EVALUATION OF THE EFFICIENCY OF BM 86 IN COTTON

Ederaldo José Chiavegato
University of São Paulo/Esalq
Piracicaba, SP - Brazil
Carlos Eduardo Carneiro Ballaminut
University of São Paulo/Esalq
Piracicaba, SP - Brazil

Abstract

In cotton, high retention of fruiting structures and increases in lint production, can lead to a better development and growing balance in the plant and consequent crop cycle regulation. To aid in the process of pollination, fructification and fruit retention, biostimulant applications are tested in cotton. Goemar Laboratories has developed a wide range of "physioactivators" in which BM 86 is designed for cotton applications. BM 86 is based on the active ingredient GA 142 (extract based from *Ascophyllum nodosum*) and field trials were conducted with the objective to understand the effects in Brazilian cotton. The variety used was FMT 701, with eight replications in a randomized complete block design. In general, cotton seed yield increased with higher product rates; however the split applications proved to be significantly more efficient. BM 86 applied two times using the rate of 1.25 L/ha (17.1 oz./acre) and applied three times at the rate of 0.8 L/ha (10.9 oz./acre), led to increases of 13.8% and 12.6% of cotton seed, respectively.

Introduction

Cotton acreage in Brazil, after a long period of decline in harvested area mainly due to economic factors and furthermore by production systems that were adopted (smaller areas), has had a recovery in area since the 1996/97 season. Cotton production in 1996/97 was 0.3 million tons of lint (1.4 million bales), reaching 1.6 million tons (7.4 million bales) in the 2007/08 season, corresponding to a harvested area of 1.1 million ha (2.7 million acres) (CONAB, 2008). This increase in area is based on the expansion of planted areas into new regions, in particular into the Cerrado region, and by the adoption of new technologies used in these new areas, such as extensive farming, total crop mechanization and intensive use of agricultural inputs. In this way, different varieties, nutritional and hormonal management have been distinguished as strategies to increase yield and fiber quality.

To aid in the processes of pollination, fructification and fruit retention, biostimulant applications are common in some horticultural crops. Reports in literature indicate that Polyamines are substances that are naturally present in plants aiding as growth promoters, by cell multiplication and differentiation during blooming and initial fruit development (Costa et al., 1984). However, today there is limited information about Polyamines applications in cotton. Recent observations have demonstrated that exogenous application of Putrescine (one of the main Polyamines) increased the level of Putrescine in cotton flowers, associated with increasing seed set, which can lead to a decrease in the stress caused by high temperature (Bibi et al., 2008b).

Goemar BM 86 applications increased the total number of seeds, however the final number of harvested seeds was not affected (Bibi et. al, 2008a). Yield cotton increases were obtained with BM 86/Mepiquat Chloride applications in Acala cotton, associated to higher number of bolls per plant. However, no consistent monitoring has identified specific locations of the plant responsible for the increased number of bolls (Kelly, et al., 2006).

In cotton, a high retention of fruiting structures and an increase in lint production, can lead to improved balance between the plant's development and growth and consequent regulation in the crop season, important to Brazilian production conditions. With the objective to understand the effects of BM 86 (Goemar Laboratories, Saint Malo, France) in Brazilian cotton, preliminary studies have begun in Brazil.

Material and Methods

Field trials were conducted in the 2007/2008 season in an experimental area located in Holambra, São Paulo state, Southeastern region of Brazil. The region's climate is classified as a type of "CWA" (Meso-thermal weather, humid, subtropical with a dry winter), presenting annual precipitation of 1200 mm (47.24 in.). The variety used was FMT 701. A randomized complete block design with eight replications was used. The plot size was 4 rows of 5 m (16.4 ft.) in length, spacing between rows of 0.85 m (2.8 ft.), and with a population 10 plants per lineal meter (3 plant/ft.).

Planting was on 12/01/2007, with first squares and first white flower occurring 29 and 66 days after emergence (dae), respectively. Fertilizing program and the necessary cultural treatments were performed during the crop season to ensure good plant development, including growth regulators (Mepiquat Chloride) for plant height control.

BM 86 (Goemar Laboratories, Saint Malo, France) is based on the active ingredient GA 142 (algae filtrate derived from *Ascophyllum nodosum*) and combined with the nutrients Nitrogen (5% as Urea), Magnesium (2.4%), Sulfur (3.2%) Boron (2.0% and Molybdenum (0,02) was applied with a backpack CO_2 sprayer using the equivalent of 150 liters of tank mix/ha (16.0 gal./acre).

Treatments:
1. Untreated control;
2. BM 86 - 2.0 L/ha (27.4 oz./acre) at pre-blooming (61 dae);
3. BM 86 - 2.5 L/ha (34.2 oz./acre) at pre-blooming (61 dae);
4. BM 86 - 3.0 L/ha (41.1 oz./acre) at pre-blooming (61 dae);
5. BM 86 - 1.5 + 1.5 L/ha (20.5 + 20.5 oz./acre) at pre-blooming (61 dae) +15 days after the first (76 dae);
6. BM 86 - 0.8 + 0.8 + 0.8 L/ha (10.9 + 10.9 + 10.9 oz./acre) at pre-blooming (61 dae) + 15 (76 dae) and 30 days after the first (91 dae).

Plant height measurements were collected 108 days after emergence, with ten plants randomly selected from the two central rows of each plot. Manual harvests of each plot were performed on 166 and 192 dae, respectively, of all the plants in the two central rows. By the time of the first harvest, a plant mapping of five plants per plot was completed, to determine the percentage of boll retention in the positions 1 (P1), 2 (P2), percentage of boll retention on the top, middle, and bottom plant positions, and the total number of fruiting branches. The data obtained was submitted to statistical analysis through the F test and the compared averages by a Duncan test at a probability level of 5%. The rainfall recorded in millimeters during the application period and cotton crop season, is found in Figure 1.

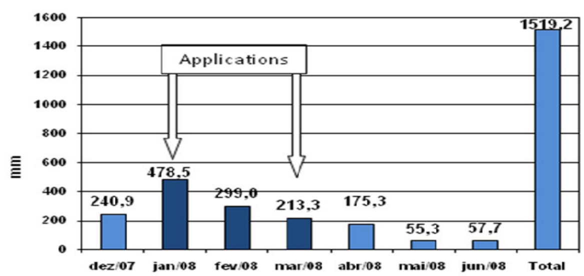

Figure 1. Total rainfall (monthly average) and applications during the cotton season 2007/2008. Holambra, SP

Results and Discussion

During the 2007/2008 season, throughout all of Brazil's cotton regions, climatic conditions were not common when compared to other years, experiencing higher rainfall throughout the cotton season. In the Southeastern region, where the experiment was conducted, rainfall amount was 1519,2 mm (59.8 in.), accumulating 990,9 mm (39 in.) from January through May, precisely during the blooming and fructification periods. The high number of cloudy and rainy days resulted in low levels of luminosity, causing high levels of reproductive structural abortion, strong vegetative development and while moreover extending the season, nearly to 192 days, about 40 days longer than usual.

BM 86 applications were applied during this period of high precipitation and low luminosity, during February and March of 2008 (512.3 mm or 20.2 in.), which were not favorable to the fixation of reproductive structures.

Concerning plant height measurements, only one evaluation was performed at 108 dae (17 days after the applications). As it is verified in Table 1, plant height was not changed significantly between treatments, although lower than the control. Other evaluations were planned for, by occasion of physiological maturity and at harvest time, however unfortunately were unable to measure due to climatic conditions harming normal plant development.

Table 1. Plant height in 108 days after emergence. Holambra, SP, 2007/2008.

Treat.	Rate L/ha or (oz./acre)	Time of Application	Height-cm or (in.) (108 dae)
1. Untreated Control	-	----	141,1 (55.5) a
2. BM 86	2,0 (27.4)	Pre-blooming	139,1 (54.8) a
3. BM 86	2,5 (34.2)	Pre-blooming	132,9 (52.3) a
4. BM 86	3,0 (41.1)	Pre-blooming	131,8 (51.9) a
5. BM 86	1,25+1,25 (20.5+20.5)	Pre-blooming + 15 days after the first	138,1 (54.4) a
6. BM 86	0,8+0,8+0,8 (10.9+10.9+10.9)	Pre-blooming + 15 e 30 days after the first	131,1 (51.6) a

In Table 2 the seed cotton average was 4043.2 Kg/ha (3632.8 Lbs./acre), a value considered reasonable given the climatic conditions. Cotton lint yield was partially compensated due to the longer crop cycle (192 dae), with new fruit retention in the top positions. Treatments 5 and 6 must be highlighted, corresponding to multiple product applications, yielding, respectively, 13.8% and 12.6% more than the untreated control. However, it was not statistically different to the other treatments. These same treatments also had an earlier harvest, in other words, more than 70% of the harvest was at the first picking. As there weren't significant differences in the boll weight among treatments, it can be inferred that the increase in production verified in treatments 5 and 6 are attributed to higher boll retention per plant.

Table 2. Cotton seed yield, harvest precocity, yield efficiency and boll weight. Holambra, SP, 2007/2008.

Treat.	Harvest 1 Kg/ha or (Lbs./acre)	Harvest 2 Kg/ha or (Lbs./acre)	Precoc. %	Total Harvest Kg/ha or (Lbs./acre)	Efficiency (%)	Boll (g)
1. UC	2435,3 c (2191.0)	1305,9 ab (1174.9)	65,1	3741,2 b (3365.9)	-	6,5 a
2. BM 86	2694,1 bc (2423.8)	1223,5 ab (1100.8)	67,4	4000,0 ab (3598.7)	6,9	6,6 a
3. BM 86	2635,3 c (2370.9)	1364,7 a (1227.8)	65,9	4000,0 ab (3598.7)	6,9	6,6 a
4. BM 86	3141,2 a (2826.1)	917,6 b (825.6)	77,6	4047,1 ab (3641.1)	8,2	6,5 a
5. BM 86	3011,8 ab (2709.7)	1200,0 ab (1079.6)	70,7	4258,8 a (3831.5)	13,8	6,7 a
6. BM 86	3058,8 ab (2752.0)	1152,9 ab (1037.2)	72,6	4211,8 a (3789.3)	12,6	6,4 a

For boll distribution analysis and its participation in cotton yield, it is important to consider the climatic conditions that occurred during the year (rainfall amount). There was no verification of significant differences between treatments for boll retention in the first position (P1) bolls, according to table 03. In the second position (P2), advantages were found in treatments 4 (higher rate of BM 86) and treatment 5 (multiple application), differing statistically only to the untreated control. The higher percentage of fruit retention in treatment 5 for the second position (P2) was a determinate for yield increases in cotton seed.

Table 3. Percentage of boll retention in the positions 1 (P1) and 2 (P2) in the plants. Holambra, SP, 2007/2008.

Treat.	Rate L/ha or (oz./acre)	Boll retention (%)	
		P1	P2
1. Untreated Control	-	63,5 a	24,6 b
2. BM 86	2,0 (27.4)	63,1 a	32,7 ab
3. BM 86	2,5 (34.2)	62,7 a	32,8 ab
4. BM 86	3,0 (41.1)	57,2 a	37,0 a
5. BM 86	1,25 + 1,25 (20.5 + 20.5)	60,2 a	35,2 a
6. BM 86	0,8 + 0,8 + 0,8 (10.9 + 10.9 + 10.9)	66,3 a	32,1 ab

In relation to fruit distribution (Table 4), multiple applications of BM 86 (treatment 6) presented the best results in fruit retention found in the lower area, but with lower fruit retention in the middle section of the plant comparing to the other treatments. The higher percentage of fruit retention in the lower part of the plant was essential to reach higher yields. Fruit retention in the top and the number of fruiting branches did not vary statistically between treatments. Significant differences were not observed as regards to the number of fruiting branches between treatments.

Table 4. Percentage of boll retention in the Top, Middle and Bottom position and number of fructiferous branches in the plants. Holambra, SP, 2007/2008.

Treat.	Rate L/ha or (oz./acre)	Boll retention (%)			Fruiting branches
		Top	Middle	Bottom	
1. Untreated Control	-	12,2 ab	37,6 a	50,2 b	11,6 a
2. BM 86	2,0 (27.4)	10,8 ab	38,9 a	50,1 b	11,5 a
3. BM 86	2,5 (34.2)	11,0 ab	38,3 a	51,4 b	11,4 a
4. BM 86	3,0 (41.1)	9,1 b	39,7 a	51,3 b	11,2 a
5. BM 86	1,25+1,25 (20.5+20.5)	13,0 a	38,9 a	48,1 b	12,0 a
6. BM 86	0,8+0,8+0,8 (10.9+10.9+10.9)	12,1 ab	29,6 b	58,5 a	11,2 a

Summary

In general, cotton seed yield increased with higher product rates; however the split applications proved to be significantly more efficient. BM 86 applied two times using the rate of 1.25 L/ha (42.3 oz./acre) and applied three times at the rate of 0.8 L/ha (10.9 oz./acre), led to increases of 13.8% and 12.6% of cotton seed, respectively.

Regarding the studies concerning boll retention, data was inconsistent, affected by excessive rainfall after "cut out", interfering with normal plant development. As it is known, with the predominance of major environmental factors, as it was the case in this year (climatic conditions), supplant other variables that could be more expressive in conditions or years more favorable to the crop.

References

Bibi, A., and Oosterhuis, D. M. 2008a. Polyamines during cotton reproductive development as affected by nodalposition and a plant growth regulator. Beltwide Cotton Conference, Nashiville, Tennessee, January 8-11, 14-17.

Bibi, A., and Oosterhuis, D. M. 2008b. Exogenous application of Putrescine on cotton ovaries under two temperature regimes. Beltwide Cotton Conference, Nashiville, Tennessee, January 8-11, 109-112.

CONAB – Companhia Nacional de Abastecimento. Avaliação da Safra Agrícola 2007/2008 – Novembro/2008. Ministério da Agricultura, Pecuária e Abastecimento.

Costa, G., Baraldi, R., and Bagbi, N. 1984. Influence of Putrescine on Fruit-set of Apple. Acta Horticultural. 149:189-195.

Kelly, S., Munk, D. S., and Wroble, J. F. 2006. Crop performance evaluation of Goemar BM 86 on Acala and Pima. Beltwide Cotton Conference, San Antonio, Texas, January 3-6, 2081-2082.