FIELD EDGES, BARRIERS AND COTTON FILED PENETRATION BY STINK BUGS

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Introduction

The stink bug complex has become a serious problem for cotton production in the southeastern United States (Greene et al. 2001; Williams 2006).

It has become increasingly apparent from that stink bug colonization of cotton fields exhibits distinctive edge effects. This effect is particularly apparent adjacent to peanut fields, where bug damage is often most intense in the rows nearest the peanut border. This pattern of colonization suggests that stink bug movement into a field may be slowed or disrupted by managing the edge of the cotton field. Management practices might involve the use of border sprays of insecticides or the insertion of barriers to slow movement. This project examined the latter option, using grain sorghum and sorghum sudangrass as planted barriers between the cotton and an adjacent peanut planting. Grain sorghum can attain heights of 4-5 feet, whereas sudangrass attains heights in excess of 10 feet, forming a taller barrier. These were compared to two no-barrier scenarios: bare ground and peanuts.

Materials and Methods

Cotton (variety DPL 543BG2/RR) was planted on 26 May at the Lang-Rigdon Farm of the Coastal Plain Experiment Station in Tift County, Georgia, using a Monosem pneumatic planter equipped to add granular insecticides in the furrow. Peanuts (variety 'Georgia Green') were planted adjacent to all cotton plots on 8 June 2006. Throughout the course of the season, all plots were irrigated for optimal growth. All cotton received 3.5 lbs of Temik at planting with the Monosem planter.

We examined the effects of three different field borders on stink bug populartions and injury in cotton. The borders were all 24 feet wide, were planted immediately adjacent to the cotton plants (and with adjoining peanuts on the other side), and were (1) bare, tilled soil, (2) grain sorghum (var Southland SL280), or (3) sorghum sudangrass (var Dekalb SX17). Each barrier treatment was replicated four times. Sorghum and sudangrass were planted with a Monosem 2-row planter, with a seed spacing of 2 3/8" to 7". Each plot was 94 feet long, and separated by 10 feet of bare ground lengthwise between plots. We sampled stink bugs in the cotton weekly by taking 25 sweep samples in each plot on rows 1, 3, 6, 12, and 18 between 9 and 11 am (EDT). Stink bugs collected in the samples were identified and counted. Samples were taken from 1 August until 19 September. Stink bugs also were sampled in peanuts with a suction sampler (50 suctions per plot, for a sample of 25 linear feet), and in grain sorghum and sorghum sudangrass by visual examinations of 30 plants per plot. The border crops were sampled on the same dates as the cotton samples were taken to determine stink bug presence. In addition, boll injury evaluations were made on sample dates for 20 bolls each on rows 1, 6, and 12 to detect any patterns of feeding injury that might relate to colonization. Bolls were considered injured if internal warting and/or lint staining was present, indicating bug feeding. An end-of-season boll injury count was made in early October, in which we examined 100 bolls on each of rows 3, 7, and 13 in each plot, using the same criteria for injury as were used for samples during the growing season.

Cotton was picked with a 2-row mechanical picker and ginned at the University of Georgia Micro-gin facility to obtain lint yields.

Data (bug numbers, boll injury, yield) were analyzed using PROC GLM of SAS, followed by separation of significantly different means using the Waller-Duncan Bayesian *k* ratio, with *k*=100 (SAS Institute 1999). Adult and nymphal numbers were transformed prior to analysis (square root transformation) due to proportionally heterogeneous variances.

Results and Discussion

Small cotton bolls first began to appear in the plots at the end of July, and presumably this would have been the period when the plants would have been most attractive to stink bugs. Adult stink bugs were collected in low numbers throughout August (Fig. 1a), and overall numbers increased somewhat in September (Fig. 1b). There were no significant differences observed in adult stink bug numbers among barrier crops or rows on any sample date. Thus, there was no clear pattern of colonization that was apparent in adult abundance. This lack of pattern also may reflect sampling errors, as the cotton plants became larger as the season progressed, decreasing the efficiency of the sweep net samples. In addition, adult stink bugs are quite active, and some of the bugs may have escaped sampling, adding another element of variability.

Unlike adults, nymphs are much more sedentary and are more likely to be captured in samples. No nymphs were collected prior to 22 August, but they were consistently collected at relatively low levels thereafter (Fig. 2). Barrier type had no effect on nymphal abundance on any date, but, unlike adult samples, row number did affect nymphal abundance on 29 August and 12 September (F=3.56; P=0.0133, df=2,27; and F=2.61, P=0.0481, df=2,27; respectively), and overall, nymphs were more abundance in rows proximate to the barriers. This suggests a progressive colonization, with reproduction concentrated on the field edge. By 19 September, nymphal abundance had increased further into the field (Fig. 2), indicating that field penetration by reproducing bugs had increased.

The boll injury data collected during the growing season support the model of progressive edge colonization, with gradual increases into the field (Fig. 3). Like nymphal abundance, boll injury was unaffected by barrier type, but was influenced by row number on 16 and 22 August, and 12 September (F=7.86, P=0.0020, df=2,27;

F=9.93; P=0.0006, df=2,27; and F=5.92, P=0.0074, df=2,27; respectively). Injury tended to progressively increase with time, but the general trajectory of the injury in relation to row number remained relatively constant (Fig. 3). This suggests that bugs are steadily colonizing the field edges and penetrating further into the field at a relatively constant rate. The increase in injury as the season progresses also may reflect the development and maturation of nymphs that were the offspring of colonizers.

The end-of-season boll injury assessment failed to indicate any significant effect of row on internal boll injury (Fig. 4). However, it should be noted that variability in injury increased with increasing distance from the field border. Increased variability suggests that the injury further into the field was more irregular than was the case for peripheral rows, adding some measure of support for the in-season injury results

Lint yield was unaffected by either barrier type or row distance from the barrier (Table 1). Assuming that a significant proportion of the yield variability was due to stink bug activity, these results suggest that the bugs were distributed across the field by the season's end.

In summary, barriers of sorghum and sorghum sudangrass separating peanuts from cotton did not significantly alter stink bug dynamics in the cotton in comparison with bare ground. There were significant differences in stink bug abundance in relation to the distance of cotton rows from the field border adjacent to the barrier and peanuts, although this pattern was inconsistent for adults. However, there was a relatively consistent pattern of increased nymphal numbers and increased boll injury during the season as the distance from the border declined. These results indicate that there is apparent colonization of the field from the edges, and that this colonization is fairly persistent when the cotton plants are maturing bolls. Colonization from the edges may create opportunities to use border treatments to effectively manage colonizing bugs, and thereby manage bugs throughout the crop.

Acknowledgment

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References Cited

Greene, J.K., S.G. Turnipseed, M.J. Sullivan, O.L. May. 2001. Treatment thresholds for stink bugs (Hemiptera: Pentatomidae) in cotton. J. Econ. Entomol. 94: 403-409.

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Table 1. Lint yields in relation to barrier crop and rows distad to barriers. No significant differences were observed in relation to barrier or row number.

No. rows from barrier	Barrier crop		
	Bare soil	Sorghum	Sudangrass
2	1167 ± 177.4	1255 ± 98.5	1047 ± 300.2
3	1111 ± 239.1	1135 ± 254.5	1267 ± 230.1
7	1195 ± 187.3	1147 ± 277.2	1049 ± 157.0
8	1186 ± 279.4	1468 ± 104.3	1243 ± 432.4
13	1272 ± 369.1	1346 ± 401.8	1199 ± 536.1
14	1188 ± 523.1	1134 ± 165.8	1080 ± 295.0

Fig. 1a. Number of adult stink bugs per 25 sweeps (y axis) in relation to border type (bare soil, sorghum, and sorghum sudangrass) and number of rows from barrier (20 bolls sampled per row per date) from 1 to 22 August 2006. No significant differences were observed among barrier treatments or rows on any sample date.

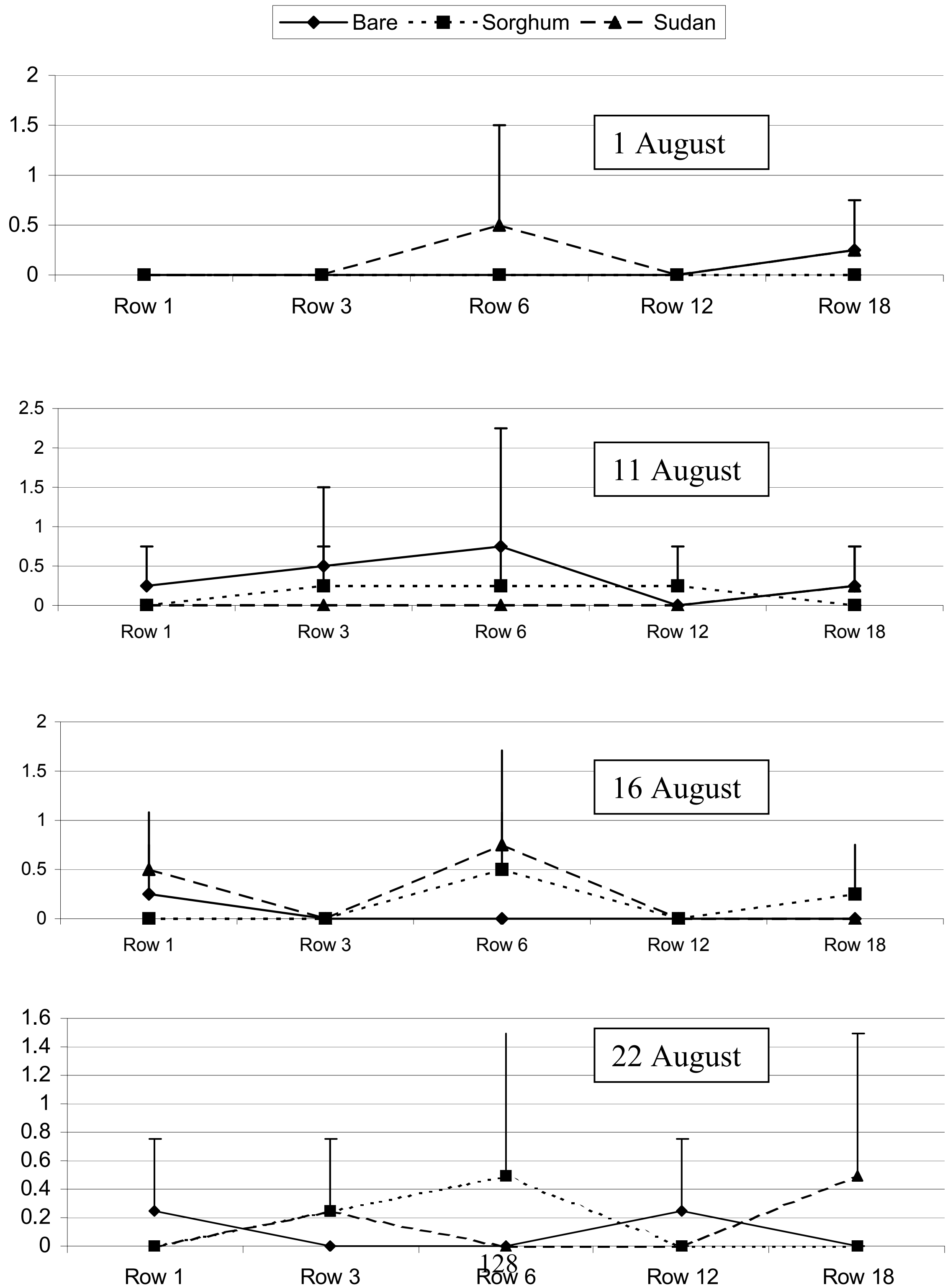


Fig. 1b. Number of adult stink bugs per 25 sweeps (y axis) in relation to border type (bare soil, sorghum, and sorghum sudangrass) and number of rows from barrier (20 bolls sampled per row per date) from 29 August to 19 September 2006. No significant differences were observed among barrier treatments or rows on any sample date.

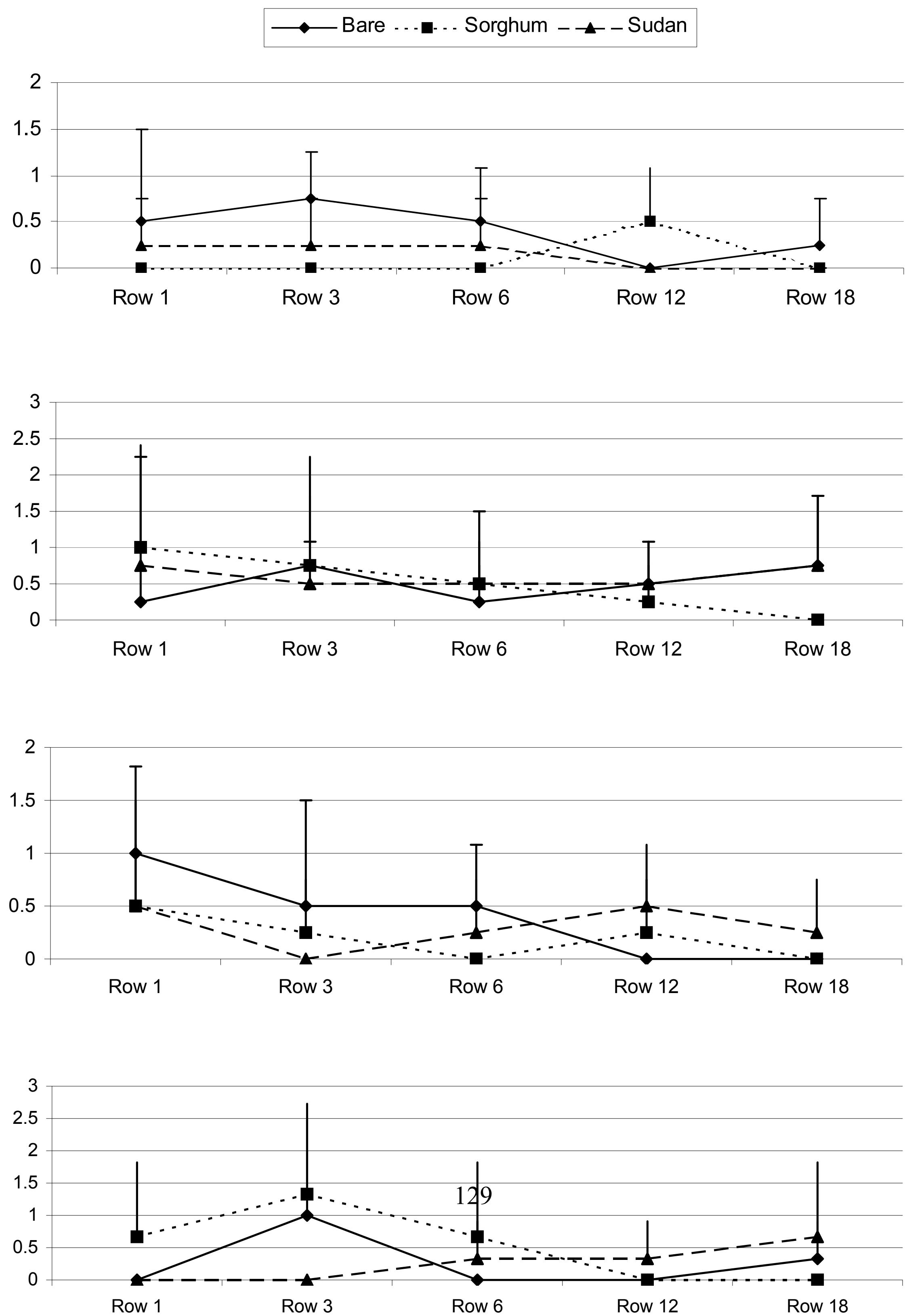
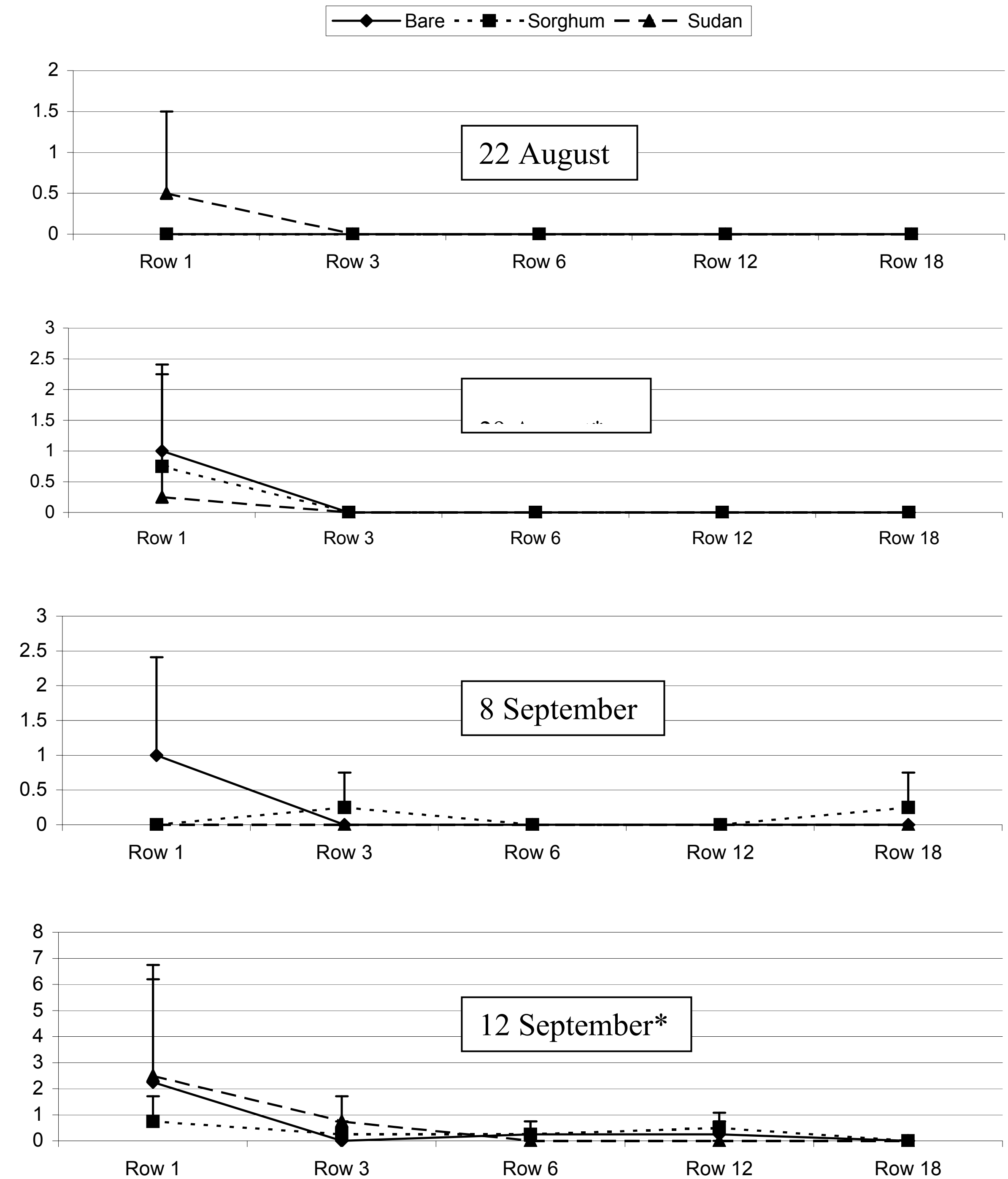


Fig. 2. Number of stink bug nymphs per 25 sweeps (y axis) in relation to border type (bare soil, sorghum, and sorghum sudangrass) and number of rows from barrier (20 bolls sampled per row per date). No significant differences were observed among barrier treatments on any sample date.



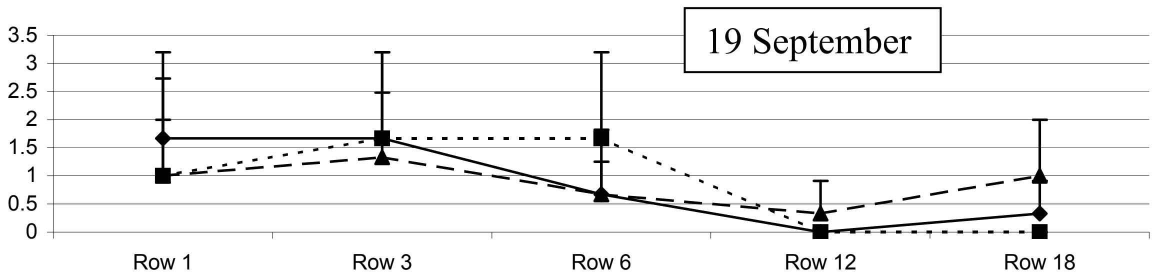

19 September
3.5
3
2.5
2
1.5
1
0.5
0
Row 1
Row 3
Row 6
Row 12
Row 18

Fig. 3. Boll injury in relation to field border in Trial 1 (20 bolls sampled per row per date). No significant differences were observed among barrier treatments, so all barrier treatments are pooled here. Significant differences among rows were observed on 16 and 22 August and 12 September.

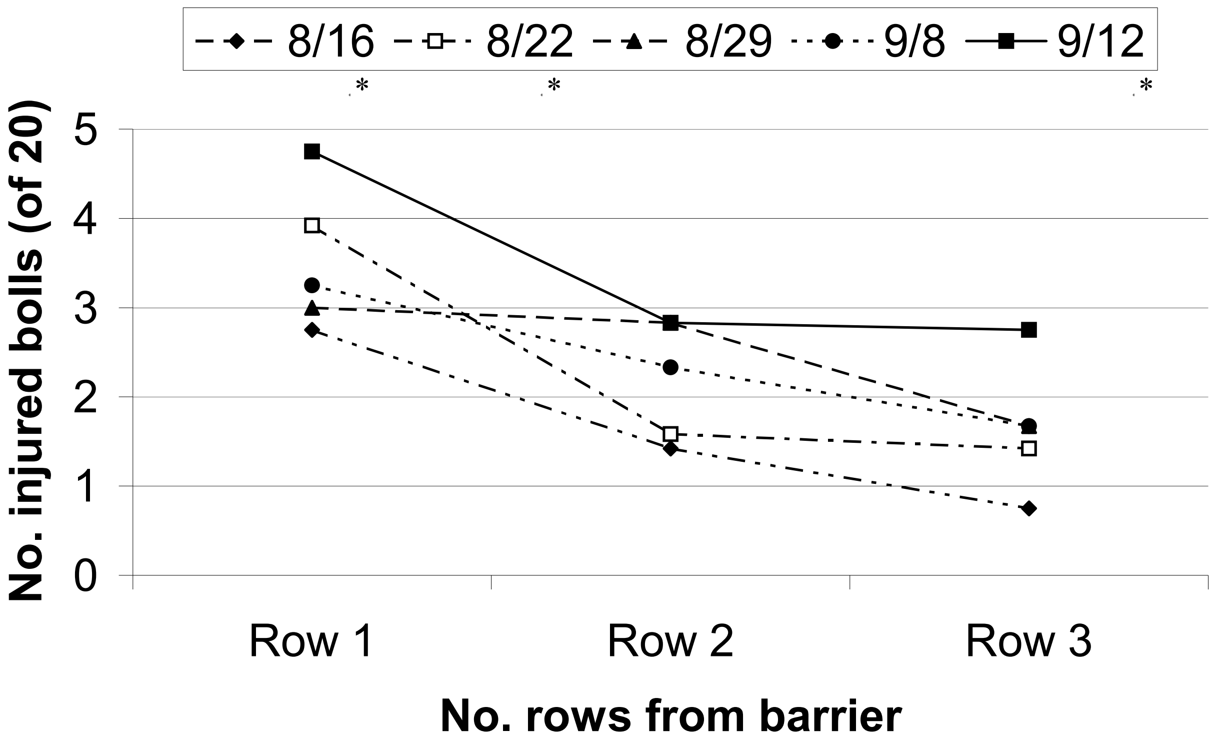


Fig. 4. Boll injury in relation to field barrier type and number of rows distant from barrier (100 bolls sampled per row at end of the season). No significant differences were observed among barrier treatments or rows.