Effectiveness of ExxAnt for the Control of Individual Red Imported Fire Ant Colonies

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This trial was initiated to test the effectiveness of the product Exxant (14.2% turpentine, 0.2% ammonia, distributed by Lang Laboratories, Inc.) when used as a mound drench. Three different solution concentrations were used to help determine the most effective. Evaluations were also made to help determine possible colony movement and/or shattering that may have been caused by treatment.

Objective: Test the effectiveness of the product Exxant at different concentrations for the control if individual colonies of fire ants.

Materials and Methods

The test was established at Coulter Field, the municipal airport serving Bryan (Brazos County), Texas. The "railroad track" individual mound treatment test design, standard for our laboratory, was used (Barr et. al 2002). Experimental units consisted of plots of variable area containing 10-mounds each. Per-treatment areas were equalized to help detect colony relocation caused by treatments and to equalize the area available for reinvasion from outside the test boundaries.

A strip of land 30 ft. wide and of indeterminate length was marked with wire surveyor's flags and mowed. Beginning at one end of the strip and moving down it, flags of one color were placed just to the east side of consecutive, active fire ant mounds until 10 mounds were marked. This set of 10 active mounds constituted a plot. Flag colors were then switched for the next set of 10 and so on, alternating flag colors, until 20 plots were established. Larger flags were placed along one edge of the strip midway between the last flag of one plot and the first flag of the adjoining plot. Distances between flags were measured and recorded, thus giving a defined length to each plot. Plot lengths (areas), were then used as described above in the treatment assignment process. When diagramed, the line of plots resembles a drawing of railroad tracks, hence its informal name, "railroad track" design (Drees and Barr 1997).

Treatments included: water-drench control, one gallon per mound; Exxant, 15 ml/gal, applied to runoff; Exxant, 30 ml/gal, applied to runoff; Exxant, 60 ml/gal, applied to runoff; Organic Plus®, 60 ml/gal/mound. Organic Plus® (0.02% pyrethrins, 97.9% silica dioxide, 1.1% piperonyl butoxide; Global Organic Resources, Inc., San Antonio, Texas) was included as a comparison drench-type treatment as pyrethrin plus diatomaceous earth products have shown effective control with little satellite mound formation (Drees and Barr 1996).

Treatments were applied on March 31, 2000. Exxant solutions were mixed in watering buckets and applied to each mound until no more solution could be applied without runoff. The amount of solution applied to each plot was recorded. Organic Plus was mixed and applied similarly, but one gallon of solution was applied to each mound, regardless of mound size or runoff. Post-treatment evaluations of treated (marked) mounds were conducted on April 1, 4, 7 and 14 and May 3 (1, 4, 7, 14 and 33 days post-treatment, respectively). Entire plots were re-surveyed at 7, 14 and 33 days to detect the presence of additional "new" (unmarked, untreated) active ant mounds. 28. To better use valuable space, this test was combined with "Evaluation of Gardenville Soil Conditioner as a Drench Treatment for the Control of Individual Red Imported Fire Ant Mounds" (p.73). Appropriate data were extracted and analyzed separately using PC SAS analysis of variance procedures with means separated using Tukey's studentized range (HSD) test, $P < 0.05$.

Results and Discussion

Conditions for the treatment of these mounds were ideal with moderate temperatures, cloudy skies and moist soil that resulted in the brood and, most likely, queens being near the tops of mounds where they could be easily reached by a drench-type treatment. Results in **Table 1** indicate a rate response to the different concentrations of ExxAnt throughout the test with the 2 oz/gallon rate performing best. Exxant took about a week to reach maximum suppression in treated mounds and was also rate-dependent with the 2 oz. rate working the fastest.

Plots were evaluated for "new" or "satellite" mound formation at 7, 14 and 33 days post-treatment (see **Table 2**) to detect colony movement, shattering and re-invasion. The untreated control and standard treatment plots are particularly critical when analyzing this data. All treatments should have an equal chance of new colonies invading since the total area for each treatment is approximately the same. So, if a treatment has an unusually high number of "new" mounds appear, it is likely the result of the treated colonies moving and/or shattering. Keep in mind that the origin of a new mound can not be determined with complete certainty unless one actually observes its formation and where the ants originated.

Table 1. Results of *marked* imported fire ant mound evaluations, 10 mounds treated (marked), 4 replications. Bryan, TX. Treated March 31, 2000.

	Mean number of active mounds				
Treatment	Day 1	Day 3	Day 7	Day 14	Day 33
Untreated	9.00 a	8.75 a	8.50 a	8.75 a	8.25 a
Exxant, 0.5 oz	8.25 a	5.00 b	2.25 b	0.50 b	2.00 b
Exxant, 1.0 oz	8.00 a	4.25 b	1.00 b	1.25 b	1.50 b
Exxant, 2.0 oz	6.50 a	3.25 ab	0.50 b	0.25 b	0.25 b
Organic Plus	0.75 b	0.75 c	0.25 b	0.25 b	0.75 b
F	16.84	9.42	20.54	93.94	31.30
P	0.0001	0.0005	0.0001	0.0001	0.0001
R^2	0.9076	0.8461	0.9230	0.9821	0.9481
MSD	2.873	3.3556	2.6106	1.3012	2.0053

Means in the same column followed by different letters are significantly different ($P < 0.05$). Data analyzed using PC SAS analysis of variance procedures. Means separated using Tukey's studentized range (HSD) test. df = 12.

The Exxant product, particularly the lower rates, had significantly ($P < 0.05$) more "new" mounds at the 7-day evaluation than either the untreated or Organic Plus treatments, both of which had relatively few "new" mounds appear. As mentioned, this is likely an indication of colony re-location and/or shattering. However, the number of "new" mounds decreased to a non-significant level by 14 days post-treatment. A possible explanation of this phenomenon is that treatment with Exxant killed colony queens, but left a substantial number of workers which built new mounds. Having no queen, the mounds were soon abandoned and the workers either died or were assimilated by other colonies.

Table 3 shows the results of the analysis of total number of active mounds present (treated mounds + "new" mounds) in plots. At 7 days post-treatment, none of the Exxant-treated plots had statistically fewer total active mounds than were found in the untreated plots. Only Organic Plus showed a significant difference ($P < 0.05$). By 14 days, however, *all* treated plots had significantly ($P < 0.05$) fewer total active mounds than the untreated control. This finding is consistent with the idea that treatment with Exxant causes new mound formation by queenless groups of workers for a short time. By the final evaluation, all treatments showed substantial numerical reductions in total mound numbers, but only Organic Plus showed significantly ($P < 0.05$) fewer total active mounds than the untreated control.

Weather and the site may have played a part in what appears to be substantial re-invasion of the plots by the end of the test. Considerable rain was received at the site shortly before the final evaluation after a three-week dry period, which often leads to fire ant colony movement. Also, this particular site is known for the ants' tendency to abandon and build mounds frequently. The very high density of active mounds likely increased re-invasion pressure, as well.

All treatments showed a substantial increase in the total number of active mounds between 14 and 33 days while the untreated plots did not. I therefore feel that re-invasion towards the plots' natural "carrying capacity" is the primary cause for increasing active mound numbers at the end of the test, not the failure of any product to eliminate treated colonies. Treatments simply opened a "gap" that the ants tried to re-fill.

In summary, of the three concentrations tested, the highest rate of Exxant, 2 oz./gallon applied to runoff, gave the best numerical control of fire ant mounds that were treated and comparable control to that of a standard treatment. It took between 3 and 7 days for this treatment to reach maximum mound suppression. Results strongly suggest that treatment with Exxant causes short-term colony movement and/or shattering before eventual elimination.

Table 2. Results of plot surveys for *"new"* active imported fire ant mounds, 4 replications. Bryan, TX. Treated March 31, 2000.

	Mean number of active mounds		
Treatment	Day 7	Day 14	Day 33
Untreated	3.00 b	2.25 a	3.00 b

Exxant, 0.5 oz	7.75 a	5.00 a	6.00 ab
Exxant, 1.0 oz	8.25 a	2.00 a	5.50 ab
Exxant, 2.0 oz	7.00 ab	4.75 a	6.75 a
Organic Plus	2.75 b	2.25 a	5.75 ab
F	3.94	1.23	4.42
P	0.0184	0.3607	0.0120
R^2	0.6997	0.4169	0.7205
MSD	4.6962	5.0606	3.3493

Means in the same column followed by different letters are significantly different ($P < 0.05$). Data analyzed using PC SAS analysis of variance procedures. Means separated using Tukey's studentized range (HSD) test. df = 12

Table 3. Results for *total* number of active imported fire ant mounds (treated + new), 4 replications. Bryan, TX. Treated March 31, 2000.

Mean number of active mounds					
Treatment	Day 1*	Day 3*	Day 7	Day 14	Day 33
Untreated	9.00 a	8.75 a	11.50 a	11.00 a	11.25 a
Exxant, 0.5	8.25 a	5.00 b	10.00 a	5.50 b	8.00 ab
Exxant, 1.0	8.00 a	4.25 b	9.25 a	3.25 b	7.00 ab
Exxant, 2.0	6.50 a	3.25 ab	7.50 ab	5.00 b	7.00 ab
Organic Plus	0.75 b	0.75 c	3.00 b	2.50 b	6.50 b
F	16.84	9.42	4.12	4.59	3.82
P	0.0001	0.0005	0.0156	0.0104	0.0204
R^2	0.9076	0.8461	0.7061	0.7282	0.6905
MSD	2.873	3.3556	5.5741	5.373	4.5636

Means in the same column followed by different letters are significantly different ($P < 0.05$). Data analyzed using PC SAS analysis of variance procedures. Means separated using Tukey's studentized range (HSD) test. df = 12.
* Treated mounds only

Literature Cited

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Acknowledgments
The authors would like to thank Jason Best for his help on the seven day post-treatment evaluation.