PRECISION-APPLIED IN-FURROW NEMATICIDE/INSECTICIDE AND SEED TREATMENT ADOPTION IN COTTON – 2008

Jeremy Greene
Will Henderson
Ahmad Khalilian
John Mueller
Dan Robinson
Richard Reeves
Clemson University
Blackville, SC

Abstract

Multiple trials in South Carolina were conducted to determine the effectiveness of in-furrow (Temik 15G) and seed-treatment (Aeris, Avicta) insecticides/nematicides in providing control or suppression of populations of thrips and nematodes in cotton. Efficacy of each system was examined in areas with varying levels of nematode infestations or in defined zones of soil electrical conductivity (EC). At one of two sites, there was a trend for higher thrips numbers in the lowest EC zone (more sandy areas). In general, nematode numbers were low at most locations, but, when threshold numbers were encountered, yield losses were greater. Under conditions of heavy pressure from nematodes, significant yield increases were observed with the addition of Temik to a seed treatment. Control of thrips was increased in plots with the combination of Temik and a seed treatment when compared with plots protected with a seed treatment alone.

Introduction

Because thrips and nematodes continue to be perennial early-season pests of cotton in South Carolina, there is much interest in protecting the crop with preventative measures. Thrips move into cotton from wild and cultivated hosts as they naturally decline and can reach high enough populations to cause economic damage to cotton if left untreated. Heavy infestations of thrips typically cause abortion of the terminal, resulting in branching and excessive vegetative growth, often leading to delayed maturity and reduced yields. Nematodes cause additional stress early in the season and can infest more than 60% of cotton fields in South Carolina at damaging levels. Because resistant cultivars are not available, management of cotton nematodes relies heavily on the use of nematicides. Pre-plant fumigant and in-furrow granular nematicides have been used for over 20 years for control/suppression of nematodes. These materials have proven to be very cost effective when used in appropriate fields. Selected in-furrow nematicides (e.g. Temik 15G, Bayer CropScience) have insecticidal properties and serve as preventative treatment for both nematodes and thrips. These materials have provided long-established preventative control of nematodes and thrips in cotton, but, in recent years, seed treatments (Avicta, Syngenta Crop Protection; Aeris, Bayer CropScience) have become available as alternative methods of pesticide delivery. Efficacy and cost-effectiveness of seed treatment nematicide/insecticide combinations remain relatively unfamiliar. The major objective of this continuing project was to evaluate potential differences in control of nematodes and thrips using various products under varying infestations of nematodes, with additional comparisons using defined zones of soil electrical conductivity.

Materials and Methods

Cotton (DP 143 B2/RF or DP 164 B2/RF – Bollgard II / Roundup Ready Flex) was planted on 5, 12, 14, 15, and 16 May (6 trials) at Clemson University's Edisto Research and Education Center near Blackville, SC, and at producer fields in Hampton and Marlboro Counties. Within matching trials, the same seed lot was obtained and treated with seed treatments according to protocol. Plot size varied from 4, 6, or 8 rows wide (38-inch row spacing) and 40, 100, or several hundred feet long. Plots were replicated at least 4 times and arranged in a RCBD. Standard fertilization and herbicide practices were followed according to current Clemson University recommendations. Thrips were collected by randomly pulling 10 plants from each plot and dipping them in 1-quart jars of 70% isopropyl alcohol. After filtration procedures, nymphs and adults were counted from filter paper. Ratings on insect injury to plants were conducted in all tests by observing the visible foliar damage caused by thrips. This damage was rated by assigning a number to each plot with “0" equal to the lowest damage and "10" equal to the highest damage. Stand counts were taken in each test. Nematode samples were collected at planting and at 6-7 wk after planting. Electrical conductivity (EC) of soil was measured with a Veris 3100 soil-sampling system pulled behind a tractor prior to planting. Zones of EC were created in two producer fields of 15-20 acres and used to modify plot design according to zone. Data were processed using Agriculture Research Manager (Gylling Data Management, Inc., Brookings, SD) and means were separated using Least Significant Difference (LSD) procedures following significant F tests using ANOVA.

Results and Discussion

Seasonal total mean numbers of thrips were lowest in plots with Temik applied at planting (Figures 1 and 2), but both seed treatments significantly reduced thrips numbers when compared with the untreated control (UTC). Seasonal average plant injury ratings were statistically very similar for both seed treatments and Temik when compared with the UTC (Figure 3). Although no significant differences were detected in numbers of thrips among foliar insecticides, plant injury ratings were highest in the lowest rate of Dimethoate (Figure 4). At another site, significantly fewer thrips were collected from plots treated with both Avicta and Temik (5 lb/acre) (Figure 5). At the same site, numbers of nematodes were reduced with the additive treatments (Figure 6). A threshold of 100 nematodes per 100-cc sample of soil for root-knot nematodes clearly delineated the effectiveness of the combination of treatments. A yield increase of 170 lb lint per acre indicated that the addition of Temik to Avicta offered enhanced protection from thrips and nematodes (Figure 7). Heavy pressure from thrips in another trial demonstrated that the addition of Temik at either 3 or 5 lb per acre improved efficacy of both seed treatments by reducing thrips (Figure 8) and plant injury (Figure 9). In another trial treated with Telone the previous year to reduce nematodes, very similar trends were observed with thrips numbers (Figure 10) and plant injury (Figure 11). In a producer's field in Marlboro County, electrical conductivity (EC) of the soil was mapped (Figure 12) to allow plot arrangement in defined zones. The highest peaks in seasonal total mean numbers of thrips occurred with both seed treatments (Figure 13), regardless of EC zone (Figure 14). Numbers of thrips were significantly highest in the low EC zones for the entire season (Figure 15), suggesting that more sandy areas of the field might be either preferred by or more prosperous for thrips. However, this trend was not observed at our Hampton County site, where pressure from thrips was a third of what is was at the Marlboro County test. Also, perhaps because of the lower numbers of thrips, populations of thrips were statistically lower in both seed treatments at the Hampton County site. Both rates of Temik (3 and 5 lb/acre) significantly reduced populations of thrips (Figure 16), and a rate response was detected with yields (Figure 17). Although there were no significant differences in yield or nematode numbers with regard to EC or seed treatment, there were trends for higher yields and lower numbers of nematodes in the low EC areas. The presence or absence of a seed treatment had no statistical affect on yield or the sub-threshold population of predominantly reniform nematodes.

In conclusion, overall numbers of thrips in our small-plot trials were lowest in the Temik treatments followed by Avicta, Aeris, and the UTC. However, ratings of visual plant injury and yields were statistically similar for Temik, Avicta, and Aeris in small plots with moderate-to-high levels of thrips and low numbers of nematodes. Replicated strip trials on a producer's field with significant levels of root-knot nematodes and low-to-moderate levels of thrips indicated that the combination of Temik (5 lb/acre) and Avicta greatly improved yields and net return. Large-plot work in defined zones of soil EC in a producer's field in northeastern SC suggested that EC could be important with higher numbers of thrips found in low EC (sandy) areas. However, this was not observed at a second site in southern SC with lower numbers of thrips, suggesting that pressure from thrips might determine the trend. Because planting dates for these sites were almost identical (mid-May), populations of thrips were likely influenced by differential availability of senescing hosts during the cotton-seedling stage in opposite geographic regions of the state (i.e. peak in thrips numbers was missed at the southern site because of planting date for that area). Producers using preventative pesticides for thrips and nematodes, whether in seed-treatment or in-furrow formulation, should consider the use of precision-agriculture techniques to properly place available controls where they will get the most benefit. We will continue in our attempt to define those areas.

Acknowledgments

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Disclaimer

The mention of trade names in this report is for informational purposes only and does not imply an endorsement by Clemson University or any of its employees.

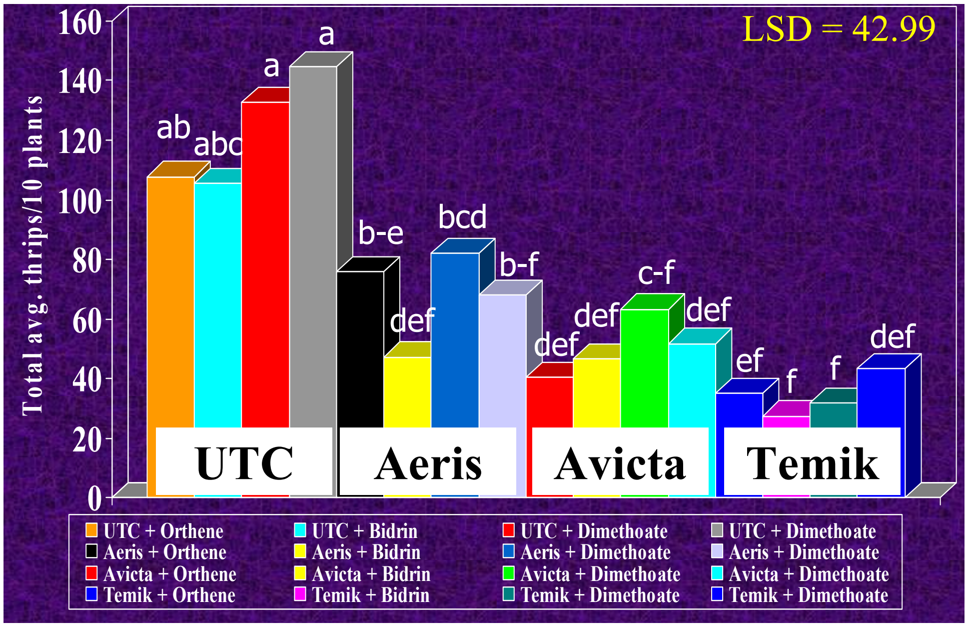

Figure 1. Seasonal total mean number of thrips following various at-planting options (Blackville, South Carolina – 2008). Temik = Temik 15G in furrow at planting at 5.0 lb/acre; Aeris, Avicta = seed treatments; Orthene and Bidrin rates = 0.2 lb ai/acre; Dimethoate rates = 0.125 and 0.25 lb ai/acre.

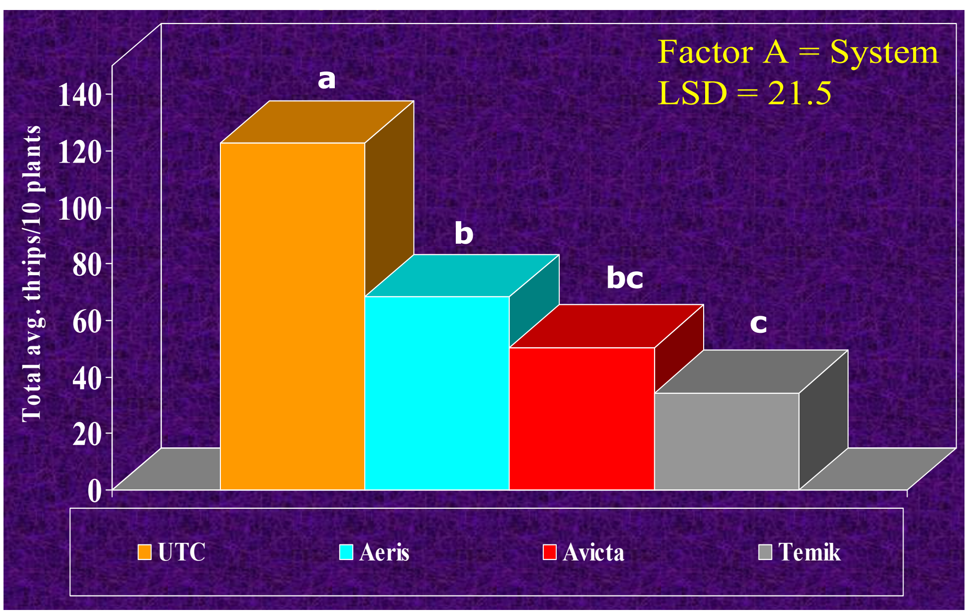

Figure 2. Seasonal total mean number of thrips by at-planting system (Blackville, South Carolina, 2008). Temik = Temik 15G in furrow at planting at 5.0 lb/acre; Aeris, Avicta = seed treatments.

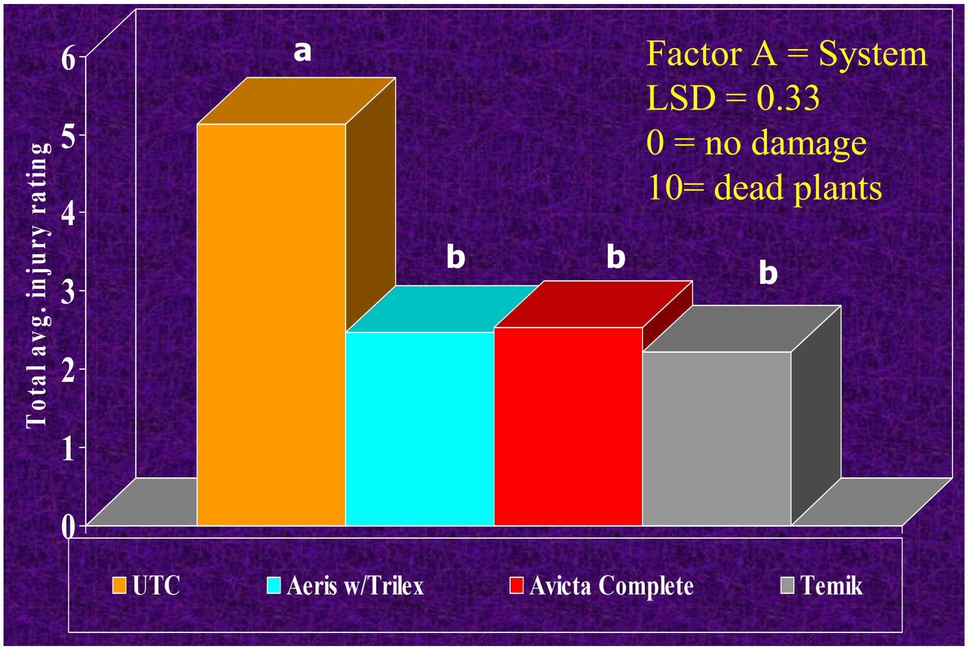

Figure 3. Seasonal average plant injury ratings caused by thrips (0 = no damage; 10 = dead plants) by at-planting system (Blackville, South Carolina – 2008). Temik = Temik 15G in furrow at planting at 5.0 lb/acre; Aeris, Avicta = seed treatments.

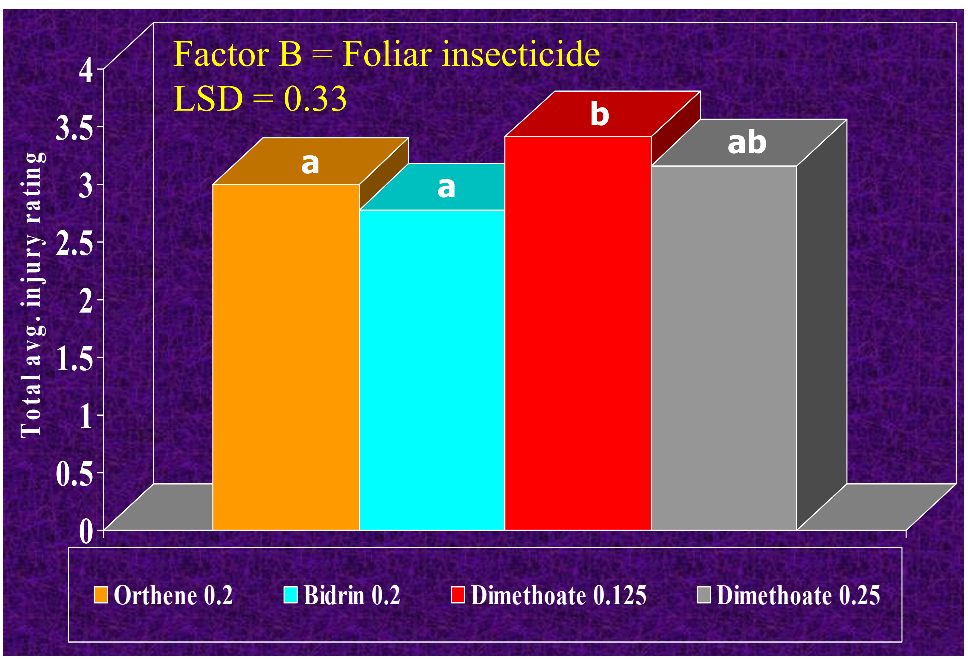

Figure 4. Seasonal average plant injury ratings caused by thrips (0 = no damage; 10 = dead plants) by foliar insecticide – Orthene 97, Bidrin 8, and Dimethoate 4 (lb ai/acre) (Blackville, South Carolina – 2008).

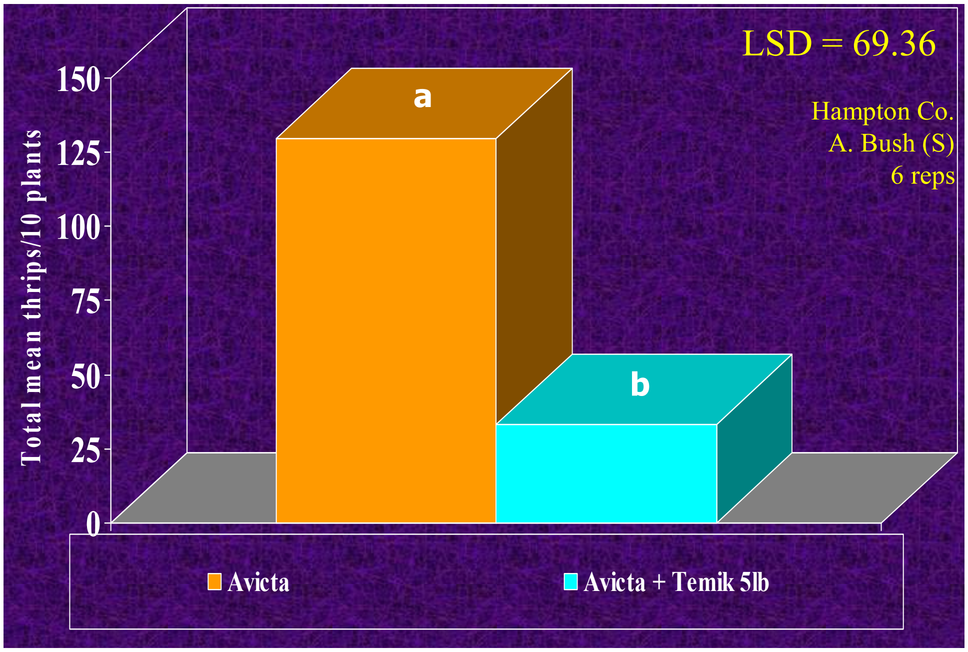

Figure 5. Seasonal total mean number of thrips following Avicta seed treatment or Avicta plus Temik 15G at 5 lb/acre (Hampton County, South Carolina – 2008).

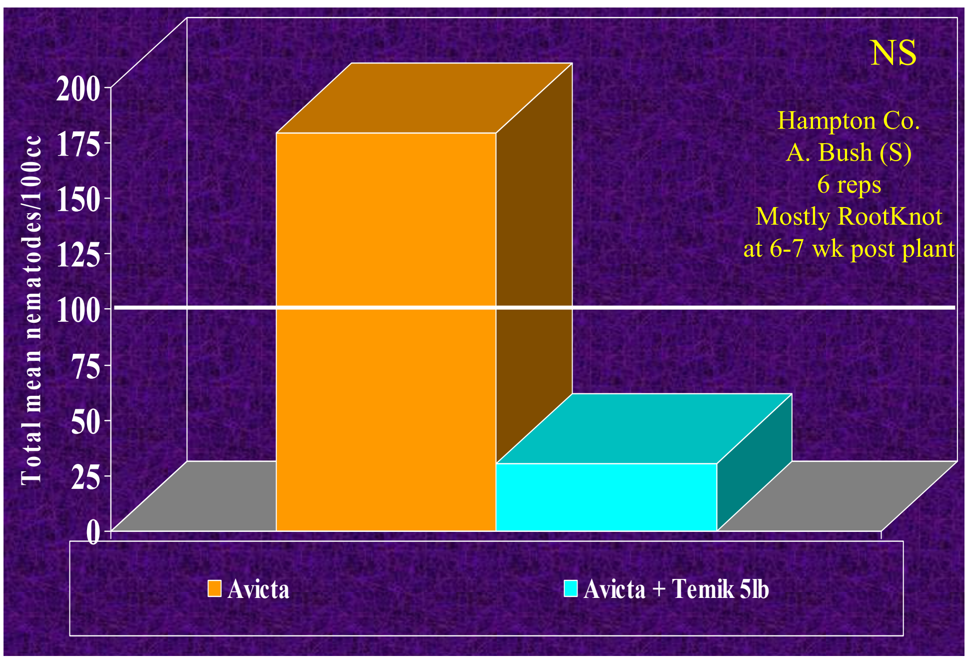

Figure 6. Total mean number of nematodes per 100-cc soil sample at 6-7 wk after planting following Avicta seed treatment or Avicta plus Temik 15G at 5 lb/acre (Hampton County, South Carolina – 2008). Horizontal line represents researched threshold roughly equivalent to 10% yield loss for root-knot nematodes.

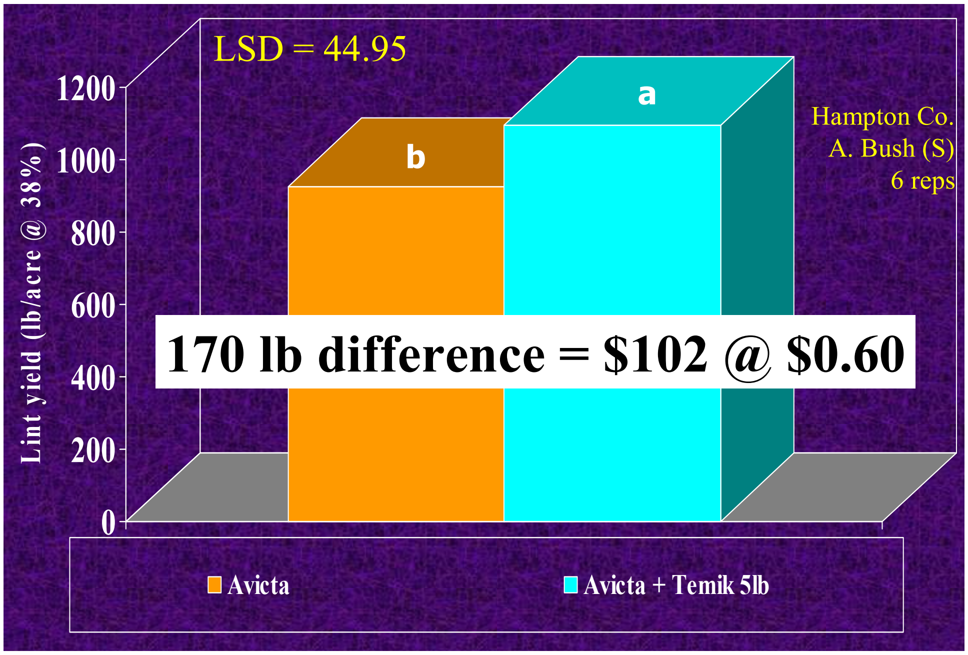

Figure 7. Mean lint yield (38% gin turnout) of Avicta seed treatment or Avicta plus Temik 15G at 5 lb/acre (Hampton County, South Carolina – 2008).

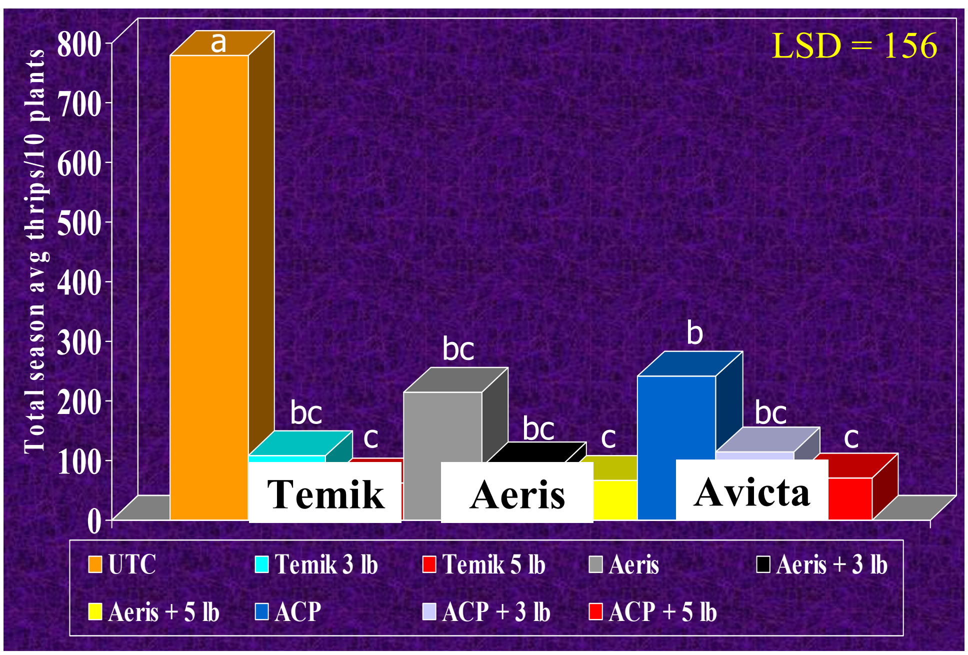

Figure 8. Seasonal total mean number of thrips following various at-planting options in test area without use of Telone for 2 yr (Blackville, South Carolina – 2008). Temik = Temik 15G in furrow at planting at 3.0 or 5.0 lb/acre; Aeris = seed treatment; ACP = Avicta Complete Pak seed treatment.

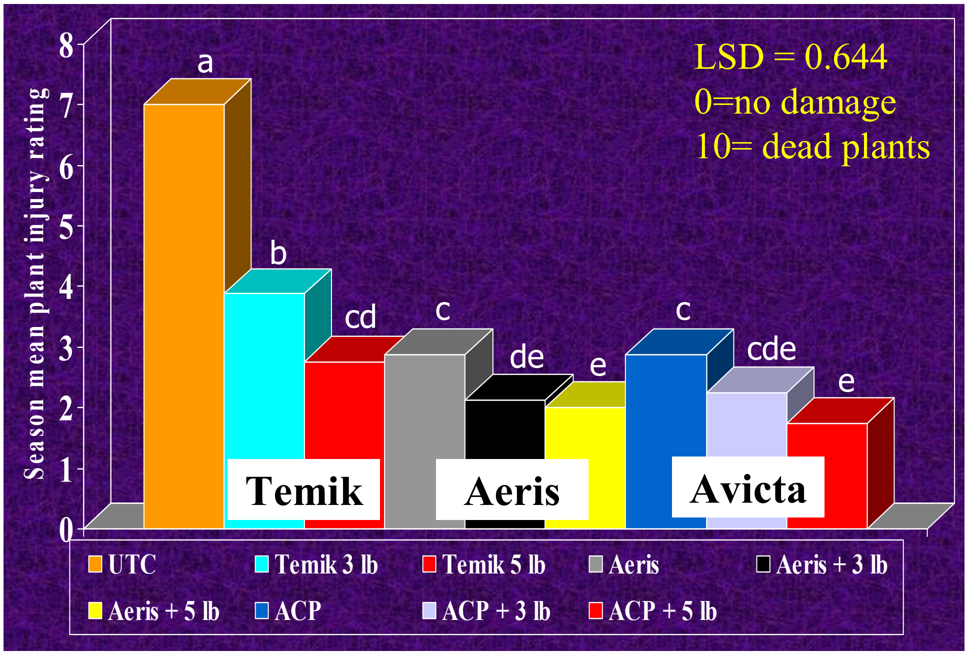

Figure 9. Seasonal average plant injury ratings caused by thrips (0 = no damage; 10 = dead plants) following various at-planting options in test area without use of Telone for 2 yr (Blackville, South Carolina – 2008). Temik = Temik 15G in furrow at planting at 3.0 or 5.0 lb/acre; Aeris = seed treatment; ACP = Avicta Complete Pak seed treatment.

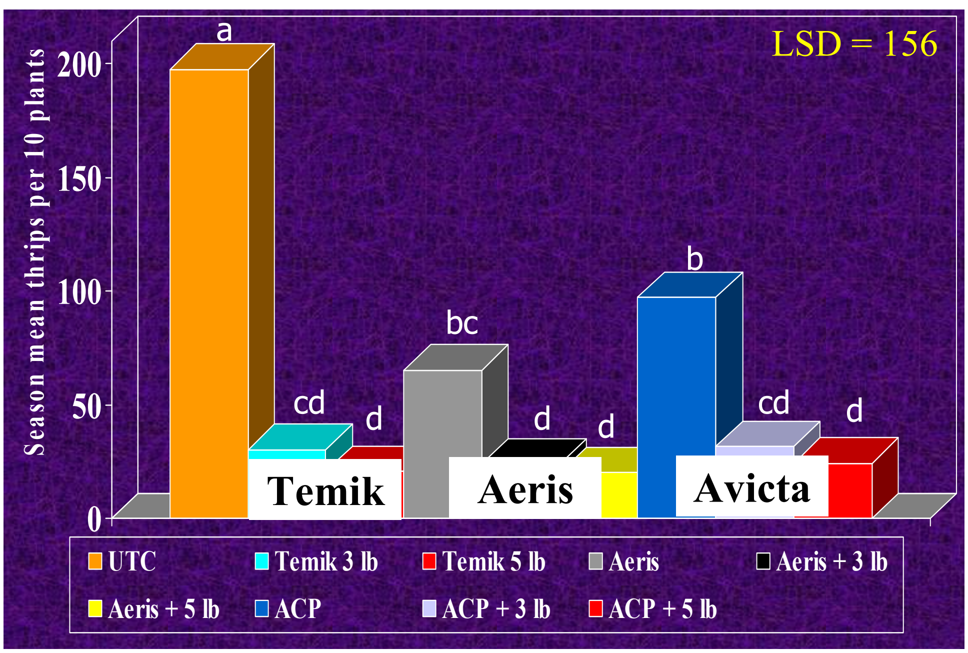

Figure 10. Seasonal total mean number of thrips following various at-planting options in test area treated with Telone the previous yr (Blackville, South Carolina – 2008). Temik = Temik 15G in furrow at planting at 3.0 or 5.0 lb/acre; Aeris = seed treatment; ACP = Avicta Complete Pak seed treatment.

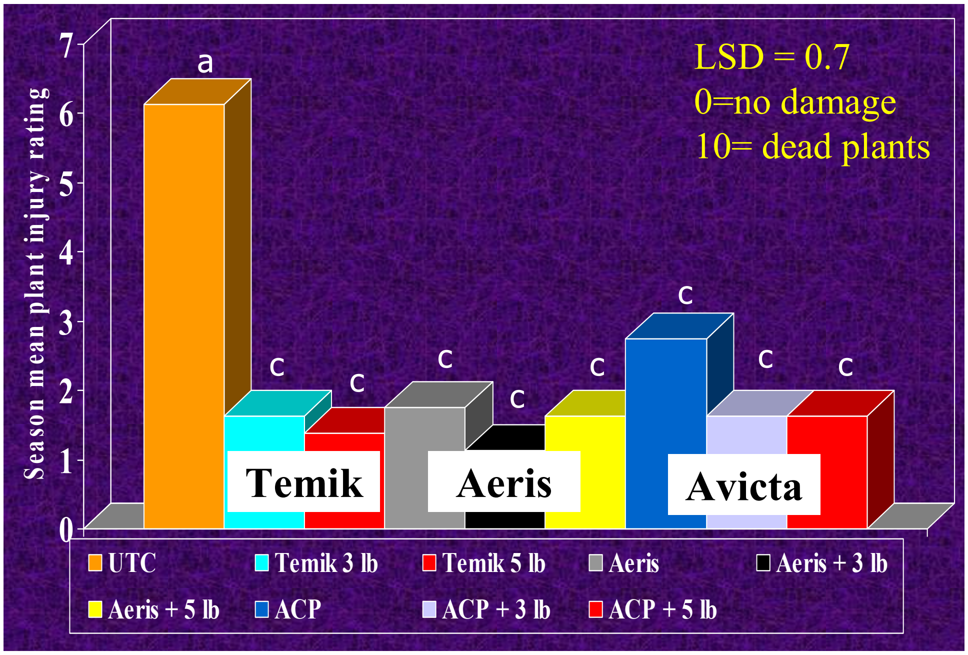

Figure 11. Seasonal average plant injury ratings caused by thrips (0 = no damage; 10 = dead plants) following various at-planting options in test area treated with Telone the previous yr (Blackville, South Carolina – 2008). Temik = Temik 15G in furrow at planting at 3.0 or 5.0 lb/acre; Aeris = seed treatment; ACP = Avicta Complete Pak seed treatment.

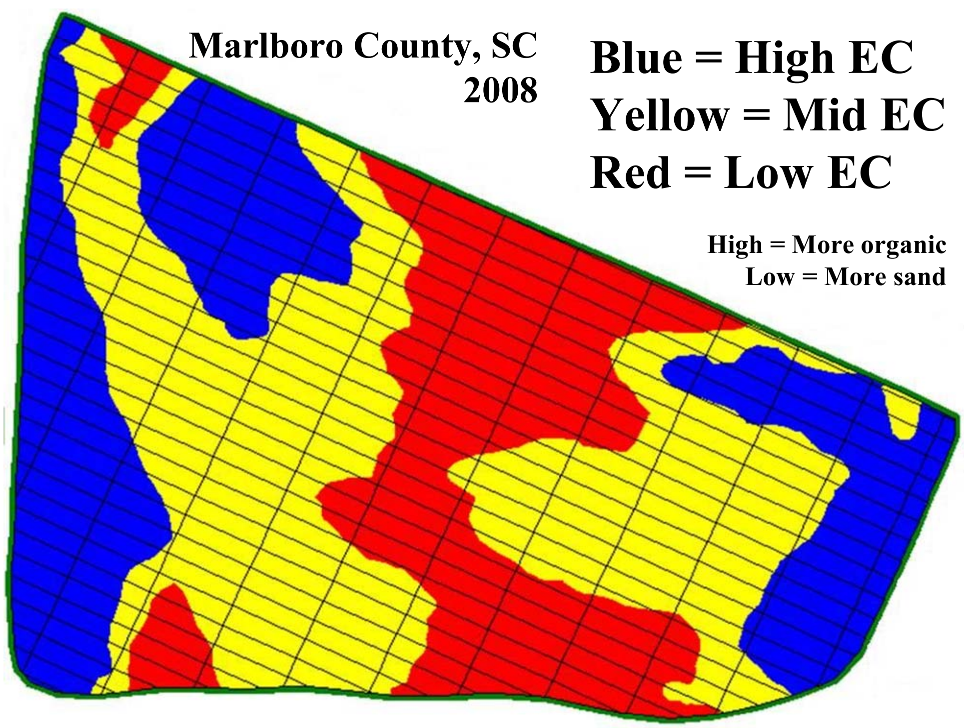

Figure 12. Map of the electrical conductivity (EC) of the soil for test site in Marlboro County, South Carolina – 2008.

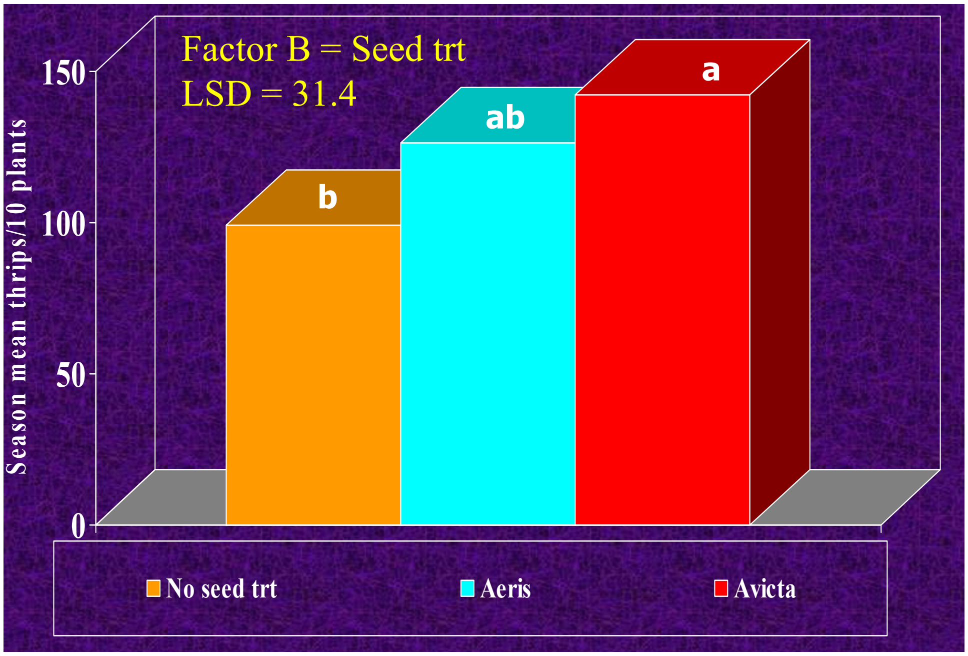

Figure 13. Seasonal total mean number of thrips by seed treatment (Marlboro County, South Carolina – 2008).

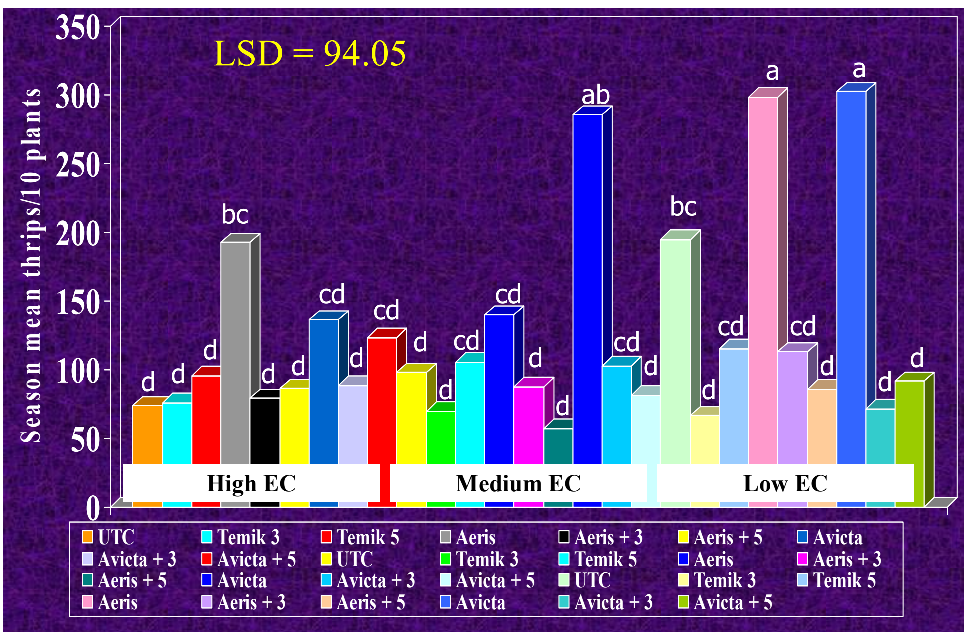

Figure 14. Seasonal total mean number of thrips following various at-planting options (Marlboro County, South Carolina – 2008). Temik = Temik 15G in furrow at planting at 3.0 or 5.0 lb/acre; Aeris, Avicta = seed treatments.

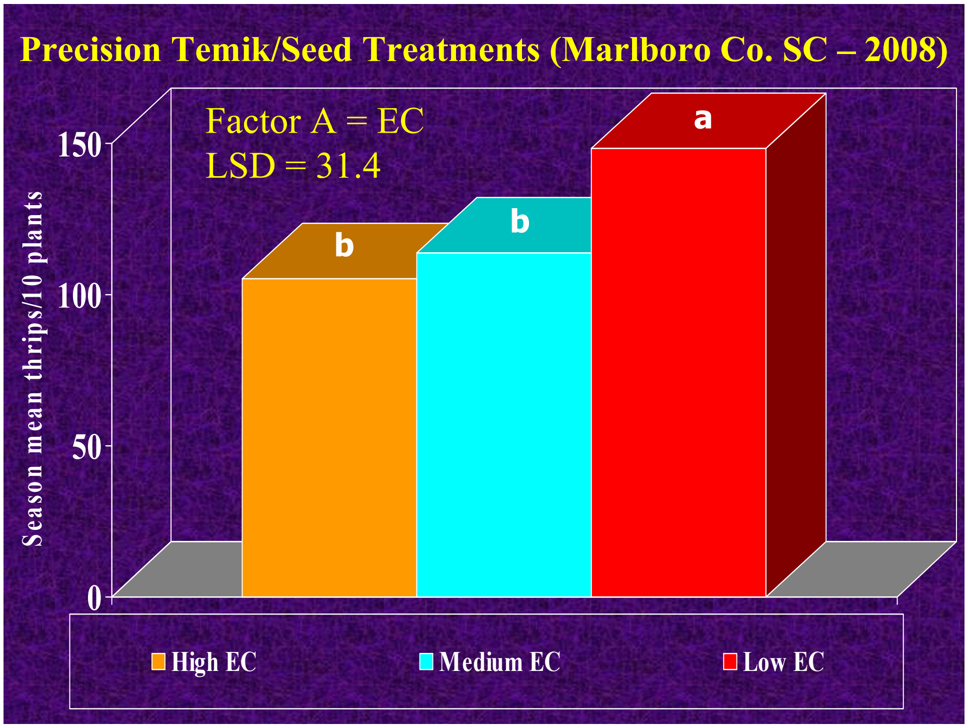

Figure 15. Seasonal total mean number of thrips by electrical conductivity (EC) of soil (Marlboro County, South Carolina – 2008).

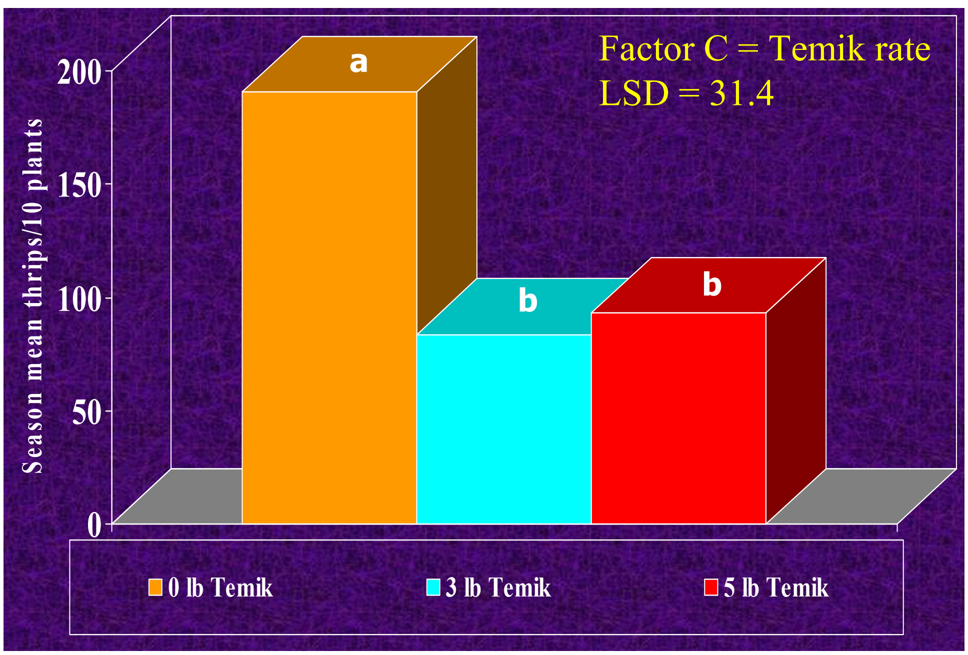

Figure 16. Seasonal total mean number of thrips by rate (lb/acre) of Temik 15G (Marlboro County, South Carolina – 2008).

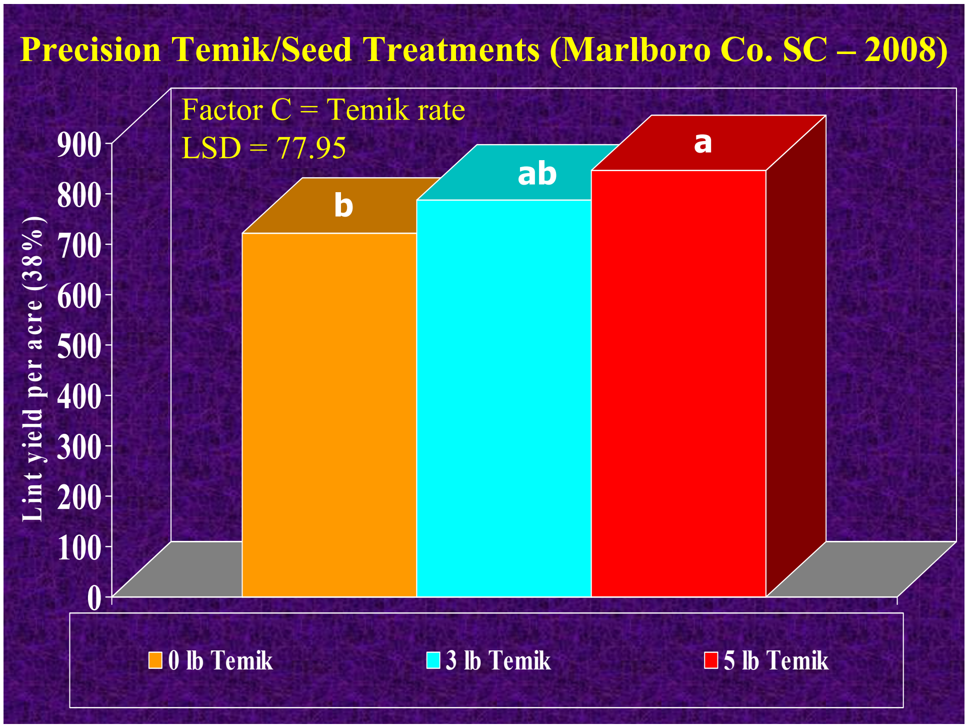

Figure 17. Mean lint yield (38% gin turnout) with varying rate (lb/acre) of Temik 15G (Hampton County, South Carolina – 2008).