

Evaluation of “Shaker Bag” for Broadcast Application of Pyriproxyfen (Esteem®) Imported Fire Ant Bait

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Esteem® Fire Ant Bait (Valent U.S.A.) is an insect growth regulator (IGR) product for control of imported fire ants. New packaging has been developed for this product using a “shaker bag” whereby the product can be applied from the bag to sprinkle the bait around ant mounds without any other application tools. The bag is plastic and can be re-sealed after use. However, directions for using the shaker bag, informing users about the rate dispensed by the bag, or considerations for ant mound numbers per unit area are lacking. In addition, the concepts of grid-spot application to simulate a full broadcast treatment without needing to search for active ant mounds is under development and this packaging could help usher in the wide-spread usage of this new treatment methodology.

Materials and Methods

Prototype trials. In February 2007, two “shaker bag” prototypes were provided by Valent U.S.A.: 1) Terro® bag, 10.5 in. wide with 3 mm holes spaced 1.3 and 1.5 mm apart in offset rows; and, 2) a clear plastic shaker bag, 11.5 in wide with 3 mm holes spaced 2.0 and 5.0 mm apart in offset rows. Distance® Fire Ant Bait (pyriproxyfen, lot #12530020095J, was provided for testing. This lot seemed to contain more oil than other similarly-formulated imported fire ant bait products and had settled, resulting in clumps of bait in the container which needed to be broken apart to assure even flow of material through holes in the bottom of the shaker bags.

Roughly 0.75 lb. Product was placed into each bag. The bag was shaken up and down 10 times over a cardboard sheet. The pattern of particle distribution was observed and documented, and the bait particles were collected and weighed. The weight of 6 teaspoon quantities of bait was also determined.

Assessment of commercial packaging. Esteem® Ant Bait was commercially available in “shaker bag” packaging in 2008. In June 2009, a 2.5 lb. bag was obtained for evaluation (**Fig. 1**). Upon opening the bag, a plastic liner with 3.0 mm holes, in off-set rows 2.0 mm apart appears in the 29.5 cm (11.5 inch) “mouth” of the plastic bag. Ten “shakes” were made over a plastic tray (replicated four times) and the quantity of bait released was weighed and volume measured (Tablespoons, replicated 8 times).

Results

Prototype trials. The bait scatter pattern on cardboard occurred in a circular area about 4 ft across with most of the particles falling within the inner 3 ft (0.84 sq m) diameter circle. The average weight of 6 teaspoons (2 Tablespoons) of this lot of pyriproxyfen bait was 14.07 g (average of 14.25, 14.30 and 13.65). The average weight from 10 shakes of the Terro shaker

bag was 11.24 g (average of 12.80, 12.85, 10.25, 9.05), or 1.12 g per shake. The average weight from 10 shakes of the clear bag was 5.68 g (average of 5.0, 5.9, 5.6, 5.4 and 6.5) or 0.57g per shake.

The broadcast application rate of Esteem or Distance ant bait products is 2.0 lbs./acre (907.18 g/4,046.86 sq m = 0.2242 g/sq m). Thus, for the clear shaker bag, application should be made at a rate of about 1 shake every 2-3 (2.54) sq m, and for the Terro bag, one shake every 5 sq m.

Assessment of commercial packaging. Ten shakes released 21.8 grams (± 1.3 Standard Deviation or S.D.) Esteem, or roughly 0.7 oz measuring 4.0 to 4.75 Tablespoons in volume. Each Tablespoon weighed $4.6 \text{ g} \pm 0.3 \text{ g S.D.}$ or 0.15 oz ($\pm 0.01 \text{ oz S.D.}$). Variation does occur between lots of ant bait product, being affected by oil content and grit size which varies even through the profile of a single container (oil and smaller particles settle to the bottom. In another trial, 1 Tbsp of product was found to weigh an average of 0.2 oz.

Discussion

Obviously, a full broadcast application can not be achieved using a shaker bag, which is more appropriate for treating individual ant mounds or applying spot treatments. The application directions for Esteem (pyriproxyfen) are:

INDIVIDUAL MOUND TREATMENT: Do not disturb the mound. Do not apply to top of mounds. Apply 1 to 4 level tablespoons of DISTANCE Fire Ant Bait per mound, uniformly distributing material 3 to 4 feet around the mound.

BROADCAST OR AERIAL APPLICATION: Apply uniformly with ground or aerial equipment calibrated to give the correct dosage. Apply at 1 to 1.5 lbs. of product per acre.

Thus, for a mound treatment, 1 to 4 Tablespoon = 0.46 to 1.84 grams or 0.2 to 0.8 oz product, with a maximum application rate per acre of 2.0 lbs (16 oz/lb x 2 = 32 oz). With 10 shakes releasing 21.8 grams Esteem, 1 Tbsp/mound or 4.6 g = 2.1 shakes and 4 Tbsp/mound or 18.4 g = 8.4 shakes. The number of ant mounds or spots in a one-acre grid will treat at 1, 1.5 or 2 lbs Esteem/acre is shown in **Table 1**.

Using this methodology, in areas with high numbers of ants, the number of mounds one can treat may exceed the amount of product once could legally apply at the labeled rate, i.e., at the lowest (1 Tbsp/mound) rate of Esteem, one could not treat more than 209 ant mounds without exceeding the 2 lb per acre maximum for broadcast application. At the high (4 Tbsp/mound rate), one could treat no more than 52 mounds.

Table 1. Broadcast application rate(s) of Esteem® Ant Bait (lb/acre) in ounces and grams, and the number of shaker bag shakes to achieve the 1 or 4 Tbsp per mound treatment rate and resulting number of treatable mounds per acre.

lb/acre	oz	g	2.1 shakes	8.4 shakes
			4.6 g 1 Tbsp	18.4 g 4 Tbsp/md
1.0	16	480	104.3	26.1
1.5	24	720	156.5	39.1
2.0	32	960	208.7	52.2

The average density of red imported fire ants in the U. S. is 68 mounds per acre (168 mounds/ha)(Porter et al. 1992). Areas infested with the multiple queens or polygyne form of this fire ant can have many more mounds per acre, in one case over 1,000 mound per acre (Drees and Vinson 1990). Thus, recognition of maximum numbers of treatable ant mounds at various rates should be included in product label directions to avoid over-application. If or when ant mound numbers exceed 20 mounds/acre, broadcast application is suggested (Drees et al. 2008).

However, an alternate treatment pattern using fenoxycarb product, containing an insect growth regulator (IGR) like pyriproxyfen, applied in a grid pattern (i.e., 2 Tablespoons fenoxycarb bait on a 20 by 20 m grid) performed similarly to a broadcast application (<http://fireant.tamu.edu/research/arr/category/broadcast/93-94Pg18/93-94Pg18.pdf>). This treatment pattern is currently being evaluated using various rates of Esteem Fire Ant Bait in Bexas (San Antonio) and Collin (Plano) Counties.

Grid-spot treatment. One acre = 43,560 sq ft, or a 208.7 ft (69.5 m) square. For a 10 m (33 ft or 11 yd = about 10 paces) grid, there are 7 spots on each side, thus, (7 x 7 =) 49 spots within an acre. At the 2 lb rate per acre of Esteem, 49 spots applies 1.9 lbs product/acre. Similarly, a 3 Tbsp (13.8 g, 0.15 oz, or 6.3 shake) application to this 49-spot pattern applies 1.4 lb/acre. With this treatment pattern, no ant mound is more than 5 meters or 16.5 ft from a bait-treated spot, and foraging ants from nearby mounds are likely to access the spot application (Drees et al. 1992). Using data provided by assessment of the shaker bag provided with the 2.5 lb Esteem Ant Bait product, other scenarios can be developed to help user this device to more effectively manage fire ants in landscape areas.

Citations

- Drees, B. M., and S. B. Vinson. 1990. Comparison of the control on monogynous and polygynous forms of the red imported fire ant (Hymenoptera: Formicidae) with a chlorpyrifos mound drench. *J. Entomol. Sci.*25(2):317-324.
- 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):313-319.
- Drees, B. M. K. Schofield, E. Brown, P. Nester, M. Keck, and K. Flanders. 2008. Fire ant control: The two-step method and other approaches. L-5496. The Texas AgriLife Extension Service. Texas A&M System, College Station, Texas. Leaflet, posted on <http://AgriLifeBookstore.org>
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Fig. 1. Esteem® Ant Bait 2.5 lb “shaker bag” container evaluated for treating red imported fire ants.



a. Plastic bag container



b. zip-lock opening at top



c. Plastic liner with 3 mm holes



d. Shaking bait product from bag