Broadcast and Skip Swath Bait Treatment Effects on Fire Ant Mound Height and Density Victoria County, Texas - 2008-2009

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Red imported fire ants (*Solenopsis invicta* Buren) cause numerous problems in cattle and hay production systems. Problems such as electrical failures and stinging incidents are directly related to the presence of the ants themselves. However, particularly in hay pastures, the ants' mounds cause most of the problems. Large mounds jam cutters and balers and can result in substantially lower equipment speed and increased wear and tear due to the roughness of the ground. Mounds are a particular problem in heavy clay soils where they are overgrown by grass and become an almost permanent part of the landscape.

There are two potentially cost-effective methods for resolving these problems - baits and dragging. Broadcast baits can reduce fire ant populations by over 90% in a single application at a cost of roughly $12 per acre (product cost only). Baits will solve most of the ant-related problems, but do nothing to solve the problems caused by mound structures. Mechanical dragging, on the other hand, effectively eliminates the mound-caused problems, but does little to kill the ants, which will immediately begin to rebuild their mounds. This trial was designed to test the effectiveness of both methods singly and in combination using two different broadcast baits - Esteem and Extinguish Plus.

Materials and Methods

The trial was located on the property of Dr. Ray Smith in Victoria County, Texas in the Texas Coastal Plain. The site is in the flood plain of the Colorado River and has heavy, black clay soil. Standing water is common after heavy rains and, in response, the ants have built very large mounds. The site was grazed, and had a good cover of well-managed native grasses.

One purpose of the trial was to replicate real-life management practices using the cooperator's equipment under his operation. Consequently, test plots were large (an average of 5.7 ac) and could not be replicated. Treatments included: Esteem (0.5% pyriproxyfen) and Extinguish Plus (0.36% hydramethylnon, 0.25% s-methoprene) and an untreated control. Both baits were applied at a rate of 1.5 lbs./acre using a Herd GT-77 seeder. Each treatment was applied to two plots. One plot was full coverage, the other was a skip swath application on approximately 50 foot centers, resulting in 0.75 lbs/acre total application weight.

Finally, half of each of the five plots was dragged. Because of the size and permanence of the mounds, dragging was not an easy task. After several attempts, the owner finally resorted to using the front-loader bucket of his tractor to knock down the mounds followed by dragging with a pin harrow to get them flush with ground level.

Pre-counts were conducted on May 14, 2008. High winds that would have made the skip swath applications very inaccurate prevented bait application until May 31. Evaluations were then conducted on July 3 and January 8, 2009.

Because of the need to mechanically drag half of each plot and ongoing grazing pressure, it would have been very difficult to accurately establish permanent marks. It was therefore decided to sample using random transects. Each transect was 150 ft. long and 30 feet wide, giving a

sample area of 0.103 acres. Transects ran perpendicular to the bait application swaths so as to encounter as many “skips” as possible in those two plots. For each transect, the approximate diameter and height of each mound was measured with a ruler or tape measure and recorded, along with whether the mound was occupied by ants.

Results and Discussion

The mounds in this trial were truly enormous, but not atypical of mounds found in heavy clay soils. The *average* mound at pre-count was over 25 inches in diameter and over 10 inches tall. Dozens of mounds were 36 inches in diameter and some were over 48 inches. Many were over 14 inches tall with some as tall as 18 inches. The mounds made the pastures unsightly, to say the least, and they were actually dangerous to drive any vehicle over at more than five or six miles per hour. Because of the large size and low density, it was assumed that the majority of colonies were monogyne (single queen).

The region had been plagued by low rainfall for some months at the time of applications and conditions only worsened. By January 2009, the area was rated as in “severe” to “extreme” drought. The drought undoubtedly affected the ants. Many of the mounds rated as “live” did, indeed, have a colony living in the mound structure, but the ants actually occupied only a small fraction of the mound. For instance, a mound 36 inches in diameter might have a pocket of worked soil only 6 inches in diameter during the January evaluation. At the July evaluation, there was no freshly worked soil whatsoever, so alive-dead ratings were highly suspect.

Because the treatments were not true replications, it was inappropriate to analyze them using statistical methods such as analysis of variance. Fortunately, many of the differences were well illustrated by simple summary statistics. One challenge of the analysis was finding a way to express the number, condition (alive or dead) and size (height and diameter) of the mounds with a simple expression that could be easily compared between treatments. Several methods proved unacceptable. Mound counts or densities did not express mound size. Average heights did not take density into account; i.e. 10 mounds could have the same average height as 100 mounds. There was also the important complication that this was a nested experimental design with a dragging treatment nested inside each bait treatment.

It was finally decided that, at this point in the trial, it was best to separate bait effectiveness and dragging. Bait effectiveness, including application method, was expressed by simple live-dead counts as shown in **Table 1.** Because the plots were not replicated, there was no way to equalize any pre-count factor so substantial differences existed between plots at test initiation.

Comparison of dragging effectiveness was more complicated. The mound structure itself causes the most damage so it was not necessary to differentiate between occupied or abandoned mounds for this comparison. Mound height is the most important factor in equipment damage, but diameter also plays a role. For example, a mound 12 inches high and 36 inches in diameter is a much more formidable and potentially damaging structure than a mound of the same 12 inch height but only 18 inches in diameter.

Therefore, it was decided that mound volume might be the most accurate and useful comparison. Volume was calculated using the formula for the volume of a partially filled sphere:

Πh^2 (r-h/3). The major assumption was that mounds are spherical which, of course, they are not, but it was the best fit of any regular geometric shape. As mentioned, averages did not take mound number into account, so the volumes of all mounds were simply summed. **Table 2** shows the

results of dragging the different treatments.

It was expected that Extinguish Plus, because of its faster-acting hydramethylnon component, would eliminate colonies considerably faster than the IGR-only Esteem. However, as shown in **Table 1**, there were few differences in effectiveness between the two baits at both Week 5 (July) and Week 33 (January). The drought was the likely reason because it both caused the Esteem-treated ants to die faster than usual and resulted in so little freshly worked soil that existing mounds were very difficult to find. By January, a total of only seven active mounds were found in all four bait-treated plots.

At Week 5, there were roughly double the number of active mounds in the skip-swath plots than in their full-coverage counterparts. It is unknown whether these differences were statistically significant, but that numerical difference disappeared by the January evaluation.

Table 1. Total number of mounds per plot. Three 150 x 30 ft. transects per dragged and un-dragged half of each plot. (Total area = 0.62 acres)

	Pre-count		Week 5		Week 33	
Treatment	Dead	Live	Dead	Live	Dead	Live
Untreated	28	29	15	15	12	22
Extinguish Plus, full coverage	26	34	23	5	26	1
Esteem, full coverage	19	14	13	6	11	3
Extinguish Plus Skip Swath	38	43	12	12	11	1
Esteem Skip Swath	27	23	14	10	18	2

The results of dragging (**Table 2**) showed the expected dramatic differences. In the dragged halves of the plots, there were almost no mounds to be seen. There were large areas of bare soil where the mounds had once been, but nothing tall enough to damage equipment. Most former mounds, in fact, were depressed an inch or two because of their collapsed underground galleries. By January, despite the drought, vegetation had begun to overgrow many of these bare patches.

Table 2. Total mound volume per half plot, expressed in **cubic feet**. (ft.^{3}) using the formula:

Πh^2 (r-h/3). Three 150 x 30 ft. transects per plot. (Total area = 0.31 acres)

	Pre-count		Week 5		Week 33	
Treatment	Dragged	Undrag	Drag	Undrag	Drag	Undrag
Untreated	62.0	98.6	0.4	45.6	3.8	34.4
Extinguish Plus, full coverage	40.7	42.4	0.1	63.8	0.0	40.2
Esteem, full coverage	38.4	34.9	0.1	41.4	0.0	16.5

Extinguish Plus Skip Swath	61.4	60.4	0.1	60.6	0.0	26.4
Esteem Skip Swath	83.1	112.9	0.1	65.4	0.0	67.0

Importantly, mounds in the dragged half of the untreated plot had begun to rebuild by January. One objective of this trial was to see if the bait treatments suppressed mound reformation sufficiently to help justify their cost. At this point in mid-winter, and with the worsening drought, it is too soon to tell if the treatments will be of substantial benefit. It is hoped that an evaluation in April or May and some rain will answer this important question.

In the world of fire ant management, the saying “perceptions are reality” is never more true. If an individual thinks he or she has a problem, they have one, whether someone else would think it was a problem or not. Similarly, if a person is happy with a treatment, it has value. Whether that value can offset the costs of treatment, or even be calculated, is almost irrelevant if the person *considers* the treatment worth the input. Despite the hours he spent dragging our plots, the owner asked if we were through with the test and whether he could drag the rest of his pastures. He obviously felt the dragging was worth it. Unfortunately, we had to ask him to delay additional dragging until after a final evaluation in late spring of 2009.

Finally, we would like to extend our deepest thanks to Dr. Smith for allowing us to use his property and for the *considerable* time and effort he spent in applying the baits and, particularly, flattening the hundreds of huge mounds in the dragged halves of the plots.