RESULTS / PROGRESS REPORT TO NATIONAL PEANUT BOARD (2002 PROJECT)

Title: Pest Management Systems for Reduced Tillage Production in S. C.

Principal Investigator: Jay W. Chapin, Professor and Extension Peanut Specialist

Institution: Clemson University


Objective:
Develop and implement more profitable reduced tillage peanut production systems.

Executive Summary of Results and Progress (2002 Results Attached):

Through this NPB sponsored research we have found that one consequence of reduced tillage systems is an increase in burrower bug injury to peanut kernels.

We documented the basic biology and management including: when they occur, generations per year, the risk of different tillage and cropping systems, correlation of damage with drought stress, use of irrigation for management, chemical control, cultural control, role in aflatoxin contamination, flavor effects, yield effects, and grade effects.

Our results from this research have been published in scientific journals, presented at APRES, and in popular press articles.

What we learned in S. C. has been broadly applicable to other southeastern states (Georgia, Florida, Alabama, N. C) as evidenced by the many calls we have gotten from growers, shellers, and university faculty on how to manage this pest.
EFFECTS OF IRRIGATION ON INSECT PEST ACTIVITY AND DISTRIBUTION, PEANUT YIELD, GRADE, AND VALUE

2002

J. W. CHAPIN AND J. S. THOMAS
DEPARTMENT OF ENTOMOLOGY
CLEMSON UNIVERSITY

Location: Edisto Research and Education Center, Barnwell Co. SC, Field D-13 C.

Design: RCB with four replicates; experimental unit = 16 rows x 40'.

Soil Type: Varina sandy loam.


Seeding Rate: Georgia Green planted at 6 seed / row foot 9 May.

General Fertility: No pre-plant fertilizer. 650 lb gypsum (16" band) 11 July; 0.4 lb Boron 10 July.

Herbicides: 2.0 pt Dual Magnum 14 May; 1.44 oz Cadre 70DG + 0.25% v:v 80% non-ionic surfactant 7 June, 12 oz Select 2E 29 July.

Insecticide: Temik 5.0 lb/ac in-furrow

Methods: The previous season's corn stubble was mowed after harvest and treated with 1 qt / ac Touchdown about five weeks prior to planting. Peanuts were planted into the corn residue with a four-row John Deere Max-Emerge II vacuum planter attached to a Powell Ro-till strip-till unit. The strip-till unit had a coulter mounted in front of the subsoil shank, followed by single fluted coulters on each side of the row (14" spacing) and a rolling basket. The fluted coulters were angled such that they produced a small raised bed (< 2''). Yetter trash handlers were mounted in front of the planter unit. Temik was distributed with the planter-attached, ground-driven applicator. Post-emergence herbicides and foliar Boron were applied with a 200 gallon three-point-hitch FMC sprayer equipped with a diaphragm pump and an eight row boom with 8003 flat fan tips (20.0 gpa @ 40 psi). Landplaster was applied on a 16" wide band with a two-row Paulk gravity-fed fertilizer/lime spreader.

Burrower bug (BB) surface activity was monitored weekly 3 June - 23 September using pitfall traps. Two stacked 450 ml, 11-cm top diameter plastic deli cups were placed in the center of each plot. Holes were punched into the bottom cup to prevent the top cup from floating up when it rained. The cups were buried so the lip of the top cup was about 1 cm below the soil surface, with the surrounding soil inclined away from the lip. Periodic manipulation was necessary to account for settling and erosion around the cup lip. The top cup was filled with approximately 110 ml of 50% ethylene glycol solution. A 16-cm white plastic plate was suspended above each trap with spiraled galvanized nails to prevent rain from overflowing the cups. The top cup was removed weekly, sealed with a labeled lid, and replaced with another cup. In the lab, trap contents were screened (US standard No. 35 sieve, 0.5 mm opening) and sorted in a white pan (28 x 36 cm) partially filled with water. A grid marked on the bottom of this pan facilitated counting. BB were removed from the pan and placed on the corresponding trap lid. Lids were examined under a dissecting microscope where adult BB sex and nymphal stages were determined.
Irrigation was scheduled by Irrigator Pro software which used daily pegging zone minimum and maximum soil temperatures (5.1 cm depth) and rainfall along with other agronomic inputs (soil type, yield goal, planting date, etc.) to run the model. Soil temperature was recorded in each of the irrigated plots with a waterproof, DeltaTRAK model 12201 min/max thermometer. Thermometers were placed within 0.3 m of the pitfall traps. Rainfall was measured with a single rain gauge located in one of the irrigated plots. Irrigation was applied through a single nozzle impact sprinkler placed near the center of each irrigated plot. Sprinkler positions were adjusted to account for wind speed and direction. Irrigation rate (0.25 cm / h) and pattern distribution (deemed acceptable) were determined on the first irrigation application date by placing a rain gauge 1 and 5 meters from the sprinkler in each plot. Subsequent irrigation rates were based on this delivery rate and verified with the rain gauge used for recording rainfall.

Soil cores were taken at specific growth stages (R-1, R-2, R-5, R-6, R-7, and R-8) to sample for soil pest insect distribution. A 10.16 cm diameter Par-Aid golf course hole cutter, set near the maximum depth (15 cm), was used to remove a 20 cm deep soil sample core from five lateral locations relative to the row center (0, 12, 24, 36, and 48 cm) within each plot. Samples were taken diagonally in relation to the first sample (0 cm), such that foot traffic and previous sampling manipulation did not interfere with the next sample. Maximum distance between the 0 and 48 cm sample sites was approximately 1m. Since the cutter could only sample 15 cm deep, two 15 cm cores were taken from each site. The soil around the cutter was pulled away or packed down before the first core was removed to reduce the chance of soil falling into the hole as the core was taken out. An 11 cm top diameter deli cup was also placed into the hole after the first sample was removed to further reduce the chance of contamination of the deeper core taken from the same hole. The top 15-cm deep soil core was then extracted with the cutter’s plunger after the hole cutter’s metal sleeve was placed into a horizontally positioned, U-shaped tray made by cutting away a longitudinal arc from a 36 cm long, 10.16 cm diameter schedule 21 PVC pipe. The opening along the top of the “U” was approximately 7 cm wide. The tray was attached to a wood base made from 5.08 x 15.24 cm treated lumber. The wood base had an “end cap” made from the same material that extended up approximately 2 cm above the pipe’s cross section, making the wooden base L-shaped. This provided a “backstop” for sample extraction. Horizontally, the PVC tray overlapped the wooden base by approximately 2 cm. The sample was divided into three equal parts by partitioning the soil core with two sharpened 10 cm diameter stainless steel discs as the plunger extracted the core. Increment marks were etched on the edge of the sampling tray to expedite sample division. Subsamples were then pushed into a 450 ml, 11-cm top diameter plastic deli cup. A 28 x 36 cm pan was placed under the cup to catch any spilled soil. Cups were sealed with a labeled lid. The hole cutter was then taken back to the sampling hole and another 15-cm deep sample was taken as previously described. This time however, only the top 5 cm was processed. After sampling was completed, sub samples represented four depths of the soil profile: 0-5 cm, 5-10 cm, 10-15 cm, 15-20 cm from each of the five lateral sample sites (20 samples / e.u.). Samples were brought to the lab and stored in a refrigerator at 4°C until they could be dried and sieved.

Wet soil would not flow through soil sieves, so samples were dried by dumping the soil, along with the empty cup and labeled lid, into a 90.8 liter (84.3 x 43.4 x 34.5 cm) Rubbermaid storage box and placing a box fan set at the lowest speed on top. Unmanipulated, the samples were dry enough to sieve in approximately 2.5 h. Samples dried faster if the soil was stirred periodically. Since drying was the most time consuming step, samples had to be dried ahead of sieving. Most dried samples were returned to the refrigerator until processed several days later. Peanut pods and stems were extracted by pouring the dried sample through a course hardware cloth (approx. 10 mm opening) screen. The samples were then sieved through a stack of three US standard sieves. Separately, contents of first two sieves were poured into a 59 x 47 x 7 cm white tray and examined under a 10X fluorescent light magnifier. The first sieve (No. 10 – 2.0 mm nominal opening) retained adult, 5th,
and some 4th instar burrower bugs and some wireworm (WW) larvae. The second sieve (No. 18 – 1.0 mm opening) retained 3rd, 4th, an occasional 1st or 2nd instar BB and other WW larvae. The final sieve’s (No. 35 - 0.5 mm opening) contents were poured back into the deli cup and buoyant material was floated from the cup by placing the cup onto another No. 35 sieve and continuously running water from a 1.9 cm diameter garden hose (used also as a stirring stick) into the cup for approximately one minute or until the water became mostly clear. The flow was regulated such that only a small amount of soil would also be extracted. We assumed if some soil overflowed into the sieve then all the eggs and nymphs would have likely been washed out since they would be lighter and more buoyant. Too much soil, however, would hinder insect or egg observation. The retained, washed-out contents were then washed into a flat-black-painted, 27 x 16 x 6.4 cm (1.66 L), Rubbermaid container and examined under a 10X fluorescent light magnifier. Surface debris cohesion to the container’s sides was reduced by applying a thin, evenly distributed film of petroleum jelly to the entire inner surface of the container. Re-application was necessary once or twice per sampling date. After the contents on the water’s surface were thoroughly examined they were removed with an aquarium fish net so sunken contents could be examined. 1st and 2nd instar BB were found floating, while BB eggs were found “rolling” around on the bottom as the water was gently stirred with a probe.

Soil moisture was determined from one 1.9 cm diameter x 30 cm deep soil core per plot immediately after core sampling. The top 20 cm was divided into four 5 cm sections which represented the four depths sampled for insect presence. Each section was placed in a numbered metal can and immediately sealed with its corresponding numbered lid. Can tare weights had been determined and recorded in a database file. Gross wet weights were determined in the field using a battery operated electronic scale. Soil from depths below 20 cm was discarded. Cans were taken to the lab, opened, and dried @ 105° C for 24 h. Lids were matched to the appropriate cans and gross dry weights were measured with the same electronic scale. Percent moisture was calculated using the wet basis formula: water weight/wet weight; where wet weight = gross wet weight – can tare weight, dry weight = gross dry weight – can tare weight, and water weight = wet weight – dry weight.

Soil texture and organic matter was determined by Waters Agricultural Laboratory, Camilla, Georgia. A 15 cm deep soil core was taken with the hole cutter within 0.3 m of the pitfall trap near the center of each plot. Prior to sampling, soil surface debris was removed.

Soil insects were also sampled with a mobile wet soil sampler developed by Dr. Steve Brown (University of Georgia) 19 Aug. A 30 x 96 cm rectangle frame was centered perpendicular to the row such that it extended out laterally 48 cm on either side of the row. Peanut plants within the sampling frame (0.3 row m) were uprooted and soil shaken from the roots. A shovel was used to extract the soil from the area inside the sampling frame, about 10 cm deep, and placed into a bucket. Soil was taken to the sampler and processed. The soil was wet sieved through a series of vibrating sieves. WW and BB retained on the sieves were counted by two observers. The sampler’s sieves retained large nymph BB, adult BB and WW larvae, but smaller BB nymphs (< 4th instar) were washed through the final sieve.

Velvetbean caterpillar (VBC) population was documented with two 3’ beat cloth samples per e.u. 13 September. Defoliation was visually estimated by two observers 12 September.

Peanuts were inverted with a KMC peanut digger on 30 Sept (143 DAP). Yield was taken from the two non-traffic rows 2 Oct (150 DAP) with a Hobbs 525 combine modified with a bagging attachment. Samples were weighed in the field using a Chatillon milk scale. One pod sample (approximately 1000 g) per plot was collected for grade (500 g) and BB kernel damage after yield weights were determined. Samples were dried for 24h @ 100° F to <10% moisture, then stored at
room temperature until graded (USDA standards).

After inversion, insect pod damage was determined by two observers, each examining 50 pods from each experimental unit.

BB kernel damage was determined by shelling approximately 400 grams of the remainder of the pod samples and examining 100 random whole kernels / plot. These kernel sub-samples (approximately 300 g) were placed in a #2 paper bag and micro waved on 100% power for 1.5 minutes, rotated once, and micro waved 1.5 minutes more before cooling several minutes to facilitate removal of the testa. The testa was removed and feeding sites were counted on each kernel and percent kernel injury was calculated.

Pod weights were measured by weighing 100 pods on an electronic scale. Pod population was calculated using pod weight and average harvested yield weights from the two harvested rows.

**Analysis:** ANOVA, Fisher's protected LSD, (P=0.05). Percentage data were transformed using arcsinc(x). Count data transformed using square root(x). Yield LSD = 786 lb/ac.

Data were not pooled across treatments and/or dates if significant interactions were detected.

### Table 1. GLM analysis of transformed data taken from soil core samples.

<table>
<thead>
<tr>
<th>Effect</th>
<th>P. b. Eggs</th>
<th>P. b Nymphs</th>
<th>P. b Adults</th>
<th>Total P. b.</th>
<th>WW</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>P</td>
<td>F</td>
<td>P</td>
<td>F</td>
</tr>
<tr>
<td>trt</td>
<td>0.09969</td>
<td>0.68</td>
<td>0.4102</td>
<td>0.16</td>
<td>0.6856</td>
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<td>rep</td>
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<td>0.7607</td>
<td>5.15</td>
<td>0.0016</td>
<td>3.04</td>
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<td>date</td>
<td>5.31</td>
<td>&lt;0.001</td>
<td>10.68</td>
<td>&lt;0.001</td>
<td>5.87</td>
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<tr>
<td>pos</td>
<td>1.38</td>
<td>0.2396</td>
<td>1.81</td>
<td>0.1249</td>
<td>1.33</td>
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<tr>
<td>depth</td>
<td>4.4</td>
<td>0.0044</td>
<td>50.07</td>
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<td>trt*rep</td>
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<td>0.1992</td>
<td>1.58</td>
<td>0.1915</td>
<td>0.25</td>
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<td>date*trt</td>
<td>0.38</td>
<td>0.8616</td>
<td>2.08</td>
<td>0.0656</td>
<td>1.55</td>
</tr>
<tr>
<td>trt*pos</td>
<td>1.3</td>
<td>0.2688</td>
<td>1.97</td>
<td>0.0968</td>
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<tr>
<td>trt*depth</td>
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<td>0.9487</td>
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<td>date*pos</td>
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<td>0.2085</td>
<td>1.13</td>
<td>0.3167</td>
<td>1.15</td>
</tr>
<tr>
<td>date*depth</td>
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<td>0.0853</td>
<td>5.82</td>
<td>&lt;0.001</td>
<td>3.91</td>
</tr>
<tr>
<td>pos*depth</td>
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<td>0.6592</td>
<td>0.97</td>
<td>0.4790</td>
<td>1.25</td>
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</table>

Treatment = irrigated or non-irrigated

### Table 2. Effect of irrigation on peanut insect population and damage, grade, pod weight, yield, and value. Blackville, SC, 2002.
<table>
<thead>
<tr>
<th>Treatment</th>
<th>VBC / row ft 13 Sept</th>
<th>% Def 12 Sept</th>
<th>BB / row m² (mobile sampler)</th>
<th>% Kern dam</th>
<th>WW / row m² (mobile sampler) 19 Aug LCB/WW (% pod dam.)</th>
<th>% TMK ($/ton)</th>
<th>% OK</th>
<th>% DK</th>
<th>Yield Lb/ac ($/ac)</th>
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</thead>
<tbody>
<tr>
<td>Irrigated</td>
<td>4.0 b</td>
<td>6 b</td>
<td>62.2 a 36.7 a 14 b</td>
<td></td>
<td>1.3 a (4.3 a) 75 a (377) a 3.7 b 0.1 a</td>
<td></td>
<td></td>
<td></td>
<td>4277 a (806)a</td>
</tr>
<tr>
<td>Non-irrigated</td>
<td>12.4 a</td>
<td>31 a</td>
<td>60.5 a 28.9 a 35 a</td>
<td></td>
<td>0.5 a (2.0 a) 71 b (356) b 5.5 a 0.7 a</td>
<td></td>
<td></td>
<td></td>
<td>3446 b (613)b</td>
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</tbody>
</table>

Means followed by the same letter are not significantly different; Fisher’s protected LSD (P< 0.05).
1. Pod weight was significantly higher in the irrigated treatment; 1.22 g / pod vs. 1.05 g / pod in the non-irrigated treatment.

Table 3. Soil analysis, BB damage, grade, pod population, yield, and peak BB population, Blackville, SC 2002.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Soil Analysis</th>
<th>% BB dam</th>
<th>% TMK</th>
<th>Pod Pop. / 0.3 m Yield (lb/ac)</th>
<th>Pitfall 7d 6-Sep</th>
<th>Soil / m² 27-Aug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rep1</td>
<td>81.2 12.4 6.4</td>
<td>18.8 0.91</td>
<td>18</td>
<td>Loamy Sand 7 74.7 123 (4317)</td>
<td>66</td>
<td>173</td>
</tr>
<tr>
<td>Rep2</td>
<td>79.2 15.4 5.4</td>
<td>20.8 0.71</td>
<td>14</td>
<td>Loamy Sand 17 75.8 120 (4176)</td>
<td>33</td>
<td>148</td>
</tr>
<tr>
<td>Rep3</td>
<td>83.2 11.4 5.4</td>
<td>16.8 0.60</td>
<td>12</td>
<td>Loamy Sand 17 75.5 115 (4655)</td>
<td>17</td>
<td>222</td>
</tr>
<tr>
<td>Rep4</td>
<td>85.2 9.4 5.4</td>
<td>14.8 0.53</td>
<td>11</td>
<td>Loamy Sand 15 74.8 121 (3962)</td>
<td>36</td>
<td>321</td>
</tr>
<tr>
<td>Mean</td>
<td>82.2 12.2 5.7</td>
<td>17.8 0.69</td>
<td>14</td>
<td>14 7 75 121 (4277)</td>
<td>38</td>
<td>216</td>
</tr>
<tr>
<td>Non-irrigated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rep1</td>
<td>73.6 18 8.4</td>
<td>26.4 0.94</td>
<td>19</td>
<td>Sandy Loam 30 72.0 109 (3186)</td>
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<td>49</td>
</tr>
<tr>
<td>Rep2</td>
<td>84.6 10 5.4</td>
<td>15.4 0.51</td>
<td>10</td>
<td>Loamy Sand 39 72.6 116 (3731)</td>
<td>21</td>
<td>77</td>
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<tr>
<td>Rep3</td>
<td>85.6 9 5.4</td>
<td>14.4 0.59</td>
<td>12</td>
<td>Loamy Sand 35 70.0 107 (3285)</td>
<td>53</td>
<td>519</td>
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<tr>
<td>Rep4</td>
<td>84.6 11 4.4</td>
<td>15.4 0.51</td>
<td>10</td>
<td>Loamy Sand 35 69.6 118 (3582)</td>
<td>18</td>
<td>222</td>
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<tr>
<td>Mean</td>
<td>82.1 12.0 5.9</td>
<td>17.9 0.64</td>
<td>13</td>
<td>35 71 113 (3446)</td>
<td>25</td>
<td>389</td>
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</tbody>
</table>

*Pangaeus biliniatus* nymphs + adults.
Figure 1. Seasonal surface activity of total *Pangaeus biliniatus* (nymphs + adults) as measured by pitfall trap sampling in irrigated and non-irrigated peanuts. Blackville, SC, 2002

Figure 2. Seasonal surface activity of *Pangaeus biliniatus* nymphs as measured by pitfall trap sampling in irrigated and non-irrigated peanuts. Blackville, SC, 2002
Figure 3. Seasonal surface activity of *Pangaeus biliniatus* adults as measured by pitfall trap sampling in irrigated and non-irrigated peanuts. Blackville, SC, 2002

Figure 3A. Seasonal surface activity of *Pangaeus biliniatus* male adults as measured by pitfall trap sampling in irrigated and non-irrigated peanuts. Blackville, SC, 2002
Figure 3B. Seasonal surface activity of *Pangaeus biliniatus* female adults as measured by pitfall trap sampling in irrigated and non-irrigated peanuts. Blackville, SC, 2002

Figure 3C. Seasonal surface activity of *Pangaeus biliniatus* adults as measured by pitfall trap sampling in irrigated peanuts. Blackville, SC, 2002
Figure 3D. Seasonal surface activity of *Pangaeus biliniatus* adults as measured by pitfall trap sampling in non-irrigated peanuts. Blackville, SC, 2002.

Figure 4. Mean soil sample catches of *Pangaeus biliniatus* from irrigated and non-irrigated peanuts on six sampling dates, Blackville, SC 2002.
Figure 5. Vertical distribution of *Pangaeus biliniatus* eggs, Blackville, SC 2002.

Figure 6. Vertical distribution of *Pangaeus biliniatus* nymphs from irrigated and non-irrigated peanuts on six sampling dates, Blackville, SC 2002.

Treatment means within sample dates and sample depths marked with different letters at their representative column bases are significantly different ($P < 0.05$)
Figure 7. Vertical distribution of *Pangaeus biliniatus* adults from irrigated and non-irrigated peanuts on six sampling dates, Blackville, SC 2002.

Figure 8. Vertical distribution of total living *Pangaeus biliniatus* from irrigated and non-irrigated peanuts on six sampling dates, Blackville, SC 2002.
Figure 9. Lateral distribution of *Pangaeus biliniatus* eggs, Blackville, SC 2002.

Figure 10. Lateral distribution of *Pangaeus biliniatus* nymphs, Blackville, SC 2002.
Figure 11. Lateral distribution of *Pangaeus billiatus* adults, Blackville, SC 2002.

Figure 12. Lateral distribution of total living *Pangaeus billiatus*, Blackville, SC 2002.
Figure 13. Seasonal Rainfall and Irrigation, Blackville, SC, 2002

- Irrigation
- Rainfall
- Soil sample date

Figure 14. Cumulative Seasonal Rainfall and Irrigation, Blackville, SC, 2002.
Figure 15. Soil moisture at different sample depths in irrigated and non-irrigated peanuts on six sampling dates, Blackville, SC 2002.

Figure 16. Soil moisture at different sample depths in irrigated and non-irrigated peanuts on six sampling dates, Blackville, SC 2002.
Figure 17. Vertical distribution of wireworms from irrigated and non-irrigated peanuts on six sampling dates, Blackville, SC 2002.

Number recovered / m²

1-Jun (R-1) 24-Jun (R-2) 9-Jul (R-5) 5-Aug (R-6) 27-Aug (R-7) 20-Sep (R-8)

Sample date and (peanut growth stage)

0-5 0 10 20 5-10 Sample depth (cm) 10-15 15-20

Irrigated
Non-irrigated

Analysis within sample dates and sample depths showed no significant treatment (irrigation) effects.

Figure 18. Lateral distribution of wireworms from irrigated and non-irrigated peanuts on six sampling dates, Blackville, SC 2002.

Number recovered / m²

1-Jun (R-1) 24-Jun (R-2) 9-Jul (R-5) 5-Aug (R-6) 27-Aug (R-7) 20-Sep (R-8)

Sample date and (peanut growth stage)

0 12 24 Distance from peanut row (cm) 36 48

Irrigated
Non-irrigated

Analysis within sample dates and sample depths showed no significant treatment (irrigation) effects.
INSECTICIDE EFFICACY AGAINST BURROWER BUG AND EFFECTS ON PEANUT YIELD, GRADE, AND VALUE
2002
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General Fertility: No pre-plant fertilizer. 650 lb gypsum (16” band) 11 July; 0.4 lb Boron 10 July.

Herbicides: 2.0 pt Dual Magnum 14 May; 1.44 oz Cadre 70DG + 0.25% v:v 80% non-ionic surfactant 7 June, 12 oz Select 2E 29 July.

Insecticide: Temik 5.0 lb/ac in-furrow

Methods: The previous season’s corn stubble was mowed after harvest and treated with 1 qt/ac Touchdown about five weeks prior to planting. Peanuts were planted into the corn residue with a four-row John Deere Max-Emerge II vacuum planter attached to a Powell Ro-till strip-till unit. The strip-till unit had a coulter mounted in front of the subsoil shank, followed by single fluted coulters on each side of the row (14” spacing) and a rolling basket. The fluted coulters were angled such that they produced a small raised bed (<2”). Yetter trash handlers were mounted in front of the planter unit. Temik was distributed with the planter-attached, ground-driven applicator. Post-emergence herbicides and foliar Boron were applied with a 200 gallon three-point-hitch FMC sprayer equipped with a diaphragm pump and an eight row boom with 8003 flat fan tips (20.0 gpa @ 40 psi). Landplaster was applied on a 16” wide band with a two-row Paulk gravity-fed fertilizer/lime spreader. At plant treatments were banded over each row after planting with a CO₂ backpack sprayer equipped with a one-nozzle (8002E) hand-held boom (11.4 gpa) and incorporated with a garden rake immediately after application. Lorsban 15G treatments were applied with a two-row Gandy applicator. A five-inch wide bander was placed directly over each row such that granules were concentrated around the plant crowns.

Burrower bug (BB) surface activity was monitored weekly 17 May - 6 September using pitfall traps. Two stacked 450 ml, 11-cm top diameter plastic deli cups were placed in the center of each plot. Holes were punched into the bottom cup to prevent the top cup from floating up when it rained. The cups were buried so the lip of the top cup was about 1 cm below the soil surface, with the surrounding soil inclined away from the lip. Periodic manipulation was necessary to account for settling and erosion around the cup lip. The top cup was filled with approximately 110 ml of 50% ethylene glycol solution. A 16-cm white plastic plate was suspended above each trap with spiraled galvanized nails to prevent rain from overflowing the cups. The top cup was removed weekly, sealed
with a labeled lid, and replaced with another cup. In the lab, trap contents were screened (US standard No. 35 sieve, 0.5 mm opening) and sorted in a white pan (28 x 36 cm) partially filled with water. A grid marked on the bottom of this pan facilitated counting. BB were removed from the pan and placed on the corresponding trap lid. Lids were examined under a dissecting microscope where adult BB sex and nymphal stages were determined.

Fire ants were counted from pitfall traps 22 August only.

Velvetbean caterpillar (VBC) defoliation was visually estimated by two observers 12 September.

Peanuts were inverted with a KMC peanut digger on 30 Sept (143 DAP). Yield was taken from the two non-traffic rows 2 Oct (150 DAP) with a Hobbs 525 combine modified with a bagging attachment. Samples were weighed in the field using a Chatillon milk scale. A pod sample (approximately 1000 g) from each plot of four of the five harvested replicates was collected for grade and BB kernel damage after yield weights were determined. Samples were dried for 24h @ 100°C to <10% moisture, then stored at room temperature until graded (USDA standards).

BB kernel damage was determined by shelling approximately 400 grams of the remainder of the pod samples and examining 100 random whole kernels / plot. These kernel sub-samples (approximately 300 g) were placed in a # 2 paper bag and microwaved on 100% power for 1.5 minutes, rotated once, and microwaved 1.5 minutes more before cooling several minutes to facilitate removal of the testa. The testa was removed and feeding sites were counted on each kernel and percent kernel injury was calculated.

Prior to BB kernel damage sampling, 100 random pods per plot (400/trt) were examined for lesser cornstalk borer or wireworm pod feeding. Damage was separated into external scarification or internal kernel injury. No significant differences in internal injury were detected so only external injury (internal + external damage) is presented in Table 1.

### Analysis:
ANOVA, Fisher’s protected LSD, (P=0.05). Percentage data were transformed using arcsine(x). Count data transformed using square root(x). Yield LSD = 287 lb/ac (5 rep), 333 lb/ac (4 rep).

### Table 1. Effects of insecticide treatment on LCB/WW pod damage, VBC defoliation, BB kernel damage, peanut grade, yield, and value, Blackville, SC 2002.

<table>
<thead>
<tr>
<th>Treatment (rate)</th>
<th>Timing</th>
<th>% Ext. Pod Dam.</th>
<th>VBC % Def.</th>
<th>BB % kern. damage</th>
<th>BB # punctures / dk / kern</th>
<th>Grade</th>
<th></th>
<th></th>
<th>Yield 4 reps 5 reps lb/ac</th>
<th>Value $/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lorsban 15G (13.3 lb / ac)</td>
<td>Aug 7</td>
<td>7.8 a</td>
<td>7 b</td>
<td>9.0 c</td>
<td>6.5 a-c</td>
<td>0.6 d</td>
<td>73.0 a</td>
<td>4.3 b</td>
<td>367 a</td>
<td>3828 a 3859 a</td>
</tr>
<tr>
<td>Lorsban 15G (13.3 lb / ac)</td>
<td>July 3</td>
<td>3.0 ab</td>
<td>43 a</td>
<td>17.8 bc</td>
<td>5.9 bc</td>
<td>1.0 cd</td>
<td>73.3 a</td>
<td>4.1 b</td>
<td>368 a</td>
<td>3645 a 3555 b</td>
</tr>
<tr>
<td>Lorsban 4E (2 qt / ac)</td>
<td>At-Plant</td>
<td>2.0 b</td>
<td>45 a</td>
<td>34.0 a</td>
<td>5.3 c</td>
<td>1.8 bc</td>
<td>70.3 b</td>
<td>6.1 a</td>
<td>354 b</td>
<td>3769 a 3734 ab</td>
</tr>
<tr>
<td>Karate Z (1.9 oz / ac)</td>
<td>At-Plant</td>
<td>3.3 ab</td>
<td>41 a</td>
<td>28.0 ab</td>
<td>8.9 a</td>
<td>2.5 ab</td>
<td>69.9 b</td>
<td>6.1 a</td>
<td>353 b</td>
<td>3728 a 3683ab</td>
</tr>
<tr>
<td>Untreated</td>
<td>---</td>
<td>5.5 ab</td>
<td>35 a</td>
<td>35.0 a</td>
<td>8.9 a</td>
<td>3.2 a</td>
<td>70.1 b</td>
<td>6.0 a</td>
<td>353 b</td>
<td>3539 a 3465 b</td>
</tr>
</tbody>
</table>

Column means followed by the same letter are not significantly different, Fisher’s protected LSD, (P=0.05).

* Value based on yield and grade of the four graded replicates.
Figure 1. Seasonal soil surface activity of *Pangaeus biliniatus* nymphs in different insecticide treatment regimes, Blackville, SC, 2002.

Figure 2. Seasonal soil surface activity of *Pangaeus biliniatus* adults in different insecticide treatment regimes, Blackville, SC, 2002.
Figure 3. Seasonal soil surface activity of total *Pangaeus biliniatus* in different insecticide treatment regimes, Blackville, SC, 2002.

Figure 4. Seasonal sexual distribution of *Pangaeus biliniatus*, Blackville, SC, 2002.
Figure 5. Seasonal soil surface activity of *Agrotis subterranea* in different insecticide treatment regimes, Blackville, SC, 2002.

Figure 6. Seasonal soil surface activity of wireworm adults in different insecticide treatment regimes, Blackville, SC, 2002.
Figure 7. Insecticide treatment effects on fire ants as measured by pitfall trap sampling 14 Aug - 22 Aug, Blackville, SC, 2002.

![Bar chart showing insecticide treatment effects on fire ants](chart1.png)

Figure 8. Insecticide treatment effects on percent damaged kernels grade factor, Blackville, SC, 2002.

![Bar chart showing insecticide treatment effects on percent damaged kernels](chart2.png)