

Protecting Harvested Hay from the Red Imported Fire Ant

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Hay infested with the red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae) is a regulated item when it is to be shipped out of quarantined areas, refer to Federal Quarantine (7 CFR 301.81) . The Texas Administrative Code (Title 4, Part 1, Chapter 19, Subchapter J, Rule §19.102) does not permit baled hay to be shipped from quarantine counties to non-quarantine counties or to other states due to infestation of the red imported fire ant (<http://lamb.sos.state.tx.us/tac/>). Currently the only USDA or TDA approved way to have hay or straw approved for shipment from fire ant quarantined counties to non-infested counties is to remove bales from the field immediately after baling and store them in an off ground location. This prevents hay that has been stored in the field in ground contact from being eligible for shipment. There is currently no USDA-APHIS or TDA approved quarantine chemical treatments for assuring that red imported fire ants are not shipped to new locations.

As part of a cooperative effort with Ron Weeks, Entomologist, USDA, APHIS, PPQ, CPHST Lab - Gulfport, MS, a results demonstration was set up in Montgomery County at the Billy Woods Ranch, 5.1 miles south Montgomery, TX on FM 149, with the help of Mike Heimer, CEA-AG/NR, to evaluate best management practices for protecting harvested hay from fire ant infestation. This study will help identify treatment methods which will reduce or eliminate fire ant infestations in round bales.

Material and Methods

Forty-eight round hay bales removed from an on-location hay holding area (**Figure 1**) were placed in a hay storage area where cattle were excluded with an electric fence. The hay bales were arranged into 12 groups of four bales with each group being considered one experimental unit. (**Figure 2**). Each experimental unit received one of three treatments, **Table 1**, and each treatment was replicated three times in a randomized block design. **Figure 1** shows the size and the approximate placement of the hay bales within the designated hay study storage area, and the location of the hay bales receiving no treatment which was considered the untreated control. The untreated bales were located away from the treated bales because the entire hay storage area was to be treated with a broadcast application of an ant bait product. The entire area had noticeable fire ant activity prior to initial treatment.

On Sept. 29, 2007 Extinguish® Plus fire ant bait (hydramethylnon plus methoprene) was broadcast at 2.0 lb product per acre over the storage area with an ATV (Kawasaki Prairie 700) mounted Herd GT-77 Sure Feed Broadcaster for Fire Ants (Herd Seeder Co., Inc., Logansport, IN (www.herdseeder.com)). The Herd GT-77 was calibrated to deliver 2.0 lb fire ant bait with a 20 ft swath while the ATV traveled at 11 mph. The Herd GT-77 was fitted with a Herd Seeder Co. #0 plate covering the hopper opening. A perimeter broadcast treatment of Extinguish® Plus fire ant bait at 2.0 lb product per acre was made around the on

location hay storage area to help minimize the presence of fire ants in hay bales before they were moved to their respective study plots.

On Oct. 19, 2007, GardStar® (permethrin) at the rate of 6 ml/gal @ 6 gal/100 sq ft was broadcast using a spray gun attached to a nurse tank calibrated to deliver 3 gallons per minute to a 12 ft X 12 ft area (**Figure 1**) in each plot location where hay bales were to be placed on pallets. All 4 ft X 5 ft hay bales were moved into plot areas on Oct. 29, 2007 making a four bale square in each. Final GardStar® perimeter broadcast treatments (3 ft perimeter around hay bales) were applied on Oct. 30, 2007. Beginning 24 hours after final GardStar® perimeter broadcast treatment (Oct. 31, 2007), and each week for 7 weeks following, food lure stations (1/4 inch pieces of hot dog) were placed approximately 4 inches from the ground on each hay bale (**Figure 3**). The number of foraging red imported fire ant workers on the stations were estimated after 45 minutes of exposure to document presence or absence of the fire ant,

Four weeks after initiation (Oct. 30, 2007), hay bales that showed fire ant activity on the food lure stations were treated using fire ant bait stations (Bell Laboratories', Inc., "Rodent Baiter" stations with 1 oz indoxacarb, Advion®, fire ant bait, **Figure 4**) placed on the ground close to the food lure station. Fresh Advion bait stations were again placed beside those hay bales showing fire ant activity after the fifth week. The test was concluded after 7 weeks of sampling

Results and Discussion

Table 2 shows the total number of foraging imported fire ant workers associated with four food lure stations placed on 4 round bales per treatment. At the 24 hr and 1 week after treatment (WAT) evaluations, there was a significant difference in fire ant numbers observed on untreated bales versus those bales within other treatments. At 2, 3 and 4 WAT there were no significant differences among insecticide treatments although the bait alone treatment had no foraging fire ants associated with the food lures. Additional treatments using the contact insecticide did not significantly improve the bait only treatment, although foraging fire ant numbers were numerically fewer in treated plots than in untreated plots

On the November 28th evaluations date (4 WAT), we decided to place bait stations containing the fire ant bait Advion® on the ground next to bales with documented fire ant foraging activity. The idea was to use this quick acting bait to remove the fire ants from the bale, as a curative treatment. **Table 3** shows that on November 28th, the Advion® bait stations were placed next to 7 hay bales (**Figure 5**) found to have foraging fire ants. Bait stations remained until the next evaluation date. These hay bales with foraging fire ant activity were in plots treated with fire ant bait followed by application of permethrin (GardStar®) around the perimeter of bales placed on the ground (Premise) and plots treated with fire ant bait followed by permethrin treatment underneath pallets on which bales were placed plus permethrin around the perimeter of bales (Full). It is interesting to note that no Advion® bait stations were placed around bales receiving fire ant bait alone treatment as these had no fire ant activity.

The next evaluation at 5 WAT (December 5th) again showed a significant difference in fire ant numbers observed on bales in the untreated area, versus those bales within treated areas (**Table 2**). Also, 5 out of the 7 hay bales where the Advion® bait stations were placed showed no fire ant foraging (**Table 3**). Advion® bait stations with fresh product were placed

next to the remaining two hay bales that still had foraging fire ant. All other bait stations were removed.

The December 11th evaluation date also showed a significant difference in fire ant numbers observed on bales in the untreated area, versus those bales within treated areas (**Table 2**). The Advion® bait stations removed the ants from one of the remaining two hay bales (**Table 3**), but, foraging fire ants re-appeared in a previously uninfested hay bale. All bait stations were removed at this date, to see if fire ants would return to the hay bales. The final evaluation date on December 19th again showed a significant difference in fire ant numbers observed on bales in the untreated area, versus those bales within treated areas (**Table 2**). As for the hay bales where the Advion® bait stations were placed, the only foraging fire ants were found in the bales with fire ants on December 11th (**Table 3**).

Table 4 shows the number of food lure cards of four (rated either present or absent) on which foraging imported fire ant workers were observed on 4 round bales per treatment plot. All treatments were significantly different from the untreated at all evaluations dates, except on Nov. 19 when the Premise treatment did not separate from the untreated plot mean. This data may be misleading. Upon inspection, if the presence of ANY fire ants on a hay shipment going to a non-quarantined area from a fire ant quarantined area is observed that hay shipment is likely to be turned away. Only those treatments that keep hay bales free of foraging fire ants are desired. The fire ant bait only treatment had “0” hay bales with no foraging ants for the longest period of time. We do not have an explanation as to why this occurred.

The use of the fire ant bait stations placed next to hay bales with foraging fire ant activity shows promise. It may be better to place bait stations on the individual hay bales instead of placing them on the ground. In this study only hay bales in a treatment area that had an additional permethrin treatment had the additional Advion® bait stations placed where foraging fire ants were observed on the food lure stations. It is not known if any permethrin residue inhibited the foraging fire ants from finding the bait station placed on the ground. Dupont™ has an ant bait station product, Advion® Ant Bait Arena that should be evaluated as a means for quick removal of fire ant from individual hay bales. This type of ant bait station may also show promise by placing bait stations on the transport trailer, to remove any fire ants that might have been undetected.

Acknowledgements

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Table 1. Treatments tested for fire ant control on hay bales, Montgomery Co. TX, 2007.

Treatment Designation	Broadcast Fire Ant Bait	# product /acre	Contact Insecticide	Insecticides Applied
Bait only	Extinguish® Plus Sept. 29	2	-	Bait
Premise	Extinguish® Plus Sept. 29	2	GardStar® Oct. 30	Bait plus perimeter treatment of GardStar at 6ml/gal
Broadcast plus perimeter	Extinguish® Plus Sept. 29	2	GardStar® Oct. 19	Bait plus perimeter plus broadcast GardStar at 6 gal/100 sq ft
Untreated	None	-	None	-

Table 2. Total number of foraging imported fire ant workers associated with food lure stations placed on 4 round bales per treatment, Montgomery Co., TX, 2007.

	No. foraging ants per four food lure stations¹							
Treatment	Oct. 31 24 hr	Nov. 6 1 WAT	Nov. 13 2 WAT	Nov. 19 3 WAT	Nov. 28 4 WAT	Dec. 5 5 WAT	Dec. 11 6 WAT	Dec. 19 7 WAT
Untreated	125.0a	131.5a	134.0	99.3	84.0	76.3a	248.5a	207.5a
Bait	0.0b	0.0b	0.0	0.0	0.0	0.0b	21.3b	0.5b
Premise	0.0b	18.8b	52.5	70.0	47.5	2.5b	7.5b	5.0b
Full	0.0b	12.5b	22.5	47.5	20.0	0.25b	23.8b	10.3b
d.f. = 3								
<i>P</i>	0.011	0.010	0.071	0.275	0.074	0.002	0.000	0.000
<i>F</i>	5.832	5.924	3.025	1.462	2.980	9.233	28.166	17,366
Mean Sq.	15,625.0	14904.229	13,731.0	7,015.563	5,298.917	5,680.167	53,565.167	40,968.536

¹ Means followed by the same letter are not significantly different using analysis of variance (ANOVA) with means separated using Tukey's HSD, $P \leq 0.05$ (SPSS 14.0 for Windows).

Table 3. Red imported fire ant infested round bales treated with indoxacarb applied in bait stations, Montgomery Co., TX 2007.

Bale	Ants, 11/28	Ants 12/5	Ants 12/11	Ants 12/19
15, 2a	10*	0	0	0
5, 3b	60*	0	85	40
6, 2b	70*	0	0	0
7, 3b	10*	0	0	0
9, 2b	30*	0	0	0
16, 3d	10*	10*	10	1
15, 2b	80*	5*	0	0
Mean \pm S. D.	38.6 \pm 30.8	2.1 \pm 3.9	13.6 \pm 31.7	5.9 \pm 15.1

*treated or retreated

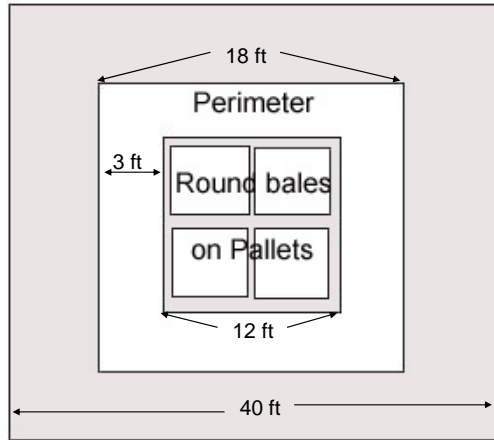
Table 4. Number of food lure stations on which foraging imported fire ant workers were observed per treatment, Montgomery Co., TX, 2007.

	No. cards/4 attracting foraging ants ¹²							
Treatment	Oct. 31 24 hr	Nov. 6 1 WAT	Nov. 13 2 WAT	Nov. 19 3 WAT	Nov. 28 4 WAT	Dec. 5 5 WAT	Dec. 11 6 WAT	Dec. 19 7 WAT
Untreated	2.8a	2.8a	3.3a	2.3a	3.0a	3.0a	4.0a	3.8a
Bait	0.0b	0.0b	0.0b	0.0b	0.0b	0.0b	0.5b	0.3b
Premise	0.0b	0.3b	0.8b	1.3ab	1.0b	0.5b	0.3b	0.3b
Full	0.0b	0.5b	0.8b	0.5b	0.8b	0.3b	0.5b	0.5b
d.f. = 3								
<i>P</i>	0.000	0.000	0.002	0.043	0.000	0.000	0.000	0.000
<i>F</i>	33.0	17.111	9.4390	3.680	16.579	16.130	56.273	43.308
Mean Sq.	7.563	6.417	8.063	3.833	6.563	7.729	12.896	11.729

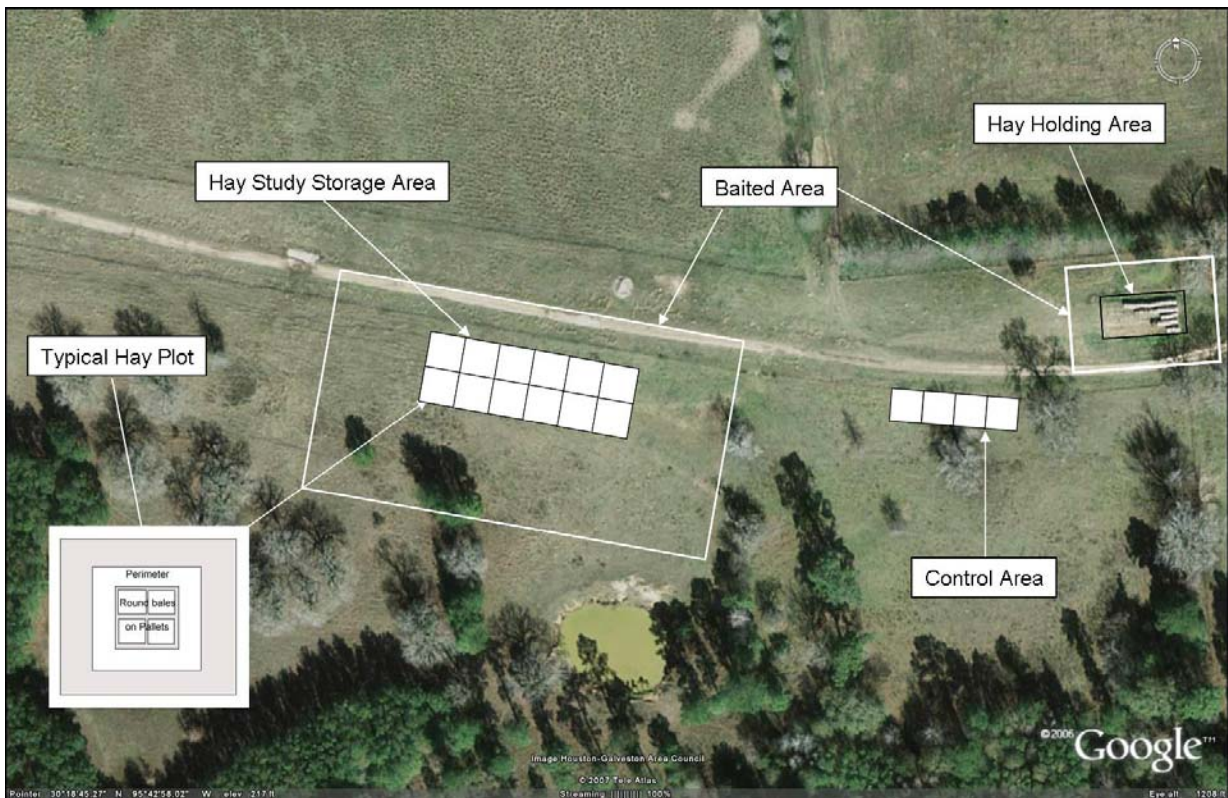
¹ Means followed by the same letter are not significantly different using analysis of variance (ANOVA) with means separated using Tukey's HSD, $P \leq 0.05$ (SPSS 14.0 for Windows).

² Total number of lure food stations per treatment were 16 (1/hay bale or 4/plot)

Figure 1: Plot plan for evaluating insecticidal treatment regiment for preventing round bales from becoming infested with red imported fire ants. The individual plot dimensions are as diagrammed in the expanded plot view. The approximate location of the individual plots is diagrammed in the location view. The expanded plot view illustrates the placement of the bales and those plots with pallets.



Expanded plot view



Location View

Figure 2: Placement of hay bales in four bale squares in hay storage area, Montgomery Co., TX 2007



Figure 3: Placement of food lure stations on hay bales.



Figure 4: Bell Laboratories', Inc., "Rodent Baiter" stations with 1 oz indoxacarb (Advion®) fire ant bait.



Figure 5: Placement of Bell Laboratories', Inc., "Rodent Baiter" stations with 1 oz indoxacarb (Advion) fire ant bait on ground close to food lure station.

