RED IMPORTED FIRE ANT
APPLIED RESEARCH/RESULT DEMONSTRATIONS
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RESULTS FROM THE TEXAS VETERINARIAN SURVEY:
IMPACT OF RED IMPORTED FIRE ANTS ON ANIMAL HEALTH

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The red imported fire ant (*Solenopsis invicta* Buren) is recognized as a major nuisance pest in the southeastern United States. With tens of millions of infested acres, there has also been a great deal of concern and anecdotal evidence about the ants' negative impact on livestock, pets and wildlife. However, very little scientific data is available in regards to frequency and economic impact on animal health. With current fire ant suppression methods estimated to cost $10 per acre per year (Drees & Vinson 1993), there is a great need to justify the cost of these treatments in agricultural and ecological systems.

The red imported fire ant can cause temporary blindness (Joyce 1983) and occasionally death (Lofgren 1986) in calves and reportedly cause problems during hay harvesting because the tall, hardened mounds destroy machinery and the ants invade hay bales (Lofgren 1986). However, ant predation also suppresses ticks and related problems (Harris & Burns 1972, Fleetwood et al. 1984). Ants also prey on the immature stages of horse flies (Johnson & Hays 1973, Drees 1987) and other insects (Lofgren 1986).

To document fire ant related losses to the Texas animal industry, the Texas Agricultural Extension Service, in cooperation with the Texas Veterinary Medical Association, Texas A&M College of Veterinary Medicine, the Texas Veterinary Medical Diagnostic Laboratory and the Texas Agricultural Experiment Station, conducted a survey of the veterinarians in the state of Texas. Direct funding was provided by the American Cyanamid Corporation and program support funding was provided by Ciba-Geigy. The survey was designed to assess the frequency, severity, and economic losses associated with fire ant activity in relation to animal health.

The impact of fire ants on livestock production systems involves many factors including effects on animal and human health, equipment damage, possible forage loss and degradation, and increased labor costs. Eventually, it is hoped that an economic injury level can be developed, but to do so, a cost must be determined for each factor. Losses reported by veterinarians in this survey document **only a part** of the impact of fire ants in livestock production systems.

Materials and Methods

Specialists in entomology, agronomy, livestock production, agricultural economics, large animal veterinary medicine, veterinary toxicology and general veterinary medicine developed the survey. A mailing list was provided by the Texas Veterinary Medical Association. Surveys were mailed the week of 15 August 1993 to **all** listed members in postage-paid return envelopes. No attempt was made to exclude certain specialties, practice types or areas of the state. All surveys received on or before 15 December were included in the analysis.

A spreadsheet program, using SuperCalc 5.0, was developed to tabulate the survey results. In order to prepare the survey data for computer entry, all surveys were examined and results converted by hand to a standard format, when necessary. Each survey was given a reference number and all data from surveys reporting fire ant injury were entered into the spreadsheet. Those surveys reporting no fire ant related injuries had county(ies) of origin and written comments recorded, but no data entered into the spreadsheet.

Using the results of the Texas Veterinary Survey and statewide statistical information, an attempt was made to calculate the impact of fire ant related animal health problems to Texas. Methods of extrapolation are presented in Barr, et. al. (1994). We have focused on cattle as an example, but similar methods can be applied to other animal groups. The major assumption in this calculation is that those veterinarians <u>not</u> responding to the survey experienced similar ant related problems as did respondents. No effort was made to contact these individuals to determine the reasons for not responding.

Results and Discussion

Over 90 percent of the counties in the state were included in the service areas of the respondents. Some veterinarians reported problems with fire ants in counties not known to be infested with red imported fire ants. However, they were not asked to report incidence by county so it is likely that their service areas included both infested and uninfested counties.

The number of surveys completed and returned was one of the most striking results of this survey: a total of 837 out of 2,499 for a return rate of 33.5 percent. On a detailed survey of this type, 15 percent is often considered adequate. Given the hectic nature and long hours of a veterinary practice, a response of this magnitude is indicative of the great interest in fire ants within the animal health community and, most likely, the general population. Of the surveys returned (837) nearly two-thirds (522) were marked as "Yes," the veterinarians having treated animals for fire ant injury. The results reported in the sections below were obtained <u>only</u> from the 522 surveys on which veterinarians responded "Yes" to treating or witnessing fire ant related animal health problems.

I. <u>Frequency and economic impact of ant related injuries and mortality</u>. The frequency of fire ant related animal injuries, by species or animal group, is summarized in **Table 1**. With a total of 7,204 cases reported annually, the average number of fire ant related cases per respondent per year was 5.2. Of the animals affected by fire ants, small animals and pets accounted for more than half of all reported injuries. Next was injuries to cattle, 17.5 percent, and then wildlife, 12.1 percent.

Considering the enormous areas that are not routinely contacted by man, and the difficulty in spotting an injured fawn or bird, fire ant impact on wildlife may be more significant than the survey indicates. If nothing else, these survey results document a need for further scientific research on fire ant damage to wildlife.

Results on the frequency and type of fire ant injuries and the average cost for treatment are summarized in **Table 2**. The average cost for treatment was $53.87, resulting in an annual total treatment cost of $726.904.53 in treating over 13,000 fire ant injuries. Dermatitis accounted for almost half of these reported cases with many instances of multiple injuries.

Only 110 respondents answered the section about animal mortality (21.1 percent of 522). A total of 2,649 animals were reported to have died from fire ant related injuries annually (**Table 3**), for a total loss of $3,486,047. Cattle, presumably mostly newborn calves, made up the largest group; 1,387 or 52.4 percent. It is difficult to establish a cause and effect relationship between fire ants and animal death since many animals are found only after they have been lying dead or incapacitated for an unknown length of time. Small animals and pets, while accounting for half the injuries, accounted for only 16 percent of the deaths. It is possible that time between human observation is a major factor in both determining and preventing fire ant related mortality. Results here are from those incidents where a veterinarian became involved. Undoubtedly, many, if not most, cases go unreported so these results are likely a very conservative estimate of mortality.

Ratites, flightless birds including ostriches, emus, and rheas, accounted for only 2.8 percent of the reported injuries and 8.0 percent of the deaths. However, ratite deaths accounted for over $2.1 million in losses, 61.6 percent of the total. This imbalance is the result of the value of these birds. The average cost of a single ratite loss was calculated at over $10,000. The cause of most losses is unclear, though. Despite the susceptibility of bird eggs to fire ant attack in the wild (Drees 1992), ratites are usually raised under almost sterile conditions. According to several reports, adult birds exhibited shock-like symptoms after fire ant stings.

Over 76 percent of all injuries were reported in the months April-September, supporting suggestions for fire ant management in livestock operations (Drees and Vinson 1993). Results should also encourage animal caretakers to pay particular attention to fire ant suppression during warmer months or reduce the potential of ant related health problems by scheduling birthing for the cooler months.

II. Opinions and perceptions. We felt it was important to know the prevailing attitudes of the veterinarians about fire ants and their control as well as their actual experiences. One concern is how much people think it costs to treat for fire ants and how much they think it should cost. The perceived annual cost per acre for fire ant treatment was an average of $13.87 per acre per year. The average economically justifiable cost was calculated at $4.42 per acre per year. Comparing the two averages, there exists a gap of $9.45. In other words, veterinarians think the cost of treatment is over three times as expensive as it should be.

Potential cost is not the only factor involved in deciding to manage fire ants. In many instances, perceptions of the threat caused by the ants' presence play an equal or more important role. Over 69.5 percent felt that fire ants were a significant threat to domestic animal health. Over 81 percent felt that they were a threat to livestock health and a surprising 83 percent felt that fire ants might cause economic loss in livestock production. Over 59 percent of respondents felt it was not economically feasible to treat large areas such as pastures and rangeland, though 31 percent reported they were unsure. Over 46 percent reported that "calving pastures" were economically feasible. Over 77.4 percent felt it was feasible to suppress ants around feed storage areas, electrical equipment and stock tanks.

III. Composition and Caseload. This section compared the frequency of fire ant related problems to the average practice caseload. In an average day the "average" veterinarian treats: 15 to 16 dogs and cats; 1 or 2 exotic small animals or birds; 7 to 8 cows; about 4 horses; about 1 sheep, goat, or pig; about 1 exotic large animal or ratite; only 1 or 2 fowl per week; and the occasional reptile, fish or other animal.

The percentage of fire ant related cases can now be estimated. For instance, if an average veterinarian sees 2,737 cattle per year (7.5 cattle per day x 365 days) and sees 6 cases of fire ant related animal health problems requiring treatment per year, only 0.22 percent of the cattle cases seen are fire ant related. **Table 4** lists a similar breakdown of injury frequency for all species.

IV. Extrapolation of Survey Results. Values calculated from the extrapolation of cattle losses to Texas are summarized in **Table 5** (Barr et.al 1994). Assuming similar results from non-responding veterinarians, the total statewide loss to cattle from fire ant related injuries and death is estimated at about $2.2 million or $0.07 per grazed acre. Though this amount is minor by itself, it is only a small part of the potential impact of fire ants on the cattle industry. The methodology used in the extrapolation can be applied to other species and animal groups with sufficient supporting economic data.

Conclusions

- Based on the rate and distribution of returns and question responses, there is considerable interest in and concern over the impact of fire ants on animal health in Texas.
- Small animals and pets are, by far, the most frequently treated type of animal for fire ant related health problems, with cattle second and wildlife a close third.
- This survey documented a conservative cost of $750,000 per year to treat fire ant injuries with over 7,200 animals treated, most with multiple injuries.
- Fire ants cause three-fourths of their yearly injuries from April through September.
- This survey documented nearly $4.5 million in death losses blamed on fire ants.
- The ratite industry suffered over $2.1 million in losses, alone.
- The respondents felt, overwhelmingly, that fire ants pose a significant threat to animal health and livestock production economic loss.
- The respondents felt that fire ant treatments are more than three times as expensive than is

necessary to make them economically feasible in a livestock operation.

- Few respondents felt it was economically feasible to treat large acreages, though many felt it feasible to treat "calving pastures" and most facilities.
- Though fire ant associated animal health losses are substantial and of great concern, they are relatively minor compared to the size of the livestock and pet industries.
- This survey documented only cases seen by veterinarians. It is likely that many more animals are affected, but are not taken for medical care.

Recommendations

- Given the great interest, particularly in areas not infested with the red imported fire ant, there needs to be increased targeting of information regarding effective fire ant management programs to veterinarians and livestock producers.
- Animal health professionals and the public need to be made aware of the seasonality of fire ant injury and educated on ways to take advantage of it with methods such as scheduled breeding and timing of fire ant treatments.
- With wildlife being third in the number of reported fire ant related cases treated by veterinarians, further research needs to be conducted to determine the impact of fire ants on wildlife, particularly deer.
- The ratite industry urgently needs a targeted program on fire ant management methods and pesticide label additions or clarifications regarding use in and around ratite facilities.
- Manufacturers and researchers will need to develop new chemicals and/or application methods to reduce fire ant treatment costs to make their use economically feasible in livestock operations.
- More surveys on economic loss need to be conducted among livestock producers and ranchers to help confirm the results found here and to justify the costs invested in fire ant treatments.

Literature Cited

Barr, C. L. et.al 1994. Texas veterinarian survey: impact of red imported fire ants on animal health. Texas Agric. Ext. Serv., Texas A&M University, College Station, Texas. 43 pp.

Drees, B. M. 1992. Impact of red imported fire ant predation on low-nesting colonial waterbirds on the Rollover Pass Islands, Texas *in* Proceedings of the 1992 Imported Fire Ant Conference (ed. C.S. Lofgren), Department of Agriculture, Commonwealth of Puerto Rico, San Juan, Puerto Rico. pp. 25-32.

Drees, B. M. and S. B. Vinson. 1993, 1992, 1990. Fire ants and their management. B-1536. Texas Ag. Ext. Serv., Texas A&M University, College Station, Texas. 20 pp.

Drees, B.M. 1987. Mud cylinders of Tabanidae (Diptera) from Texas. Annals Entomolo. Soc. Amer. 80(1): 51-54.

Fleetwood, S.C., P.D. Teel and G. Thompson. 1984. Impact of imported fire ant on Lone star tick mortality in open an canopied pasture habitats of east central Texas. The Southwestern Entomologist. 9(2):158-163.

Harris, W.G. and E.C. Burns. 1972. Predation on the Lone star tick by the imported fire ant. Environ. Entomolo. 1:362.365.

Johnson, A.W. and K.L. Hays. 1973. Some predators of immature Tabanidae (Diptera) in Alabama. Environ. Ent. 2:1116-1117.

Joyce, J.R. 1983. Multifocal ulcerative keratoconjunctivitis as a result of stings by imported fire ants. Veterinary Medicine/Small Animal Clinician. July 1983. pp. 1107-1108.

Lofgren, C.S. 1986. The economic importance and control of imported fire ants in the United States. in Economic Impact and Control of Social Insects, S.B. Vinson (Ed.). Praeger Publishers. pp. 222-251.

Table 1. Number and percent of fire ant injuries occurring annually by species or animal group.

Species	No. responses (% of tot.)	No. cases (% of tot.)	Avg. cases/respondent
Small Animal	489 (35.3%)	3,715 (51.6%)	7.6
Bovine	225 (16.3%)	1,260 (17.5%)	6.0
Equine	213 (15.4%)	622 (8.6%)	2.9
Poultry	149 (10.8%)	335 (4.7%)	2.2
Wildlife	215 (15.5%)	872 (12.1%)	4.1
Ratites	56 (4.0%)	205 (2.8%)	3.7
Other Exotic	31 (2.3%)	182 (2.5%)	5.9
Other	5 (0.4%)	13 (0.2%)	2.6
Total	1383 (100%)	7,204 (100%)	5.2

Table 2. Incidence of fire ant injury type and associated costs.

Injury Type	No. responses	No. cases	Avg. cost	Total Cost
Blindness	209	2,717 (20.1%)	$67.59	$183,642.03
Dermatitis	453	6,688 (49.6%)	$52.24	$349,381.12
Secondary infection	249	1,948 (14.4%)	$44.54	$86,763.92
Gastritis	76	440 (3.3%)	$54.16	$23,830.40
Injury to conval-escent animals	159	1,658 (12.3%)	$48.39	$80,230.62
Other	12	43 (0.3%)	$71.08	$3,056.44
Total		13,494	$53.87	$726,904.53

Table 3. Frequency and economic loss associated with animal mortality.

No. Animals (% of total)	Avg. Loss/Animal	Total Loss (% of total)
Bovine		
1,387 (52.4%)	$474.17	$657,670 (18.9%)
Equine		
83 (3.1%)	$1,649.75	$136,930 (3.9%)
Poultry		
381 (14.4%)	$44.17	$16,830 (0.5%)
Small/Animal		
423 (16.0%)	$488.59	$206,675 (5.9%)
Ratite		
214 (8.0%)	$10,029.42	$2,146,295 (61.6%)
Other Exotic		
161 (6.1%)	$1,997.81	$321,647 (9.2%)
Total		
2,649	$1,315.99	$3,486,047

Table 4. Composition and caseload analysis of respondent practices.

	Number of responses	No. of cases	Average cases per respondent	Fire ant related percent of caseload
Small animal				
Dog/Cat	462	7,092	15.4	0.19%
Avian/exotic	281	455	1.6	N/A
Large Animal				
Bovine	206	1,502	7.3	0.32%
Equine	215	903	4.2	0.27%
Poultry	106	34	0.32	2.64%
Sheep/Goat/Swine	154	124	0.81	N/A
Exotic	133	120	0.91	1.56%
Other	24	22	0.92	N/A

Table 5. Extrapolation from responses to statewide cattle losses.

0.069%	Percent cattle estimated to be treated for ant injury in Texas
0.076%	Percent cattle estimated to be lost due to ant related mortality in Texas
$203,736.34	Statewide value of cattle treated due to fire ant related health problems
$1,963,063.80	Statewide value of cattle lost due to fire ants
$2,166,800.00	Estimated statewide economic impact of fire ants on livestock health
$0.01	Per acre cost of fire ant related treatments to cattle in Texas
$0.06	Per acre cost of fire ant related death to cattle in Texas
$0.07	Total extrapolated per acre impact of fire ants of cattle health

PRELIMINARY REPORT OF THE TEXAS CATTLE PRODUCER'S SURVEY: IMPACT OF RED IMPORTED FIRE ANTS ON THE TEXAS CATTLE INDUSTRY

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The Survey of Texas Veterinarians (Barr et al., 1994) quantified red imported fire ant (*Solenopsis invicta* Buren) injuries to livestock, pets, and wildlife. Injuries and deaths were found to be somewhat infrequent, but costly when they do occur. However, many veterinarians indicated that a significant number of animal injuries and deaths are not reported to them by producers. Complaints heard from livestock producers and historical accounts (Lofgren, 1986) concern not only fire ant damage to animals themselves, but also electrical equipment, feed, hay bales, and many types of farm machinery. In addition, fire ants are blamed for reductions in forage and hay quantity, and wildlife populations.

To address these concerns, the Texas Agricultural Extension Service, with the sponsorship of Ciba Geigy Corp. and the assistance of the Texas and Southwestern Cattle Raiser's Association, conducted a survey of fire-ant related impacts on the Texas cattle industry. The overall objective was to gain detailed frequency and economic data on fire ant-related damage from cattle producers themselves. It is hoped that, using this information, methods can be developed to determine an economic injury level so that individual producers can make cost-effective fire ant management decisions.

Materials and Methods

The survey instrument was developed in conjunction with specialists in the areas of entomology, cattle production and pasture management. The survey was printed in an 8-page saddle-stitch format with a cover letter on the front and the entire back page left open for comments. Respondents were assured of confidentiality and no spaces were included for names or addresses, only county.

To help concentrate the survey on "serious" cattle raisers, those who are in closer contact with their herd and who maintain more detailed financial records, the mailing list was provided by the Texas and Southwestern Cattle Raiser's Association (TSCRA). To obtain a geographically thorough distribution, survey recipients were chosen by randomly selecting fire ant-infested counties. Those counties with large urban centers were avoided due to high concentrations of absentee landowners. The list of 72 counties was sent to TSCRA who printed out a list of all members in those counties - a total of 4,521. Survey mailouts included the survey and a postage-paid return envelope in a large manila envelope. To maintain confidentiality of the mailing list, the surveys were transported to a mailing service used by the TSCRA in Fort Worth, Texas where they were addressed and mailed.

Surveys were mailed on or about 1 December 1994. The TSCRA provided 2 reminders in newsletters in mid-December and February. Surveys were opened and given a sequential identification number upon receipt. The last surveys included in tabulations were received on 15 March 1995. To ensure as much uniformity as possible with very non-uniform responses, data were entered into a Paradox 4.5 database *solely* by the senior author who made every attempt to standardize responses for accurate analysis. All comparative agricultural data was obtained from the 1992 Census of Agriculture (U.S. Dept of Agriculture, 1992).

Results and Discussion

Due to the detail of the survey instrument and magnitude of the response, a full analysis of the data is incomplete at this time. Also, it is not possible to cover more than the most concise summary of the results and include detail on the most significant findings here.

I. General Response Statistics. A total of 1,540 surveys were returned, a rate of 34.0% and 1.04% of the total number of farms in Texas (**Table 1**). Of these respondents, 1,090 or 70.7%, reported "Yes", that they have experienced fire ant-related economic losses. Respondents were first asked to list the county(ies) in which they grazed cattle (own or lease) and corresponding acreage. Approximately 20% of respondents listed more than one county. Acreage responses were received from 166 different counties and all but 1 of the targeted counties.

A total of 3,208,998 acres were listed by respondents, accounting for 3.12% of all pastureland in the state of Texas (an area larger than Connecticut) and 4.67% of the land in fire ant-infested counties. Of this total, 1,650,935 acres were reported by "Yes" respondents and 1,558,063 by "No" respondents (**Table 2**). Note that "No" respondents are much larger landholders than those responding "Yes", 3,795 ac. vs 1,515 ac. respectively, due largely to changes in stocking rate and fire ant density as one moves west and south across Texas (**Table 3**). It should also be noted that these results may be skewed by two "No" respondents who reported raising cattle on a total of 300,000 acres.

The most obvious thing about the overall results are their sheer numbers. A return rate of 34% for such a long and very detailed survey is truly remarkable. The survey contained space for 250 possible answers, mostly fill-in-the-blank. Fifty to 100 questions were commonly answered by "Yes" respondents. Also remarkable was the geographic coverage of returns. Of the 167 infested counties (according to TAEX entomological records), 144 had responses while 22 uninfested counties reported.

The main area of non-reporting counties was along the extreme eastern edge of the state and a few counties on the Gulf Coast. Curiously, this area of East Texas is the same that failed to respond to the veterinary survey. It is also the area that has been infested with fire ants the longest in Texas. One can only guess the reasons as to why both veterinarians and cattle producers failed to respond. Perhaps they have just learned to live with fire ants. Perhaps they just don't like to answer surveys.

II. Impacts in Hay Production. Of the 1,090 "Yes" responses, 580 in 92 counties indicated that they had experienced ant-related problems with hay production, 312 with storage problems (multiple responses allowed) and 224 with no problems associated with hay. Of those 580 "Yes" responses, 545 included acreage figures for a total of 73,004 acres, 2.02% of the state's hay pasture total. The average hay pasture size was 134 acres, compared to 46 acres for the state. This figure may be large due to the size of the landholdings and since some of the larger responses were totals from custom baling operators who hay others' pastures.

Respondents were asked to provide details about their hay production and per bale profit per cutting. Many respondents who did not report having fire ant problems filled in this section anyway for a total of 453 responses. Those producing large round bales accounted for 84% of the responses with an average yield for a first cutting of 3.5 large round bales per acre and a profit of $11.96 per bale.

A total of 140 respondents (24.1% of those reporting some hay-related losses) answered the question regarding purchase of new machinery as a result of fire ant activity, reporting a total expenditure of $835,425 or $5,967 per respondent. For the analysis of costs associated with repair of damaged machinery, care was taken to ask the respondents about both material and labor costs and how often these costs were incurred. In summary, 267 respondents filled out all 3 parts of the question - cost of parts, cost of labor, and frequency of these amounts. Total costs amounted to $270,407 or an average of $1,012.76 per respondent per year. These same respondents reported hayed acreage of 40,557 (1.31% of total hay acreage in infested counties) or **$6.67 per acre per year.**

Ranchers were asked to estimate the number of times they stop during a cutting to unclog fire ant-caused jams and for how long per stop. They were also asked to estimate their hourly labor and machine-time costs. A total of 247 respondents completed the 3 parts of this question - number of times stopped during a cutting, how many minutes per stop, and the hourly cost of this time including machine time and labor. They stated that they stopped an average of 27 times per cutting for an average of almost 17 minutes each time. They also stated that their hourly costs were $24.92. This group reported a total of 34,380 acres or 144 acres per respondent. All of this averages out to **$0.88 per acre.** Some respondents commented that this number of stops only occurs during the first cutting of a season when mounds are more numerous, freshly built, and muddy.

As a result of so much damage and so many stops, many producers raise the hay cutter bar to avoid fire ant mounds. There are two ways this is done: raising it a few inches over the entire field and/or adjusting it continuously to avoid individual mounds. Cutter bars were raised over the entire field an average of 3.5 inches as reported by 184 respondents. Of these, 173 accounted for 24,370 total acres. Only 52 respondents reported adjusting cutter bars continuously, but raised them a much greater average of 5.4 inches.

The respondents were then asked to estimate how much hay production raising the cutter cost them. Due to a wide variety of units in response, determining an exact dollar value was quite difficult. Nevertheless, results from about 50 respondents indicate that avoiding mounds by either means causes a production loss of about 0.5 large round bales per acre, on the order of 15%. Using the production figures, that loss translates to about **$6.00 per acre** on at least one cutting.

The comments section provided tremendous insight into how fire ants affect hay production. Several respondents stated that it was necessary to move bales, particularly square bales, out of the field before nightfall or a large portion of them would be infested before morning. Some baling crews will not handle square bales from heavily infested pastures out of concerns for worker safety. Still other comments from ranchers who do not bale their own hay indicate that custom balers have increased prices 10-15% solely because of the extra time and trouble associated with fire ant infestations. Still more comments indicated that there are serious losses in time because equipment must be driven more slowly across fire ant-infested fields. To alleviate problems, other respondents reported dragging their fields to knock down mounds at reported costs of up to $10 per acre.

Therefore, not counting costs of new machinery, which would be depreciated over several years, off-ground storage costs, or the other factors for which there is insufficient data, fire ant-caused losses to these hay production are as follows:

Repairs and lost labor due to breakage	$6.67
Stops to unclog jams (assume per year)	$0.88
Raised cutter bar/lost production (once)	$5.98
	$13.53 per acre per year

The responses to the section on hay production were, by far, the most complete and detailed of the entire survey. Though the response was great, there were perhaps an equal number of ranchers who have their hay cut and bailed by others and could not give such specific information. The outcome of this section, a per acre per year cost of $13.55, was both surprising yet logical when the problem is broken down into its components.

Take, for example, the figures on cleaning out jams in hay machinery. Stopping 26 times per cutting may sound like a lot, but not when the average pasture size is 144 acres. That is only one stop per 5.5 acres. Similarly, 17 minutes to clean out a clog is quite reasonable. Tools must be on hand, panels removed, the clog untangled, and the whole thing reassembled - this with the area covered in angry fire ants. Many times were in the 30-45 minute range with comments that the equipment had to be taken back to the workshop to, if nothing else, avoid working in a fire ant-infested field.

The question also arises as to whether these various economic losses are counter-indicative. In other words, if a rancher buys a disc-type cutter and raises it 4 inches, will he still suffer losses from breakdowns and jams? A review of individual surveys and a knowledge of hay production suggests that the answer is, to a large degree, yes. Even if a disc-type cutter knocks down the mounds without breakage, they still require more frequent tooth sharpening and replacement than would a sickle-bar cutter because of these repeated impacts. By the time the hay is dry days later, the mounds are rebuilt enough to jam the baler just as often and that 4 inches of forage is still lost.

Perhaps the most obvious question that arises from these results is whether these economic losses occur in every hay pasture in the fire ant infested area of Texas? Obviously not. Losses depend greatly on the size and character of the mounds which depends on soil type, rainfall and density. Nevertheless, these numbers are <u>averages</u> from about 250 respondents. Some ranchers are experiencing *worse* losses, while others, none. These losses are not occurring everywhere, but they are occurring and there are producers suffering serious economic losses.

A $13.55 per acre per year, assuming that it does occur, can justify treatment of hay pastures with a chemically-based fire ant suppression program. Using currently labeled baits and ground application equipment, it is estimated to cost $10-12 per acre per year to satisfactorily suppress fire ants (Drees and Vinson, 1993). Easy equipment modification allows bait application simultaneous with other agronomic practices such as fertilization (unpublished data). This virtually eliminates the labor involved and brings the cost down to $8-10 per acre. Recently developed skip-swath application methods with fenoxycarb bait, though not approved for pasture use at the present time, can cut material costs in half. (Drees, et. al., 1993)

III. Other Causes of Economic Loss. **Table 4** details a brief summary of all economic responses that were either reported directly or that could be calculated reliably from information given. Respondents in this and other sections usually rounded off their answers to even tens or hundreds of dollar. There were, however, respondents who obviously went into their computers or record books and extracted values to the penny. These two sets of values were well within range of each other. Responses that were far out of range, such as the man who valued his time at $200 per hour, were not included in final tabulations.

Losses due to cattle injuries and deaths are relatively minor compared to the size of the cattle industry as a whole - unless it's your cow. An average of $1,850 per lost animal is substantial, particularly for a small operation. We suspect that this number is somewhat inflated, probably by the natural tendency of respondents to report "memorable" losses, such as carefully bred calves and registered breeds. They may have also reported sale prices had the animal gone to market rather than net profits.

The section on equipment and material losses yielded several surprises. The first was the frequency at which these incidents occur. Over 78% of all "Yes" respondents reported something in this category with fully two-thirds reporting damage to electrical equipment, many indicating that these losses occur annually. Secondly, these losses are relatively unrelated to the size of individual operations. A $300 water pump can burn out due to fire ants on a 10 acre ranch just as easily and frequently as on a 10,000 acre ranch. The difference is that the owner of the 10 acre ranch can realistically and economically treat his entire place for ants, preventing such damage. The same does not hold true for the entire 10,000 acres.

The total dollar value of equipment and material losses came to about $0.84 per reported acre. Again, losses cannot be spread over acreage. A more accurate representation is the average loss per operation. Unfortunately, this can't be determined with great accuracy because not every respondent listed losses in every category. However, dividing the total loss by the number of producers that responded to at least one of the questions is a good approximation - $1,367. For a 10 or 100 acre ranch, losses of this magnitude can justify treatment costs. For a 1,000 acre ranch, cost is prohibitive.

Expenses related to pesticide treatment of fire ants totaled only about $400,000. When extrapolated to the total number of ranches in the infested areas, this comes to about $20 million. A substantial sum, but small compared to the state's $8 billion cattle industry. The interesting feature is the distribution of pesticide use. Almost every respondent replied to this question. Pesticide use around the home was reported by over 80% with the percentage decreasing steadily as the value of the site decreases. Unimproved rangeland received treatments by only 61 respondents. The cost of such treatments, however, did not follow such a pattern. Home use averaged $250 per respondent, but these people (most respondents used pesticides in both areas) used only $97 worth of chemicals around barns and outbuildings. Those who did treat their production land spent from $117 to $212. It is important to note that these figures are not per year or per acre.

Conclusions

Since the purpose of this survey was to gather data towards the development of economic injury levels on a per acre basis, the simple thing to do is to divide the reported losses by the reported acreage. Therefore, the figure for those respondents listing some economic loss equals **$2.06 per acre**. Extrapolating that figure to the "problem" areas of the state, the loss comes to $67 million. A large number, but still only 0.99% of the states 6.8 billion dollar beef cattle industry.

However accurate $67 million may be, its derivation is unrealistic. The survey shows that fire ant problems are not evenly distributed, even within a single county or a few square miles. It must be emphasized that this is an operation-by-operation phenomenon where treatment decisions must be made by each producer after analysis of his or her particular problem. One conclusion is clear, if fire ant damage occurs, it is usually significant to the individual, but the circumstances cannot be applied to his neighbors.

Without a doubt, fire ants are still an issue of major concern to Texas cattle producers. Though this impression is firmly supported by the return rate and geographic distribution it can only be fully appreciated by reading the voluminous comments included on the surveys. About 40% wrote something and many respondents filled the back page, several attaching extra sheets. Many respondents provided their names and addresses even though the confidentiality of their membership was of utmost concern to the TSCRA. Many respondents gave detailed descriptions of their location versus the location of the nearest fire ants or when they were first invaded, giving us an irreplaceable historical record of the fire ant's westward expansion. One gentleman even sent photos.

Survey results and comments point out a paradox that would seem to be peculiar to fire ants among other pests of agriculture - perceptions and opinions versus reality. Many respondents listed virtually no economic impact while reporting hundreds of dollars spent on control. Others listed thousands of dollars in losses, particularly regarding hay production, yet spent almost nothing on pesticides. What many respondents mentioned was the need for an eradication program similar to that conducted on the screw worm - a cheap, one-shot, government-sponsored effort that solves the problem.

Results indicate, among many other things, that there is tremendous confusion about fire ants and treatment options and a general condemnation of treatment costs and effectiveness. They also showed that there is an almost desperate need for education in the areas of impact and cost analysis, management options, and pesticide use. Based on this survey, the veterinary survey, and numerous fire ant control field experiments, the Texas Agricultural Extension Service is well on its way towards the development of an economic injury level for fire ants in individual cattle operations.

Acknowledgments

The authors are grateful to Dr. L.R. Sprott, Professor and Extension Beef Cattle Specialist, and Dr. David H. Bade, Professor and Extension Forage Specialist, for their help in developing the survey instrument. We would also like to thank Mr. Don C. King, Secretary-General Manager (ret.) and Ms. Crystal Bryant of the Texas and Southwestern Cattle Raiser's Association for their kind cooperation in providing the mailing list for this survey and the follow-up reminders in the TSCRA newsletter.

Very special thanks to the cattle producers who took the time to give us this invaluable information.

Literature Cited

Barr, C.L. et. al. 1994. Texas veterinary survey: impact of red imported fire ants on animal health. Texas Agric. Ext. Serv., Texas A&M University, College Station, Texas. 43 pp.

Drees, B.M., C.L. Barr and M.E. Heimer. 1993. Skip-swath application of Amdro® and Logic® broadcast baits for the suppression of the red imported fire ant, pp. 69-72 *in* Proceedings of the 1993 Imported Fire Ant Conference (compiled by J.P. Ellis), Charleston, South Carolina.

Drees, B.M. and S.B. Vinson. 1992, 1993 (rev.). Fire ants and their management. TAEX B-1536.Texas A&M University System, College Station, Texas.

Lofgren, C.S. 1986. The economic importance and control of imported fire ants in the United States *in* Economic Impact and Control of Social Insects, S.B. Vinson (Ed.) Praeger Publishers. pp. 2322-251.

United States Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 1994. 1992 Census of Agriculture (AC92-A-43), Volume 1, Part 43A and 43B. U.S. Government Printing Office, Washington, D.C. 20402

Table 1. Response statistics to the Texas Cattle Producer's Survey.

Number mailed	4,521	Counties in Texas	254
Number undelivered	3	Infested Counties	167
Number returned	1,540	"Targeted" Counties	72
Return rate	34.0%	Counties w/responses	166
"Yes" responses	1,090	Infested w/responses	142
"No" responses	450	Non-infested w/resp.	22

Table 2. Breakdown of acreage responses to the Texas Cattle Producer's Survey.

Total Texas pastureland	102,805,890	(61% of total land area)
RIFA infested pastureland (by county)	55,838,986	(54.3% of pastureland)
Acreage of targeted counties	28,613,193	(51% of infested area)
Total acreage listed on surveys	3,208,998	(3.1% of Texas total)
Acreage from infested counties	2,610,172	(4.7% of infested counties)
Acreage with "Yes" responses	1,650,935	(2.96% of infested area)

Table 3. Acreage, cattle and stocking rate characteristics of respondents.

	Avg. acreage	Cattle	Avg./Respondent
All respondents	2,083.8	299,282	-
"Yes" respondents	1,514.3	218,238	211
"No" respondents	3,795.3	81,044	206

Average stocking rate for Texas	7.76 acres/head
Average "Yes" respondent* stocking rate	7.58 acres/head
Average "No" respondent** stocking rate	19.22 acres/head

* Respondent indicating economic losses due to fire ants.
** Respondent indicating no economic losses due to fire ants.

Table 4. Summary of losses and expenses reported from the Texas Cattle Producer's Survey, 1994.

Item		Responses	Total loss	Avg./resp. reporting loss[1]	Avg./"Yes" respondent[2]
Cattle Losses					
Injuries (# cows=1544)		378	$ 34,757	$121.10	$ 31.89
Deaths (# cows=793)		278	514,449	1,850.54	471.97
Sub-total			**549,206**		**503.86**
Equipment and Material Losses					
Ruined feed	material	359	155,386	432.83	142.56
	labor	219	22,975	104.91	21.08
Ruined hay	material	416	197,486	474.73	181.18
	labor	246	54,045	294.70	49.58
Shredder dmg.	material	304	155,242	510.66	142.42
	labor	243	71,620	294.73	65.71
Elect. equip.	material	687	259,719	378.05	238.27
	labor	504	96,678	191.82	88.70
Other	material	75	53,959	719.45	49.50
	labor	60	22,721	378.68	20.84
Sub-total			**1,089,831**		**999.84**
Hay Production					
New Equipment		140	835,425	5,967.32	766.44
Equipment Repairs		267	279,010	1,044.98	255.97
Jam Removal		247	45,027	182.30	41.31
Sub-total (not incl. lost production)			**1,159,462**		**1063.72**
Pesticide Use					
Home/living quarters		828	207,596	250.72	190.46
Outbuildings		686	66,138	96.41	60.67
Hay storage		562	54,635	97.22	50.12
Calving Pastures		206	19,748	95.86	18.12
Hay Meadows		111	18,755	168.96	17.21
Improved pastures		109	23,062	211.58	21.16
Unimp. pasture/range		61	8,541	140.02	7.84
Sub-total			**398,475**		**365.58**
Other Animal Injuries and Deaths (Including horses, sheep, goats, swine, working dogs, pets of any type, food fowl, ratites, and other exotics)					
Sub-total			**203,583**		**186.77**
TOTAL Direct Reported Losses			**$3,400,557**		**$3,119.77**

[1] Total losses in category/number of respondents reporting losses in that category only.
[2] Total losses in category/total number of surveys with "Yes" response in any category (1,090).

REDUCING TREATMENT COSTS FOR FIRE ANT SUPPRESSION IN TEXAS CATTLE PRODUCTION SYSTEMS

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Treatment programs conducted to suppress populations of the red imported fire ant, *Solenopsis invicta* Buren, can be expensive and time consuming. Short of subsidizing the cost of fire ant insecticides by government programs, potential techniques for reducing treatment costs include: 1) develop economic injury levels and implementation of economic thresholds or action levels; 2) use modified treatment patterns; 3) reduce equipment requirements; 4) treat for ants while conducting other field operations such as fertilizing; and 5) adjust treatment timing to optimize residual effectiveness (i.e. fall broadcast insecticide bait applications provide suppression of fire ants during early spring months). Methods (2,3 and 4) were investigated in the trials reported below.

I. EVALUATION OF ALTERNATIVE RATES AND TREATMENT PATTERNS FOR RED IMPORTED FIRE ANT BAIT PRODUCTS, LOGIC® AND AMDRO®.

Previous studies (Drees et al. 1992; Drees et al. 1993) showed that the effects of a spot application of Logic® Fire Ant Bait (containing fenoxycarb, also sold as Award®) affect more than one fire ant mound. Broadcast application, applied as a "skip swath" pattern (0.75 lbs./acre), provided suppression of fire ant mound numbers similar to that obtained using conventional, full coverage (1.5 lbs./acre), treatment. In the trial reported in 1993, swaths were 35 ft. wide. In addition, the application of a 1.5 lbs. mixture of Amdro® Fire Ant Granules/Insecticidal Bait (hydramethylnon, 0.75 lbs. of formulation) plus Logic (0.75 lbs.) provided quick initial fire ant suppression, characteristic of the effects of an Amdro treatment, and long (over 1 year) suppression, characteristic of a Logic treatment. The trial reported here is a replication of this earlier study and included a spot treatment applied without a manual or electric seeder.

Materials and Methods

This trial was established behind the earthen dam at Granger Lake in Williamson County, Texas. This area is routinely mowed and has restricted access to U. S. Army Corps of engineers personnel, only. No livestock was grazed in this area and cut grass was not harvested for hay. Plots, 150 by 300 ft. (1.03 acres), were established with 30 ft. buffer areas. Active fire ant mounds were counted in each plot by using a 30 ft. long pole (made from 0.75 inch diameter PVC pipe reinforced internally with 0.5 inch electrical metal tubing (EMT)). This pole was carried by at least two people and walked lengthwise across 260 ft. of each plot on each side of the centerline (0.36 acre sample area). Active ant mounds were counted using the minimal disturbance method. Mounds were disturbed with a pointed stick and considered to be active when 25 or more worker ants emerged from the mound within 30 seconds.

Resulting ant mound counts were arrayed by plot and blocked into 4 blocks (replicates) of eight treatments each. Treatments (**Table 1**) were randomly assigned within each block. Full rate broadcast and strip treatments were applied using a tractor mounted Herd® Model GT-77 seeder, July 1, 1993. Reduced rate (0.75 lb./acre) Amdro and Logic broadcast applications were applied using a hand held Cyclone® Model 1C1 seeder, July 2. Periodically after treatments (4 weeks, 3 months, 6 months, 12 months and 18 months), fire ant mounds were monitored using the technique described above. Results were analyzed using analysis of variance (ANOVA)($P \leq 0.05$) and means were separated using Tukey's Studentized Range test.

Table 1. Treatments evaluated for red imported fire ant suppression, Granger Lake, Williamson Co., Texas, 1993.

Treatment	Pattern	Rate
1. Amdro® (hydramethylnon)	complete coverage broadcast	1.50 lbs./acre
2. Amdro® (hydramethylnon)	complete coverage broadcast	0.75 lb./acre
3. Logic® (fenoxycarb)	complete coverage broadcast	1.50 lbs./acre
4. Logic® (fenoxycarb)	complete coverage broadcast	0.75 lb./acre
5. Logic® (fenoxycarb)	skip swath broadcast	0.75 lb./acre
6. Logic® (fenoxycarb)	spot application	2 Tbsp./spot on a 30 by 30 ft. grid pattern (1.424 lbs./acre)
7. Logic® plus Amdro® (fenoxycarb plus hydramethylnon)	complete coverage broadcast	0.75 + 0.75 lb./acre
8. untreated control	---	—

Results

This site did not receive rain from 26 June 1993 until well into September. This dry weather suppressed ant mounding activity in all plots, including the untreated control plots (**Table 2**). The full Amdro and Amdro plus Logic treatments numerically reduced active ant mound numbers relative to other treatments by four weeks after treatment. However, significant differences between treatments did not occur until 3 months following treatment with all treatments except Amdro® having significantly fewer active ant mounds than untreated plots. Statistically, all Logic®-based treatments performed similarly throughout this trial. The mound numbers in Logic skip swath and spot treatment plots began to increase after 12 months and all treatments approached or exceeded pre-treatment levels after 18 months. Although results obtained from this trial were not as clear as those documented in the trial conducted at Lake Conroe Dam (Drees et al. 1993), the trends obtained from treatments remained the same.

Table 2. Number of active red imported fire ant mounds per 0.36 acre subplot and total ant mounds per treatment (for four replications) before and after treatment, Granger Lake, Williamson County, Texas, 1993.

		Mean no. active fire ant mounds/0.36 acre*				
TREATMENT	0 week	4 week	3 month	6 month	12 month	18 month
Untreated	57.75a	20.75a	20.00a	36.75a	50.00a	60.50a
Amdro, full rt	55.00a	7.00a	6.25abc	6.25b	24.75ab	61.50a
Amdro, half rt	56.75a	13.50a	15.5ab	25.25ab	35.25ab	74.50a
Amdro:Logic	55.00a	6.75a	1.50bc	2.00b	15.50b	49.25a
Logic, full rt	58.25a	13.50a	0.25c	2.50b	13.50b	67.25a
Logic, half rt	56.00a	17.50a	5.75abc	2.75b	14.50b	71.00a
Logic, skip	55.00a	19.75a	4.50bc	1.75b	16.75ab	61.25a
Logic, spot	54.75a	15.50a	4.25bc	1.25b	16.00ab	60.25a
F	29.49	4.19	4.11	4.66	2.74	0.96
P	0.0001	0.0028	0.0031	0.0015	0.0247	0.5003
R sq.	0.9335	0.6659	0.6620	0.6894	0.5662	0.3147
MSE	123.74	43.293	39.429	125.57	220.281	426.756
Crit. val.	4.743					
df	21					
Min. Sig. Dif.	26.383	15.605	14.843	26.577	35.201	48.995

* Means followed by the same letter(s) are not significantly different using analysis of variance and Tukey's Studentized Range Test ($P \leq 0.05$).

II. EVALUATION OF AMDRO® (HYDRAMETHYLNON) GRANULAR INSECTICIDE AND FERTILIZER FORMULATIONS FOR SUPPRESSION OF THE RED IMPORTED FIRE ANT.

This trial examined the efficacy of three formulations of Amdro® (hydramethylnon) Insecticide Bait blended with encapsulated fertilizer. Performance of these formulations were compared to Amdro® applied alone and applied simultaneously with urea fertilizer using separate applicators mounted and operated together on one tractor. Previous efforts have shown that mixing or blending fire ant bait products with fertilizer instantly reduces the attractiveness of the bait to the ant, but that bait applied simultaneously with fertilizer did not hinder ant foraging on bait particles.

Materials and Methods

This trial was conducted on pasture land on the Alex Gilstap and Bobby McGeehee Farms, Montgomery County, Texas. The test site is located along State Highway 105 in an area of clayey, blackland soil and consists of two pastures. The first pasture is a mix of improved and native grasses. The second, adjacent pasture is a mixture of planted switchgrass and kleingrass. Both pastures are moderately grazed throughout the year. Both pastures had fire ant mound densities of approximately 50 mounds per acre. That and the large size of both the ants and the mounds indicate a monogyne infestation.

Six test plots were marked and pre-counts taken on 10 June 1994. Plots consisted of 5 rectangles 450 ft. by 150 ft. or 1.55 acres or larger. Due to application considerations and a limited amount of treatment material, only one large plot was marked for each treatment. Within these treatment areas, three pieces of rebar were evenly spaced as sample subplot centers. Subplot samples consisted of a 58 foot circle encompassing 0.25 acres. The number of active red imported fire ant mounds were counted and recorded within each subplot area before and periodically after treatment (5 July, 20 July and 3 Oct. 1994). Mounds were considered active if numerous ants emerged from the mound upon minimal disturbance. Colony vigor was rated during post-treatment evaluations using a rating scale of 0 to 3, with 0 = no ants; 1 = 1 - 100 ants; 2 = 101 - 1,000 ants; 3 $\geq$ 1,001 ants. Subplot data were analyzed using analysis of variance (ANOVA) and means separated using Tukey's Studentized Range test ($P \leq 0.05$).

On 14 June, treatments (**Table 3**) were applied using tractor mounted equipment. All fertilizer plus Amdro® treatments were applied using a PTO-operated Crop Spreader fertilizer applicator with a rotary-type agitator (setting 13). Amdro®, applied alone or simultaneously with urea was applied with an electric Herd GT-77 Seeder calibrated to apply 1.5 lbs. formulation per acre, and mounted on top of the Crop Spreader (**Fig. 1**). Treatments were applied between 5:15 and 7:15 pm. Ground was dry at time of application. Light rain was reported the evening before application, and rain was in the area during the middle of the night after treatments.

Results

The number of fire ant mounds initially present in each subplot was very similar between treatment plots: 1) Untreated - 10,9,9 2) Amdro® - 12,11,14
3) Pursell - 15,14,18 4) Lessco - 8,13,16
5) Scott's - 10,11,17 6) Urea + Amdro - 9,13,14

None of the microencapsulated fertilizer plus Amdro® formulations reduced fire ant mound numbers or activity rating relative to the untreated plots (**Table 4**). Of the fertilizer blends evaluated, the J. M. Scott's & Sons, Inc. blend numerically outperformed other formulations.

Amdro applied alone significantly reduced ant activity ratings from 2 to week 4, while Amdro applied simultaneously with fertilizer significantly reduced both active mound numbers as well as activity throughout this 16 week trial, providing a 96 to 97 percent reduction in active mound numbers relative to untreated subplots. More effort to develop fertilizer plus Amdro® may result in an efficacious formulation. Fertilizer, applied simultaneously with Amdro® Insecticide Bait performed well and may be a useful treatment method for both urban and agricultural operations. Additional field trials will provide documentation for these treatments and treatment methods. In future work, a treatment using fertilizer (i.e., urea) alone should be added to determine if fertilizer suppresses fire ant mound numbers.

Conclusions

Results of trials reported here provide documentation for methods designed to reduce fire ant treatment costs. With little or no reduction in product performance, Logic® (fenoxycarb) spot treatments can suppress ants without the need for application equipment, and strip or skip-swath treatments can cut product and labor (time) costs in half. These alternative treatment methods should be considered by the manufacturer as additions or modifications to existing product labels.

Amdro® Insecticide Bait (hydramethylnon) continues to be the fastest acting conventionally formulated fire ant bait treatment. Simultaneous application of Amdro® while fertilizing pastures can reduce treatment costs, although two applicators must be mounted and calibrated on a single tractor and thorough coverage by both materials is necessary. Blending Logic® and Amdro® and applying the mixture at half rates of each product continues to provide a product performance profile that appears to offer both a quick suppression of ant mound numbers (characteristic of Amdro®) as well as long residual activity (characteristic of Logic®).

Results generated from these applied research trials do not constitute a recommendation for use of these practices by the Texas Agricultural Extension Service or the Texas Agricultural Experiment Station.

Table 3. Treatments and rates evaluated for suppression of red imported fire ant mound numbers, Montgomery County, Texas, 1994.

	Treatment	Rate
1.	Pursell Industries (LaRoche) 33-0-11 Mini plus Amdro® (green & yellow) 125 lbs/acre = 1.5 lbs. Amdro	188 lbs./1.5 acres
2.	Lessco Poly Plus 35-0-0 plus Amdro® (yellow) 150 lbs./acre = 1.5 lbs. Amdro	225 lbs./1.5 acres
3.	J.M. Scott & Sons, Inc. S-6012, Ext. No. 4-138-1CW plus Amdro® (orange) 103 lbs./acre = 1.5 lbs. Amdro®	150 lbs./1.5 acres
4.	Amdro (1.5 lbs./acre), fertilizer Urea 45-0-0 (white) (300 lbs./acre = 65 lbs. N) Amdro® 3.2 lbs.*	600 lbs./2.2 acres
5.	Amdro® (1.5 lbs./acre)**	2.25 lbs./1.5 acres
6.	Untreated control**	1.5 acres

* (Note: due to space limitations, this plot was placed in a treated area in the shape of a triangle with two 450 feet sides for an area of 2.21 acres.)

** These two plots were located in an adjacent (across the fence) switchgrass field.

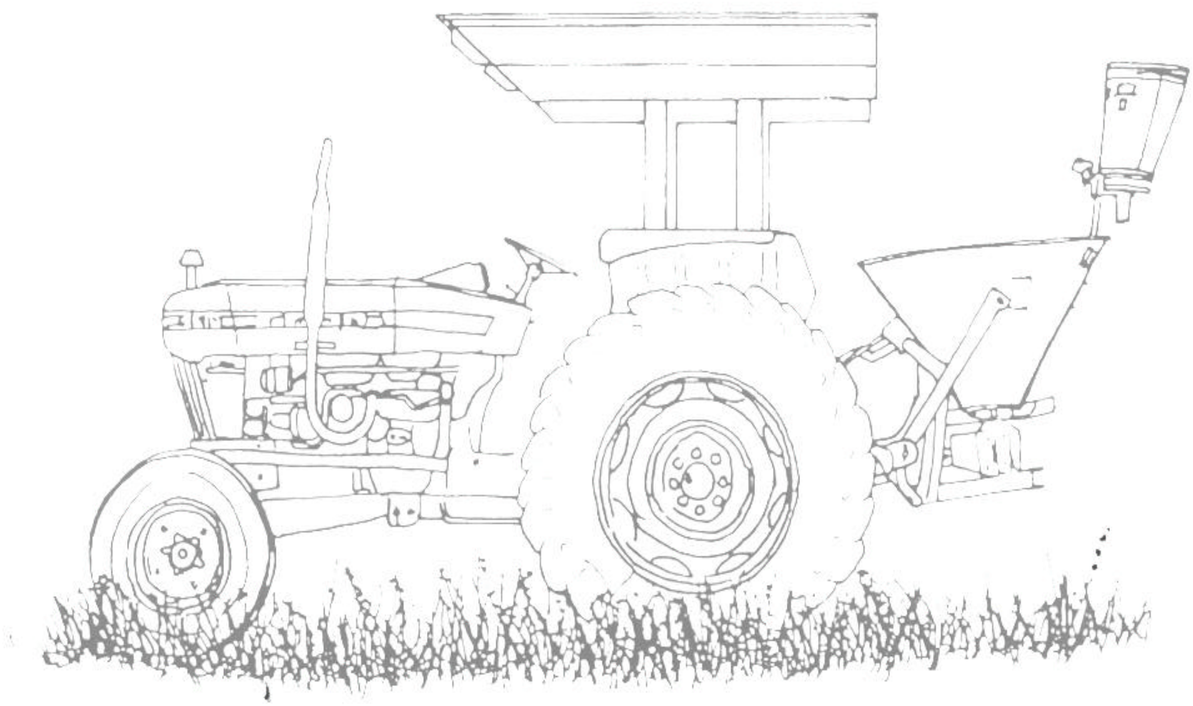
Table 4. Mean number of active red imported fire ant mounds and average activity rating per 0.25-acre circular subplot (n = 3), Dobbin, Texas, 1994.

Treatment	Weeks following treatment 2 weeks	 4 weeks	 6 weeks
	Mean no. mounds*		
Untreated control	9.33 ab	9.00 ab	10.00 ab
Amdro® (1.5 lbs./acre)	6.67 b	2.67 bc	3.33 bc
Pursell Industries + Amdro®	11.00 a	10.67 a	11.00 a
Lessco Poly Plus + Amdro®	9.67 ab	9.00 ab	8.33 ab
J.M. Scott's & Sons, Inc.	7.33 ab	5.67 abc	4.00 abc
Urea (300 lbs) + Amdro® (1.5 lbs./acre)	0.33 c	0.33 c	0.33 c
F-value	11.43	7.14	5.41
P	0.0005	0.0031	0.0087
MSE	2.8556	5.0556	7.2000
MSD	4.7922	60.764	7.6096
df	10		
Crit. Val.	4.912		

Treatment	Rating*		
Untreated control	25.33 ab	26.33 a	28.00 ab
Amdro® (1.5 lbs./acre)	10.00 cd	6.67 b	8.00 bc
Pursell Industries + Amdro®	32.00 a	29.67 a	30.67 a
Lessco Poly Plus + Amdro®	26.33 ab	25.33 a	23.33 ab
J.M. Scott's & Sons, Inc.	19.00 bc	14.00 ab	9.33 abc
Urea (300 lbs) + Amdro® (1.5 lbs./acre)	0.67 d	1.00 b	0.67 c
F-value	15.37	9.15	5.50
P	0.0001	0.0012	0.0082
MSE	19.2889	32.5667	59.8333
MSD	12.455	16.184	21.936
df	10		
Crit. Val.	4.912		

* Means followed by the same letter are not significantly different using analysis of variance (ANOVA) and means separated using Tukey's Studentized Range Test ($P \leq 0.05$). Colony vigor was rated during post-treatment evaluations using a scale of 0 to 3, with 0 = no ants; 1 = 1 - 100 ants; 2 = 101 - 1,000 ants; 3 $\geq$ 1,001 ants. Rating indicates mean total per subplot.

Figure 1. Tractor mounted PTO-operated Crop Spreader fertilizer applicator with an electric Herd® GT-77 Seeder mounted on top, used to apply 1.5 lbs. per acre Amdro® simultaneously with 300 lbs./acre urea (45-0-0).



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Literature cited

Drees, B. M., C. L. Barr and S. B. Vinson. 1992. Effects of spot treatments of Logic® (fenoxycarb) on polygynous red imported fire ants: an indication of resource sharing? Southwestern Entomol. 17(4):313-317.

Drees, B. M., C. L. Barr and M. E. Heimer. 1993. Skip-swath application of Amdro® and Logic® for the suppression of the red imported fire ant *in* Proceedings of the 1993 Imported Fire Ant Research Conference (ed. J. P. Ellis), Charleston, South Carolina.

EFFECT OF RED IMPORTED FIRE ANTS ON WILDLIFE (RODENT) POPULATIONS LAKE CONROE DAM, MONTGOMERY COUNTY, 1994: FIRE ANT MOUND MONITORING AND SUPPRESSION PROGRAM

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Initial results of a two-year project to document the impact of the red imported fire ant, *Solenopsis invicta* Buren, on wildlife populations are reported. Large plots were established and maintained in which fire ants were suppressed using a biannual application of Amdro® Insecticide Bait (hydramethylnon). This product was selected because of its rapid reduction of fire ant numbers (80 percent in 3 to 5 weeks) and minimal effects on ants outside treated plots. Results from rodent trapping efforts in these plots are to be compared to those from untreated plots. The value of conducting long-term research using this plot design and potential methods of optimizing a sequential bait treatment program using a theoretical re-treatment threshold are discussed.

Materials and Methods

Ten plots, 620 to 656 ft. long and 240 ft. wide (approximately 3.47 acres) were established. On 24 May, 1994, alternating plots were treated with a broadcast application of Amdro® Insecticidal Bait (Lot #310401E, 0.73% hydramethylnon), using 5.2 lbs. (1.5 lbs./acre) of the bait formulation per plot using a tractor mounted Herd Model GT-77 spreader. Each treatment plot was covered with eight 30 ft. wide swaths. The weather was partly cloudy and temperature was 80-87○F. Grass was dry during treatment (10:15 am to 12:15 pm).

Fire ants were monitored by counting the number of active mounds along three 30 by 160 ft. (0.11 acre) transects, starting and ending 40 ft. from the edge of each plot, using the minimal disturbance method, May 25, 1994. Treatment plots were treated a second time on 6 October 1994 and the effects of the treatment were monitored on 18 November. Results were analyzed using the Students *t* test ($P \leq 0.05$).

Results

Mean numbers of active fire ant mounds were not statistically different: 20.33 versus 17.07 for treated and untreated control plots, respectively (d.f. = 17; P = 0.4141; F = 1.11)(Table 1). One month following treatment, Amdro® treated plots had significantly fewer active ant mounds than the untreated control plots (1.67 versus 8.73 for treated and untreated control plots, respectively (d.f.

= 17; P = 0; F = 99999.99)), an 80.9 percent reduction. During the week of 16 October 1994, Montgomery County received flooding rains (31 inches of rain). The lower subplots/transects may have been flooded temporarily. However, the remaining area in this trial was not flooded. The 6 October treatment resulted in 86 percent reduction in numbers of fire ant mounds in treated plots versus untreated plots by 18 November (67/472).

Discussion

Results from monitoring the number of active fire ant mounds using the minimal disturbance method reported here are being correlated with results of methods to monitor foraging ant recruitment to bait stations by Jim Martin. Correlations results will be help improve decision making in fire ant suppression programs.

Long-term fire ant suppression studies are seldom undertaken. However, such studies are help document potential resistance of fire ants to insecticides. Although physiological resistance to insecticides is not anticipated to occur in fire ants because of their long reproductive cycle, behavioral resistance and avoidance of bait-formulated products remains a concern, particularly in light of recent resistance to cockroach bait formulations (Pennisi 1993). Long-term suppression program monitoring is also useful for documenting successful treatment programs utilizing sequential treatments of one or more insecticide as in the two-step method (Merchant and Drees 1993). These programs are often initially based on the combined results of short-term studies. Finally, long-term studies are required to document long-term ecological and economic effects caused by fire ants and/or fire ant treatments. Changes in fauna and flora are not expected to occur quickly.

Sterling (1984) discussed the concept of action levels and inaction levels. As economic injury levels (EILs) are developed for the red imported fire ant in agricultural situations, the concept of an economic threshold (ET) or action level (set below the EIL to allow action to be taken before that level is reached) will become a useful method to improve decision-making in fire ant management programs. The inaction level, justifying no chemical treatment for the cotton boll weevil occurs when four or more red imported fire ants are collected per 10 samples of cotton plant terminals using the beat bucket method (Knutson et al. 1993). Re-treatment thresholds that differ from the economic threshold for an initial treatment are established for certain pests such as the cotton bollworm and tobacco bollworm (Knutson et al. 1993). This integrated pest management (IPM) concept can also be useful for managing the red imported fire ant.

In the development of re-treatment thresholds for applying bait-formulated products for the suppression of the red imported fire ants, there is a need to consider cost (per mound and per acre), fire ant biology, desired level of suppression in time, and residual suppression provided by the treatment. The approximate per acre cost of a conventional fire ant bait treatment is $10.00 per acre and a reasonable average cost of an individual mound treatment is $0.50 (ranging from $0.17 to over $1.50). Using this price, one could treat about 20 mounds at $0.50 for the price of one $10.00 broadcast treatment. Treatment using a broadcast bait application is already discouraged in areas with less than 20 mounds per acre based on concerns for non-target ants (Drees and Vinson 1993). Fire ant foraging must occur in the treatment area in order for particles from a broadcast bait treatment to be collected, carried back to mounds and fed to the colony. Therefore, a reasonable re-treatment threshold for bait products may be 20 to 30 or more mounds per acre.

There are a number of potential reasons for broadcast bait treatment failures. These include: 1) stale product and fertilizer blends; 2) low rate and poor coverage; 3) no ants actively foraging at time of treatment (too hot or too cold) or rain during or shortly after treatment; 4) contact insecticide applied sometime prior to treatment, suppressing foraging activity; 5) occurrence of flooding after application of a slow-acting bait causing treated colonies to float or migrate in or out of the treated area; 6) high initial mound density requiring additional applications to achieve acceptable suppression levels; and 7) no ants present because of successful prior treatments. If a product claiming to provide long-term suppression is applied when no ants are present to collect the bait, the bait quickly degrades in the environment and the possibility of rapid recolonization of ants begins shortly following application. Use of re-treatment thresholds, rather than use of a calendar-based treatment schedule can prevent this likelihood and optimize time between treatment intervals. This method can take advantage of natural environmental and seasonal ant suppression conditions such as periodic droughts and freezing winter conditions.

Acknowledgement

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Literature Cited

Drees, B. M. and S. B. Vinson. 1993. Fire ants and their management. B-1536. Texas Agricultural Extension Service, The Texas A&M University, College Station, Texas.

Knutson, A., R. D. Parker, R. L. Huffman, C. G. Sansone and J. Swart. 1993. Management of cotton insects in the southern, eastern and blackland areas of Texas. B-1204. Texas Agricultural Extension Service, The Texas A&M University, College Station, Texas.

Merchant, M. E. and B. M. Drees. 1993. The two-step method do-it-yourself fire ant control. L-5070. Texas Agricultural Extension Service, The Texas A&M University, College Station, Texas.

Pennisi, E. 1993. How a cockroach lost its sweet tooth. Sci. News 143:27.

Sterling, W. 1984. Action and inaction levels in pest management. B-1480. The Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas.

Table 1. Active fire ant mounds in 30 by 160 ft. (0.11 acre) transects across treated and untreated 3.47 acre plots, Lake Conroe Dam, Montgomery Co., Texas 1994.

	Plot (Treated/Untreated)									
Transect	1T	2U	3T	4U	5T	6U	7T	8U	9T	10U
24 May 1994										
A	31	21	15	19	21	14	22	6	17	16
B	28	21	14	15	34	18	30	24	8	21
C	7	8	11	7	25	20	20	29	22	17
A-C	66	50	40	41	80	52	72	59	47	54
27 June 1994										
A	1	8	0	6	0	22	1	6	3	9
B	1	10	2	13	4	13	0	2	3	4
C	3	15	2	7	2	10	0	7	3	9
A-C	5	33	4	26	6	45	1	15	9	22
18 Nov. 1994										
A	2	8	0	38	6	43	0	31	10	25
B	4	21	1	31	11	53	5	16	1	38
C	3	39	12	50	7	42	4	22	1	15
A-C	9	68	13	119	24	138	9	69	12	78

EVALUATION OF AWARD® (FENOXYCARB) FORMULATIONS AND AN AWARD®-FERTILIZER BLEND

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Conventional bait formulated products for red imported fire ant suppression have not changed dramatically since their development and early use with mirex. They consist of processed de-fatted corn grit coated in a vegetable oil (usually soybean oil) in which the active ingredient is dissolved. This formulation, although effective, has a limited shelf life and can not be mixed with fertilizer granules, a practice that can result in reduced attractiveness of the bait to foraging ants. Flow differences resulting from inconsistent granule size and oil content cause application inconsistencies. New formulations of baits are under development, along with methods for mixing baits with specially-formulated fertilizers. This trial was conducted to evaluate several of these new formulations being developed by the CIGA-Geigy Corporation.

Materials and Methods

This trial was established on approximately 12 acres of hay pasture in Montgomery County, Texas. Plots were established on 12 September 1994, less than a week after hay harvesting was completed. Treatment areas consisted of 150 x 150 foot squares (0.52 acres) with a circular sampling area of 0.25 acres in the center, allowing for a minimum of 32 feet of non-sampled buffer area between adjacent sampling circles. The plots were established using a surveyor's transit and measuring wheel to ensure accuracy. Due to the irregular shape of the test site, plots were established in uneven rows and columns to take advantage of the space available.

Fire ants were monitored after plot establishment by counting all active ant mounds within the 0.25 acre center circle. A mound was considered to contain an active fire ant colony if a dozen or more ants swarmed to the surface upon light disturbance with a pointed tool handle. Based on mound density, the ants appeared to be of the monogyne form and were very evenly distributed across the field. After all plots had been evaluated, ant active mound numbers from the 16 plots were arrayed from highest to lowest and divided into four replicate groups (blocks) of four treatments, thereby providing a range of ant mound densities across treatments while decreasing variability within blocks. The treatments were randomly assigned to each of the four plots within each block. Treatments and rates were as follows:

1) Untreated control
2) Award® Fire Ant Bait - 1 lb. per acre
3) CGA-114597 1GR-A - 1 lb. per acre
4) Pursell Industries, Inc. 33-0-11 mini + Award® Fire Ant Bait (0.01%; 1 lb. product contains 0.13 oz ai) - 100 lbs. per acre.

Treatments were applied the morning of 20 September 1994 from approximately 8:30 to 10:30. The 33-0-11 + Award® blend was applied using a tractor-mounted fertilizer spreader traveling at roughly 3.5 miles per hour and throwing a 30 foot swath. Award® and CGA-114597 were applied using a hand-held Cyclone® 1C1 seeder.

The 1, 2 and 9 month evaluations were conducted on 21 Oct., 18 Nov., 1994 and 14 June 1995, respectively. Mounds were disturbed with a shovel rated using the population index method (Harlan et al. 1981) as modified by Lofgren and Williams (1982):

	Weighting factor	
No. worker ants	Without worker brood	With worker brood
<100	1	5
100-1,000	2	10
1,000-10,000	3	15
10,000-50,000	4	20
>50,000	5	25

These numerical ratings are the population index values for each colony.

The population index for each plot is calculated by multiplying the number of colonies in each category by the numerical rating (=weighting factor) of that category. Results were analyzed using analysis of variance and means were separated using Tukey's Studentized Range Test ($P \leq 0.05$).

Results and Discussion

The 33-0-11 fertilizer plus Award® Fire Ant Bait blend was applied very evenly with little of the material caking onto the agitator. The Award® Fire Ant Bait seemed unusually oily and some difficulty was encountered applying it the same way twice between plots because of the uneven flow. CGA-114597 1GR-A was much more consistent in its application, though complete coverage of the plots may not have been achieved between swaths. A 1/8 cup quantity of Award® weighs 13.15 g, while CGA-114597 weighs 17.47 g. Thus, Award® is roughly 25% less dense than CGA-114597. The small particle size and higher density of the CGA-114597 formulation necessitated closing the spreader gate down to an opening the thickness of a quarter. This gave a very even and consistent flow, but only 8 swaths per plot could be applied. Good coverage has traditionally been achieved with 12 swaths using conventional bait formulations. Attempts to further reduce the gate opening resulted in erratic or blocked flow of CGA-114597.

By 21 October, the increase in mound numbers above pre-count could be accounted for by rainfall. After several months of drought, the site received **28 inches** of rainfall 14-18 October. The soil was very wet at the time of evaluation, but there was no standing water.

A significant reduction in active ant mounds resulting from the Award® treatment occurred 9 months after treatment, 14 June 1995 (Table 1). Ant numbers in colonies had slowly been declining over time, but a mild winter and spring allowed worker ants (particularly larger ants and queens) to survive. Active ant mound numbers in plots treated with CGA-114597 1GA-A or the Award-Fertilizer Blend declined numerically, but were not significantly different from numbers in the untreated control plots.

Mean "Population Index" values separated dramatically after only one month of treatment (Table 1). Differences were maintained or increased during the 9 month monitoring period. These data indicate that the CGA-114597 1GR-A formulation of fenoxycarb did produce a statistically significant suppressive effect on fire ant colonies, although numerically less than that produced by the Award® treatment. The Award-Fertilizer Blend treatments caused no significant reduction of "Population Index" values, although a slight numerical decline occurred relative to those of untreated control plots.

The extruded CGA-114597 bait shows promise as a substitute for the conventional Award® formulation. Though not tested, increased density should increase swath width and require fewer passes, thus reducing labot. Also, application seemed much more uniform. Experience gained from this trial suggestes that twice as much of this bait formulation with half the concentration of fenoxycarb would give more complete coverage of an area. Attractiveness of the bait particles in the Award®-Fertilizer Blend to foraging fire ants should to be re-assessed. These data appear to indicate that attractiveness was largely lost.

Literature cited

Harlan, D. P., W. A. Banks, H. L. Collins, and C. E. Stringer. 1981. Large area tests of AC-217,300 bait for control of imported fire ants in Alabama, Louisiana, and Texas. Southwest. Entomol. 6:150-157.

Lofgren, C. S. and D. F. Williams. 1982. Avermectin B_1a: A highly potent inhibitor of reproduction by queens of the red imported fire ant. Jour. Econ. Entomol. 75:798-803.

Table 1. Evaluation of Award® Fire Ant Bait (1 lb. per acre), CGA-114597 1GR-A (1 lb. per acre) and Pursell Industries, Inc. 33-0-11 mini fertilizer plus Award® Fire Ant Bait (100 lbs. per acre), applied 19 September 1994, Montgomery Co., Texas, 1994.

	Mean no. active mounds per 0.25 acre circle[a]			
	12 Sept.	21 Oct.	18 Nov.	14 June
Treatment	Pre-count	1 month	2 months	3 months
Untreated control	10.00	17.25a	18.25a	14.25a
Award® (0.01% fenoxycarb)	11.25	14.50a	14.00a	2.50b
CGA-114597 1GR-A	10.50	16.25a	18.25a	6.75ab
Award-Fertilizer Blend	11.00	15.75a	15.50a	11.75ab
F		1.37	1.31	3.57
P		0.03205	0.3420	0.0428
MSD		11.413	13.844	10.498
d.f. = 9				
	Mean no. "Population Index" per 0.25 acre circle[a]			
Untreated control	---	329.3a	331.0a	269.25a
Award® (0.01% fenoxycarb)	---	58.3c	52.8b	10.75b
CGA-114597 1GR-A	---	103.8bc	68.3b	24.25b
Award-Fertilizer Blend	---	245.0ab	182.3ab	177.25ab
F		6.80	5.62	5.77
P		0.0059	0.0111	0.0102
MSD		165.50	178.9	169.43
d.f. = 9				

[a] Means followed by different letters are significantly different using analysis of variance (ANOVA) and Tukey's Studentized Range Test ($P \leq 0.05$).

EVALUATION OF INDIVIDUAL RED IMPORTED FIRE ANT MOUND TREATMENTS USING ORGANIC SOLUTIONS™' FORMULATIONS OF PYRETHRINS PLUS DIATOMACEOUS EARTH

Bastiaan M. Drees, Professor and Extension Entomologist and
Charles L. Barr, Extension Associate

This trial was conducted to evaluate the effectiveness of two pyrethrins, piperonyl butoxide plus diatomaceous earth formulations (PermaGuard™, marketed as Organic Solutions™ Fire Ant Killer) as individual mound or surface treatments to suppress red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae), mound activity as compared to commonly used individual mound treatments (acephate, chlorpyrifos).

Materials and Methods

Six treatments were evaluated to reduce the number of red imported fire ant mounds in treated areas. Treatments included:

1) PermaGuard™, D-20 (0.2 % pyrethrins, 1% piperonyl butoxide plus diatomaceous earth)
   - 4 tbsp./gal./mound
     NOTE: Quanta Lab (9330 Corporate Dr. #703, Selma, TX 78154-1257; 210/651-5799; FAX: 210/651-9271) analysis of this material documented 0.1% pyrethrins plus 0.9% piperonyl butoxide (Report #950S1004, 26 April 1995).
2) PermaGuard™ D-21 (0.1 % pyrethrins, 1% piperonyl butoxide plus diatomaceous earth)
   - 4 tbsp./gal./mound
     NOTE: Quanta Lab analysis of this material documented 0.1% pyrethrins plus 0.6% piperonyl butoxide (Report #950S1003, 26 April 1995).
3) Ortho-Klor® Soil Insect and Termite Killer (12.8% chlorpyrifos) - 2 tbsp./gal/mound
4) Orthene® Systemic Insect Control (9.4% acephate liquid) - 2 tbsp./gal/mound
5) Untreated control - 1 gal. water per mound
6) Permaguard D-20 applied with a Ortho® Dial'n Spray Hose-End Sprayer driven by a Shurflo® Diaphragm Pump powered by a 12 volt battery that delivers 40 psi. calibrated to deliver 2 lbs. Permaguard® in 50 gal. water per acre after spraying each mound within the treated area using an inward spiral spray pattern until the mound structure collapsed.

Four sets of replicated plots of equal width and variable length, containing ten (10) red imported fire ant mounds were established for each treatment (40 mounds treated per treatment). Treatment blocks were assigned by arraying plot length from longest to shortest and treatments were randomly assigned within each block. Each mound was marked with a plot flag and received one of the six treatments. Periodically (3, 7, 14 and 31 days; on 6, 10, 17 Feb. and 6 March, respectively) following treatment, treated mounds and plots were inspected for ant activity using the minimal disturbance method. Results were analyzed using Analysis Of Variance (ANOVA) and means separated using Tukey's Studentized Range Test ($P \leq 0.05$).

Results and Discussion

The area chosen to conduct this trial had a high number (580.8 mounds) of red imported fire ant mounds per acre, suspected to be an infestation of the polygynous form of the fire ant. The average plot size was 750 sq. ft. On the day of treatment, the temperature ranged from 64.5 to 68.2 degrees F and relative humidity from 50 to 43 percent. Individual mound drenches of flagged mounds required about 2.4 man minutes per mound ($0.17 per mound at minimum wage of $4.25 per hour). Per mound cost for treatments was $0.48/mound for Orthene® Systemic Insect Control and $0.55/mound for Ortho-Klor® Soil Insect & Termite Killer.

Ten ounces of Permaguard® were mixed per gallon of water and used to fill the sprayer. The Ortho® Dial'n Spray Hose-End Sprayer, set at 8 oz rate, emitted 1.62 gal water/minute and sprayed out 13.5 fl oz dissolved insecticide per minute. Permaguard™ was dispensed at 0.0176 oz per minute. The amount of spray used on the hose-end treated plots is listed below:

Plot no./length		Spray time/plot	Spray time/10 mounds	Total amount
6	15 ft	19 sec. (4.3 fl. oz.)	80 sec. (18 fl. oz)	= 1.74 oz. Permaguard® D-20
7	46 ft	59 sec. (13.3)	69 sec. (15.5)	= 2.25 oz.
23	24 ft	31 sec. (7.0)	56 sec. (12.6)	= 1.53 oz.
24	18.5 ft	24 sec. (5.4)	85 sec. (5.4)	= 1.91 oz.

Four tablespoons of Permaguard™ D-20 weighs 22.2 grams or 0.78 oz. Plots receiving individual mound drenches for 10 mounds received 7.8 oz. product.

The Permaguard® formulations performed differently, with D-20 (0.2% pyrethrins, 1% piperonyl butoxide plus diatomaceous earth) providing significantly better elimination of ant activity than D-21 (0.1% pyrethrins) 3 days following application (**Table 1**). Permaguard™ D-20, applied as an individual mound treatment eliminated ant activity in treated mounds more quickly than did Orthene® Systemic Insect Control (9.4% acephate), and performed statistically similar to Ortho-Klor® Soil Insect and Termite Killer (12.8% chlorpyrifos) throughout the trial. From 1 to 4 weeks following application, all individual mound treatments significantly reduced ant activity in treated mounds relative to ant activity in untreated control (water drench only) mounds and performed statistically the same, providing 75 to 100 percent suppression of ant activity in treated mounds.

The surface application of Permaguard™ D-20 significantly reduced the number of ant mounds 1 to 4 weeks following treatment relative to the untreated control (water drench only) plots by 50 to 53 percent. Apparently, the "spiral pattern spray" to individual mounds failed to deliver sufficient product to eliminate ant activity in treated mounds to the extent that 1 gallon individual mound treatments achieved. However, less material was applied to the plots using the surface treatment (1.9 oz. versus 7.8 oz for individual mound treated plots). (Note: The individual mound treatment rate of PermaGuard™ would have resulted in the application of 28.3 lbs. per acre for 581 ant mound infestation in this study area. Obviously, in areas with fewer mounds per acre would require less material.)

None of the treatments applied appeared to greatly aggravate colony movement (**Table 2**), although more "new" colonies appeared in the plots treated with the surface application of PermaGuard™ D-20. However, new mounds appeared in the plots during the course of this 4 week long trial. By the fourth week, only the Ortho-Klor® Soil Insecticide and Termite Killer (chlorpyrifos 12.8%) treated plots contained significantly fewer mounds than did the untreated control plots, having 65 percent fewer mounds. The other treatments performed statistically similar to Ortho-Klor® Soil Insecticide and Termite Killer, achieving percent reductions of active fire ant mounds ranging from 58 to 13 percent.

This trial was conducted in February, and was characterized by mild and wet climate conditions. Field plots were mowed 1 and 27 Feb. Conceivably, colony migration into mowed plots from high grass adjacent areas may have increased because of the mowings or because of natural ant behavior during this period of the year. Further testing with these treatments will provide additional confidence in the results generated from this trial.

Table 1. Mean number active ant mounds following application of individual red imported fire mound treatments, Brazos Co., Texas, 1995.

	Mean no. active mounds/10[a]			
Treatment	3 days	1 week	2 week	4 weeks
untreated control 1 gal. water/mound	10.00 a...	10.00 a..	8.75 a..	9.25 a..
Permaguard™ D-21 (0.1% pyrethrins, 1% PBO) 4 tbsp./gal./mound	6.00 .b..	2.50 .bc	1.25 ..c	2.00 .bc
Permaguard™ D-20 (0.2% pyrethrins, 1% PBO) 4 tbsp./gal./mound	1.50 ..cd	0.25 ..c	0.25 ..c	1.00 ..c
Permaguard™ D-20 surface treatment[b] 2 lbs./50 gal./acre	9.75 a...	4.75 .b.	4.75 .b.	5.00 .b.
Orthene® Systemic Insect Control (9.4% acephate EC) 2 tbsp./gal./mound	4.00 .bc .	1.00 ..c	1.00 ..c	1.25 ..c
Ortho-Klor® Soil Insect and Termite Killer (12.8% chlorpyrifos) 2 tbsp./gal./mound	0.00 ...d	0.00 ..c	0.00 ..c	0.00 ..c

F	22.32	30.40	17.80	13.12
P	0.0001	0.0001	0.0001	0.0001
MSE	1.952	1.200	1.7111	2.333
Min. Sig. diff.	3.2104	2.5166	3.0052	3.5093

d.f. = 15; Critical value = 4.595

[a] Means followed by the same letter are not significantly different using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).

[b] Permaguard™ D-20 applied with a Ortho® Dial'n Spray Hose-End Sprayer driven by a Shurflo® Diaphragm Pump powered by a 12 volt battery that delivers 40 psi. to spray plot surface after spraying each mound within the treated area using an inward spiral spray pattern until the mound structure collapsed.

Table 2. Mean number of new mounds appearing per plot and total number of active ant mounds per plot following treatment of individual red imported fire ant mounds, Brazos Co., Texas, 1995.

	Mean no. active mounds/plot[a]		**No. "satellite" mounds/plot**[a]	
Treatment	2 weeks	4 weeks	2 weeks	4 weeks
untreated control	10.25 a..	11.50 a.	1.50 a	2.25 a
Permaguard™ D-21	2.75 .bc	7.25 ab	1.50 a	5.25 a
Permaguard™ D-20	1.00 ..c	4.25 ab	1.25 a	3.25 a
Permaguard™ D-20 surface treatment	7.50 ab.	8.75 ab	2.75 a	3.75 a
Orthene® Systemic Insect Control	2.25 .bc	5.00 ab	1.25 a	3.75 a
Ortho-Klor® Soil Insect and Termite Killer	0.50 ..c	3.50 .b	0.50 a	3.50 a
F	6.35	5.23	0.69	2.14
P	0.0011	0.0029	0.6934	0.0972
MSE	6.275	6.964	2.919	11.986
Min. Sig. diff.	5.755	6.0626	3.9254	7.9537

d.f. = 15; Critical value = 4.595

[a] Means followed by the same letter are not significantly different using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).

EVALUATION OF BIFENTHRIN FORMULATIONS FOR RED IMPORTED FIRE ANT SUPPRESSION ON A COMMERCIAL TURF FARM WARREN TURF FARM - MILAM COUNTY, TX

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This trial was conducted on Warren's Turf Farm in Milam County on commercial Saint Augustinegrass production areas that had not been treated for red imported fire ants for over a year (pers. comm. Andy Tremble, Production Manager). Plots, 0.5 acre square (150 by 150 ft.) were established, 12 October, 1993. Thirteen plots were established contiguously in an area with black gumbo soil. Most of this areas had not recently been harvested and had a solid stand of turfgrass. The area adjacent to these plots had recently been treated for ants and harvested. Another six plots were established in another area with sandier soil. This area had been harvested within the past year and soil was evident between strips of turfgrass growing back into harvested areas.

Fire ants were monitored within each plot using circular subplots created using a 72 ft. surveyors string attached to a center poles. The area of the area circumscribed by the string around the center stake was 0.3738 acres. Ant mounds (considered active if 25 or more ants emerged en mass from the mound within 5 seconds after minimal disturbance with a stick) were counted in each subplot. Pre-count ant mound counts were arrayed from highest to lowers density and divided into 3 blocks (replications) of six plots each. Treatments, listed below, were randomly assigned to each block.

Product	Rate (lb. a.i./acre)	Amount used to treat 0.5 acres
bifenthrin		
sand formulation:		
Talstar® 0.2G	0.25	62.5 lbs.
Talstar® 0.2G	0.50	125.0 lbs.
ground peanut hull formulation:		
Pennington® 0.2G	0.25	62.5 lbs.
Pennington® 0.2G	0.50	125.0 lbs.
Standard: chlorpyrifos		
Dursban® 50WP	8.00	8.0 lbs.
untreated control	----	----------

Bifenthrin treatments were applied, 25 October 1993, using a Gandy® Model 1006A drop spreader (6 ft. long with 4 inch spacing between holes) pulled behind a riding mower. The chlorpyrifos treatments were applied, 26 October 1993, by Witiker's Fertichem under contract. This is the "standard" treatment mandated by the U.S.D.A. Imported Fire Ant Quarantine regulations. Periodically following treatments, fire ant mounds were monitored as described above. Results are to be statistically analyzed (ANOVA and Tukey's Studentized Range Test at $P \leq 0.05$).

Results and Discussion

Pre-count data was obtained at the end of a persistent period of dry weather (it had not rained since late June). Ant activity was suppressed as evident by the increase in ant mound numbers in untreated control plots in post-treatment evaluations. Timely rains, 29-30 October 1993, eliminated the need to irrigate treatment plots. However, early freezing conditions and cold weather may have reduced ant activity, resulting in a slower effect of treatments.

All treatment provided significantly fewer fire ant mound numbers than those in the untreated control plots (**Table 1**) for the first 6 weeks following application. Dursban® 50WP, applied in accordance with the fire ant quarantine program rate (8.0 lb. a.i./acre) did not totally eliminate ant mounding activity in treated plots. By 19 weeks after application, Dursban treated plots contained a number of ant mounds similar to those found in untreated plots. By 10 months after treatments, no significant treatment differences remained. Talstar® 0.2G and Pennington® 0.2G, applied at the 0.5 lb. a.i. per acre rate performed statistically similar throughout the trial.

Table 1. Mean number of red imported fire ant mounds following 25 October 1993 treatments using bifenthrin (Talstar® 0.2G and Pennington® 0.2G) formulations as compared to untreated control and the imported fire ant quarantine program treatment using chlorpyrifos (Dursban® 50WP), Warren Turf Farm, Milam Co., Texas, 1993.

			Mean no. mounds/0.37 acres*			
Treatment	Pre-count	1-week	3-week	6-week	19 weeks	10 months
Dursban	10.0 a	3.3 .b	2.7 .b	5.0 .b	12.3 ab.	2.7 a
Talstar 0.5%	10.0 a	4.0 .b	3.7 .b	3.0 .b	1.0 ..c	3.0 a
Talstar 0.25%	10.3 a	8.3 .b	6.7 .b	10.0 .b	4.0 .bc	8.3 a
Pennington 0.5%	10.3 a	7.7 .b	3.7 .b	7.7 .b	2.0 ..c	2.0 a
Pennington 0.25%	10.0 a	9.3 .b	5.7 .b	10.3 .b	4.3 .bc	4.0 a
Untreated	10.7 a	21.7 a.	21.0 a.	28.3 a.	15.0 a..	9.7 a
F	8.32	5.29	5.00	9.24	8.24	2.64
P	0.0017	0.0094	0.0115	.0011	.0015	0.0797
MSE	1.9222	21.1222	21.9889	20.4556	8.7222	11.0556
R-square	0.8534	0.7873	0.7777	0.8667	0.8580	0.64897
Min. Sig. Diff.	3.9318	13.039	13.298	12.826	8.3754	9.4294

Critical value = 4.912
d.f. = 10

* Means followed by the same letter are not significantly different using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).

EVALUATION OF ACEPHATE 15G (PINPOINT™) FOR SUPPRESSION OF RED IMPORTED FIRE ANTS IN TURFGRASS

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Although Orthene® Turf, Tree and Ornamental Spray (Valent U.S.A. Corp.) and Orthene® Fire Ant Killer (Solaris), both formulations of 75 percent acephate wettable powder, have become standard individual fire ant mound treatments, broadcast application of these formulations are not registered fire ant treatments. Surface treatments are thought to not have sufficient residual activity to suppress ant mound activities. Trials reported here were conducted to evaluate the efficacy of acephate 15% granular insecticide, marketed to the turf industry as Pinpoint™ and to the cotton market as Payload® when broadcast applied to ornamental landscapes for control of red imported fire ants, *Solenopsis invicta* Buren.

Materials and Methods

Trial 1. This trial was established on The Texas A&M University Riverside Campus, 16 December 1993, in an area of mowed turf. Plots consisted of 16 1/8-acre (75 ft. X 75 ft.) squares arranged in a block and were surveyed for fire ant mounds by counting the number of active ant mounds in each entire plot using the minimal disturbance method. An ant mound was considered active if a dozen or more ants rose to the surface within 15-30 seconds after light disturbance. All subsequent evaluations were made in a similar manner.

Pre-treatment mound numbers were arrayed from highest to lowest and then grouped into 4 blocks of 4 plots each. Treatments were assigned randomly within blocks. Treatments were applied, 10 January 1994, and included: 1) untreated control; 2) 6.67 lb/acre 15% acephate (Pinpoint™); 3) 13.3 lb.acre Pinpoint; and 4) 5% diazinon (Ortho® Diazinon Soil & Insect Control, 2 lb/acre). Treatments were applied using an Earthway® Ev-N-Spred® push-type broadcast spreader. Data were analyzed using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).

Trial 2. This trial was conducted on mowed ornamental Bermudagrass on The Texas A&M University Riverside Campus. On 10 October 1994, 16 plots, 0.096 or 1/10 acre (65 by 65 ft.) in size were established. The number of active red imported fire ant mounds within a 32.5 ft. radius (0.076 or 1/13 acre) circle within each plot was counted. The plots were arrayed from lowest to highest number of ant mounds and separated into four blocks (replicates) of four plots each. Treatments were randomly assigned to one plot within each block, and treated 11 October 1994: 1) 15% acephate (Pinpoint™) at 3.75 lb. a.i. or 25 lbs./acre (2.5 lbs./plot); 2) Pinpoint at 6.45 lb. a.i. or 43 lbs./acre (4.3 lbs./plot); 3) acephate 75%WP (Orthene® Tree, Turf and Ornamental Spray) applied at 2 tsp./mound, documenting the number of mounds treated; and 4) untreated control.

Broadcast treatments were applied using a push-type Earthway® Ev-N-Spred® broadcast applicator. A second treatment was applied, 28 October (17 days post-treatment, delayed from 10 days post-treatment by weather) using the same treatments. Plots were evaluated 10 (20 Oct.), 31 (10 Nov.) and 63 (12 Dec.) days following initial application. Data were analyzed using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).

Results and Discussion

Trial 1. At the time of treatment weather conditions were as follows: Temperature: 60-65 degrees F, cloudy, windy. The soil was dry and the ants relatively active. The plots received a light rain within 2 hours of treatment. The next substantial rain was received between the first and second post-treatment evaluations. Treatment using the Earthway® Ev-N-Spred® push-type broadcast spreader was difficult to accomplish. Calibration required reducing the size of the openings in the spreader hopper. The gate opening was closed to the extent that further closing prohibited any flow of the granular material and wider opening resulted in over-treatment. Single application of either 6.67 or 13.31 lbs. Pinpoint® per acre resulted in no noticeable reduction in fire ant mound numbers (**Table 1**). The diazinon application had minimal affect until after a rainy period that occurred between the 1 week and 1 month post treatment evaluations.

Trial 2. The number of mounds treated with 75% acephate for each replicate plot were as follows: I-16; II-22; III-45; IV-40. On 15 October, the area received about 0.7 inch rainfall. However, beginning in the evening of 16 October, over 13 inches of rainfall were recorded in a 24 hour period. The plots are well drained, but the massive rainfall may have washed much of the acephate applied out of the plots. During the second application, 28 October, the number of mounds treated with 75% acephate were as follows: I-25; II-20; III-18; IV-16.

The number of active ant mounds increased in the untreated plots during the course of this trial due to periods of heavy rainfall. Initially, the acephate treatments merely prevented or suppressed similar increases in ant mound numbers from occurring in treated plots (**Table 2**). Reduction of ant mounding activity appeared slowly in treated plots with significant reductions (55 to 59 percent) occurring 10 Nov., 31 days following initial application. Maximum suppression from treatments (70-73 percent) occurred 12 Dec., 63 days following initial application. During the last two monitoring dates, reduced ant mound building activity in treated plots was observed relative to untreated plots. No differences in performance were documented between the three acephate treatments. This is the first trial we have conducted where individual mound treatments using 75% acephate dust did not perform with 95 to 100 percent effectiveness. Heavy rains and mild temperatures conducive to ant mound building during this period may have been a factor in this reduced performance.

Table 1. Number of red imported fire ant mounds per 1/8 acre plot before and after 10 January 1994 treatments using 15 percent acephate granules (Pinpoint®) or Ortho® Diazinon Soil & Insect Control, Brazos Co., Texas.

	Mean no. active mounds per 1/8 acre plot*		
Treatment	Pre-count	1 week	1 month
Untreated	26.50 a	26.5 a	20.50 a
acephate 15G, 6.67 lb	25.25 a	25.5 a	21.25 a
acephate 15G, 13.31 lb	26.50 a	27.5 a	19.00 a
1% diazinon, 2 lb/acre	25.75 a	20.0 a	3.50 b
F =	21.38	3.63	3.44
P =	0.0001	0.0140	0.0476
d.f. =	9	9	9
MSD =	7.722	14.693	15.321

* Means in columns with the same letters are not significantly different using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).

Table 2. Mean number of red imported fire ant mounds per 32.5 ft. radius circle subplots following acephate 15% granular (Pinpoint®) treatments 11 and 28 October 1994, Brazos County, Texas.

	Mean* no. red imported fire ant mounds per 32.5 ft. radius circle			
	Pre-treatment	10 days	31 days	63 days
Treatment	10 Oct.	20 Oct.	10 Nov.	12 Dec.
acephate 15G 3.8 lbs.	23.00 a	26.75 ab	18.50 b	11.50 b
acephate 15G 6.5 lbs.	22.75 a	27.00 ab	17.00 b	12.25 b
acephate 75 WP 1-2 tsp./mound	21.25 a	21.75 b	18.25 b	11.25 b
untreated control	22.50 a	34.00 a	41.00 a	41.00 a
F =	12.66	6.28	27.42	5.32
P =	0.0006	0.0077	0.0001	0.0132
d.f. =	9	9	9	9
MSD =	8.1357	10.864	7.1364	21.377

* Means in columns with the same letters are not significantly different using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).

EVALUATION OF ACEPHATE 15G (PINPOINT™) FOR ELIMINATION OF RED IMPORTED FIRE ANTS FROM POTTING MEDIA

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The red imported fire ant, *Solenopsis invicta* Buren, often invades potting media in field nurseries and greenhouses, causing a potential hazard to workers and consumers. Potting media treatments have been developed to meet qualifications for the Texas Floral and Nursery Law and the United States Department of Agriculture Red Imported Fire Ant Quarantine regulations. Acephate is an ingredient in several products currently registered for control of the red imported fire ant as an individual mound treatment. A 15 percent granular formulation has been developed and was tested for its efficacy in controlling red imported fire ants as a potting media treatment.

Materials and Methods

Custom blended potting media was treated, 2 November 1993, by Joe Daniel at Powell Plant Farm in Cherokee County, Texas. Treatments incorporated into the media were as follows:

1. untreated control
2. standard: Oxamyl® 10G, 3 oz./ cubic yard
3. acephate 15G, 0.017 lb. a.i.
4. acephate 15G, 0.034 lb. a.i.
5. acephate 15G, 0.067 lb. a.i.
6. acephate 15G, 0.100 lb. a.i.

On 18 November, this media was potted in 4 inch pots and watered with 1 cup water per pot and 1 cup in tray so media could soak up sufficient water. On 19 November (1:00 to 3:30 pm), each 4 inch pot was placed in a plastic bag with a rubber band constricting the bag around the pot rim and received a heaping 1/4 tsp. fire ants, some brood and one or more queen ants. Bags were closed using a twist tie. The temperature in the laboratory was 73.2 degrees F. On 20 November (approximately 24 hrs. later, 1:54 pm) each pot was inspected for the presence of live ants. This assay was repeated on the remaining media-containing pots on 2 December, 24 January 1994 and 14 July 1994. All pots were watered prior to each assay, only.

Results and Discussion

Oxamyl® 10G-treated potting media had little to no effect on red imported fire ant survival during the 24-hour exposure period used in this assay (**Table 1**). Potting media treated with acephate 15G was effective in eliminating ant activity in treated pots, with higher treatment rates being more effective. Media treated with 0.10 lb. a.i. caused mortality to most ants introduced into the pots for 3 months following treatment. Had the media been watered daily, as is customary in plant production operations, this length of ant control would have probably been reduced.

Table 1. Red imported fire ant survival in acephate and oxamyl potting media treatments, 2 November 1993.

Treatment and rate	No. pots with fire ant activity 24 hrs. following exposure/4			
	Nov. 19*	Dec. 3	Jan. 25	July 14
untreated control	4	4	4	4
standard: Oxamyl® 10G	4	4	4	4
acephate 15G 0.017	1	1	4	4
acephate 15G 0.034	1	3	3	4
acephate 15G 0.067	0	0	3	4
acephate 15G 0.100	0	1	1	3

* After the 19 November 1993 post-treatment evaluation, pots were checked again on 22 November (9:00 am), after the ants had been exposed to treated media for 3 days. In the check, ants were active in all pots (50 to 75 percent of the number of ants initially applied). In the Oxamyl® treated pots fewer ants were found to be active (30-50, 10-20, 10-20, 30-50 in each pot, respectively). No live ants were observed in the acephate treated media.