Effects of Goëmar® BM86 and Mepiquat Chloride on DPL 449BR/DPL 494R Cotton

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Abstract

A field experiment compared several rates of mepiquat chloride and Goëmar® BM86 on Upland cotton in the Palo Verde Valley during 2005 for their effects on cotton growth and yields. Leaf chlorophyll levels were significantly increased in DPL 449BR by usage of mepiquat chloride on initial samples dates after applications, and these treatments also effected cotton heights. Retention percentages and numbers of fruiting structures per plant were initially increased by treatments which contained Goëmar® BM86, although late in the season significant differences existed between Goëmar® BM86 treatments as a result of interaction with mepiquat chloride. All treatments resulted in a slight (0.01 inch) increase in fiber length as well as staple, resulting in increased lint value. The combination treatment of Goëmar® BM86 plus 12 oz./acre of mepiquat chloride had highest cotton value ($1,035/ acre), and was worth $178/acre more than the untreated check.

Introduction

A number of plant nutritional products lay claim that their usage will result in increased yields, quality and/or economic return. Few of these products have actually had adequate testing in the low desert production environment to determine if such claims are substantiated when subjected to the extreme conditions associated with this geographic area.

Investigations of Goëmar® BM86 on cotton in the San Joachin Valley had noted consistent yield responses over a five year testing period (Munk, unpublished). Goëmar® BM86 (distributed by Agrimar Corporation, Flowery Branch, GA) is a foliar nutritional formulation (5-0-0) consisting of 5% water soluble nitrogen, 2.4% water soluble magnesium, 3.2% sulfur, 2% boron, 0.6% sodium, and 0.02% molybdenum. It is derived from urea, magnesium sulfate, boric acid, sodium molybdate and kelp. As kelp (*Ascophyllum nodosum*) is involved, natural plant hormones, such as cytokinin, are also expected to be contained in the formulation.

Limited testing of cytokinin containing products on upland cotton in the low desert has noted some diverging results. Application of products containing cytokinin prior to bloom resulted in an earlier flower set but also reduced yields, although a single application after bloom resulted in a small yield increase (Rethwisch et al., 1996). Applications of a combination treatment of both Pix (mepiquat chloride) and Cytokin (active ingredient = cytokinin) were noted to result in greater yield increases over the untreated check or either chemistry by itself at a number of locations in the low desert and the San Joachin Valley (Mayeux, 1992). Since these tests were completed, commercial cotton varieties have changed greatly, including the advent of genome modifications for herbicide resistance and insecticide inclusion.

This experiment was initiated to document the effects of Goëmar® BM86 on cotton growth, yields, quality and values on a current widely planted variety in the low desert, as low desert cotton varieties differ than those in the San Joachin Valley due to the hotter environmental conditions associated with the low desert. These conditions may also negate the consistent yield responses previously noted in the San Joachin Valley.

Methods and Materials

A cotton field located between the communities of Ripley and Palo Verde, CA, was selected for this experiment. This field was somewhat unusual in that of each 12 planted rows 11 rows were DPL 449BR with one row being DPL 494R. This would allow plant parameter data to be collected from two varieties, rather than one, although yield data collection via commercial harvest machinery from the single row DPL 494R would not be feasible.

The first treatment date was June 16, 2005. Cotton in the DPL 449BR plots had begun flowering a few days prior to this date, and 34% of the plants had petal foliage evident. A few small bolls were already present in DPL 494R on this date. Treatments were applied with a tractor mounted three-point hitch sprayer, calibrated to deliver 10 gallons/acre. Plots were eight rows wide and consisted of seven rows of DPL 449BR and 1 row of DPL 494R.

Four treatments were applied on this date. Treatments were 1). Goëmar® BM86 at 1 qt./acre; 2). Goëmar® BM86 @ 1 qt./acre + 12 oz./acre of Mepiquat Chloride 2.4% (Farm$aver); 3). 16 oz/acre of Mepiquat Chloride 2.4%; and 4). 24 oz./acre of Mepiquat Chloride 2.4%. All Goëmar® BM86 were buffered with TriFol (25% aliphatic polycarboxylate and 9% calcium chloride; Wilbur Ellis Co.) at the rate of 1 pt/100 gal. prior to BM86 being added due to high alkalinity concerns. All treatments were replicated four times in a randomized complete block design with the exception of the 24 oz./acre rate of Mepiquat Chloride 2.4%, which had 6 replications (with several consisting entirely of the DPL 449BR variety).

A second application was attempted the afternoon of July 11. Only two treatments were scheduled on this application date, being Goëmar® BM86 at 1 qt./acre, and Goëmar® BM86 @ 1 qt./acre + 12 oz./acre of Mepiquat Chloride 2.4%. Both treatments were buffered with TriFol at the rate of one pint/100 gal. prior to BM86 being added. The same sprayer was used as in the previous application, but was calibrated to deliver 16 gpa at beginning of application. A malfunction with the pump resulted in a continuous reduction of gallonage (and product) sometime after the first plot was treated, resulting in less product being applied then expected. The average gallonage level for the Goëmar® BM86 plots was 13.3 gal/acre (= 0.83 qts./acre of Goëmar® BM86), while the combination plots averaged only 5.33 gallon/acre of material (= 0.33 qts./acre of Goëmar® BM86 + 4 oz./acre of Mepiquat Chloride 2.4%) applied, with individual treated plots receiving greater or less than this amount.

Chlorophyll data were collected from plants on a weekly basis for five weeks beginning in late June with a Minolta 502 SPAD meter. Data were collected from the fifth terminal leaf of 15-25 plants. Care was taken to separate the two varieties so that data would not be invalidated at time of analyses.

Plant mapping was conducted June 29, July 11 (prior to application), and July 29, and consisted of removing five plants per plot, and counting and recording numbers of nodes, plant height, first fruiting node, and presence/absence of fruiting structures at the first three positions for each fruiting branch. Percent retention and fruiting structures/plant were then calculated. Leaf temperatures were also obtained on June 20 utilizing a Raytek® Raynger® ST infrared temperature gun, but only from the DPL 449BR cotton variety.

Plots were harvested on Dec. 15, 2005. All eight rows of each individual plot were harvested, and seed cotton weights were then obtained using a Crust Buster boll buggy. All 32 rows of the same treatment were placed together in a module and kept separate from cotton from other treatments to obtain quality and turnout data after ginning (Modern Gin, Blythe, CA). The turnout and other information were then utilized to calculated lint yields per acre as well as acreage values of cotton.

Data and treatment means were statistically analyzed using Fisher's least significant difference (Statgraphics for Windows, Manugistics, Inc.).

Results

Leaf Temperatures

No significant differences were noted for leaf temperatures due to treatment on June 20. Temperatures ranged from 84.5-93.0°F. Highest mean leaf temperature (91.0°F) was noted from cotton treated with the 1 qt./acre BM86 + 12 oz./acre mepiquat chloride combination treatment, followed by the untreated check (90.0°F). Cotton treated with BM86 at 1 qt./acre had a mean leaf temperature of 89.6°F. Lowest cotton leaf temperature (87.8°F) was noted from the 16 oz./acre treatment. No data were collected from cotton treated with 24 oz./acre of mepiquat chloride, nor after June 20.

Chlorophyll

Significant differences were noted for leaf chlorophyll content associated with treatments in DPL 449BR cotton on each of the first four sampling dates (Table 2), but this was not true for DPL 494R cotton (Table 1). As expected, mepiquat chloride treatments resulted in higher cotton leaf chlorophyll readings on all five sample dates for both varieties. Application of BM86 resulted in numerically higher leaf chlorophyll readings than the untreated check in DPL 494R cotton on each of the first three sample dates, although the untreated cotton had numerically higher leaf chlorophyll readings than the BM86 treatment on July 22 and 29 (Table 1). It should be noted that these final two sample dates were obtained after the second partial application, which may explain why the leaf chlorophyll content in the 1 qt./acre BM86 + 12 oz./acre mepiquat chloride combination treatment was numerically higher than that of cotton treated with 16 oz./acre rate of mepiquat chloride.

Chlorophyll levels in leaves of DPL 449BR cotton corresponded with mepiquat chloride levels for the first three sample dates with increases levels noted as rate increased (Table 2). The chlorophyll levels of mepiquat chloride treated cotton were significantly higher than the untreated check or the BM86 treatments on June 29 and July 7. On July 11 only the 24 oz./acre rate of mepiquat chloride (45.2) resulted in significantly higher chlorophyll readings than the untreated check (40.4). On the first sample date after the July 11 application (July 22) the highest mean chlorophyll readings were noted from cotton treated with 1 qt./acre BM86 + 12 oz./acre mepiquat chloride combination treatment (56.8) thought due to the partial treatment on July 11. All mepiquat chloride treatments resulted in cotton with significantly higher chlorophyll readings than untreated or BM86 alone treated cotton on July 22. No significant differences existed on July 29, although mean chlorophyll levels in the untreated check (54.6) was numerically higher than cotton receiving either of the treatments containing BM86.

Heights, nodes and height:node ratios

Heights

Plant heights were signficantly affected by treatments containing mepiquat chloride (Tables 3-5) with cotton receiving treatments containing mepiquat chloride being about 6 inches shorter than the untreated check (36.9 inches tall) on June 29, the first sample date after application (Table 3). The BM86 treated cotton (36.8 inches) was very similar to that of untreated cotton throughout the study.

Mean plant heights were not consistent in their increase from one sample date to the next however. Slowest growth rate was noted in the BM86/mepiquat chloride combination treatment, as mean cotton height increased only 3.4 inches between June 29 and July 29. Very little growth (actually shorter mean heights) was measured for this treatment between June 29 and July 11 (Tables 3, 4). Mean plant height were also shorter for the untreated check between July 11 and July 29 (Tables 4, 5). These results are thought due to random sampling as variation in plant heights existed in each plot.

Nodes

Usage of BM86 resulted in numerically more mean nodes per plant on all three sample dates when compared with all other treated and untreated cotton (Tables 3-5), although these differences were not statistically significant on any sample date. When compared with the untreated check the BM86 treatment resulted in 0.6, 1.0 and 1.2 nodes per plant more on June 29, July 11 and July 29 respectively than the untreated check, indicating an increased growth rate due to this product.

The 1 qt./acre BM86 + 12 oz./acre mepiquat chloride combination treatment resulted in numerically more nodes than either treatment with higher rates of mepiquat chloride on each of the first sample dates (June 29, July 29) following application. Cotton treated with the combination treatment had the least nodes on July 11 however (Table 4). Fewest nodes on June 29 were noted from the 24 oz./acre rate of mepiquat chloride (Table 3), although this treatment resulted in slightly more nodes/plant than the 16 oz./acre rate on the following two sample dates.

Height to node ratios

Height to node ratios remained fairly constant during the sampling period of this experiment (Tables 3-5). On June 29, highest ratios were noted for untreated cotton (1.92), followed by cotton receiving treatments that included BM86 (average = 1.86). The two mepiquat chloride treatments resulted in an average height to node ratio of 1.67 (Table 3). Ratios were slightly different on the July 11 sample date (Table 4), with untreated cotton having a significantly higher ratio (2.04) than that noted from cotton receiving any treatment. The BM86 treatment resulted in the next highest ratio (1.83) while all treatments containing mepiquat chloride resulted in fairly similar DPL 449BR cotton height to node ratios (1.65-1.72).

Data from the July 29 sample date (Table 5) were noted to have similar ratios for each of the treatments as the June 29 sample date, rather than the July 11 sample date. This is not surprising, as partial applications for treatments containing BM86 were applied on July 11.

First fruiting node and total fruiting branches

First Fruiting Node

First fruiting nodes on the cotton stalk increased for all treatments during the period of June 29-July 29 (Tables 3-5). Significant differences were noted only on the June 29 sample date (Table 3). First fruiting node of cotton treated with 24 oz./acre of mepiquat chloride (1.9) and the BM86 treatment (first fruiting node = 2.2) had statistically lower means than that noted for all other treatments and untreated cotton (ave. = 3.5).

No statistical differences were noted on subsequent sample dates, although the BM86 treatment had the lowest first fruiting branch on both dates (Tables 4, 5), with only this treatment resulting in a first fruiting branch below the fourth node on the July 29 sample date (Table 5). First fruiting branch for all other treatments in the experiment were at for slightly above four nodes.

Total Fruiting Branches

Fruiting branches per plant increased for each treatment during the June 29-July 29 sampling period (Tables 3-5). Statistical differences existed only on June 29, when the BM86 treated cotton had significantly more total fruiting branches (17.7) than cotton receiving 16 oz./acre rate of mepiquat chloride (15.2). Cotton treated with only 1 qt./acre BM86 had the highest number of fruiting nodes through this time period, however, cotton treated with the combination treatment of BM86 + 12 oz./acre of mepiquat chloride had the fewest number of fruiting branches on the July 29 sample date (Table 5). Mean number of cotton fruiting branches as a result of the combination treatment were among the lowest noted during the entire plant mapping period.

Retention rates

Retention rates (percentages) were determined on each of the three sample dates (Table 6-8) and reflect the fruiting structures (flowers, bolls) of DPL 449BR present, beginning with the first (oldest) node noted to have a fruiting structure somewhere on the branch associated with that node. Retention rates declined throughout the study, typical of that generally noted for the low desert. No statistical differences were noted on the first sample date (June 29) as a result of any treatment. Retention rates on this date for positions 1-2 ranged from a high of 72.1% (BM86 + 12 oz./acre of mepiquat chloride combination treatment) to 67.1% for the 24 oz./acre rate of mepiquat chloride (Table 6).

Similar retention rates and patterns were noted on July 11 (Table 7) as the combination treatment had the highest retention percentage for positions 1-2 (68.7%). This was significantly greater than that observed for the 24 oz./acre rate of mepiquat chloride (63.8%), although not statistically so when compared with any other treatment.

The trends noted for retention rates from the first two sample dates were no longer applicable on the July 29 sample date (Table 8). Retention rates were lowest for positions 1-2 in the combination treatment (39.8%), while retention rates for the untreated check and the 16 and 24 oz./acre rates of mepiquat chloride were 40.2, 41.3 and 41.1% respectively for these positions. The 1 qt./acre rate of BM86 had the greatest retention (46.7%) although no statistical differences existed between treatments for mean retention rates for positions 1-2.

Treatments containing BM86 had numerically higher retention rates for position 1, however, a significant difference existed between BM86 (43.3% retention) and BM86 plus 12 oz./acre of mepiquat chloride (34.4%) treated cotton for position 2. At position 3, all treatments resulted in numerically higher retention rates than the untreated check (24.9%), with only the 24 oz./acre rate of mepiquat chloride (38.1) resulting in statistically increased retention for this position (Table 8).

Calculated fruiting structures/plant

No statistical differences were noted for calculated fruiting structures (flowers, bolls) on June 29 (Table 9). Numbers of fruiting structures were noted to be highest on this date from cotton treated with 1 qt./acre of BM86 (39.2), although all other treatments resulted in very similar numbers of fruiting structures to that of untreated cotton (34.4). The 1 qt./acre BM86 treatment had higher numbers of fruiting structures for all plant mapping dates (Tables 9-11).

Statistical differences involving the 1 qt./acre rate of BM86 were noted on both July 11 and July 29. On July 11, higher numbers of fruiting structures per plant were noted for this treatment for both position 1 and 2 when compared with the 24 oz./acre of mepiquat chloride, and for position 3 when compared with the untreated check (Table 10). The 1 qt./acre rate of BM86 also resulted in significantly more fruiting structures per plant (26.1) for positions 1-2 combined when compared with the 24 oz./acre rate of mepiquat chloride (21.8). No statistical differences existed for fruiting structures at combined positions 1-3 although cotton treated with the 1 qt./acre rate of BM86 had almost five more such structures per plant (Table 10).

Numbers of fruiting structures per plant declined about 40% from July 11 to July 29 as a result of hot summer temperatures. Highest numbers of fruiting structures per plant continued to be noted on cotton treated with the 1 qt./acre rate of BM86 (Table 11). At positions 1-2 this treatment had significantly more fruiting structures (19.1) than the combination treatment (14.1) or the untreated check (14.9), as well as combined positions 1-3 (26.0, 19.6, 19.5 respectively).

Seed cotton yields, lint turn-out and lint yields

Seed cotton yields per acre (Table 12) ranged from 4,540 lbs./acre (combination treatment of BM86 + 12 oz./acre of mepiquat chloride) to 4,895 lbs./acre (16 oz./acre of mepiquat chloride). No statistical differences existed for seed cotton yields.

Turnout data did not mirror seed cotton yields (Table 12). Highest turnout (39.05%) was noted from cotton treated with the BM86 + 12 oz./acre mepiquat chloride combination treatment, followed by the untreated check (35.21%). The module containing the cotton from the 24 oz./acre rate of mepiquat chloride (which had a higher percentage of DPL 449BR cotton than noted in the other treatments) resulted in a turnout of 33.83%, followed by the BM86 treatment (32.39%). The smallest lint turnout percentage (30.35%) was noted from the 16 oz./acre rate of mepiquat chloride (Table 12).

Lint amounts per acre differed significantly and reflected turnout percentages. The highest lint per acre (1,810 lbs.) in this experiment was noted as a result of the combination treatment of BM86 + 12 oz./acre of mepiquat chloride. This finding is consistent with that of Mayeux (1992) who had noted that combination treatments of cytokinin (as Cytokin) + mepiquat chloride resulted in highest lint yields. The amount of lint/acre from BM86 + mepiquat chloride in this experiment was almost 130 lbs./acre greater than that of untreated cotton (1,681 lbs), and significantly greater yet over that noted for cotton treated solely with either mepiquat chloride rate or BM86 (Table 12). Least lint per acre (1,520 lbs.) was noted from cotton treated with the 16 oz./acre rate of mepiquat chloride, although this treatment resulted in the greatest amount of seed cotton.

It should be noted that the turnout percentage is a single number received from the gin for the entire module rather than multiple data points, and lint yields are then calculated based upon this turnout percentage. Each module did contain a number of bales however (8+). Further testing of the products involved is recommended to verify turnout percentages (and related calculated lint yields) noted in this experiment, thereby increasing confidence of data accuracy.

Lint Quality Characteristics

Whiteness and Spotting Grades

All cotton bales in this experiment were either grade 21 or 31 for whiteness (first number) while all bales were considered to have no spotting (hence "1" for second number). No significant differences were noted for white coloration due to treatment as color grades ranged from a high of 2.11 for cotton treated with the 16 oz./acre rate of mepiquat chloride to 2.33 for both BM86 as well as the 24 oz./acre rate of mepiquat chloride (Table 12).

Leaf content

Differences in leaf content of lint existed as a result of treatments (Table 12), with the BM86 treatment resulting in significantly higher leaf content (3.0) than both the untreated check (2.42) and the combination treatment of BM86 + 12 oz./acre of mepiquat chloride (2.27). Cotton treated with only mepiquat chloride was intermediate for leaf content between the two extremes, with slightly high leaf noted for cotton treated with 16 oz./acre (2.67) than for 24 oz./acre (2.60).

Fiber Length

All treatments resulted in a slightly longer fiber length (1.08 inches, 35 staple) than the untreated check (34 staple, 1.07 inches). The exact reason for this is unclear, but differing growth rates associated with treatments may have resulted in slightly larger seed and therefore longer fiber length than the untreated check.

Micronaire

Treatments which included mepiquat chloride resulted in a slight decrease in micronaire (4.7, 4.8) compared with the other treatments and the untreated check (4.9) when examining only the combination (7/8 DPL 449BR, 1/8 DPL 494R) cotton variety plots. DPL449BR plots treated with 24 oz./acre of mepiquat chloride had a micronaire of 4.9.

Strength

Most treatments resulted in cotton lint strength in the strong category (27-29 g/tex). Fiber strength was affected by the treatments, with results noted apparently being the opposite of those noted for color. Treatments containing mepiquat chloride resulted in lowest strength fibers (range of 27.6-28.4), although strength values increased as amount of mepiquat chloride increased. Cotton treated with only BM86 had the highest lint strength (29.9), while untreated cotton lint was also above the 29 g/tex level (29.3).

Uniformity

All cotton was noted to be in the intermediate class of uniformity (80-82%). Usage of mepiquat chloride was noted to result in slightly higher uniformity, with mepiquat chloride treatments thought to result in a slower growth of plants in the time period after application. Of the DPL 449BR/DPL 494R cotton plots, highest uniformity was noted from cotton treated with 16 oz./acre of mepiquat chloride, followed by the 12 oz./acre rate.

Color attributes

Grey (Rd) Significant differences existed due to treatment existed for grey reflection of lint, with usage of BM86 by itself resulting in cotton lint with a significantly higher level of grey than any other treatment (Table 12). This was followed by the untreated check. All cotton treated with mepiquat chloride had significantly less grey reflectance than the untreated check. Highest reflectance (81.4) was noted from cotton receiving the combination (BM86 + 12 oz./acre mepiquat chloride) treatment.

Yellow (+b) Similar results as noted for grey reflectance were also noted for yellowness of cotton lint. Highest amount of yellowness was noted for the BM86 treatment (8.41), followed by the untreated check (8.26). Mepiquat chloride

treatments affected yellowness as all cotton treated with treatments containing this chemistry had statistically less yellowness than cotton not treated with mepiquat chloride. The BM86 + 12 oz./acre mepiquat chloride combination treatment had statistically the least yellowness noted (7.62).

Trash

Differences existed due to treatments for trash content of ginned cotton lint (Table 12). All treatments that contained mepiquat chloride had leaf content of 2.0 The BM86 treatment had a signficantly lower trash score (1.56), while that of untreated cotton was 1.90.

Economics

A reduced value per pound of untreated cotton ($0.51) was noted compared with any treated cotton ($0.57-0.58/lb). This was due primarily to the difference in staple length (34 for untreated cotton, 35 for treated cotton), and was also reflected in the lint value per acre (Table 12). The BM86 + mepiquat chloride treatment resulted in cotton with the highest value per acre ($1,035). This was over $100/acre greater than any other treatment, and slightly more than $175/acre more than the untreated check ($858). The remaining treatments were somewhat similar in their resulting cotton lint values per acre ($881-911), but had less value on a per acre basis than the combination treatment as a result of less lint per acre.

Discussion/Summary

The differences in calculated fruiting structures per plant noted on July 29 appear to be inversely correlated with actual lint yields, as the cotton with the least amount of fruiting structures (combination treatment of BM86 + 12 oz./acre of mepiquat chloride, untreated check) had the highest amounts of cotton lint per acre. A study of retention as a result of elongated pistils in 2005 in the Palo Verde Valley noted that less retention (and fewer bolls) resulted in larger bolls thought due to more nutrients available on a per boll basis. Number of seeds were not affected, however seeds weights/size were much larger in the bolls associated with the reduced retention rates (Rethwisch et al., unpublished). This may have also happened in this experiment as well.

Literature Cited

Mayeux, J. V., 1992. Cytokin and Pix interaction increases cotton production. Pp. 45-46. Proc. 1992 Beltwide Cotton Conferences. National Cotton Council, Memphis, TN. 1504 pp.

Rethwisch, M.D., N. Rovey, N. Heeringa, and A. Quist. 1996. Comparison of early season and mid-season applied plant growth regulators on DPL 5415 cotton. Pp. 98-104. In University of Arizona College of Agriculture 1996 Cotton Report, Series P-103. J. Silvertoooth, ed. 393 pp.

2005 DAILY TEMPERATURES, BLYTHE, CA

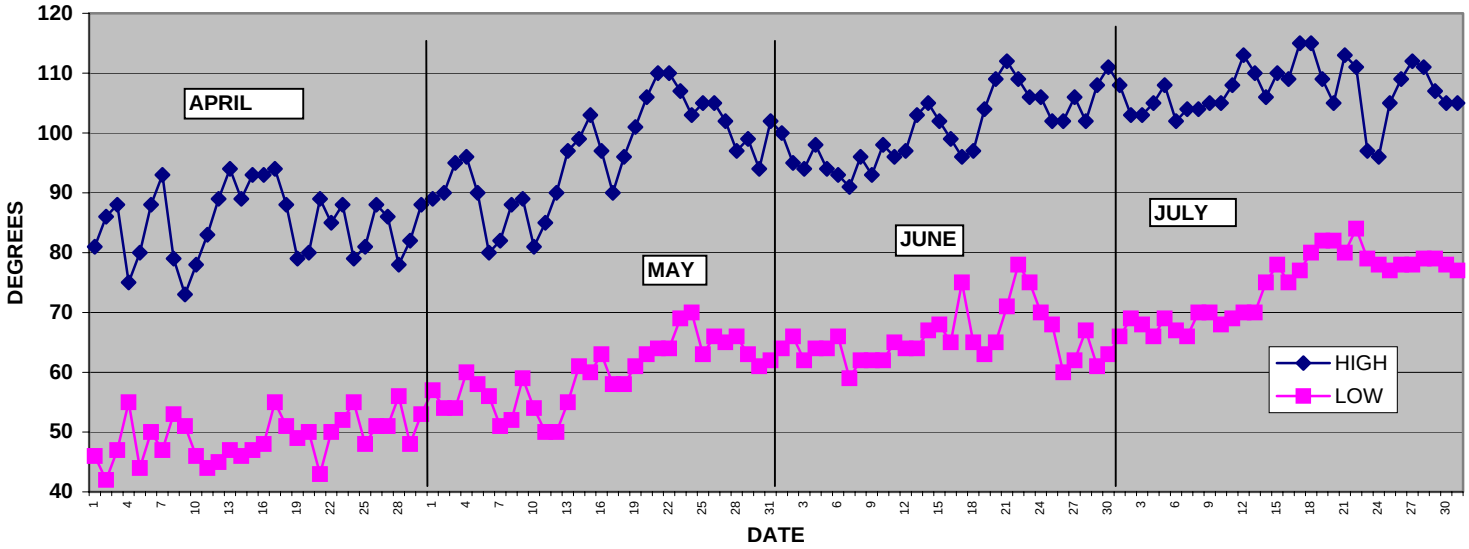

Table 1. Leaf chlorophyll data from DPL 494R cotton treated June 16, 2005, with second application of treatments containing BM86 on July 11, 2005.

		Treatment date						
Treatment	Rate/acre	June 16	July 11[1]	June 29	July 7	July 11	July 22	July 29
BM86	1 qt	x	x	44.1a	45.1a	41.7a	50.4a	50.4a
BM 86 + Mepiquat chloride	1 qt 12 oz	x	x	46.3a	48.2a	43.1a	54.3a	54.7a
Mepiquat chloride	16 oz	x		46.6a	45.6a	44.2a	52.4a	54.1a
Untreated check	----			42.5a	43.9a	39.9a	52.3a	52.1a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).
[1] Treatments on this date resulted in less than listed amounts of product. See methods and material section for exact details.

Table 2. Leaf chlorophyll data from DPL 449BR cotton treated June 16, 2005, with second application of treatments containing BM86 on July 11, 2005.

		Treatment date						
Treatment	Rate/acre	June 16	July 11[1]	June 29	July 7	July 11	July 22	July 29
BM86	1 qt	x	x	41.7 d	39.8 c	42.6ab	50.3 b	52.9a
BM 86 + Mepiquat chloride	1 qt 12 oz	x	x	46.2ab	45.6 b	42.8ab	56.8a	53.7a
Mepiquat chloride	16 oz	x		44.2 bc	50.2a	43.3ab	53.8a	55.9a
Mepiquat chloride	24 oz	x		47.1a	------	45.2 b	54.7a	56.5a
Untreated check	-----			42.8 cd	40.7 c	40.4a	48.8 b	54.6a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).
[1] Treatments on this date resulted in less than listed amounts of product. See methods and material section for exact details.

Table 3. Plant heights, nodes, height to node ratios, first fruiting node and total fruiting nodes of DPL 449BR cotton on June 29 after initial application on June 16, 2005.

Treatment and Rate/acre	Height (inches)	Nodes	Ht:node ratio	Fruiting nodes First	Fruiting nodes Total
BM86 @ 1 qt	36.8 b	19.8a	1.87a	2.2a	17.7a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	34.9ab	19.1a	1.85a	3.7 b	15.4 b
Mepiquat chloride @ 16 oz	31.4a	18.9a	1.66a	3.7 b	15.2 b
Mepiquat chloride @ 24 oz	30.7a	18.3a	1.68a	1.9a	16.4ab
Untreated check ----	36.8 b	19.2a	1.92a	3.2 b	16.1ab

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 4. Plant heights, nodes, height to node ratios, first fruiting node and total fruiting nodes of DPL 449BR cotton on July 11 after initial application on June 16, 2005.

Treatment and Rate/acre	Height (inches)	Nodes	Ht:node ratio	Fruiting nodes First	Fruiting nodes Total
BM86 @ 1 qt	40.3 bc	22.0a	1.83a	2.5a	19.4a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	34.7a	20.4a	1.69a	3.3a	17.1a
Mepiquat chloride @ 16 oz	34.8a	20.9a	1.65a	3.4a	17.6a
Mepiquat chloride @ 24 oz	36.1a	21.1a	1.72a	4.0a	17.1a
Untreated check ----	43.1 c	21.0a	2.04 b	3.9a	17.1a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 5. Plant heights, nodes, height to node ratios, first fruiting node and total fruiting nodes of DPL 449BR cotton on July 29 after initial application on June 16, 2005.

Treatment and Rate/acre	Height (inches)	Nodes	Ht:node ratio	Fruiting nodes First	Fruiting nodes Total
BM86 @ 1 qt	42.8 b	23.8a	1.80a	3.4a	20.4a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	38.3a	21.8a	1.76a	4.0a	17.8a
Mepiquat chloride @ 16 oz	37.7a	22.8a	1.73a	4.0a	18.9a
Mepiquat chloride @ 24 oz	37.8a	22.7a	1.68a	4.1a	18.5a
Untreated check ----	41.8 b	22.6a	1.85a	4.2a	18.5a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 6. Percent retention means of fruiting structures of DPL 449BR on June 29 after initial application on June 16, 2005.

	Fruiting position on node				
Treatment and Rate/acre	1st	2nd	3rd	1-2	1-3
BM86 @ 1 qt	71.2a	69.6a	80.2a	70.4a	73.7a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	72.3a	71.9a	83.5a	72.1a	75.9a
Mepiquat chloride @ 16 oz	69.8a	73.9a	81.4a	71.8a	75.6a
Mepiquat chloride @ 24 oz	63.4a	70.8a	80.3a	67.1a	71.4a
Untreated check ----	65.9a	69.1a	79.4a	67.5a	71.5a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 7. Percent retention means of fruiting structures of DPL 449BR on July 11 after initial application on June 16, 2005.

Treatment and Rate/acre	Fruiting position on node				
	1st	2nd	3rd	1-2	1-3
BM86 @ 1 qt	65.7a	68.4a	73.7a	67.0ab	69.2a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	65.6a	71.8a	71.7a	68.7a	69.7a
Mepiquat chloride @ 16 oz	63.2a	68.1a	71.3a	65.6ab	67.5a
Mepiquat chloride @ 24 oz	62.8a	64.8a	75.6a	63.8 b	67.7a
Untreated check ----	66.1a	69.4a	65.5a	67.7ab	67.0a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 8. Percent retention means of fruiting structures of DPL 449BR on July 29 after initial application on June 16, 2005.

Treatment and Rate/acre	Fruiting position on node				
	1st	2nd	3rd	1-2	1-3
BM86 @ 1 qt	50.1a	43.3a	34.2ab	46.7a	42.5a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	45.1a	34.4 b	31.0ab	39.8a	36.8a
Mepiquat chloride @ 16 oz	41.8a	40.8ab	34.7ab	41.3a	39.1a
Mepiquat chloride @ 24 oz	42.1a	40.2ab	38.1a	41.1a	40.1a
Untreated check ----	44.7a	34.7ab	24.9 b	40.2a	35.1a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 9. Mean calculated fruiting structures per plant at positions 1, 2, and 3 of fruiting nodes of DPL 449BR on June 29 after initial application on June 16, 2005.

	Fruiting position on node				
Treatment and Rate/acre	1st	2nd	3rd	1-2	1-3
BM86 @ 1 qt	12.6a	12.3a	14.2a	24.9a	39.2a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	11.1a	11.1a	12.9a	22.2a	35.1a
Mepiquat chloride @ 16 oz	10.6a	11.3a	12.4a	21.9a	34.3a
Mepiquat chloride @ 24 oz	10.5a	11.6a	13.3a	22.1a	35.4a
Untreated check ----	10.6a	11.1a	12.7a	21.7a	34.4a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 10. Mean calculated fruiting structures per plant at positions 1, 2, and 3 of fruiting nodes of DPL 449BR on July 11 after initial application on June 16, 2005.

	Fruiting position on node				
Treatment and Rate/acre	1st	2nd	3rd	1-2	1-3
BM86 @ 1 qt	12.8a	13.3a	14.3a	26.1a	40.4a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	11.2ab	12.3ab	12.3ab	23.5ab	35.8a
Mepiquat chloride @ 16 oz	11.0ab	12.0ab	12.5ab	23.0ab	35.4a
Mepiquat chloride @ 24 oz	10.7 b	11.0 b	13.0ab	21.8 b	34.7a
Untreated check ----	11.3ab	11.9ab	11.2 b	23.2ab	34.4a

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 11. Mean calculated fruiting structures per plant at positions 1, 2, and 3 of fruiting nodes of DPL 449BR on July 29 after initial application on June 16, 2005.

	Fruiting position on node				
Treatment and Rate/acre	1st	2nd	3rd	1-2	1-3
BM86 @ 1 qt	10.2a	8.9a	7.0a	19.1a	26.0a
BM 86 @ 1 qt + Mepiquat chloride @ 12 oz	8.0ab	6.1 b	5.5a	14.1 b	19.6 b
Mepiquat chloride @ 16 oz	7.8 b	7.7ab	6.6a	15.5ab	22.1ab
Mepiquat chloride @ 24 oz	7.9ab	7.6ab	7.0a	15.5ab	22.5ab
Untreated check ----	8.2ab	6.6 b	4.7a	14.9 b	19.5 b

Means in columns followed by the same letter are not statistically different at the P<0.05 level (Fisher's LSD test).

Table 12. Lint yields and quality parameters of DPL 449BR/DPL494RR cotton.

Treatment and rate/acre		Seed Cotton lbs./acre	Lint Yield lbs./acre	Percent turnout	Color Grade	Leaf
BM86	1 qt	4,700a	1,566 bc	32.39	2.33a	3.0 b
BM86 + Mepiquat chloride	1 qt 12 oz	4,540a	1,810a	39.05	2.27a	2.27a
Mepiquat chloride	16 oz	4,895a	1,520 c	30.35	2.11a	2.67ab
Mepiquat chloride	24 oz*	4,677a	1,571 bc	33.83	2.33a	2.42a
Untreated check	------	4,703a	1,681ab	35.21	2.30a	2.60ab

Treatment and rate/acre		Staple	Length Inches	Mic	Strength g/tex	Unif
BM86	1 qt	35	1.08	4.9c	29.9a	80.0c
BM86 + Mepiquat chloride	1 qt 12 oz	35	1.08	4.8b	27.4e	80.1b
Mepiquat chloride	16 oz	35	1.08	4.7a	27.6d	80.4a
Mepiquat chloride	24 oz*	35	1.08	4.9c	28.2c	80.1c
Untreated check	------	34	1.07	4.9c	29.3b	80.0b

Treatment and rate/acre		Color Rd	Color + b	Trash	$ value (¢/lb)	Value/ acre($)
BM86	1 qt	79.27a	8.41 c	1.56a	57.99a	908.11
BM86 + Mepiquat chloride	1 qt 12 oz	81.44 d	7.62a	2.0 b	57.21a	1,035.49
Mepiquat chloride	16 oz	81.04 c	7.84 b	2.0 b	57.98a	881.36
Mepiquat chloride	24 oz*	80.75 cd	7.84 b	2.0 b	57.98a	910.89
Untreated check	------	80.10 b	8.26 c	1.90ab	51.01 b	857.51

**Data for this treatment consisted of 46 rows DPL 449BR and 2 rows DPL 494R cotton.*
Means in sub-columns followed by the same letter are not statistically different at the $p \leq 0.05$ level (Fisher's Least Significant Difference test).