use only pesticides labeled for the location or "site" you want to treat. For instance, DO NOT use a product in your vegetable garden unless that site is listed on the label.

Home lawns and other ornamental turf

Fire ants commonly infest lawns, school yards, athletic fields, golf courses and parks, where they pose a medical threat to people and animals. Their mounds also detract from the appearance of the landscape and can damage lawn care equipment.

Treatment options

Program 1. The "Two-Step Method": This program suppresses ants in ornamental turf and non-agricultural lands, including roadsides. It is also

THE TWO-STEP METHOD	
STEP 1.	Once or twice per year, usually in the spring and fall, broadcast a bait-formulated insecticide as directed on the label. Most conventional baits are applied at a rate of 1 to 1½ pounds of product per acre, although some products are applied at higher rates. Periodic broadcast applications of fire ant baits will suppress ants about 90 percent when properly applied. A bait can be broadcast with hand-held, vehicle-mounted or aerial applicators. The speed and duration of ant suppression differs with the product used. Indoxacarb bait, Advion™, may control colonies within 3 days. Hydramethylnon, fipronil and spinosad baits (see Table 1 for trade names) provide maximum control 2 to 4 weeks after application, while insect growth regulator (IGR) bait products (i.e., those containing fenoxycarb, methoprene or pyriproxyfen) provide maximum suppression 2 to 6 months after treatment depending on environmental conditions. Abamectin baits act more slowly than hydramethylnon, indoxacarb and spinosad but more quickly than IGR products. Using higher rates of an IGR bait does not eliminate colonies more quickly. A late summer application produces maximum suppression the following spring. The blending of half rates of a faster-acting bait (such as hydramethylnon) plus an insect growth regulator (methoprene) may provide fast and longer-lasting suppression, a suggested practice in Texas. A commercial product, Extinguish® Plus, contains a blend of methoprene and hydramethylnon baits. At least one hydramethylnon bait label has directions for blending with a methroprene bait. Where there are many mounds per acre (200 or more), a second application may be needed after the maximum effects of the first treatment have occurred, because not all mounds are affected by a single bait application.

THE TWO-STEP METHOD (CONT'D.)	
STEP 2.	Wait several days or more after applying the bait, and then treat nuisance ant colonies (such as those in sensitive or high traffic areas) using an individual mound treatment method (see Program 2, Step 1, below). Otherwise, be patient and wait for the bait treatment to work. Any nuisance mounds that escaped the effects of the bait treatment, or colonies migrating into treated areas, should be treated as needed. In large areas individual mound treatment may not be feasible and routine broadcast bait treatments alone may provide sufficient control. Repeat the bait application when ants reinvade the area and mound numbers reach about 20 to 30 per acre. Bait products do not protect against reinvasion by ant colonies from surrounding land or by newly mated queens. Ant populations can fully recover within 12 to 18 months of the last bait treatment. Low-lying, moist and flood-prone areas are more prone to re-infestation.

suitable for pasture and rangeland, provided that the products selected are specifically registered for use in these sites. It is best suited to medium-sized or large areas, and the cost is moderate. This approach is not suggested for previously untreated areas with large numbers of native competitor ants and few fire ant mounds (20 per acre or fewer). The goal of this program is to reduce fire ant problems while minimizing the need to treat individual mounds.

INDIVIDUAL MOUND TREATMENTS	
STEP 1.	Treat undesirable fire ant mounds using an individual mound treatment (see Table 1). Products are applied as dusts, granules, granules drenched with water after application, liquid drenches, baits or aerosol injections. Non-chemical methods such as drenching mounds with very hot water also may be used.
STEP 2.	Continue treating undesirable mounds that appear, as needed.

Program 2. Individual Mound Treatments: This approach is best used in small areas of ornamental turf (usually 1 acre or less) where there are fewer than 20 to 30 mounds per acre or where preservation of native ants is desired. This program selectively controls fire ants, but rapid re-invasion should be anticipated. It generally requires more labor and monitoring than other programs and is not suggested for heavily infested areas.

Program 3. The "Ant Elimination Method": This program eliminates nearly all ant species in treated areas. Its effects are more rapid than those of other programs, and it minimizes re-invasion of treated areas as long as the contact insecticide remains effective. However, it is more expensive, uses more insecticide and has greater environmental impact. This approach is frequently used by commercial applicators.

THE "ANT ELIMINATION" METHOD	
STEP 1.	(Optional). Broadcast a bait-formulated insecticide in areas where there are many mounds (more than 20 per acre), or individually treat fire ant mounds. Wait 2 to 3 days after applying a bait before conducting the next step.

STEP 2.	Apply a contact insecticide with long residual activity (i.e. fipronil, or a pyrethroid such as bifenthrin) to turfgrass periodically as directed (generally every 4 to 8 weeks for most products, or once per year using a granular fipronil product). Liquid or granular products that can be evenly applied to an area, and which are usually watered in after treatment, are appropriate for this use. With most products, initial surface treatment may not eliminate ants located deep in mounds, but routine re-application will eventually eliminate mounds. However, granular fipronil treatment may eliminate ant mounds within four weeks of treatment.

Program combinations: Any of the three programs can be used on specific sites within a managed area where different levels of fire ant control are desired. On golf courses, for instance, Program 3 might be suitable for high use areas such as putting greens and tee boxes. In fairways and rough areas, Program 1 may be sufficient. On athletic fields, fire ants must be eliminated, so Program 3 should be begun at least 6 to 8 weeks before athletic fields will be used. Program 1 can be employed to use less pesticide, provided treatments are initiated far enough in advance to allow for maximum control to be achieved with the bait product(s) selected. People with severe allergies to fire ant stings should use Program 3 for their lawns or consider using a bait on a calendar schedule.

For treating schools, daycares, playground areas and other child-sensitive sites, fire ant bait products provide one of the safer methods of control. In some states, special regulations may govern the selection and use of fire ant products on school grounds. In Texas, for example, all pesticide applications must be made by licensed applicators. Schools in Texas are further encouraged to use products that contain botanical-, microbial-derived- or insect growth-regulator-based insecticides because of their extra high margin of safety. Appropriate bait treatments for Texas schools include formulations containing abamectin, spinosad, fenoxycarb, pyriproxifen, or methoprene. Appropriate mound treatments for schools include botanical-based insecticides containing pyrethrins, d-limonene or other plant compounds, which are good first choices for mound treatments in such sensitive areas. For greatest safety, use only formulations that are washed immediately into the mound and leave minimal surface residues. Laws governing pesticide use in and around schools are changing each year. If in doubt about laws governing pesticide use around schools in your state, contact your state's lead agency for pesticide regulation. State by state summaries of pesticide laws can be found on the internet at http://schoolipm.tamu.edu.

Homes and buildings

Fire ants from colonies close to homes and other buildings sometimes forage indoors for food and moisture, particularly during the hot, dry, summer months. Entire colonies occasionally nest in wall voids or rafters or behind large appliances, sometimes moving into buildings during floods or drought. They are a nuisance and can threaten sleeping or bed-ridden individuals and pets.

TREATMENT OPTIONS	
1.	If ants are entering or could enter the home from outdoor colonies, treat mounds near the building using one of the programs described for Home Lawns and Other Ornamental Turf Areas. A contact insecticide with a long residual effect, such as a pyrethroid, also can be applied as an outside barrier (10 to 15 feet wide) around the base of the home. Caulking cracks and crevices and keeping plants and branches from touching buildings also may help prevent ants from entering.

2.	If fire ants are foraging indoors and do not pose an immediate threat to residents or pets, use a bait labeled for use indoors. Examples are baits containing abamectin (Ascend®), hydramethylnon (MaxForce® Granular Insect Bait or Fire Ant Killer Bait), or bait stations containing hydramethylnon (MaxForce®, Combat®) or sulfluramid (Raid® Ant Baits Plus). Fire ant baits eliminate the colony slowly. Bait products not specifically registered for imported fire ant control may or may not control them.
3.	Follow trails of foraging ants to colonies located indoors and treat them with contact insecticide dusts or sprays (containing pyrethroids and others) injected into the nest. Treating only ant trails with a fast-acting spray will not eliminate the entire colony and interferes with the use of baits.
4.	Vacuum indoor ant trails and dispose of the vacuum bag immediately. Treat the source colony or entry site of the trail using the options above.

Electrical equipment and utility housings

Fire ants frequently infest electrical equipment. They chew on insulation and can cause short circuits or interfere with switching mechanisms. Air conditioners, traffic signal boxes and other devices can be damaged. Fire ants also nest in housings around electrical and utility units. The ants move soil into these structures, which causes corrosion, shorting and other mechanical problems.

Note: For safety reasons, an electrician or a licensed pest control operator should treat infested electrical equipment. Specialized products and training are necessary to treat these sites safely and effectively.

TREATMENT PROGRAM	
STEP 1.	Turn off all electrical service before starting. Use an individual mound treatment method to eliminate colonies around electrical and plumbing casings and housings. Injectable aerosol products containing pyrethrins, or similar products, give rapid control. Indoxacarb, hydramethylnon, abamectin or spinosad baits applied to individual fire ant mounds will control colonies in about 1 week, even if a colony is located within the structure. Do not use liquid drenches, sprays or products that may damage insulation around electrical fixtures. Treating a larger area around the electrical structure is optional. Mound and area treatments are described in the section on Home Lawns and Other Ornamental Turf Areas. Be extremely careful when applying pesticide around water systems and well heads to prevent contamination of wells and ground water. Once ants are eliminated, remove debris and soil from the equipment housings to reduce the possibility of short circuits.
STEP 2.	Treat the inside of equipment housings with products labeled for this use, such as Rainbow® Fire Ant & Insect Killer (chlorpyrifos), Ascend® (abamectin), or Hot Shot® No-Pest Strip , Spectracide® Bug Stop Pest Strip (dichlorvos).

Maintenance

After ants are removed from the electrical equipment, prevent reinfestation and damage. Where possible, seal all sensitive electrical components, particularly those that are not insulated. Examples are plastic housings containing contact points of switches, relays and circuit breakers.

Spray long-residual contact insecticides around housings, making sure to avoid the electrical circuitry or components. Apply specifically labeled products to the housing itself or to the mounting pad (see Step 2 in the treatment program above).

Home gardens

Ants occasionally feed on vegetable plants in home gardens. They tunnel into potatoes underground and feed on okra buds and developing pods. The worst damage usually occurs during hot, dry weather. Ants may be a nuisance to gardeners during weeding and harvesting. Ants prey on some garden pests such as caterpillars, but protect or "tend" others, such as aphids, by keeping natural enemies away.

TREATMENT OPTIONS	
1.	Ant mounds can be shoveled out of the garden or treated with very hot water, taking care not to disturb plants or allow hot water to contact them. Care should be taken by the applicator to prevent skin burns from the steam and hot water.
2.	Only a few products (those containing carbaryl, pyrethrins, pyrethrins plus diatomaceous earth or rotenone) have been registered for treating ants in vegetable gardens.
3.	Granular products containing carbaryl (Sevin®) or carbaryl plus metaldehyde, and cyfluthrin have been registered for "ants" foraging in the garden. Follow all preharvest intervals indicated on the label when using a pesticide on and around food plants.
4.	The bait product Extinguish®, which contains methoprene, is now registered for use in "cropland." Bait products, however, are not specifically registered for use inside home vegetable gardens, though they can be applied outside the garden's perimeter. Foraging ants from colonies both inside and outside the garden will collect the bait and take it to their colonies.
5.	To keep ants from entering a garden, manage them properly in the surrounding landscape. Products registered for controlling ants in turfgrass can be applied outside the perimeter of the garden as a barrier or used to treat individual mounds near the garden.

Compost piles, mulched flower beds, pavement cracks, etc.

Fire ants invade compost piles and mulched flower beds seeking warmth and moisture. They also nest under cracked pavement, removing dirt from underneath sidewalks and roadways and aggravating structural problems. Colonies in these sites may be difficult to locate precisely. When the exact location of a fire ant colony is unknown, treat the area of greatest ant activity with a fast-acting bait product containing indoxacarb, hydramethylnon, abamectin or spinosad.

Around bodies of water

Fire ants require water to survive and are often found near creeks, run-off ditches, streams, rivers, ponds, lakes and other bodies of water. If surface water is unavailable, they tunnel down to the water table many feet below the ground. Every effort must be made to avoid contaminating water with pesticides. Fire ant bait products contain very small amounts of active ingredients and can be applied close to shorelines but not directly to the water. To decrease the risk of runoff into waterways, apply baits when ants are actively foraging. Near water or in drainage or flood-prone areas, individual mound treatments should be made with care, using products such as acephate (Orthene®) that have low toxicity to fish. Pyrethrins and rotenone products should not be used because they are highly toxic to fish. Do not apply surface, bait or individual mound treatments if rain is likely to occur soon after treatment.

Organizing a Community-Wide Fire Ant Suppression Program

Fire ant management programs can be successful, but because they are usually implemented by individual landowners and managers, reinfestation from nearby untreated areas generally occurs. Many of the baits on the market today came from efforts to develop products suitable for area-wide treatment programs, and are best suited for large-scale use.

Despite great public concern, neither the state nor federal government is currently planning on funding any large-scale fire ant treatment programs. It is up to local organizations to decide on the best IPM strategy for a particular situation. With the help of experts in the field and county Extension agents, any group can organize an effective fire ant suppression program.

The Two-Step Method (Program 1) for Home Lawns and Other Ornamental Turf Areas is often the method best suited for community-wide treatment. Homeowners and land managers may still need to treat a few mounds (step 2) between large-scale bait treatments, but they will need to treat far fewer than if no bait had been applied. In other areas, where ant surveys have documented that there are few imported fire ants and many competitor ant species, Program 2, or program combinations, may be more suitable.

Matching the program to your resources and needs

Basic education is critical. If you treat and your neighbor does not, you will find your yard is quickly re-infested. If you educate your neighbors, you can coordinate your battle against the imported fire ant more effectively and efficiently. Developing leadership in some neighborhoods may be difficult but is not an insurmountable problem. Many states have agencies that can help in organizing communities, be it a neighborhood watch program or a fire ant management program. There are many ways people can work together to conduct community-wide fire ant suppression programs.

Coordinating neighborhood treatment

Homeowners can coordinate treatment of their entire neighborhood each year, usually once in the fall and once in the spring. Each homeowner should receive instructions on:

1) appropriate fire ant bait products to purchase;

2) how to properly broadcast a bait; and

3) treatment date(s).

Each homeowner is expected to make his own applications or arrange for treatment on the designated treatment date(s). Contingency dates should be scheduled in case rain is forecast or the temperature is less than 65 or greater than 90 degrees F on the primary treatment date. Volunteers can be enlisted to treat common areas, vacant lots and yards of homeowners who are unable to make applications themselves.

Working through homeowner associations

Homeowner associations might contract with a local commercial applicator to broadcast fire ant bait over the entire subdivision periodically, including common areas and medians. The contractor should be asked to evaluate the area and re-treat areas as needed.

Working through city and county government

Some states have legislation or other laws in place that could aid your community in organizing treatment programs, (e.g., fire ant abatement

legislation in Arkansas, or public health laws in many states). With enough citizen support, local governments can establish fire ant control programs that treat public areas and perhaps allow homeowners to have their properties treated for a fee. The municipal or county government could contract with a commercial pest control applicator. Advertising should encourage entire blocks or neighborhoods to sign up, because the larger the area treated, the longer lasting the control. Treatments would include annual broadcast applications of a fire ant bait, follow-up checks, and possibly individual mound treatments as needed. The fee paid by individual landowners could pay for the program.

A city government might help coordinate the aerial application of a fire ant bait to an entire town. Areas where baits must not be applied, such as swimming pools and vegetable gardens, would have to be covered during application. Widespread citizen support would be essential. The aerial applicators contracted by the city would have to agree to modify equipment to apply the recommended amount of bait per acre, heed the FAA flying height over populated areas, and avoid bodies of water and agricultural areas where food is produced. Make sure the product(s) used is registered for application to the sites treated. Many volunteers would be needed to successfully coordinate and implement this program.

Planning to ensure success

Determine treatment areas. Some localized areas, even within heavily infested regions, have little or no imported fire ant infestation. Surveys should be conducted to determine if the number of imported fire ant mounds is high enough to justify treatment, or what type of treatment is necessary.

Respect individual differences. Sensitivity to fire ants and to the use of insecticides varies dramatically from person to person. Some individuals might not want to participate in a control program because they believe fire ants are not a problem and serve useful purposes or because they are opposed to using insecticides, natural or otherwise, on their property. At the other extreme are people who want no fire ants on their property and don't care about the methods used to achieve that goal. Participation in an area-wide program should be voluntary or decided upon through a democratic process.

Promote education and recognize limitations. The strengths and limitations of the program should be acknowledged. For instance, a broadcast bait will eliminate most (usually 90 to 95 percent) of the fire ant mounds in an area temporarily (6 to 18 months). It will not eradicate them permanently. The speed at which suppression will occur is rather slow. Periodic, coordinated re-application will be necessary to maintain control. Between broadcast treatments, some individual colonies may require individual mound treatment. Properties that border untreated areas such as agricultural lands, water edges, flood plains and wilderness will likely be reinfested unless the borders of these areas are treated to form a barrier or buffer zone.

Follow pesticide laws and regulations. In each state there is an agency that regulates the commercial application of pesticides (e.g., Tennessee Dept. of Agriculture). Although you can apply insecticides on your own property, you cannot treat other yards in the neighborhood for a fee without pesticide certification. State laws mandate that anyone applying insecticides for a fee be certified and under the supervision of a licensed operator. In some states, there are special regulations governing the use of pesticides to treat public school grounds.

Read and retain the insecticide product label. Those who use insecticides must keep the label with the product. Never purchase a large quantity of insecticide and repackage, divide or store it in a container without the label. Always follow the directions on the product label.

Take bids and review credentials. Before contracting with a commercial applicator company or private pest control operator, get several bids based on the specific services you require. These firms must be licensed by the appropriate state agency.

Fire Ant Treatment Methods

Treatment methods and products vary greatly in effectiveness, speed of activity, practicality (labor requirements), toxicity to the user and the environment, compatibility with other options, and cost. Carefully study available treatment methods and their proper use in order to choose the best one for a particular situation. Many methods and products have been evaluated. Information is available from county Extension agents and Extension entomologists. Individual mound treatment cost ranges from about $0.15 to more than $1.00 per mound, and bait treatments can cost $8.00 per acre or more.

Natural and biological control

Newly mated fire ant queens, which can start new colonies, are killed by a number of organisms. These include birds, lizards, spiders, toads, dragonflies, robber flies, other ant species and fire ants from surrounding colonies. Animals that eat ants such as armadillos may disturb mounds to eat some workers, but they are not really useful in control.

The microorganism, *Thelohania solenopsae*, and parasitic phorid flies, *Pseudacteon spp.*, also known as decapitating flies, have been introduced in Tennessee as biological control agents for imported fire ants. *Thelohania* has been most successful in areas of the southern United States where multiple-queen fire ant colonies occur. Our lack of multiple-queen fire ant colonies in Tennessee may explain its failure to establish here. In 2004, *Pseudacteon curvatus* was found in over 20 Tennessee counties. Not only do parasitized ants loose their heads and die, but the fly also disrupts the foraging of other workers. This may weaken the colony from diminished food returns. For up-to-date information on the use of these biological control organisms see The USDA Area-Wide Fire Ant Suppression Program web site (http://fireant.ifas.ufl.edu) or the UT Fire Ants in Tennessee web site at http://fireants.utk.edu.

Another biological control for fire ants is the preservation of native and exotic ant species that compete with them for food and nesting sites, attack small fire ant colonies or kill newly-mated queen ants. One way to preserve native ants is the judicious use of insecticides.

Physical and mechanical methods

Pouring very hot or boiling water on a mound is a fairly effective treatment, particularly at times when ants are close to the mound surface, such as on a cool, sunny morning in the warmer seasons. Approximately 3 gallons of very hot (almost boiling) water poured on each mound will eliminate about 60 percent of the mounds treated. Be careful handling large volumes of hot water to prevent serious burns, and keep hot water off of desired plants and grass.

Sometimes it may be sufficient to move colonies away from sensitive areas such as gardens. Disturbing or knocking down mounds frequently will cause colonies to move. Some people believe shoveling one mound on top of another will force ants to kill each other, but this is not true.

Certain barriers can keep ants out of sensitive areas such as duck nesting boxes or greenhouse benches. Talcum powder and Teflon®-like tape or spray products can be used on vertical surfaces, but these treatments lose their effectiveness in humid or damp conditions. Tanglefoot®, a petroleum-based sticky material available as a gel or aerosol, is effective temporarily until it becomes coated with dust and other debris. Plates or wires heated to about 140 degrees F form a hot barrier that ants will not cross.

Control devices

Various mechanical and electrical products have been marketed for fire ant control. One device is designed to electrocute fire ant workers as they climb onto an electric grid inserted into the mound. It will kill many worker ants, but the queens and brood are unaffected. There have been vibrating and sound-producing units designed to repel colonies and devices that use microwaves or explosive elements to heat mounds or blow them up. Such products are often marketed without scientific evaluation. The fact that a "control" device is on the market does not indicate that it is effective. These products may kill some ants but rarely eliminate a colony. Deceptive or fraudulent claims concerning fire ant control devices should be reported to the state's Attorney General or the Federal Trade Commission.

Home remedies

In addition to very hot or boiling water, other "home remedies" have been tried. While these methods sometimes appear to work, they rarely eliminate colonies. Usually, the ant colony simply moves to a new location because of the disturbance, or the queen and a few workers temporarily remain hidden underground.

Gasoline and other petroleum products do kill some fire ant colonies. However, petroleum products are dangerously flammable or explosive, kill grass and plants around the treated mounds, and can seriously pollute the soil and ground water. Use of petroleum products, solvents, battery acids, bleaches or ammonia products can be dangerous and is strongly discouraged, except when they are ingredients in a registered pesticide product accompanied by usage directions.

Soap solutions, cleaning products or wood ashes soaked into the mound are believed to remove the protective wax coating from the ants or suffocate them. Generally, their use is discouraged because they have not been proven effective or this use is not supported by the product(s) manufacturer. Recently, some recipes for solutions containing citrus oil and other ingredients have been shown to hold promise as a mound drench treatment. Citrus oil, containing a natural extract of citrus peels, d-limonene, is toxic to fire ants.

Sprinkling grits or other solid food substances onto fire ant mounds is ineffective. In theory, the ants eat the grits, which then swell and rupture the ants' stomachs. In fact, only the last larval stage of the fire ant is known to digest solid food. All adults feed only on liquids or greasy materials.

"Organic" insecticides

Any chemical product sold with a claim that it kills fire ants must be registered by the Environmental Protection Agency (EPA) or approved by the appropriate state regulatory agency. Several products said to be "organic" (of natural origin) are currently marketed for fire ant control (see Table 1 for naturally produced metabolite and botanical products). All of these products are registered by the EPA as pesticides and some are very effective. However, they are not necessarily safer than other insecticides and should be used with care.

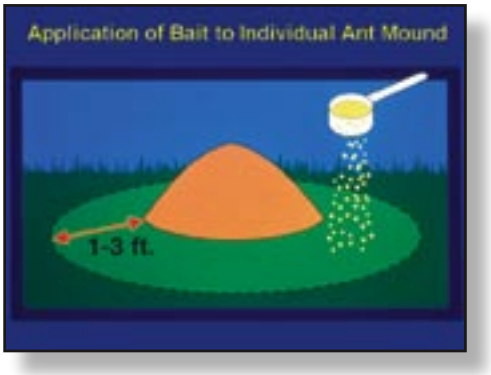
For more information on using organic insecticides see "Organic Two-Step Method for Imported Fire Ant Control" (http://fireant.tamu.edu/materials/factsheets/039_revfinal.pdf).

Chemical control

Pesticides are products designed to kill target organisms. An insecticide is a pesticide formulated to kill insects. Using chemical insecticides (both "organic" and synthetic) continue to be the main method of battling fire ants. Insecticides registered by the EPA are considered to pose minimal risk to the user and the environment when used as directed. Insecticide applications can be aimed at the foraging ants and/or at the entire colony. Table 1 lists fire ant insecticides by generic names of active ingredients.

Carefully follow directions on the product label for the proper method of application, the use of protective clothing, re-entry intervals and watering practices before and after treatment.

Baits



Most conventional bait formulations combine pesticide ingredients with soybean oil, which is absorbed onto processed corn grit. Soybean oil is an attractive food for ants that is important to the success of the bait. Because these baits are granular in texture, be careful not to confuse them with granular products that contain contact insecticides (see Table 1). Fire ant baits should have the word "BAIT" clearly listed on the label. Baits can be applied as spot treatments to individual mounds or broadcast over larger areas. To achieve satisfactory results:

The availability of bait products is a problem, especially in areas recently invaded by the fire ant. If you cannot find some of the products mentioned in this publication, contact the store manager, visit your local co-op or contact your county Extension agent to determine if the product is available in your area. Sometimes many of the bait products are sold only through specialty stores such as lawn and garden supply stores or pesticide wholesalers that sell professional products.

1.	Use fresh bait, preferably from a just opened container or one which has been tightly resealed and stored for no more than 2 years. Purchase only enough bait to make one treatment and do not store large quantities once the containers have been opened. Bait is collected by ants only when it is fresh. It is then carried back to the colony and shared with other members of the colony. Rancid or stale bait is ignored by foraging ants. To check the quality of your bait, place a little near an ant mound to see if ants are attracted to it, as described below. Rancid bait also often has a pungent, "latex paint" odor.
2.	Apply when worker ants are actively foraging. This can also be determined by leaving a small pile, e.g., 1 to 2 tablespoons, of bait in the area to be treated. When ants are seen actively removing the bait 10 to 30 minutes later, you will know that the bait is attractive to ants and that ants are foraging. You can also use tuna fish, pet food or potato chips to see if ants are foraging. Foraging activity slows when soil temperature is lower than 65 to 70 degrees F or higher than 90 degrees F. In mid-summer, apply bait in late afternoon or early evening, because foraging ants are less active during the heat of the day.
3.	Apply baits when the ground and grass are dry and no rain is expected.
4.	Do not mix bait with other materials such as fertilizer or seed.
5.	Use appropriate application equipment and calibrate it properly. Differences in the oiliness of bait brands and production batches can cause variations in applicator output. Temperature and humidity also affect the rate at which bait flows through the applicator opening. The speed at which the applicator is moving is an important factor, particularly with factory-calibrated settings. Over-application provides little or no increase in control and adds greatly to the cost. Under-application may decrease effectiveness.

Hand-operated spreaders such as the EarthWay® Ev-N-Spred and Scott's® HandyGreen® are ideal for treating small areas with fire ant baits. The operator can walk or ride on the back of a vehicle. Some push-type applicators, such as Spyker® Models 24 and 44, also may be suitable, but some modification (attach fire ant plate) is required to keep from applying too much material. Most rotary and drop-type fertilizer spreaders will not apply fire ant baits at the recommended rate.

Electric spreaders such as the Herd® Model GT-77A or similar applicators are best for treating large areas. These spreaders have vibrating opening plates that prevent clogging. Swath width is either pre-set or adjustable with a rheostat. Applicators can be mounted on any vehicle that will maintain a low speed. Do not use ground-driven or power take off-driven equipment, because it can rarely be set to apply such a low rate. Aerial application requires some modifications to the aircraft and application equipment. A description of these relatively simple modifications and calibration methods can be obtained from bait product manufacturers.

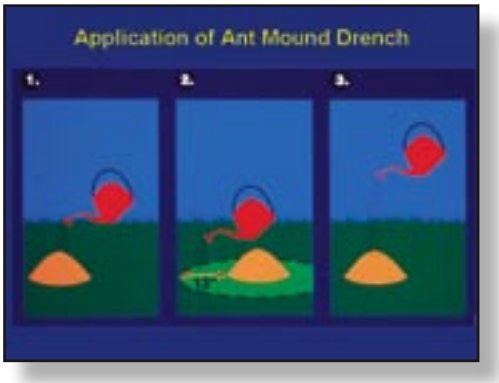
In addition to their use as a broadcast treatment, baits can be used for an individual mound treatment or spot treatment. Compared to other mound treatment products, baits cause less hazard to the environment and less mound relocation. Several bait products (hydramethylnon, sulfluramid) are available in bait stations that you place where ants are foraging (indoors or outdoors). Bait products containing indoxacarb, hydramethylnon, abamectin or spinosad used to treat individual ant colonies work faster than when broadcast-applied. This is, however, not the case with insect growth regulator (IGR) baits containing fenoxycarb, methoprene or pyriproxyfen. Apply bait products as directed on the product label.

Individual mound treatments with contact insecticides

In addition to baits, mound treatment insecticides are formulated as dusts, liquids, granules and aerosols. Their effectiveness depends on proper application. Contact insecticides must contact ants to work and should be applied during times of the year (and times of the day) when ants are close to the mound surface. It is also important not to disturb the mound during treatment if this is stated on the product label. Individual mound treatment selectively eliminates only the ant colonies treated and preserves desirable competitor ant species.

Mound drenches

Some insecticides to be used as drenches are ready-to-use, while others are formulated as liquid concentrates that must be diluted in the amount of water specified on the label. Avoid skin contact with the concentrate or mixture. Mix the proper amount in a gallon container, such as a sprinkling can, plainly marked "POISON." Do not use the container for any other purpose. Properly store or discard containers after use. Pour the solution on top of and around an undisturbed mound. Most mound drenches require a day or two to eliminate the colony, although those containing pyrethrins and d-limonene are effective almost immediately.



Granular products

To treat a single mound with a granular product, measure the recommended amount in a measuring cup and sprinkle it on top of and around the mound. Do not disturb the mound. If the label specifies to water in the insecticide, use a sprinkling can and water the mound gently to avoid disturbing the colony. Several days may pass before the entire colony is eliminated.

Dusts

Some products, such as those containing acephate (Orthene®) or pyrethroid insecticides (some products containing cyfluthrin, deltamethrin, or permethrin), are specially labeled for dusting individual fire ant mounds. Distribute the recommended amount of the powder evenly over the mound. Treatments work best when ants are near the top of the undisturbed mound. Treated colonies are usually eliminated in several days.

Injectable Products

Products containing pyrethrins, resmethrin, or tetramethrin are manufactured in special aerosol containers to which an injection rod is attached. The rod is inserted into the mound in a number of places, according to instructions on the product label, and the pesticide is injected for a specified time into each mound.

Surface applications and barriers in and around structures

Products used to treat ant trails and colonies in wall voids are usually dusts or sprays, although some are mixtures of insecticide and latex paint. Unless the colony itself is treated, these products only reduce the number of foraging worker ants. Surface treatments are also used to create barriers to protect items or areas from foraging worker ants.

Surface applications outdoors

Granular insecticides are applied with fertilizer spreaders. These materials must be thoroughly watered into the soil after application. Liquid formulations are often applied with a high-volume hydraulic, hose-end or boom sprayer. Some contact insecticides are relatively long-acting (weeks to months), suppress foraging ants quickly and prevent small mounds from becoming established. Through repeated use, these treatments can eliminate colonies. When applied as directed, granular products containing fipronil provide a slow elimination of fire ant colonies, requiring about four weeks to provide control. A single treatment will continue to eliminate ant colonies for about one year. However, the treatment is non-repellent to ants, and new colonies migrating into treatment areas can survive temporarily.

Fire Ant Biology and Identification

Properly identifying the ant species is the first step in determining the need for control. Most homeowners recognize imported fire ants by the mounds they build or the sting the ants inflict. However, there are other characteristics for which to look. Their aggressive nature relative to other ant species is one such trait. Generally, hundreds of fire ant workers will swarm out of the ant mound when disturbed and run up vertical surfaces to sting. If you are unsure of the ant species you have, contact your county Extension office for assistance with proper identification.

The red imported fire ant (RIFA), *Solenopsis invicta* Buren, the black imported fire ant (BIFA), *Solenopsis richteri* Forel, and their hybrid (HIFA) all share common characteristics such as a ten-segmented antenna with a two-segmented club and a two-segmented waist. The red has a dark gaster and the rest of its body is a lighter red. The black is darker at the end and has a golden patch at the top of the gaster defined by distinct dark outlines. For the hybrid, the light patch on the gaster still exists, but the lines defining it are hazy and indistinct. See University of Tennessee Extension SP 624 or http://fireants.utk.edu for images of the fire ant types, and other ants and their mounds that are commonly encountered or confused with fire ants.

Fire ants are social insects and unlike many insect pests, they are very organized. Imported fire ant colonies consist of the brood and several types (castes) of adults. The whitish objects often found at the tops of the mounds are actually the ant's developmental stages—the eggs, larvae and pupae. Types of adults are:

1.	winged males (distinguished from the females by their smaller heads),
2.	red-brown (RIFA) or black/dark brown (BIFA and HIFA) winged females,
3.	one or more queens (wingless, mated females), and
4.	workers.

Worker ants are wingless, sterile females. They protect the queen by moving the queen from danger, defending the nest from intruders, and feeding the queen only food that the workers or larvae have eaten first. They also forage and care for the developing brood.

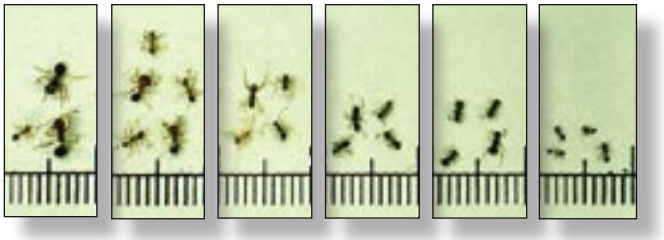
The winged forms, or reproductives, live in the mound until their mating flight, which usually occurs in the late morning/early afternoon soon after a rainy period. Mating flights are most common in spring and fall. Males die soon after mating, while the fertilized queen lands and walks around to find a suitable nesting site, sheds her wings and begins digging a chamber in which to start a new colony. Sometimes several queens can be found within a single nesting site.

A newly mated queen lays about a dozen eggs. When they hatch 7 to 10 days later, the larvae are fed by the queen. These larvae will develop into small worker

ants that will feed the queen and her subsequent offspring. Later on, a queen fed by worker ants can lay from 800 to 1,000 eggs per day if needed. Larvae develop in 6 to 10 days and then pupate. Adults emerge 9 to 15 days later. The average colony contains 100,000 to 500,000 workers and up to several hundred winged forms and queens. Queen ants can live 7 years or more, while worker ants generally live about 5 weeks, although large workers can survive much longer.

There are two kinds of imported fire ant colonies—the single-queen and multiple-queen forms. Workers with a single queen are territorial. Workers from multiple-queen colonies move freely from one mound to another, which has resulted in a dramatic increase in the number of mounds per acre. Areas infested with single-queen colonies contain 40 to 150 mounds/acre (rarely more than 7 million ants/acre). In areas with multiple queens, there may be greater than 200 mounds and 40 million ants/acre.

Imported fire ants build mounds in almost any type of soil, but prefer open, sunny areas such as pastures, parks, lawns, meadows and cultivated fields. Mounds can reach 18 to 24 inches in height, depending on the type of soil. Often mounds are located in rotting logs and around stumps and trees. Colonies also can occur in or under buildings. Colonies frequently migrate from one site to another and can build a new mound several hundred feet away from the previous location almost overnight. A queen needs only half a dozen workers to start a new colony and can build a new mound several hundred feet away from the previous location almost overnight. Flooding causes colonies to leave their mounds and float until they can reach land and establish a new mound. Colonies also can migrate indoors.



Imported fire ants | Big-headed ants | Crazy ants | Argentine ants | Forelius ants | Little black ants

Little black ants attacking fire ant queen

Little black ant nest

Forelius ant nest

Forelius ant

Medical Problems

Fire ants are aggressive and will defensively attack anything that disturbs them. Fire ants can sting repeatedly. Symptoms of a fire ant sting include burning, itching and a white pustule that forms a day or two afterward. Often people note a circular pattern of pustules, which may be caused by one ant stinging several times. Although the stings are not usually life threatening, they are easily infected if the skin is broken and may leave permanent scars.

If the only symptoms are pain and the development of pustules, stings can be treated with over-the-counter products that relieve insect bites and stings. If a sting causes severe chest pain, nausea, severe sweating, loss of breath, serious swelling or slurred speech, the person should be taken to an emergency medical facility immediately. These are symptoms of an allergic reaction or anaphylactic shock. Some people may lapse into a coma from just one sting. Compared to deaths from bee and wasp stings, relatively few deaths from fire ant stings have been documented.

People sensitive to fire ant stings should seek the advice of an allergist. Once a person has discovered that he/she is allergic to the fire ant venom, extra care must be taken to avoid stings. Often individuals allergic to the venom will carry epinephrin ("Epi kits") or undergo treatment in an attempt to desensitize their reaction to the venom.

TIPS FOR AVOIDING MEDICAL EMERGENCIES AND FOR TREATING ANT STINGS:	
1.	Teach children and visitors about fire ants and their hazard.
2.	Wear protective clothing during outdoor activities. Wear shoes or boots and/or tuck pant legs into socks.
3.	Treat stings with an insect bite remedy that deadens pain and protects against infection.
4.	Control fire ants in areas used most frequently by people and pets.

History of Control Efforts

More than 65 years ago, the red imported fire ant, *Solenopsis invicta Buren*, was accidentally brought into Mobile, Alabama, from South America. It now infests more than 320 million acres in Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, Texas and Puerto Rico. Another species, the black imported fire ant, *Solenopsis richteri* Forel, was also introduced, but the range of this species is limited to northeastern Mississippi, northwestern Alabama and southern Tennessee, with a large population of hybrids between *S. richteri* and *S. invicta* that extends into parts of Georgia, Mississippi, Alabama and Tennessee. Surveys are being conducted to determine the presence of the three fire ant types in Tennessee. East Tennessee is predominantly hybrid and West Tennessee contains mostly black imported fire ants. Red imported fire ant colonies don't appear to be established in large numbers. Fire ants can travel long distances when newly mated queens land on cars, trucks or trains, or when winged forms are carried by the wind. Shipments of nursery stock or soil from an infested area may relocate entire colonies or nests.

Why eradication programs failed

Attempts in the late 1960s and early '70s to eradicate the imported fire ant were not successful. The pesticides used, although effective, were no match against species capable of re-invading previously treated areas. The reasons for failure are debatable, but it is now known that eradication is hindered by the ant's biology and by problems with treatment methods.

Biological obstacles to eradication

The ants infest such an extensive area that a single treatment would take years and massive resources to apply. Fire ants have a high reproductive rate and disperse easily. Thousands of reproductive females are produced per colony, and the mated females begin a colony wherever they land. Queens can fly up to a mile on their own or farther when carried by the wind. The ants eliminate competing insects and then rapidly overwhelm an area. Whole colonies can move, and in the multiple-queen form, the colonies can split into many new colonies. The queen is protected from many poison baits because she is fed only food eaten first by workers and larvae. If a poison works too rapidly, the worker is killed before the poison is passed to the queen. Finally, worker ants from well-fed colonies may not forage on a bait product, or a bait may not be as attractive as some abundant natural food. Colonies move vertically and horizontally in the soil profile to escape the effects of flood, drought, and extreme temperatures. When new colonies are not actively foraging, they may be protected from baits or other pesticides applied to the soil surface.

Pesticidal obstacles to eradication

Pesticide treatments are expensive and time-consuming, and there are only three basic approaches. The first is surface treatment using a residual contact poison. This approach is the least environmentally sound because the treated surface remains toxic for a long time. The ants may survive by foraging underground. The second is individual mound treatment, which involves the application of a large volume of pesticide to reach the queen. However, it is nearly impossible to locate all of the colonies in an area, difficult to manipulate large volumes of liquid, and treatment is more expensive and time-consuming. Colonies not eliminated may move or split into several colonies. The third method is bait treatment, which uses some sort of attractive substance the ants like to eat. Unfortunately, baits are not always consumed, and the bait's attractiveness is short-lived. The bait must be slow-acting and effective over a range of doses, since the dose the ants get cannot be controlled. Baits may also be attractive to and kill some native ant species that compete with fire ants.

Economic, regulatory and environmental obstacles to eradication

The best way to treat large areas (hundreds of acres) is by an aerial application of bait. However, not all areas can be treated because of label restrictions and application limitations. Even with a bait product, it is not feasible to treat the entire infested area or even a large part of a single state, and untreated areas are sources for reinfestation. The larger the treatment area the more slowly reinfestation occurs. If periodic treatments are discontinued, the area may become more infested than it originally was within a year or two because treatments may have eliminated competing ant species.

Policy statement for making chemical control suggestions

Suggested pesticides must be registered and labeled for use by the Environmental Protection Agency and the appropriate state Department of Agriculture or regulatory agency. The status of pesticide label clearances is subject to change and may have changed since this publication was printed. County Extension agents and specialists are advised of changes as they occur.

The USER is always responsible for the effects of pesticide residues, as well as for problems that could arise from drift or movement of pesticides from his property to that of others. Always read and follow carefully the instructions on the product label.

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the participating states' Cooperative Extension Service is implied.

For additional information about imported fire ant management, contact your county Extension agent or visit our UT Fire Ant Web Site at http://fireants.utk.edu.

TABLE 1.	Fire ant insecticides, modes of action and formulations, with generic names of active ingredients and some examples of products registered with the Tennessee Department of Agriculture Nov., 2004. FA=Fire Ant, K= Killer, B=bait, G=Granule, D= dust
BAITS	**Indoxacarb** – Workers bring bait back to colony and larvae metabolically activate the indoxacarb. Colony death can occur within 3 days. **Advion™FAB**
	Hydramethylnon (amidinohydrazone) and **sulfluramid** (n-ethyl perfluorooctanesulfonamide) - These ingredients kill ants by preventing them from converting food into energy. These baits eliminate fire ant colonies within a week when applied to individual mounds, but these take several weeks when broadcast. They are also formulated in bait granules and bait stations. **(hydramethylnon: Amdro®, AmdroPro, Siege®Pro, ProBait, Combat®, MaxForce®; sulfluramid: Raid® Ant Bait Plus)**
	Avermectins (abamectin) - This bait product is derived from a soil fungus and inhibits nerve transmission. As a mound treatment, it kills worker ants and colonies quickly, but as a broadcast treatment it acts more like an insect growth regulator, preventing the production of viable eggs. **(Ascend®, Clinch®, Varsity®)**
	Spinosyns (spinosad) - These natural metabolite products are produced by a soil microorganism (Saccharopolyspora spinosa), and affect the nervous system. Bait formulations have a speed of activity similar to hydramethylnon and sulfluramid baits. **(Safer Brand FAB, Green Light FA Control, Ferti-Lome Come and Get it! FAK, Ortho FAKB, Southern Ag Payback FAB** and others)
	Phenyl Pyrazole (fipronil) - A nervous system toxicant, it blocks the passage of chlorine ions by interacting with gamma-aminobuteric acid (GABA) gated chloride channels on nerve membranes. A bait formulation is available for use as a broadcast or individual mound treatment for use on home lawns, golf courses and commercial and recreational turf, adjacent landscape beds and sod farms. Broadcast application provides maximum control 6 to 12 weeks after treatment. **(Chipco® FireStar® Bait, CeaseFire)**
	Insect Growth Regulators (fenoxycarb, methoprene, pyriproxyfen or 2-[1-methyl-2-(4-phenoxyphenoxy) ethoxyl] pyridine)) - These materials mimic the effects of the insect's own juvenile hormone, reducing the production of viable eggs and preventing the development of worker ants for up to a year after application. They do not kill adult ants. Treated ant colonies persist for several months after treatment, until worker ants present at the time of treatment die naturally. These products are formulated as a bait to be applied to individual mounds or broadcast. (**fenoxycarb**: **Award®, Logic®, methoprene**: **Extinguish®, pyriproxyfen**: **Distance®, Spectracide® Fire Ant Killer Plus Preventer Bait)**
CONTACT INSECTICIDES	**Botanicals** (d-limonene, pyrethrins, others) - These plant-derived products have various modes of action. D-limonene is a citrus oil extract that kills ants quickly. Pyrethrins, which act on the nerve axon, also kill ants quickly (within minutes to hours) and can be used as mound treatments or surface sprays. Rotenone acts on respiratory tissues, along with nerves and muscles. Pyrethrins and rotenone products break down rapidly in the environment. Rotenone and pine oil (turpentine) products are relatively slow-acting (days to weeks) and are applied as mound drenches. **(pyrethrins, PBO and silicon dioxide**: **BombsAway FADehydrator, Demise FA & Insect Dehydrator, Diatect III**; **d-limonene**: **Rainbow Liquid FA & Insect Killer; Victor Safer Brand FAK)**
	Derivatives of Pyrethrins (allethrin, resmethrin, sumithrin, tetramethrin) - Like pyrethrins, these products destabilize nerve cell membranes and kill quickly, but are quickly deactivated and have little residual activity. They are applied as aerosol injections, mound drenches or surface sprays. **(tetramethrin: Misty FAK & Injector)**
	Pyrethroids (bifenthrin, cyfluthrin, cypermethrin, deltamethrin, fenvalerate, fluvalinate, lambda-cyhalothrin, permethrin, s-bioallethrin, s-fenvalerate, tefluthrin, tralomethrin) - These products also destabilize nerve cell membranes. They can persist in the environment longer than pyrethrins and their derivatives. They are relatively quick-killing and are applied as mound drenches, dusts or surface sprays and granules. **(bifenthrin: Talstar® or Ortho® FAK G; cyfluthrin: Bayer® Advanced Lawn FAK D and G, Real-Kill FAK G; deltamethrin: Eliminator FAK, Eagles-7 FA Destroyer, Basic Solution FAK, Bengal Ultradust 2X FAK, Terro FAKD; lambda-cyhalothrin: Spectracide FAK Mound and Broadcast G_2, Spectracide FAK G_2, Spectracide TriazideSoil and Turf Insect Killer Granules; permethrin:Hi-Yield Imported FA Control G, Maxide FAK II and FAK Plus!; Green Light FAK, Howard Johnson's FAK, Spectracide No Odor FAK D**)
	Carbamates (carbaryl) - These materials disrupt nerve transmission (cholinesterase inhibitor). They are relatively quick-killing and are used as mound drenches and surface sprays. **(Sevin®)**
	Organophosphates (acephate, chlorpyrifos, dichlorvos, fenthion, isofenphos, malathion, propetamphos, trichlorfon) - These products also interfere with nerve cell transmission (cholinesterase inhibitor). They are relatively quick-killing. Formulated as aerosols, liquids, dusts or granules, they are applied as mound treatments or surface applications. **(acephate: Orthene®, Surrender Fire Ant Killer** and others).
	Phenyl Pyrazole (fipronil) - A nervous system toxicant, fipronil blocks the passage of chlorine ions by interacting with gamma-aminobuteric acid (GABA) gated chloride channels on nerve membranes. Granular formulations are available to broadcast-apply to turfgrass areas achieving maximum control four to eight weeks following application, and maintaining control for up to a year. **(Chipco® TopChoice Insecticide, Chipco® Choice Insecticide, Over 'n Out! Fire Ant Killer)**
	Inorganic Compounds - Boric acid is a slow-acting stomach poison. It is commonly formulated as a dust or liquid bait for control of ants. Diatomaceous earth products (D.E., silicone dioxide) are usually applied to ant trails indoors. D.E. abrades the waxy layer from the insect exoskeleton, causing the insect to desiccate. However, D.E. does not eliminate colonies within treated mounds. When D.E. is used as a carrier in formulations of pyrethrins, it may enhance penetration of this botanical insecticide into insect bodies.

Texas Imported Fire Ant Research & Management Plan

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