Evaluation of MaxForce®FC, Siesta™, Advion®, Amdro®, and Extinguish® Plus Fire Ant Baits for the Management of the Red Imported Fire Ant

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The red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae) has become an important economic problem in urban Texas, according to a 1998 study conducted by the Department of Agricultural Economics, Texas A&M University. Fire ant related costs in Dallas, Fort Worth, Austin, San Antonio, and Houston, fire ants have serious economic effects for these metro areas of Texas (Lard, Hall, and Salin 2000). Households experienced the largest costs among sectors examined with an average of $151 per household spent annually. These costs include repairs to property and equipment, first-aid, pesticides, baits, and professional services. A full damage assessment for Texas must include additional sectors, and the estimated costs of $581 million per year for the selected sectors underscore the impact of this pest. Treatment costs accounted for over 50% of the total cost. In Houston, the average medical treatment cost per household was $25.46. The duration of injury for children and adults was 6.6 days and 5.6 days, respectively. The fire ant limits outdoor activities and homeowners and agricultural producers incur added costs in managing fire ants.

Management of the fire ant on large mixed use land tracts using insecticide products is economically feasible when the economic impact of high fire ant population levels equals or exceeds the cost of control (Flanders and Drees 2004). Mixed use land tracts may include parks, camp grounds, convention centers, animal-care facilities, or a mixture of any of these. The use of these areas by large numbers of the general public can expose them to fire ants if no control measures are undertaken.

Fire ant bait products offer a means to treat large areas of managed turf to obtain a level of fire ant control and reduce the exposure of the general public to the fire ant. Fire ant bait formulations vary somewhat but most consist of de-fatted processed corn grit as a "carrier," soaked with soybean oil as an attractant that contains the active ingredient. The broadcasting of fire ant bait products allows foraging fire ants from visible or hidden mounds access to the bait particles that they pick up and take back to their respective colonies. When foraging ants return to the colony the product is fed ant-to-ant, ant-to-larva, larva-to-ant and ant-to queen(s) so that all members of the colony are affected. This is also why most bait ingredients must be rather slow to kill ants. If ants die too fast, the active ingredient fails to reach the queen or multiple queens.

This study evaluated new fire ant baits being developed for use in fire ant infested areas from Bayer Environmental Science, MaxForce®FC (fipronil); BASF Corporation, Siesta™ (metaflumizone), Dupont™, Advion® (indoxacarb), against the existing products from Central Life Sciences, Amdro® (hydramethylnon) and Extinguish® Plus (hydramethylnon + methoprene)

Material and Methods

This study was established in a grassy field at the Five Eagle Ranch, Caldwell, TX, in Burleson County (**Figure 1**). Twenty-four 0.5 acre plots were established on October 9, 2007. Pre-treatment assessments of the number of active red imported fire ant mounds were made within a 0.2 acre circle (53 ft radius) sampling area within each 0.5 acre plot. Plots were mapped using a handheld GPS unit (Trimble® Geo Explorer XT with submeter accuracy) before applying the fire ant bait products. Plots were arrayed in order from the plot containing the highest to the lowest number of fire ant mounds per plot. Replications were established by dividing the array into four blocks and randomly assigning the six treatments to plots within each block and then adjusting to assure that pre-treatment mean differences between treatments in all replications or blocks were minimal. All plots were monitored prior to and periodically following treatment throughout the entire result demonstration period. Analysis of variance (ANOVA) was performed of the data set (SPSS 14.0) and treatment means were separated using Tukey's Post-hoc test at P= 0.05.

Treatments are listed in **Table 1**. Moderate rainfall occurred during the testing period. All treatments (**Table 1**) were broadcast applied October 9, 2007, in the late afternoon, with a Herd GT-77 Sure Feed Broadcaster for Fire Ants (Herd Seeder Co., Inc., Logansport, IN **www.herdseeder.com**) mounted to either an ATV (Kawasaki Prairie 700) or John Deer Gator. The Herd GT-77 was calibrated to deliver 1.5 lb fire ant bait with a 20 ft swath. The Herd GT-77 was fitted with a Herd Seeder Co. #1 plate covering the agitator. After all the replications of each treatment were applied, the broadcaster hopper was swept clean before the next treatment.

At 0, 24 hours, 2 days, and 7 days after treatment (DAT) each plot was monitored for fire ant foraging activity using a survey station consisting of a small slice of hot dog (0.75 inch diameter by 0.375 inch thick, Bar-S Jumbo brand) placed on the ground and marked with a small flag. Four survey stations were placed, one in each corner, of the 0.2 acre monitoring area (approximately 15 foot from each corner). After 45 minutes each station was checked for the number of fire ants present on the hot dog. The number of ants from 0 – 100 were recorded for each hot dog observed, **Figure 2**.

At 0, 14, 35, and 69 DAT, the number of active fire ant mounds within the monitored area of each plot was counted and recorded. Periodic rains resulted in visible mounds on the ground surface throughout the trial. To determine if a mound was active, a shovel was used to slightly disturb the mound. If no fire ants appeared after 15 seconds, the mound was considered inactive. Total active fire ant mounds in each plot were counted, and the data was recorded as the number of active fire ant mounds per 0.2 acre subplot.

Results and Discussion

Table 2 indicates the mean number of foraging fire ants on hot dog bait stations, 0, 1, 3, 7 days after treatment (DAT). At the 1 DAT (October10) evaluation, significant differences between the untreated control plot mean (check) and Advion® fire ant bait plot mean was documented. At 3 and 7 DAT significant differences from the check were documented for Siesta™, Advion®, Amdro®, and MaxForce®FC. The mean number of fire ants per hot dog slice from plots treated with baits containing an insect growth regulator (IGR), Extinguish® Plus, was not significantly different form the check. This was expected since IGR baits work very slowly in a fire ant population

Figure 2 depicts the sharp significant decline in the foraging ant numbers at 1 DAT for Advion® and the decline at 3 and 7 DAT for MaxForce®FC, Advion®, Amdro® and Siesta™.

Table 3 shows the mean number of fire ant mounds present in the 0.2 acre evaluation area at 0, 14, 35 and 69 DAT. No significant differences in mounds per plot means were detected 14, 35 or 69 DAT for any of the fire ant bait products.

Figure 3 illustrates the variations in fire ant mound numbers at each of the evaluation dates with only Advion® and Siesta™ showing a numerical (but not statistically significant) decline at 14 DAT, and no differences in the fire ant bait products 35 and 69 DAT .

Evaluations of active fire ant mounds at 35 DAT and 69 DAT were disappointing. Visual observations indicated some effect (i.e., possible brood shift from worker to reproductive) at early evaluations but mound counts did not confirm this during later evaluation dates. The reduction in foraging fire ants at 3 and 7 DAT show that the fire ant bait applications were having an effect. We do not have an explanation for why subsequent decreases in active mounds numbers did not. Possible competition for the broadcast fire ant bait as a food source may have occurred since the pasture grass was seeding at this time.

Figure 1. Map of 5 Eagle Ranch, Caldwell, TX, experimental plots and respective treatments are shown in yellow. (A= Advion®, AM= Amdro®, C= untreated control, E= Extinguish®, MX= MaxForce®, S= Siesta™)

Table 1. Red imported fire ant bait products evaluated on 0.2 acre subplots, Five Eagle Ranch, Caldwell, TX, in Burleson County, October 7, 2007

Treatment	**Rate (lb Product /acre)**
Untreated check	0
MaxForce®FC (fipronil)	1.5
Advion® (indoxacarb)	1.5
Amdro® (hydramethylnon)	1.5
Extinguish® Plus (methoprene plus hydramethylnon)	1.5
Siesta™ (metaflumizone)	1.5

Table 2. Mean number and ±SE of fire ants on hot dog slices per 0.2 acre subplot before and following imported fire ant bait product treatments, Five Eagle Ranch, Caldwell, TX, in Burleson County, treated October 9, 2007.

Treatment	**Pretreatment Oct. 9, 2007**	**Oct. 10, 2007 24 hr***	**Oct. 12, 2007 3 DAT***	**Oct. 15, 2007 7 DAT***
Untreated check	100±0	100±0	100±0	90.31±5.83
MaxForce®FC (Fipronil)	98.43±0.78	94.38±2.42	**51.56±5.87***	**49.38±5369***
Advion® (Indoxacarb)	97.81±1.06	**80.31±3.16***	**7.94±25.97***	**2.25±2.25***
Amdro (Hydramethylnon)	99.68±0.31	96.88±3.13	**52.50±6.54***	**45.50±15.63***
Extinguish® Plus (Methoprene+ Hydramethylnon)	100±0	100±0	90.63±5.41	87.81±6.34
Siesta™ (Metaflumizone)	98.75±0.72	94.38±4.84	**40.63±7.85***	**20.75±3.84***
d.f =	5,18	5,18	5,18	5,18
F	2.112	12.20	38.69	20.11
P	0.111	0.00	0.00	0.00
M. Sq.	1.584	17.513	117.92	246.94

* Means (±SE) followed by an asterisk (*) are significantly different compared to mean values observed on the untreated check. Analysis of Variance (ANOVA) with means separated using Tukey Post-hoc Test, values significant when $P < 0.05$ (SPSS 14.0).

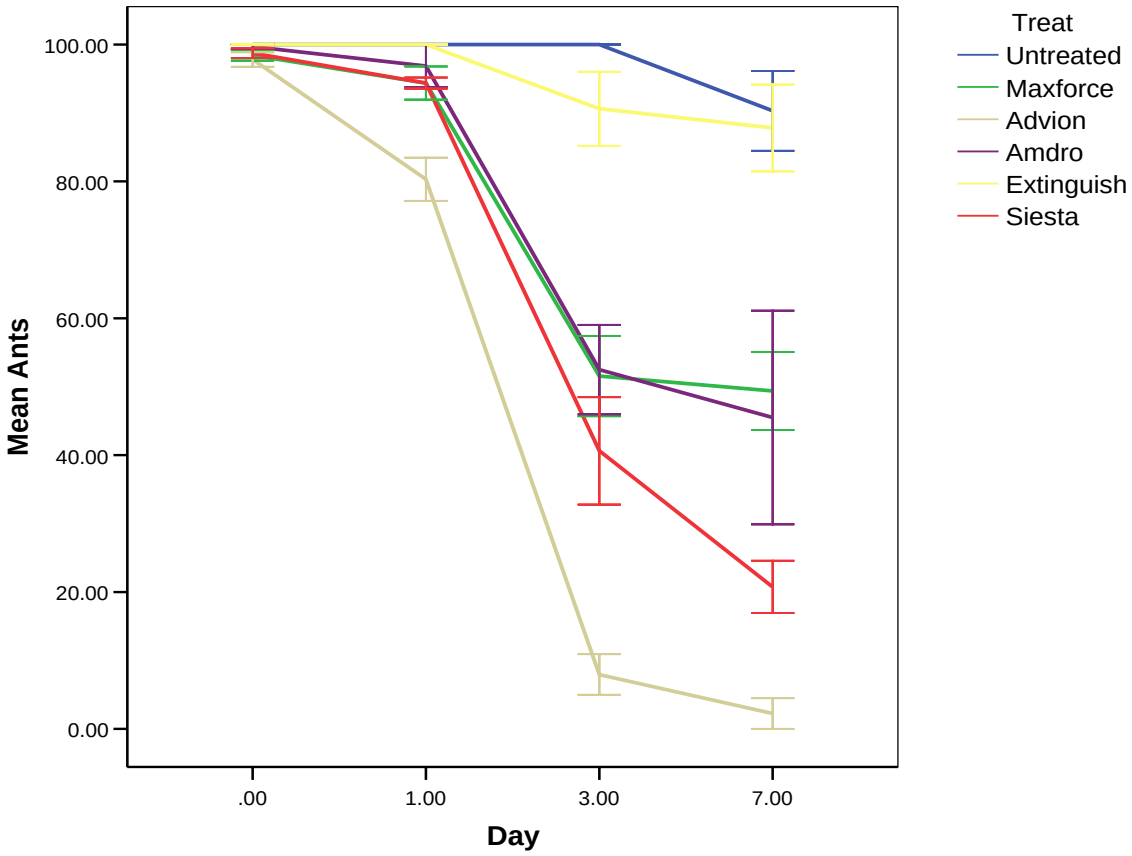

Figure 2. Mean fire ants observed on food lures (hot dog slices) before and following imported bait product applications, Five Eagle Ranch, Caldwell, TX, in Burleson County., treated October 9, 2007.

Table 3. Mean number and ± SE of imported fire ant mounds per 0.2 acre subplot before and following broadcast-applied fire ant bait product treatments, Five Eagle Ranch, Caldwell, TX, in Burleson County, treated October 9, 2007.

Treatment	**Pre-treatment Oct. 9, 2007**	**Oct. 23, 2007 14 DAT***	**Nov. 13, 2007 35 DAT***	**Dec. 17, 2007 69 DAT***
Untreated check	16.5±2.9	20.50±3.23	20.50±3.12	24.25±3.75
MaxForce®FC (fipronil)	16.5±2.1	18.50±1.71	22.75±2.14	17.25±2.10
Advion® (indoxacarb)	17±1.87	10.25±2.10	19.25±2.63	14.75±1.18
Amdro (hydramethylnon)	16.5±1.85	14.25±3.28	19.50±2.25	16.75±3.99
Extinguish® Plus (methoprene+ hydramethylnon)	16±2.04	16.50±2.60	22.25±2.93	16.50±1.94
Siesta™ (metaflumizone)	16±2.04	12.00±2.12	15.75±4.39	13.50±2.90
d.f. =	5,18	5,18	5,18	5,18
F	0.03	2.303	0.704	1.75
P	0.99	0.08	0.627	0.173
M. Sq.	18.72	26.472	36.05	36.94

* Means (±SE) followed by an asterisk are significantly different compared to mean values observed on the Untreated check. Analysis of Variance (ANOVA) with means separated using Tukey Post-hoc Test, values significant when $P < 0.05$ (SPSS 14.0).

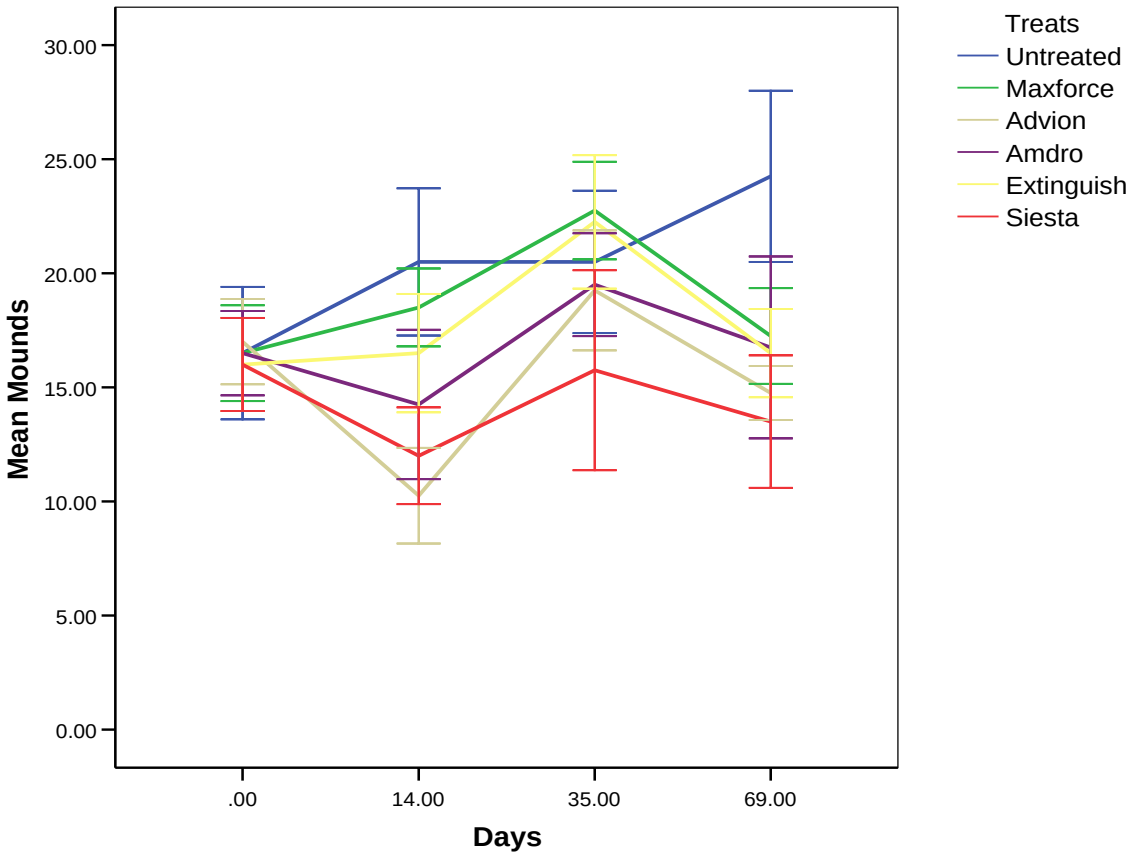

Figure 3. Mean fire ants mounds observed before and following imported bait product applications, Five Eagle Ranch, Caldwell, TX, in Burleson County, treated October 9, 2007.

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