A Review of "Organic" and Other Alternative Methods for Fire Ant Control

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Disclaimer: This is a *review* article and is, therefore, fundamentally different from many documents developed by the Texas Cooperative Extension that contain management suggestions for insects and other pests. There is a great deal of controversy whenever discussing "organic" and other alternative methods of gardening or farming, in part, because the term is defined differently by different practitioners. Since the following discussion includes both non-traditional and purely organic means of control, we use quotes around the term "organic" in this fact sheet. When the word, organic, appears with quote marks in the section titled **"Organic" Fire Ant Control Products and Treatment Methods**, the term "organic" may describe control methods that are not considered by some people to be organic. This is done for convenience purposes only to avoid the necessity of placing additional disclaimers in the article. We have made every attempt to review remedies that have historically been proposed to be non-chemical and/or "organic" and to provide, wherever possible, the literature citations for this information. Some of these methods, such as hot water, nicotine sulfate, rotenone, bleach, ammonia products or soap are no longer recommended by today's organic gardeners. ***Recipes and remedies provided in this fact sheet are presented for educational purposes only and do not constitute a recommendation for use or endorsement for their use by the Texas Cooperative Extension.*** "Organic" methods are presented along with other chemical and non-chemical methods for fire ant control in **B-6043, "Managing Red Imported Fire Ants in Urban Areas"** so that the *reader* can decide which method(s) is most appropriate for a particular situation.

What is "Organic?"

In chemistry, the term *"organic"* molecule is defined as one containing one or more carbon atoms, hydrogen, and oxygen. Compounds that do not contain these elements (e.g., water, silicone dioxide or diatomaceous earth, sulfur, and boric acid) are *"inorganic"* molecules. However, the word "organic" has a different meaning when applied to a system of farm management.

The term, "organic gardening", is of fairly recent origin. The word, organic, was first used to describe the natural method of gardening and farming in 1942. The term "organic farming" was first used in a 1940 publication. "Organic" gardening or farming is a philosophy, and components of it have been practiced for centuries (from Gates, J.P. 1989 [mimeo]: "Organic gardening," Agri-Topics, National Agricultural Library, USDA).

Most practitioners of "organic" farming concentrate on preparing soil with a high organic content using materials such as fertilizers and amendments that are deemed to be *of natural origin*. Practitioners contend that most pests are secondary problems of crops, and are symptoms of unhealthy plants. This philosophy holds that plants grown organically have fewer pest problems. However, pest control is sometimes necessary, so "organic" farmers use cultural, non-chemical (physical and mechanical) and

biological methods of pest control - in addition to a selected number of pesticides that are considered to be *of natural origin*.

What is acceptable as an "organic" method varies greatly between practitioners. To some, it implies use of no pesticides, relying on physical, mechanical and biological methods exclusively. Generally, however, pesticides *of natural origin* are thought of in two categories: first are plant-derived, such as products which contain pyrethrins, rotenone, sabadilla, nicotine or other plant-created chemicals; second are "inorganic" products which include sulfur, diatomaceous earth and boric acid.

Regardless of origin, "organic" insecticides are regulated by the EPA. Any insecticide product sold in Texas must also be approved by and registered with the Pesticide Division of the Texas Department of Agriculture (TDA). Products that contain only certain "exempt" active and inert ingredients (e.g., garlic and garlic oil, citronella or citronella oil, or citric acid) are not subject to federal pesticide regulations (see FAPFS037).

In Texas, the Department of Agriculture has developed an ***Organic Standards and Certification Program*** (see http://agr.state.tx.us). These standards establish the types of materials (including those used as insecticides) that are approved for use by producers who want to be certified as producing organic crops. The United States Department of Agriculture's "Federal Organic Program" (see http://www.ams.usda.gov/nop) has developed "organic" standards and a certifying process.

Finally, not all "organic" methods are necessarily "safer" than synthetic insecticides, either to the user or to the environment, and they should always be used with care (see FAPFS036). For instance, products containing rotenone or pyrethrins are extremely toxic to fish, and nicotine-containing products may be hazardous to humans. Prolonged breathing of excessive concentrations of the crystalline form of diatomaceous earth (DE) dust may cause lung damage (silicosis). This is not the form used in insecticide-grade DE formulations.

"Organic" Fire Ant Control Products and Treatment Methods

Methods and products for fire ant suppression or control vary greatly in effectiveness, speed of activity, practicality (labor requirements), toxicity to the user and the environment, and cost. Careful study of available treatment methods and their proper use is necessary in order to make the best choice(s) for the product's use in a particular situation. Many products containing biological control agents, non-chemical methods, as well as conventional and "organic" insecticides have been evaluated through research and result demonstration efforts by research and Extension personnel. This information is generally available from Extension Entomology Agents and Specialists. Per mound treatment costs range from about $0.10 to over $1.00, and bait treatments can cost at least $8 per acre.

Natural and biological control (See FAPFS009)**.** A number of organisms kill fire ant queens and workers. These include dragonflies, other ants, some types of birds, lizards, spiders, and toads. Animals that eat ants, such as armadillos, may disturb mounds and eat some workers, but they are not really effective in control. Currently, the best method for the biological control of fire ants is the preservation and encouragement of native ant species that compete with the fire ant for territory and resources.

Some parasites and pathogens are known to attack ants, and several have been marketed for fire ant control. The predatory **straw-itch mite**, *Pyemotes tritici* (Lagreze-Fossat & Montane), that feeds on and paralyzes developing fire ants is not effective, and is potentially hazardous to the user (Thorvilson *et al.* 1987. *The Florida Entomologist* 70:440-444). **Parasitic nematodes** (*Steinernema* spp. and others) are roundworms that seek out and enter insects, paralyzing them and developing within their bodies. Species and strains of nematodes vary markedly in their effectiveness (Drees *et al.* 1992, *Journal of Economic Entomology* 85:365-370). Strains tested to date caused ants in treated mounds to temporarily move away from the treated mound, but few colonies were actually eliminated.

Other organisms such as **parasitic fungi** (*Beuvaria bassiana*) and insects (phorid flies, Strepsiptera, parasitic ants) are currently being evaluated for control. One product containing the fungal spores of *B. bassianna*, Naturalis-L®, is currently being marketed for fire ant control. Mycelia of this fungus (vegetative growth stages) formulated as a bait, appear to show promise for fire ant control. Additional

strains of this species are under development as mound treatments (Oi *et al.* 1994. *Journal of Economic Entomology* 87:623-630). Natural enemies applied to individual mounds that do not persist in the environment, or spread naturally, may be unsuitable for large area-wide treatment programs because of the high cost and labor needed for application.

There is hope for success from the use of biological control agents such as the parasitic **phorid fly** currently being evaluated for release in the United States; however, large-scale releases of exotic natural enemies of the ant may be still in the future. Even if they are successfully introduced and established, at best they will provide only suppression of fire ant activity. They will not eradicate the imported fire ant. In South America, where fire ants live with many natural enemies, these ants are also still abundant in disturbed land areas.

Physical and mechanical methods. Use of ***very hot or boiling water*** is a fairly commonly used treatment for individual fire ant mounds, particularly when ants are close to the mound surface, such as on cool, sunny mornings. Approximately 3 gallons of hot water poured on each mound will eliminate about 60 percent of the mounds treated (Tschinkel, & Howard. 1980. *Journal of the Georgia Entomological Society* 15:102-105). Steam generators have also been used for ant mound treatments. This method may work well in certain situations, but care must be taken not to pour hot water on desired plants and grasses. Also, use care in handling large volumes of hot water to prevent serious burns.

A mound can be dug up and moved or dispersed. Care must be taken to prevent fire ants crawling up the handle of a shovel or out of a bucket. ***Talcum powder*** liberally dusted on tool handles or the inner surface of a bucket will deter ants from crossing the dusted vertical surfaces. Colonies in mounds that are regularly disturbed or knocked down may move, but this does not eliminate the ants. Since the multiple queen form of the fire ant is tolerant of ants from neighboring mounds, attempts to shovel one mound on top of another to force the ants to kill each other are ineffective.

Barriers across which fire ants will not cross can be effective in keeping ants out of sensitive areas such as wood duck boxes, greenhouse benches, and other objects. Non-chemical barriers on vertical surfaces such as talcum powder and Teflon-like tape or spray products generally lose their effectiveness in highly humid or wet conditions (Drees 2002, Southwestern Entomologist 27(1):111-113). Tanglefoot®, a petroleum-based sticky material, available as a gel or aerosol, may be effective temporarily. Such products lose their effectiveness when coated with dust and other debris. Barriers have also been created using electrical or heating elements.

Control devices. Numerous products have been marketed for fire ant control that do not involve the use of chemicals. These products are considered to be part of the "organic" arsenal by some practitioners. Others, however, reject devices or methods that employ electricity, microwaves, vibrations, sound or ant crushing mechanisms. Devices that do not use chemical insecticides or microorganisms are not required to be labeled as pesticides by the Environmental Protection Agency, and are often marketed without scientific evaluation. The fact that a "control" device is on the market does not indicate that the device is effective. These products may kill some ants, but they are often incapable of eliminating a colony. Deceptive or fraudulent claims concerning fire ant control devices should be reported to the office of the Texas Attorney General or the Federal Trade Commission.

Home remedies. In addition to use of very hot or boiling water described above, many "home remedies" have been used or proposed. Whether these methods are "organic" or not is arguable. Most home remedies are ineffective, and virtually none are recommended for use by practitioners of "organic" gardening and farming.

Use of gasoline and other petroleum products (e.g., refined decomposed plant material similar to dormant, summer and horticultural oils which are sometimes considered to be "organic" products) are *strongly discouraged.* These materials are not EPA registered pesticides, are dangerously flammable, kill grass and plants around the treated mounds, and can seriously pollute the soil and groundwater.

Other home remedies include soap solutions or cleaning products soaked into the mound; which are believed to remove the protective oil coating from the ants. Although the ***Organic Food Standards and Certification Program*** allows use of EPA registered insecticidal soap products according to labeled uses, these insecticidal products are not registered to treat fire ant mounds. Manufacturers of soap, liquid

detergent and other non-pesticide products do not support uses not specified in the directions, and will not assume liability for any problems that may arise with their unregistered use.

A substance in oragne oil released from crushed or grated citrus peels (d-limonene) is toxic to fire ants, as are some other natural plant oil substances. Citrex® Fire Ant Killer, containing 78.2% d-limonene (www.envirosafelabs.com), is now available commercially for use as a fire ant mound drench that provides quick elimination of treated colonies. Recipes have been published that allow homeowners to concoct their own mixtures and try them on their own. Evaluation of one of these orange oil-containing recipes has documented effectiveness as an ant mound treatment. However, evaluations of grits and Malt-O-Meal failed to document As with many recipes for home remedies; however, most have not been scientifically evaluated (see reports on http://fireant.tamu.edu under "research" and "applied research").

Examples of some "organic" home remedies:

- ***"Garrett Juice"*** (personal communication, H. Garrett). This formulation is for preparing a basic foliage feeding spray and is available commercially as Garden-Ville Anti Fuego Soil Conditioner. To make a home brew, use the following per gallon of water:
  1-2 cups manure compost tea
  1 tablespoon blackstrap molasses
  1 tablespoon liquid seaweed
  1 tablespoon natural apple cider vinegar

  For FIRE ANT CONTROL, add 2 oz. of orange or other citrus oil (i.e., Erath® or Green Sense®) per gallon of water. The solution is applied as an individual fire ant mound drench.
- ***Grits and Malt-O-Meal***: "Applying instant grits or Malt-O-meal to dry soil around mounds is reported to have impressive results" (Garrett, H. 1993. page 140 in *Howard Garrett's Texas Organic Gardening Book*, Gulf Publishing Company, Houston, Texas, 245 pp.). In theory, the ants eat the grits which then swell and rupture the ants' stomachs. In fact, only the last stage of the developing fire ant is known to ingest solid food. All other life stages feed only on liquids, sugary solutions or greasy materials. Fire ant workers are physically incapable of ingesting solid food particles larger than 1.0 μm diameter in size (J. M. Petti, 1997. Proceedings of the 1997 Imported Fire Ant Research Conference). *Note: This method has not been shown to control fire ants*.

"Organic" botanical insecticides. Botanical insecticides are those derived from plants. Most are *contact insecticides* and work in several ways. ***Pyrethrins***, which act on the nerve axon, are effective and kill ants quickly (within minutes to hours). Some products mix pyrethrins with a synthetically-produced additive (piperonyl butoxide or PBO) and diatomaceous earth (silicone dioxide) for application as ant mound treatments or surface sprays. Formulations containing PBO are not acceptable as an "organic" product by most practitioners. ***Rotenone*** acts on the respiratory system, including nerves and muscles. Pyrethrins and rotenone products break down rapidly in the environment. Rotenone and ***pine oil*** (***turpentine***) products are slow-acting (days to weeks) contact insecticides applied as mound drenches (e.g., trade names of some products of these which have been marketed include Insecto® Formula 7, Organic Plus® Fire Ant Killer, Bonide® Rotenone 5 Insecticide). ***D-limonene*** (Citrex® Fire Ant Killer) is a fast-acting mound drench is currently available to consumers (see Fire Ant Trails 3(1)). The clove oil extract, ***eugenol***, plus thyme oil has been marketed as EcoExempt™G Granular Insecticide as a fire ant mound treatment. However, it has not been evaluated in Texas field trials to date.

Example of an "organic" fire ant program using botanical ingredients

The program provided in this fact sheet is presented for educational purposes only and does not constitute a recommendation for use or endorsement for it's use by Texas Cooperative Extension.

From "The Natural Way - Put the heat on fire ants without poison", Howard Garrett, April 1998:

"An organic approach has worked better for me and creates no contamination. To control fire ants and other pests such as fleas, termites, chinch bugs, ticks, crickets and grasshoppers, try the following method"(*Authors' note: This approach has not been scientifically evaluated.*).

Step 1: Spray the site with a citrus product. Use a d-limonene product, an orange oil product or any product that contains a citrus base. Follow label instructions for mixing.

Homemade citrus can be made by soaking citrus peels in water for ten days to two weeks. Use one cup of homemade concentrate per gallon of water to create a spray. Adding garlic-pepper tea makes the spray even more powerful. This same spray also will help control aphids, whiteflies and mosquitoes.

The garlic-pepper tea spray also will kill beneficial insects, so use it carefully. In addition, don't use more than the recommended rates of any of the citrus concentrates or it could kill plants or burn foliage.

Step 2: Treat mounds with a drench of manure compost tea, molasses and citrus oil. Commercial products may become available that contain these ingredients. The homemade mix includes the following per gallon of water: 1 to 2 cups compost tea, 2 ounces molasses and 2 ounces citrus oil (see recipe above).

Step 3: Distribute beneficial nematodes on problem areas. Be sure to apply these living organisms within the date listed on the container - nematodes have a limited shelf life.

Step 4: Spray the site at least monthly with a mixture of manure compost tea, seaweed, natural vinegar and molasses.

Inorganic Compounds. ***Boric acid*** is a slow-acting stomach poison. It is commonly formulated as a dust or liquid *bait* for indoor control of ants. One product has been formulated as a fire ant bait for outdoor broadcast treatment; however, scientifically acceptable data supporting its effective use have not been produced. Care should be taken when using any boron-containing product around plants, as excess amounts can lead to boron toxicity. ***Diatomaceous earth*** (D.E., silicone dioxide) products registered by EPA as pesticides are usually applied as a fine dust *contact insecticide* to ant trails indoors or to produce barriers. No other forms of D.E. (e.g. swimming pool filter grade or treated D.E.) should be used as a pesticide. D.E. abrades the waxy layer from the insect exoskeleton causing the insect to desiccate. Although suitable for dusting foraging ant trails indoors, when applied as a dust or drench to fire ant mounds, diatomaceous earth usually does not eliminate colonies.

Home-Made Boric Acid Baits. The recipe below can be prepared and used to eliminate fire ants in indoor situations (from Klotz et al. 1996 *Journal of Economic Entomology* 89:673-677: 1% boric acid in 10% sugar solution; and, Drees &. Summerlin. 1998. See L-2061 and FAPFS024):

- Choose the most attractive food material for the ant species present, e.g., peanut butter, mint apply jelly, corn syrup, etc.
- Mix 1 part boric acid powder (available from most pharmacies) per 100 (or 50) parts bait material, *e.g.*, 1 teaspoon per 2 (or 1) cups food material

Do not make the bait concentration of boric acid too strong as this reduces its acceptance. The one percent bait is better than higher concentrations since it is less repellent to the ants and kills ants as efficiently. Keep the bait fresh and moist. Small quantities of bait can be placed in bottle caps or on pieces of tin foil, or injected into short (2 inch long) sections of soda straws using a squeeze bottle. Place 20 to 30 small bait stations where ants have been seen or were attracted to baits as described in the previous section. Do not place stations in areas accessible to small children or pets. If the proper food is used and the bait is kept fresh, control should be achieved after 3 to 4 weeks for a careful, thorough baiting program.

- For outdoor use, a boric acid solution can be made by mixing 1 tsp boric acid, 3 Tbsp sugar in 2 cups water and placing it in a container laid on its side near an ant hill (from a quote from David Williams, USDA, *Organic Gardening Magazine*, March 1997). However, organic gardeners feel that boric acid should not be used outdoors since it can be toxic to plants.

Fire Ant Management Approaches in IPM or Integrated Pest Management

IPM, or Integrated Pest Management is a systems approach for control of insects and other pests that reach intolerably high population levels. Programs based on this approach or philosophy use a combination of selected cultural, mechanical, physical, biological, chemical and regulatory methods to achieve cost-effective, environmentally-sound pest control. IPM programs utilize "threshold levels" based on pest population densities or damage levels as decision-making points to justify the implementation of suppression tactics. Although IPM does not rule out the judicious use of selected synthetic pesticides, it encourages using the least-toxic and most target-specific methods of pest suppression available. IPM programs can be modified to include only those tactics which are perceived to be "organic" by the user or in approved for use in an organic certification program .

"Organic" and Alternative Methods

Many IPM programs for fire ant control include the judicious use of a bait-formulated product(s). ***Unfortunately, few of the conventionally-formulated bait products available today are considered to be "organic."*** At least two groups of commercially available bait products are exceptionally low in toxicity to non-target species and may be acceptable ***alternatives*** to some "organic" practitioners:

- **abamectin** baits, such as PT® 370 Ascend™ Fire Ant Stopper Bait and Raid® Fire Ant Kller, affect fire ants and related ants. Abamectin is a natural fermentation product produced by a soil microorganism *Streptomycetes avermitilis*, an actinomycete. Because the product is natural in origin, it may fit into some "organic" production programs .
- **spinosad** baits, such as Justice®, Eliminator® Fire Ant Killer Bait, Penn-Kill™ Fire Ant Killer, Strike™ Fire Ant Killer Bait and Maxide® (CGP brand), is a blend of the two most active forms, A and D, of compounds called spinosyns. Spinosyns are the products of the fermentation of the soil actinomycete *Saccharopolyspora spinosa*. Spinosad received the 1999 Presidential Green Chemistry Challenge Award which recognizes chemicals that reduce negative impacts on human health and the environment. Because this fermentation product is of natural in origin, it may fit into some "organic" production programs (see Fire Ant Trails 3(3)).
- **fenoxycarb** baits, such as Award™ and Logic® , **s-methoprene** bait (Extinguish™) and **pyriproxyfen** (Distance®, Spectracide® Fire Ant Bait) contain a synthetically-produced compounds that 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. Treatments do not kill adult insects. Treated ant colonies can persist for several months after treatment, until worker ants present at the time of treatment die naturally. These products are formulated as a ***bait*** and is applied to individual mounds or can be broadcast over an area (see B-6099). **Note:** The EPA has classified fenoxycarb as a Class "B2" carcinogen (contact Novartis Crop Protection, Inc. for more detailed information). Thus, like ***all*** insecticides, these products should be used strictly in accordance with instructions provided on the product label.

The "Two-Step Method." (See L-5070) This program is a product neutral, integrated approach for fire ant control that uses a sequential application of (1) broadcast application of a selected bait product followed by (2) use of a selective treatment of individual mounds (**Note:** Available "organic" products or methods can be selected for use in this program). This approach provides long-term ant suppression in

ornamental turf and non-agricultural lands, including roadsides, and is best suited to moderate to larger sized areas. The cost is moderate. It is *not* suggested for previously untreated areas with large numbers of native ants and few fire ant mounds (15 to 20 per acre or fewer (see FAPFS007, L-5070 and B-1536). The goal of this program is to minimize the use of individual mound treatments (**Note:** This program is also suitable for pasture and rangeland, provided that the products selected are specifically registered for use in these sites, see B-6076).

The version of the Two-Step Method presented below has been proposed for small areas (less than an acre) where minimal pesticide use is desired, such as areas frequented by young children. This option is very labor intensive, and may be practical if only a few mounds are present (from Oi, D. H., D. F. Williams, P. G. Koehler and R. S. Patterson, Imported Fire Ants and Their Management in Florida, SP-161, University of Florida):

Step 1. *(Optional.)* Broadcast a bait-formulated insecticide. Note that relative rates of population reductions from fire ant baits are from fastest to slowest: hydramethylnon (Amdro®), abamectin (PT®370, Ascend™) and fenoxycarb (Award® or Logic®). However, while all baits have low mammalian toxicities, relative toxicities for the three baits from highest to lowest are Amdro®, Ascend™ and Award®. At the 1- to 1 ½- pound-per acre application rate for the above products, bait particles are widely scattered and difficult to find.

Step 2. At least 3 days after baiting (if baits were applied), drench individual mounds with hot (scalding) water.

Step 3. Excavate and/or reapply hot water to mounds that are still active. Repeat when necessary.

Step 4. *(Optional.)* Make an annual or semi-annual broadcast application of a bait-formulated insecticide in the spring and/or fall to suppress re-infestations.

For More Information about the *Organic Standards and Certification Program*:

Visit the Texas Department of Agriculture Website at http://agr.state.tx.us or contact:

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For more information regarding fire ant management, see Extension publications B-6043, *Managing Red Imported Fire Ants in Urban Areas*; B-6076, *Managing Red Imported Fire Ants in Agriculture*; B-6099, *Broadcast Baits for Fire Ant Control*; or L-5070 *The Texas Two-Step Method Do-It-Yourself Fire Ant Control for Homes and Neighborhoods.* Also visit our web site at http://fireant.tamu.edu.
