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Evaluation of Gaucho® Seed Treatment and Soil Insecticides for Management of the Red Imported Fire Ant on Seedling Grain Sorghum During 1994-1996

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Introduction

Grain sorghum is an important feed grain crop in Louisiana. Its acreage has increased rapidly in recent years. However, like in other crops, yields can be highly variable due to environmental conditions and insect pressure.

The red imported fire ant, Solenopsis invicta Buren, has become a serious pest of many crops in the southeastern United States (Lyle and Fortune 1948, Lofgren 1986). Severe damage to sorghum has been observed in Texas since 1980 (Drees et al. 1991). It is a sporadic pest of sorghum seeds and seedlings in conservation tillage systems in Louisiana (Leonard et al. 1993).

Reduced tillage systems create a favorable environment for red imported fire ants. Preplant herbicides used in reduced tillage systems to burn down spring vegetation reduce the available food supply for red imported fire ants. When vegetation is removed, red imported fire ants are likely to increase their foraging behavior and feed on grain sorghum seed and seedlings (Leonard et al. 1993). Moreover, reduced tillage systems often do not maintain a closed seed furrow, which facilitates red imported fire ant access to seeds and developing seedlings (Leonard et al. 1993). Because of their small size, sorghum seeds are easily removed from the furrow and carried toward the ant nest (Drees et al. 1991). Red imported fire ants also destroy sorghum seeds by breaking the pericarp and removing the embryo and the endosperm (Drees et al. 1991).

Dry soil conditions delay and prolong sorghum germination, favoring predation on the seeds by red imported fire ants (Drees et al. 1991). Furthermore, dry conditions reduce the effectiveness of some soil-applied insecticides used to control red imported fire ants (Drees et al. 1992), which can have devastating effects on grain sorghum seedling populations.

Seed treatments have been used in Louisiana and Texas to prevent red imported fire ant damage in grain sorghum (Baldwin et al. 1997, Drees et al. 1992). Seed-protecting insecticides often repel or kill red imported fire ants. Other preventive insecticides for use in red imported fire ant control are very limited (Leonard et al. 1993).

Current research in Louisiana is focused on developing insecticide use strategies to manage the red imported fire ant in grain sorghum. Maintaining low levels of insect damage while keeping control costs to a minimum is essential to obtain profitable yields for Louisiana grain sorghum producers.

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Materials and Methods

The experiments were conducted at the Macon Ridge Location of the Northeast Research Station, near Winnsboro, Franklin Parish, LA, for three consecutive years: 1994, 1995, and 1996. Paraquat (Gramoxone Extra 2.5S; 1.5 pints form./acre; Zeneca Agricultural Prod., Wilmington, DE) and glyphosate (Roundup; 1 qt. form./acre; Monsanto Agricultural Company, St. Louis, MO) were applied at one and three weeks, respectively, prior to planting to burn down spring vegetation. Sorghum hybrids Pioneer 8333 (1994), Pioneer 8358 (1995) and Asgrow A570 (1996) were planted no-till on May 3, May 19, and June 11 for 1994, 1995, and 1996, respectively, with a John Deere 7300 planter. Sorghum was planted directly into a bermuda grass sod containing a high density of red imported fire ant mounds. Plots consisted of four rows (40-inch centers) by 30 ft (1994) or 15 ft (1995 and 1996) in length arranged in a RCB design with four replications. Imidacloprid (Gaucho 480FS; 8.0 fl oz form/cwt. seed; Gustafson, Inc., Dallas, TX) was applied as a seed treatment (SEEDT), chlorpyrifos (Lorsban 15G; 0.5 lb AI/acre; Dow AgroSciences, Indianapolis, IN) as T-banded granules at planting (T-BAND), and carbofuran (Furadan 4F; 1.0 lb AI/acre; FMC Corporation, Middleport, NY) in 1995 and 1996 only as an in-furrow spray at planting (IFSAP) with a CO_2 charged system, calibrated to deliver 5 gpa at 35 psi (1995) and 25 psi (1996) through 8002E flat fan nozzles (1/row).

Red imported fire ant densities were estimated on June 1, 1994; May 29, 1995; and July 9, 1996. An unruled index card (3 x 5 inches) was baited with a teaspoon of creamy peanut butter evenly distributed on the center of one side of the card. One card was placed, baited side down, in each plot and secured to the ground with a three-inch nail. The number of red imported ants attracted to the cards was recorded after 1 to 3 hours (1994 and 1995) and after 30 minutes (1996). Plant population densities were recorded on May 31, 1994; June 15, 1995; and July 9, 1996 by counting the number of plants in the center two rows. Plant heights were recorded on May 31, 1994; June 15, 1995; and July 9, 1996 by measuring 20 randomly selected plants per plot. Intra-row skips between plants were recorded on June 13, 1994; June 15, 1995; and July 9, 1996 by counting the number of skips > 12 inches between plants in the center two rows.

Data analysis. Numbers of red imported fire ants were subjected to the log (x + 1) transformation to stabilize the variance. All data were analyzed by analysis of variance (ANOVA) using PROC GLM (SAS Institute Inc. 1996). Insecticide treatment means were compared with the untreated control using Dunnett's two-tailed t-test. Treatment means were compared at the 5% significance level.

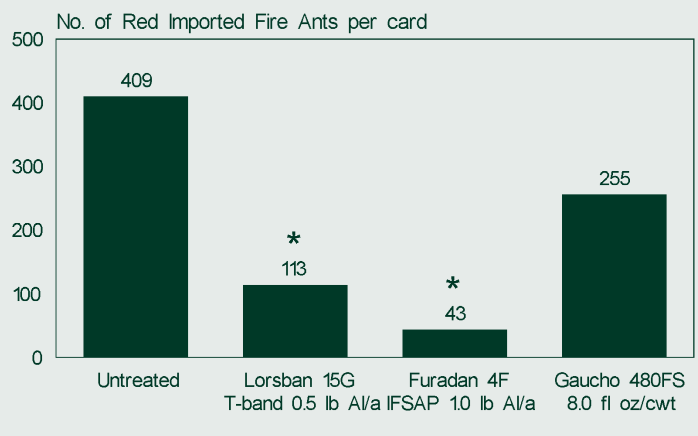

Figure 1. Number of Red Imported Fire Ants per Card, Winnsboro, Louisiana, 1994 - 1996.
Furadan 4F data are from 1995 and 1996 tests. Mean values are untransformed data. Bars with an asterisk are significantly different from that of the untreated control (Dunnett's test; $P = 0.05$).

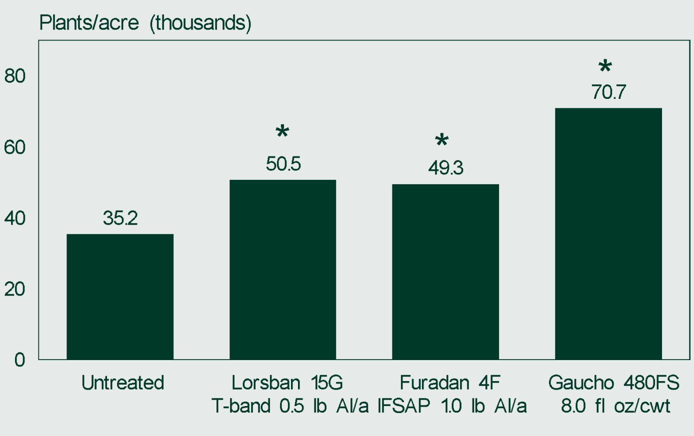

Figure 2. Plant Population Density in Grain Sorghum, Winnsboro, Louisiana, 1994 - 1996.
Furadan 4F data are from 1995 and 1996 tests. Bars with an asterisk are significantly different from that of the untreated control (Dunnett's test; $P = 0.05$).

Results and Discussion

Significant (F = 10.06; 3, 24; P = 0.0002) reduction in red imported fire ants was observed in Lorsban- and Furadan-treated plots compared with untreated plots. No significant differences in ant numbers were observed between the Gaucho treatment and the untreated control (Figure 1). Plant population densities were significantly (F = 32.43; 3, 24; P = 0.0001) higher in all insecticide-treated plots than in untreated plots (Figure 2). No significant (F = 2.04; 3, 24; P = 0.1350) differences in plant heights were observed between sorghum plants in the untreated control and those from all other insecticide treatments (Figure 3). However, a trend toward increasing plant height was observed in the insecticide treatments. An increase in plant height of 11.6% was observed in the Lorsban and Furadan treatments, and an increase of 17.4% in the Gaucho treatment compared with the untreated control. The number of intra-row plant skips (>12 inches) between plants was significantly (F = 15.34; 3, 24; P = 0.0001) lower in the Gaucho-treated plots than in the untreated plots. Intra-row plant skips in the Lorsban- and Furadan-treated plots were not significantly reduced compared with untreated plots (Figure 4).

The Gaucho seed treatment performed consistently well during the three-year study. The use of Gaucho as seed treatment in grain sorghum improved sorghum plantings as indicated by significantly higher population densities and significantly lower number of intra-row skips compared with the untreated control. Although the Furadan and Lorsban treatments significantly increased plant stand and decreased red imported fire ant population densities, their performance was less consistent than that of Gaucho. Numbers of foraging red imported fire ants were not affected by the seed treatment as no differences were observed between Gaucho-treated plots and untreated plots.

The consistent performance of Gaucho is important since effectiveness of many approved soil-applied insecticides varies with soil moisture conditions. Other benefits derived from the use of insecticide seed treatments are reduced exposure and threat to beneficial arthropods and other non-target organisms and less environmental contamination. Seed treatments also eliminate the need for specialized insecticide delivery attachments on planting equipment.

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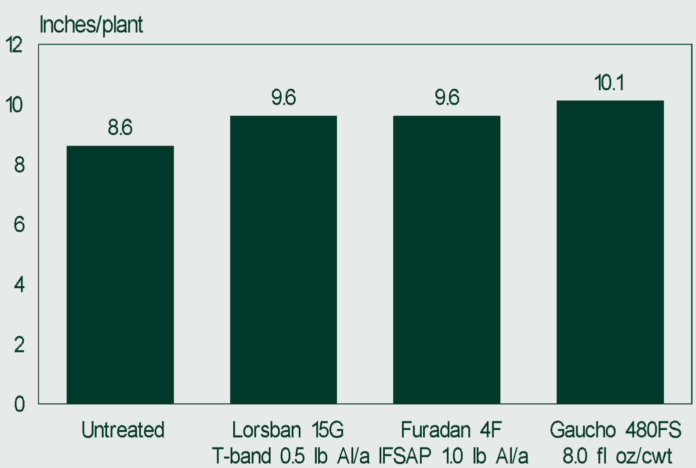

Figure 3. Mean Plant Heights in Grain Sorghum, Winnsboro, Louisiana, 1994 - 1996.
Furadan 4F data are from 1995 and 1996 tests.

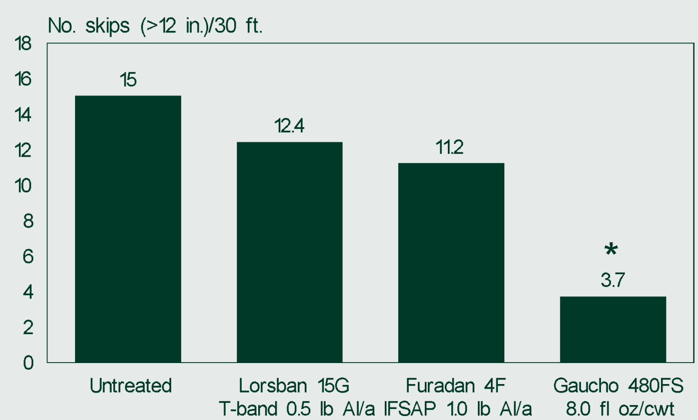

Figure 4. Intra-row Plant Skips (>12 inches) in Grain Sorghum, Winnsboro, Louisiana, 1994 - 1996.
Furadan 4F data are from 1995 and 1996 tests. Bars with an asterisk are significantly different from that of the untreated control.(Dunnett's test; P = 0.05).

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