EFFECTS OF TEMIK 15G ON EARLINESS AND YIELD OF TRANSGENIC AND NON-TRANSGENIC COTTON VARIETIES

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Abstract

Aldicarb 15 G (Temik®) and Acephate 15 G (Payload®) have been used for several years on cotton in the Mid-South for early-season insect control. However, they have not been investigated comprehensively across the currently grown transgenic and non-transgenic varieties for impacts on growth and development.

In 1997, Rhone-Poulenc, in conjunction with the Agricenter International in Memphis, TN. initiated such a trial to investigate these characteristics. The objectives were to obtain data pertinent to the effects of a carbamate insecticide across 15 commonly grown cotton varieties (transgenic and non-transgenic) in the Mid-South compared to that of an organophosphate insecticide. The objectives were to further explore their impacts on earliness and growth and development which extended beyond sole insect control.

Results from the location in West TN- showed that the Temik® treatment across the 15 cotton varieties showed less thrips injury, improved plant stands, showed greater height: node ratios and first position boll retention, improved earliness, harvest-aid efficacy, days to harvest and yield over the organophosphate treatment.

Introduction

Background

Protection of pre-squaring and early-squaring cotton has been shown to be an important link to earliness (Parvin et al., 1987). Rusco et al., 1997 noted a delay in cotton maturity while evaluating foliar insecticides on pre-squaring cotton. This was further verified by Andrews et al., 1997, while evaluating the impacts of insect complexes on early fruiting sites. From mechanical square removal studies, these delays have been further qualified. Turnipseed et al., 1995 showed a week delay in maturity from mechanical fruit removal. One of the most detailed studies was performed by Phelps et al., 1997 through box-mapping processes and showed harvest delays of 2-14 days in maturity when square removal occurred at 2, 3 and 4 weeks following square initiation. In the extreme North Delta where the cotton, growing -season is shorter than many regions, Stevens et al. 1995 noted the importance of early-season inputs in securing early maturity. The importance of protecting early fruiting-sites and alleviating early stresses to pre-squaring cotton has been further related to varietal differences. Jenkins and McCarty, 1995 showed that early maturing cotton varieties like DES 119 produced 41 percent of its crop on the first five main-stem fruiting nodes while DP&L 5415 only produced 27% of its crop on the same main-stem nodes. Several researcher have explored varietal differences relative to early thrip damage and shown differences pertaining to this issue (All et al.., 1995, Studebaker et al., 1995 and Scott et al., 1997). All et al., 1995 and Studebaker et al., 1995 show positive responses from Aldicarb brand insecticide in these cases. Roberts and Rechel, (1996) have shown ,via growth chamber studies, that Temik® in the presence of thrips increased biomass of the root and stalk systems which converted to earliness and yield increases. Other researchers have also shown improved earliness and yields with Temik® compared to organophosphate and other at-planting treatments relative to thrip control (Burris et al., 1995, Cook et al. 1997, Herbert et al., 1997, Lentz et al., 1994, Lentz et al, 1997, Scott et al., 1997).

Materials and Methods

Fifteen cotton varieties were planted at the Agricenter International in Memphis, TN- on May 15, 1997. The two-way treated seed were planted at four seed/ row foot into two-row plots that were 40 feet long. These varieties were categorized into non-transgenic and transgenic (herbicide tolerant and Bacillus thurengiensis) varieties. The varieties included: Paymaster 1215® & 1220®, Delta & Pineland 20®, 50 ® & 5409®, Stoneville 474®, Stoneville BXN 47®, Paymaster Roundup-Ready 1220®, Paymaster Roundup-Ready/BG 1220® & 1330®, Delta & Pineland Roundup-Ready 50®, Delta & Pineland BG 20®, 50® & 5409® and Paymaster BG 1215®. At-planting insecticide treatments included Temik 15G® @ 3.5 Lb. product/Ac. and Payload 15G® @ 6.67 Lb. product/Ac.

The statistical design was established as a 2 X 15 Split Block using a Randomized Complete Block factor with three replications. In this design the whole plots represented the insecticide treatments and the sub plots represented the varieties. The data was analyzed using the Duncan's Multiple Range Test at the .05 level of probability.

In-the-Season Monitoring

Plant emergence/20 feet over a three week period was evaluated beginning eight days following planting. Plants were considered emerged when the cotyledons were completely unfurled. Visual Thrips injury/plot were evaluated over a two week period beginning on 6-15-97 and terminating on 6-25-97. Plant mapping of six plants/plot was conducted from 7-27-97 to 9-19-97 using the nodes above white bloom methodology. This method was used to determine height: node ratios, percent boll retention at first position fruiting sites and percent open bolls at first position

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fruiting sites. Percent natural plant defoliation was assessed on 9-12-97 and 9-19-97 and related to boll retention. Harvest-aid efficacy was evaluated on 9-27-97, six days following an application Finish® at 2.0 Lb. AI/Ac, for percent defoliation, percent open boll and days to harvest. Harvest was conducted eight days following the harvest-aid application on 9-29-97 and Lb. of seed cotton was converted to Lb. of lint cotton/Ac. using each varieties' respective lint percent.

Discussion

Whole Plot vs. Subplot Statistical Differences

Few differences occurred between varieties (subplots) within the at-planting treatments (whole plots). Therefore, only data comparing whole plot differences is presented.

Plant Emergence

Temik® at 3.5 Lb. product/Ac. showed significantly greater emergence levels across all varieties than in the organophosphate treatment. At eight days following planting, emergence in the Temik® was 1.6 plants/foot. By 14 days following planting, emergence across varieties in the Temik® treatment had stabilized at 3.2 plants/foot. The organophosphate treatment remained 1.1 plants/foot less than the Temik® treatment at 24 days following planting (Figure 1).

% Thrips Injury & Height: Node Ratio

All varieties the showed significantly lower levels of thrip injury in the Temik® treatment on 6-15-97 at the .05 probability level (Figure 2). On 6-25-97, thrip injury in the Temik® treatment was significantly lower at the .1 probability level. The Temik® treatment showed strong numerical differences even following pin-head square. Further diagnosis was that Temik® gave longer control of thrips than the organophosphate. This resulted in a significantly greater height: node ratio at the .1 probability level in the Temik® treatment on the 7-27-97 rating date (Figure 3).

% First Position Boll Retention

There were no statistical differences in % first position boll retention between insecticide treatments across all varieties on the 7-27-97 rating date at the .05 levels (Figure 4). However, there were strong numerical differences in boll retention in favor of Temik®. There was a 13 percent increase in boll retention from this date across Temik® treated varieties. However, significant increases did occur on 9-4-97 and 9-12-97 in the Temik® treatment as boll retention fell below 70% in the organophosphate treatment. Temik® stabilized boll retention earlier and maintained a level above 80 percent from 9-4-97 to 9-12-97 while the organophosphate treatment fell below 70 percent during this period.

Nodes Above White Bloom

Temik® treated varieties showed a significantly lower number of nodes above white bloom at the .05 level on 7-27-97 (Figure 5). The Temik® treatment remained one node ahead in earliness on 8-18-97 over the organophosphate and showed a strong numerical difference at all dates.

% Natural Open Boll & Defoliation

Temik® treated varieties showed a higher level of natural boll opening on 9-12-97 and 9-19-97 compared to the organophosphate treatment which further verifies the earliness of the Temik® treatment. The Temik® treatment maintained 10 to 27 percent greater open bolls respectively than the organophosphate (Figure 6). Percent natural defoliation in the Temik® treatment on 9-12-97 was 23% higher than with the organophosphate treatment while on 9-19-97 the Temik® treatment was 10% greater in defoliation (Figure 7). This can be further linked to the increased level of first position bolls retained.

Harvest-Aid Impacts

Six days following the application of Finish® at 2.0 Lb. AI/Ac. all varieties within the Temik® treatment showed improved percent defoliation and boll opening. There was a 22 percent increase in defoliation with Temik® and a 23 percent increase in open bolls. The Temik® treatment did reduce the number of days to harvest by 13 days over the organophosphate (Figure 8).

Yield

At eight days following the application of Finish®, varieties within the Temik® treatment showed a yield increase of 239 Lb. Lint /Ac. over the organophosphate. The Temik® treatment stabilized yield among all varieties better than the organophosphate treatment (Figure 9).

Summary

Varieties within the Temik ® treatment showed an improved plant stand, less thrip injury and a greater height: node ratio. This treatment also showed a greater retention of first position bolls, fewer number of nodes above white bloom , a higher level of naturally occurring open bolls and natural defoliation and improved yield by 293 Lb. Lint/Ac. When treated with the harvest-aid Finish®, percent defoliation, open bolls and days to harvest were improved by the Temik ® treatment compared to organophosphate. Each of these impacts can be linked to earliness. Earliness improved the efficacy of harvest-aids, improved harvest efficiency and yield.

Acknowledgments

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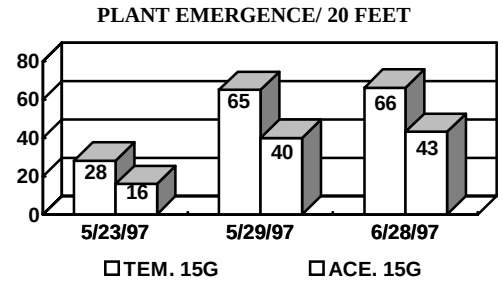

Figure 1. Plant emergence/20 feet summarized across 15 cotton varieties.

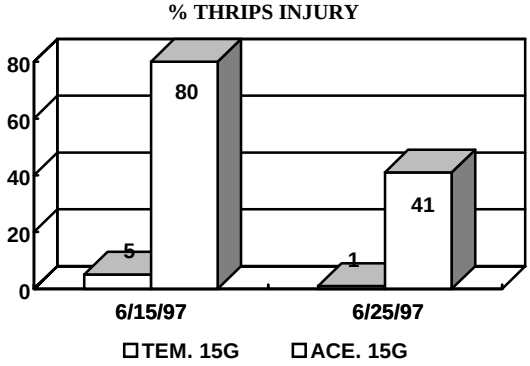

Figure 2. % Thrip injury rated visually and summarized across 15 cotton varieties.

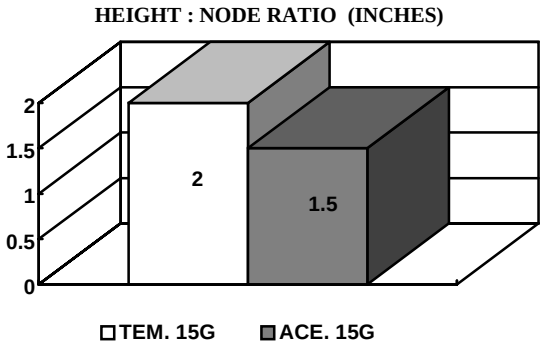

Figure 3. Height : Node Ratio expressed in inches and summarized across 15 cotton varieties. Rated on 7-27-97.

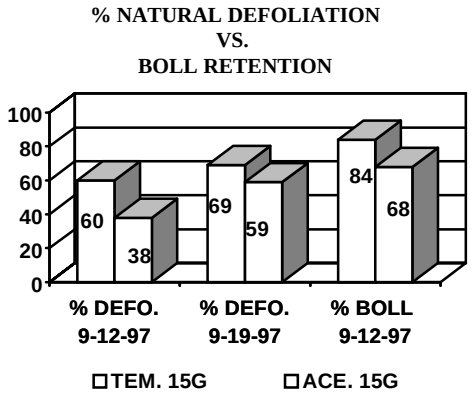

Figure 6. Percent natural defoliation vs. Boll retention summarized across 15 cotton varieties.

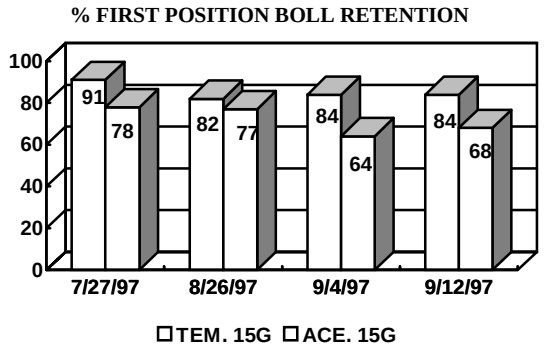

Figure 4. % First position boll retention summarized across 15 cotton varieties.

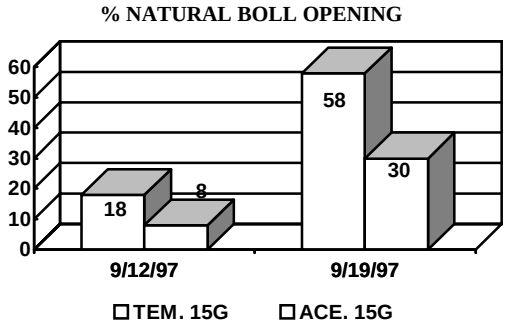

Figure 7. Percent natural boll opening summarized across 15 cotton varieties.

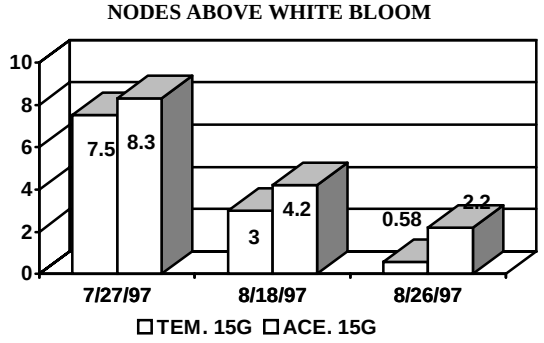

Figure 5. Nodes above white bloom summarized across 15 cotton varieties.

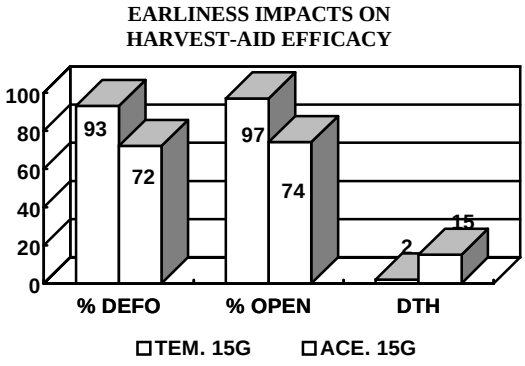

Figure 8. Earliness impacts on harvest-aid efficacy six days following the application of Finish @ 2.0 Lb. AI/Ac. summarized across 15 cotton varieties. Harvest-aid applied on 9-21-97.

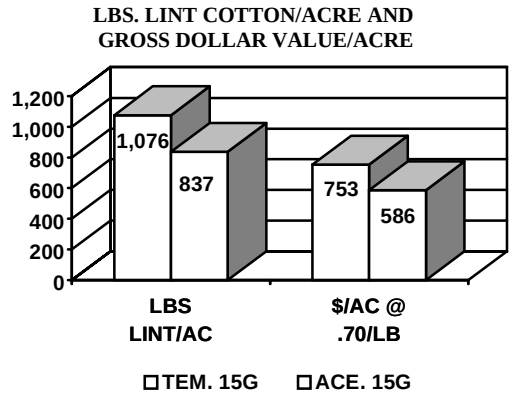

Figure 9. Pounds lint cotton/acre and gross dollar value summarized across 15 cotton varieties. Harvest date was 9-29-97.