2002 BELTWIDE COTTON CONFERENCES, ATLANTA, GA – JANUARY 8-12

POTENTIAL OF COTTON TRANSPLANTS AND RHIZOBACTERIA TO SHORTEN THE GROWING SEASON

N.W.Greer, K.S. McLean and J.W. Kloepper
Department of Entomology and Plant Pathology
Auburn University
Auburn, AL

Abstract

Field tests in northern and central Alabama were conducted to assess cotton transplants with and without plant growth-promoting rhizobacteria (PGPR) with the objective of extending the northern range of the cotton producing area. Transplants were prepared using PayMaster 1218 BG/RR cotton seed grown in styrofoam trays with an individual cavity size of 3.2 x 3.2cm containing a volume of 35cc. A commercial preparation, BioYield™, which contains *Paenobacillus subtilis* strain GBO3 and *Bacillus amyloliquefaciens* strain IN937a was added into the soil-less medium prior to planting in some treatments. Three and four week old seedlings were manually transplanted into two fields. Stand counts, mapping data, and harvest data were collected. Data indicate that cotton transplants matured earlier than direct seeding and that the addition of PGPR in the transplant system further enhanced maturity. These results indicate that transplanted cotton has the potential for an earlier harvest. More research needs to be done to find the full potential of this transplanting system and specifically to optimize transplant age and density in the field.

Introduction

Rhizobacteria are bacteria that aggressively colonize roots (Schroth and Becker 1990). Beneficial rhizobacteria are termed plant growth promoting rhizobacteria (PGPR). PGPR have been shown to promote plant growth and reduce disease incidence on many commercial crops such as peanut, potato, tomato, cucumber, and cotton (Kloepper 1993). A few PGPR-based products have been developed and are available for use, such as, Kodiak® (*Bacillus subtilis*) which is labeled as a seed treatment (Gustafson LLC), Recharge *(Azosporillum brasilence*) which is labeled on turf (Ecosoil Systems, Inc.), and BioYield™ (*Paenobacillus macerans* + *B. amyloliquifaciens*) which is marketed for tomato and pepper growth promotion (Gustafson LLC). BioYield™ is used in soil-less media used to prepare transplants for the field. It results in systemic disease protection and significant root and shoot growth promotion. This project aims at applying some of the previous work with PGPR to cotton and testing the feasibility of extending the northern range of the cotton producing area via the use of PGPR-treated transplants.

Materials and Methods

Transplants

Field experiments to test PGPR-treated transplants were initiated at the beginning of the 2001 cotton season. Cotton cultivar, Paymaster 1218 BG/RR, was used for this test. There were four different transplant treatments. Two treatments with and two treatments without a commercial preparation BioYield™, which contains *Paenobacillus macerans* strain GBO3 and *B. amyloliquifaciens* strain IN937a which was on a chitosan medium. BioYield™ was mixed with a soil-less medium and put into styrofoam trays with an individual cavity size of 3.2 x 3.2 cm containing a volume of 35 cc. Non-treated transplants were prepared in a similar manner. One cotton seed was then planted into each cavity of the trays. Transplants were placed in the greenhouse and grown to three and four weeks old, where they were then manually planted in the field at a rate of two plants per foot.

Seeding

There were also two direct seeding treatments for comparison of the transplants. One was a non-treated direct seeding and the other was an in-furrow spray, which contained a BioYield™ powder mixed with water. The BioYield™ in-furrow spray was applied at seeding by an 8002E nozzle mounted on the cotton planter and calibrated to deliver 6 GPA at 18 PSI. Cotton was seeded at a rate of five seeds per foot by a mechanical planter. All data were analyzed using ANOVA and means were compared using Fisher's protected LSD.

Results and Discussion

Cotton emergence and survival was observed at three intervals early in the season at both locations (Table 1 & 2). At the E. V. Smith Research Center there was no difference in the percent healthy stand among all the treatments, but at the Tennessee Valley Research Center the healthy stand of the direct seeding was lower than that of all the transplant treatments. At

Tennessee Valley the healthy stand ranged from 99% for the 4-week-old without BioYield™ treatment to 48% for the seeding with BioYield™ at seven weeks after planting. Plant mapping conducted throughout the season indicated differences in growth. There were some differences in the maturity between the transplants and the direct seeding (Table 3 & 4). In E.V. Smith at 71 days after planting (DAP) the number of bolls was greater for the transplants than for the seeding treatments. This also occurred at Tennessee Valley at 98 DAP for all of the transplant treatments compared to the non-treated control. Also at both locations open bolls occurred on the transplants before the direct seeding treatments, exhibiting earlier maturity for the transplants. Seed cotton yield was taken at the conclusion of the season indicating that at the E. V. Smith Research Center there was a significant decrease in the yield of the transplants (Table 5). This decrease in yield could be from the loss of transplants to shock early in the season. At the Tennessee Valley Research Center the yields were not significantly different (Table 5). Although, there was a 141 lb./A increase in the average yield of the BioYield™ treated transplants over the direct seeding treatments. There was also a 373 lb./A increase in the average yield of the BioYield™ treated transplants over the transplants without BioYield™.

In conclusion, data indicate that cotton transplants matured earlier than direct seeding and that the addition of PGPR in the transplant system further enhanced maturity. These results indicate that transplanted cotton has the potential for an earlier harvest. More research needs to be done to find the full potential of this transplanting system and specifically to optimize transplant age and density in the field.

Table 1. Healthy stand at E.V. Smith Research Center, 2001.

Treatment	14 DAP	28 DAP	42 DAP
4-week-old transplants with BioYield™	79.3	76.3	75.3
3-week-old transplants with BioYield™	84.0	77.0	76.7
4-week-old transplants without BioYield™	91.3	87.7	86.3
3-week-old transplants without BioYield™	80.7	75.3	73.3
Non-treated control	81.0	74.3	77.0
Seeding with BioYield™	76.0	64.2	68.3
LSD ($P = 0.05$)	11.3	10.8	12.4

Table 2. Healthy stand at Tennessee Valley Research Center, 2001.

Treatment	14 DAP	28 DAP	49 DAP
4-week-old transplants with BioYield™	80.5b*	80.5b	79.0b
3-week-old transplants with BioYield™	93.5ab	92.0ab	89.5ab
4-week-old transplants without BioYield™	100.0a	99.5a	99.0a
3-week-old transplants without BioYield™	97.5a	96.5a	95.0a
Non-treated control	45.8c	49.8c	51.3c
Seeding with BioYield™	46.0c	50.3c	48.3c
LSD ($P = 0.05$)	14.9	14.4	13.7

*Means within columns followed by the same letter are not significantly different according to FLSD ($P = 0.05$).

Table 3. Maturity differences at E.V. Smith Research Center, 2001.

Treatment	71 DAP # of Bolls	110 DAP Bolls Opening
4-week-old transplants with BioYield™	4.5ab*	Yes
3-week-old transplants with BioYield™	4.3ab	Yes
4-week-old transplants without BioYield™	5.3a	Yes
3-week-old transplants without BioYield™	3.4b	Yes
Non-treated control	0.9c	No
Seeding with BioYield™	1.3c	No
LSD ($P = 0.05$)	1.41	

*Means within columns followed by the same letter are not significantly different according to FLSD ($P = 0.05$).

Table 4. Maturity differences at Tennessee Valley Research Center, 2001.

Treatment	98 DAP # of Bolls	119 DAP Bolls Opening
4-week-old transplants with BioYield™	7.7a*	Yes
3-week-old transplants with BioYield™	6.7ab	No
4-week-old transplants without BioYield™	5.3bc	Yes
3-week-old transplants without BioYield™	4.8c	No
Non-treated control	4.7c	No
Seeding with BioYield™	4.9bc	No
LSD ($P = 0.05$)	1.87	

*Means within columns followed by the same letter are not significantly different according to FLSD ($P = 0.05$).

Table 5. Seed Cotton Yield at both locations, 2001.

Treatment	Seed Cotton lb./A E. V. Smith	Seed Cotton lb./A Tennessee Valley
4-week-old transplants with BioYield™	2728.0b*	3102.0
3-week-old transplants with BioYield™	2802.8b	3154.8
4-week-old transplants without BioYield™	2807.2b	2758.8
3-week-old transplants without BioYield™	2811.6b	2752.2
Non-treated control	3308.8a	3102.0
Seeding with BioYield™	3440.8a	2871.0
LSD ($P = 0.05$)	452.0	703.3

*Means within columns followed by the same letter are not significantly different according to FLSD ($P = 0.05$).