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YIELD AND YIELD CONTRIBUTING CHARACTERS OF COTTON AS AFFECTED BY GENOTYPES AND SHADING WITH JACKFRUIT TREES IN MADHUPUR TRACT OF BANGLADESH

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ABSTRACT

A field experiment was carried out at the Central Cotton Research, Training and Seed Multiplication Farm at Sreepur, Gazipur during the period from August 2005 to March 2006 to evaluate the performance of five cotton genotypes in regard to yield contributing characters and yield of seed cotton at different distances from the base of jackfruit tree. The experiment was laid out in Complete Randomize Design (concentric rows of crop at different distances around single tree with five cotton genotypes) with four replications. Cotton genotypes i.e. CB-8, CB-9, CB-3, CB-10 and SR-05 were considered as factor A and distances of cotton genotype rows from jackfruit tree were (1m, 2m and 3m distance from tree base) considered as factor B. Cotton genotypes responded differently in terms of all studied parameters due to variation of distances from the tree base. Yield attributes of cotton genotypes i.e., number of boll per plant, boll length, boll diameter, boll weight and seed cotton yield were found better under open field condition. Among the genotypes, SR-05 produced significantly the highest seed cotton yield under open field condition which was followed by CB-10, CB-3 and CB-9. Among the three distances, the farthest distance (3 m from tree base) gave higher yield. At this distance (3 m), CB-10 genotype gave higher yield followed by CB-3 and SR-05 genotypes. At middle distance (2 m), CB-10 genotype produced higher yield, which was identical to SR-05. At the closest distance (1 m from the tree base), CB-10 produced the highest seed cotton yield, which was identical to SR-05. Interestingly, CB-8 produced the lowest yield at all distances from the tree base. The study revealed that the entire tested genotypes produced higher seed cotton yield under open field condition, while yield recorded at the partial shade provided by jackfruit was lower, but yield recorded at the farthest distance (3m) except CB-8 genotype was comparable or even higher with regard to national average.

Key Words: cotton genotype, yield and jackfruit tree

INTRODUCTION

Cotton (*Gossypium hirsutum*) is an important natural fiber in the world (Munro, 1994). It is grown primarily as a fiber crop, but after the lint, the long, twisted unicellular hairs are removed by ginning, the seed can be crushed to extract vegetable oil and protein rich animal food (Mathews, 1989). In many countries, cotton is a major cash crop and basis for national textile industry and source of foreign exchange. It is one of the important fibers as raw material for textile industry in Bangladesh. Before independence, raw cotton requirement of our textile industry was met from the then West Pakistan. After independence, local textile industry faced serious problems for inadequate-supply of raw cotton. In Bangladesh, the annual requirement of raw cotton for textile industry is estimated at 1.7-1.8 million bales against the local production of about 0.1 million bale.

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Though cotton is an important raw material, but the relative weightage of cotton with in the cropping system scenario is rather marginal. The area under cotton cultivation ranges only between 0.08 percent (1987-1988) and 0.27 percent (1996-1997) of the total cropped area, respectively (BBS, 2000). The production of American cotton in Bangladesh started since mid 1970s. Since 1977-1978 growing season, country's total area under cotton production experienced a grater jump from one thousand ha to over 24 thousand ha in mid-eighties. During the recent year, there has been a great deal of fluctuations in area under cotton, generally showing down trend. The area and production seemed to have stabilized at around 45000 ha and 85000 bales (Alam, 2005). It is estimated that the country has at least 250000 ha of land suitable for cotton cultivation (Alam, 2005).Under this alarming condition, it is necessary to find out a sustainable alternative to overcome the current demand of cotton. Therefore, there is a need to develop new approaches to intensify agriculture to fulfill the diversified cotton production requirements of the rapidly growing population. There is an opportunity for expanding cash crop including cotton production by growing them in unutilized space under tree species either fruit tree, timber tree or growing trees and crops in margin land or char land, which is now called agroforestry.

In Bangladesh, cotton is generally grown in upland areas. A good number of high yielding cotton genotypes have been released for cultivation in Bangladesh. The main cotton genotypes grown in central terrace ecosystem are CB-3, CB-8, CB-9, and CB-10. A potential advanced line SR-05 has been developed by Sreepur cotton farm, which is awaiting for release. However, none of the genotype has been tested in partial shade or tree-crop association. The aforementioned discussion revealed that jackfruit based agroforestry system is a potential agroforestry practice in terrace ecosystem especially in Gazipur district, while cotton is an important cash crop in this land type also. Like other crops, opportunity of growing cotton in association with jackfruit needs to be explored. The positive response of this practice could be a new era of cotton production in Bangladesh and elsewhere in the world. With this view in mind, the study was undertaken to examine the yield and yield contributing characters of cotton genotypes grown in association with jackfruit tree; and to identify suitable cotton genotypes for jackfruit based agroforestry production system.

MATERIALS AND METHODS

A field experiment was carried out at the Central Cotton Research, Training and Seed Multiplication Farm at Sreepur, Gazipur during the period from August 2005 to March 2006. The experiment was laid out in Complete Randomize Design (concentric rows of crop at different distances around single tree with five cotton genotypes) with four replications. Cotton genotypes i.e. CB-8, CB-9, CB-3, CB-10 and SR-05 were considered as factor A and distances of cotton genotype rows from jackfruit tree were (1m, 2m and 3m distance from tree base) considered as factor B.

Sampling procedure

Five plants from each plot were randomly selected at the early growth stage in each plot and following data were recorded on square of each plant, flowers of each plant, number of days to first flowering, number of days to first boll bursting, boll length, boll diameters, weight of boll, number of bolls of each plant, and, yield. Seed cotton was harvested in four picking. The harvesting of seed cotton was started at 180 DAS. Yields of cotton genotypes were determined and converted to tha^{-1}. Data on various yield contributing parameters of cotton genotypes were statistically analyzed using MSTAT-C software to examine the significant variation of the results due to different treatments. Treatment mean was compared by DMRT at 5% level of significance.

RESULTS AND DISCUSSION

Square per plant

The number of squares per plant of cotton genotypes grown in different distances from base of jackfruit tree and open field was significant.

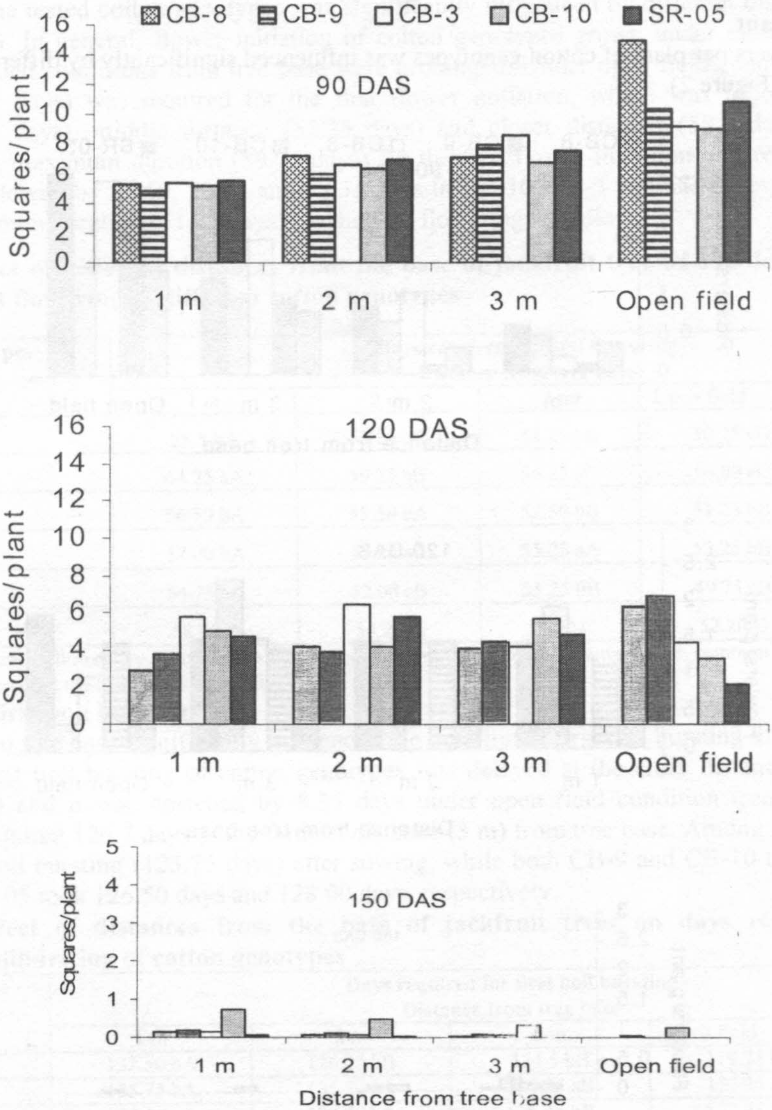

Figure 1. Squares per plant of cotton genotypes grown under different distances from tree base and in open field at 90, 120 and 150 DAS

The highest number of squares per plant (10.87) was observed in the open field condition (Figure 1). The lowest number of squares per plant (5.26) was found at closer distance (1 m) from tree base. Similarly, number of squares per plant from among different genotypes varied significantly. At 90 DAS, the highest number of squares per plant (8.64) was recorded in CB-8 and the lowest number of squares per plant (6.83) was observed in CB-10 genotype.

Flowers per plant

Number of flowers per plant of cotton genotypes was influenced significantly by different distances from tree base (Figure 2).

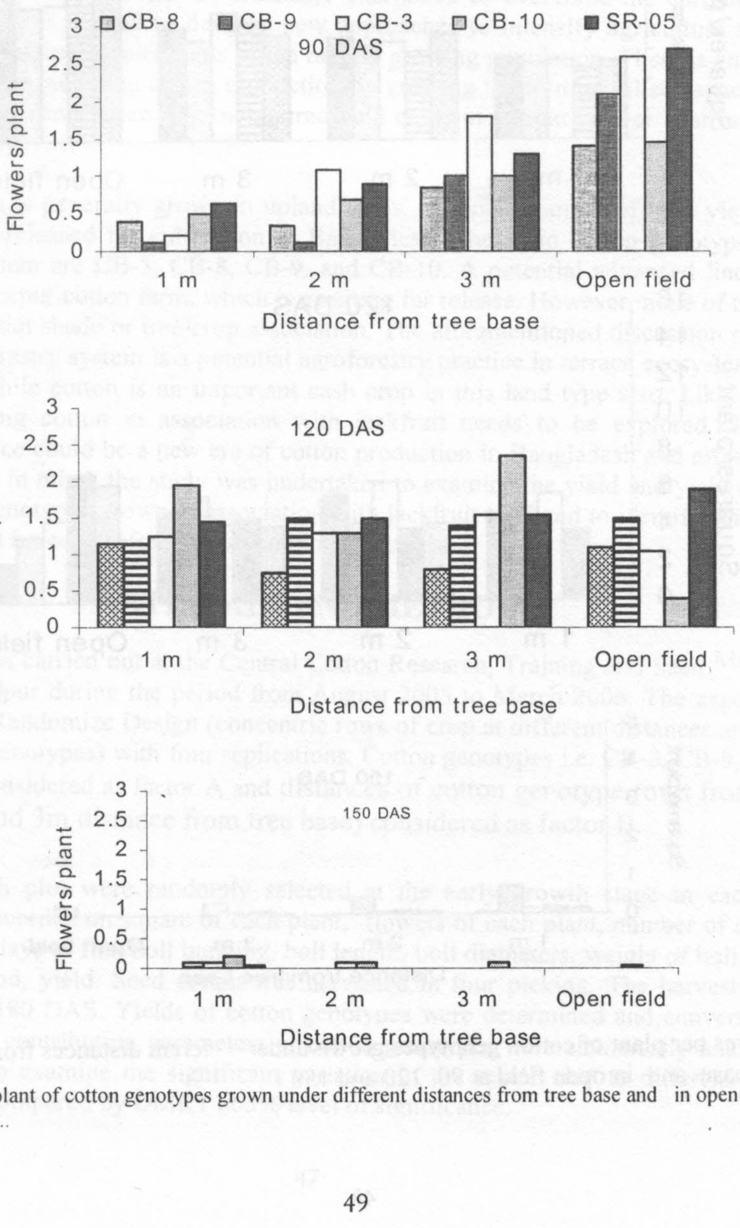

Figure 2. Flowers per plant of cotton genotypes grown under different distances from tree base and in open field at 90, 120 and 150 DAS..

Among the different crop row positions, the highest number of flower per plant (2.05) was recorded at open field condition, which was followed by the farthest (3 m) distance from tree base. Among the genotypes, the highest number of flowers per plant (1.43) was found in CB-3, which was identical with SR-05 (1.39). The lowest number of flowers per plant was found in CB-8 (0.75).

Duration of first flowering

The cotton genotypes were found indeterminate in flowering habit. Time required for the first flowering of the tested cotton genotypes was significantly influenced by different distances form tree base (Table 1). In general, flower initiation of cotton genotypes grown under closer distances i.e., maximum shaded conditions from tree base were prolonged. Under open field condition, the shorter duration (52.1 days) was required for the first flower initiation, which was followed by farthest distance (53.5 days), middle distance (55.25 days) and closer distances (58.2 days). Among the genotypes, the maximum duration (59.06 days) for the first flower initiation was recorded in CB-9, which was followed by 55.69, 53.94 and 53.31 days in CB-10, CB-3 and CB-8, respectively. SR-05 required minimum duration (51.94 days) for the first flowering initiation.

Table 1. Effect of different distances from the base of jackfruit tree on the days required for first flowering of different cotton genotypes

Genotypes	Days required for first flowering Distance from tree base				
	1 m	2 m	3 m	Open field	Mean
CB-8	58.5 bA	52.25 cB	52.25 bB	50.25 cB	53.31 cd
CB-9	64.25 aA	59.25 aB	56.25 aC	56.00 aC	59.06 a
CB-3	56.50 bA	55.50 bA	52.50 bB	51.25 bB	53.94 c
CB-10	57.00 bA	57.25 aA	55.25 aA	53.25 bB	55.69 b
SR-05	54.75 cA	52.00 cB	51.25 bB	49.75 cB	51.94 d
Mean	58.20 A	55.25 B	53.50 C	52.20 D	

In a column, means followed by a common small letter and in a row, means followed by a common capital letter are not significantly different at the 5% level by DMRT

Duration of first boll bursting

Distances from tree base significantly influenced the duration of first boll bursting in cotton (Table 2). In general, first boll bursting of cotton genotypes was delayed at the close distance from tree base (134.64 days) and it was hastened by 8.35 days under open field condition (required 123 days), whereas, it required 126.7 days at the farthest distance (3 m) from tree base. Among the varieties, CB-8 had early boll bursting (125.75 days) after sowing, while both CB-9 and CB-10 took 132.19 days, CB-3 and SR-05 took 126.50 days and 128.00 days, respectively.

Table 2. Effect of distances from the base of jackfruit trees on days required for first bollbursting of cotton genotypes

Genotype	Days required for first boll bursting Distance from tree base				
	1 m	2 m	3 m	Open field	Mean
CB-8	132.50 bA	126.25 bB	124.5 bB	119.75 bC	125.75 c
CB-9	135.75 bA	135.50 aA	130.25 aB	127.25 aB	132.19 a
CB-3	130.00 cA	128.50 bA	125.25 bB	122.25 bB	126.50 c
CB-10	140.25 aA	135.50 aB	128.75 aC	124.25 aD	132.19 a
SR-05	134.75 bA	131.00 aA	124.75 bB	121.50 bB	128.00 b
Mean	134.65 A	131.35 B	126.70 C	123.00 D	

In a column, means followed by a common small letter and in a row, means followed by a common capital letter are not significantly different at the 5% level by DMRT.

Boll length

Distances of crop rows from tree base significantly influenced the boll length of cotton genotypes (Figure 3). Open field treatment produced the longest boll (43.12 mm) compared to the shaded conditions irrespective of distances from the tree base.

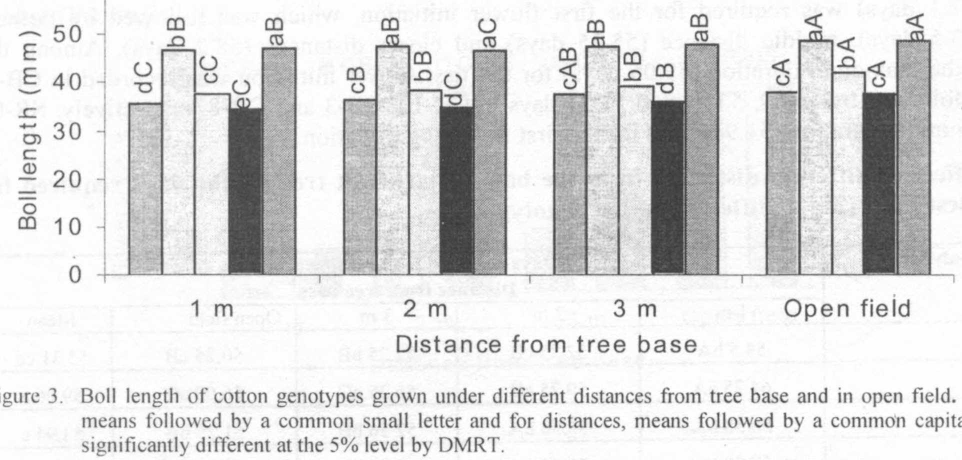

Figure 3. Boll length of cotton genotypes grown under different distances from tree base and in open field. For genotypes, means followed by a common small letter and for distances, means followed by a common capital letter are not significantly different at the 5% level by DMRT.

Among the three distances from the tree bases, the shortest mean boll (40.28 mm) was observed at closer distance (1 m) from tree base. Among the genotypes, the longest boll (47.66 mm) was recorded in CB-9 which was statistically similar with SR-05. The shortest boll length was found in CB-8.

Boll diameter

Boll diameter of different cotton genotypes grown at different distances from the tree base varied significantly (Figure 4). The highest boll diameter (32.42 mm) was found under open field condition, which was followed by the farthest (3 m), middle (2 m) and closer (1 m) distances from the tree base. Among the cotton genotypes, the differences of boll diameter were significant. The highest boll diameter was recorded in CB-9 (34.16 mm), while the lowest boll diameter (27.2 mm) was noted in CB-8.

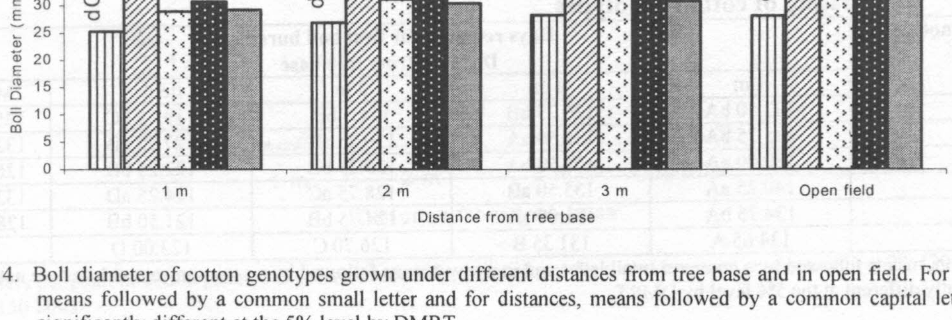

Figure 4. Boll diameter of cotton genotypes grown under different distances from tree base and in open field. For genotypes, means followed by a common small letter and for distances, means followed by a common capital letter are not significantly different at the 5% level by DMRT.

Boll weight

Boll weight of cotton genotypes differed significantly at different distances from the base of jackfruit trees (Figure 5).

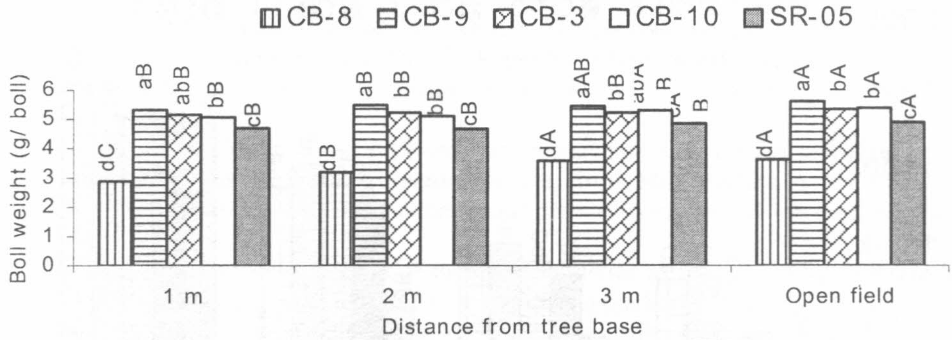

Figure 5. Boll weights of cotton genotypes under different distances from tree base and open field. For genotypes, means followed by a common small letter and for distances, means followed by a common capital letter are not significantly different at the 5% level by DMRT.

The mean highest boll weight (4.99 g) was observed at open field condition, which was followed by the farthest (3m), middle (2m) and closer (1m) distances from tree base. Among the genotypes, the highest boll weight was observed in CB-9 (5.48 g) which was followed by CB-3 (5.25 g), CB-10 (5.23 g), SR-05 (4.79 g) and CB-8 (3.33 g) respectively.

Number of boll per plant

Distances from tree base significantly influenced the number of bolls per plant (Figure 6).

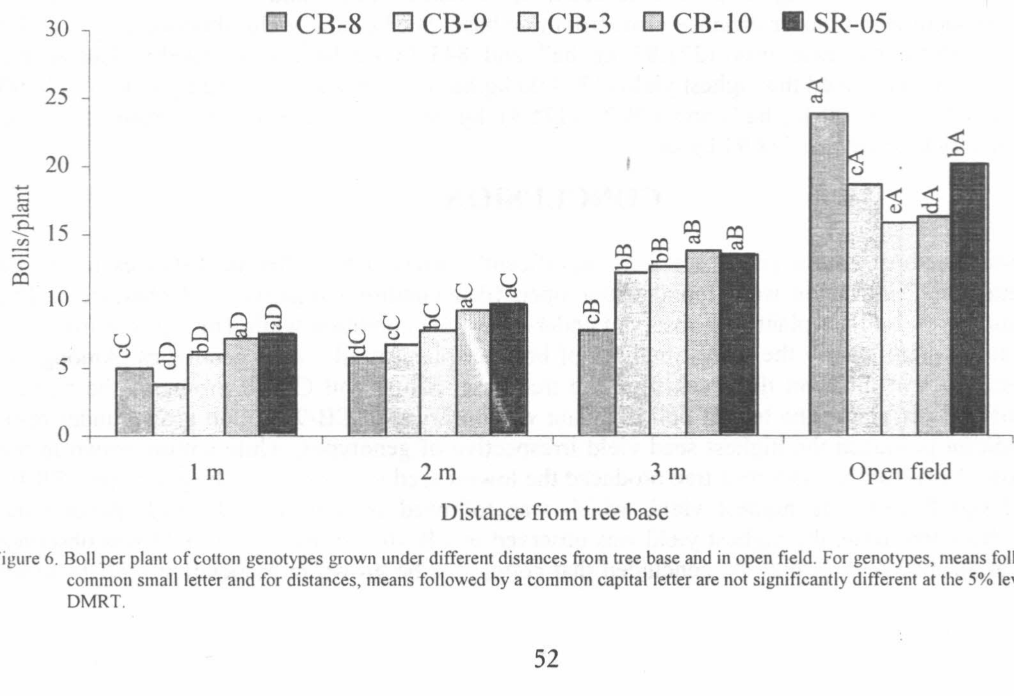

Figure 6. Boll per plant of cotton genotypes grown under different distances from tree base and in open field. For genotypes, means followed by a common small letter and for distances, means followed by a common capital letter are not significantly different at the 5% level by DMRT.

Seed cotton yield

Seed cotton yield of cotton genotypes was influenced significantly by distances of cotton rows from tree base (Figure 7).

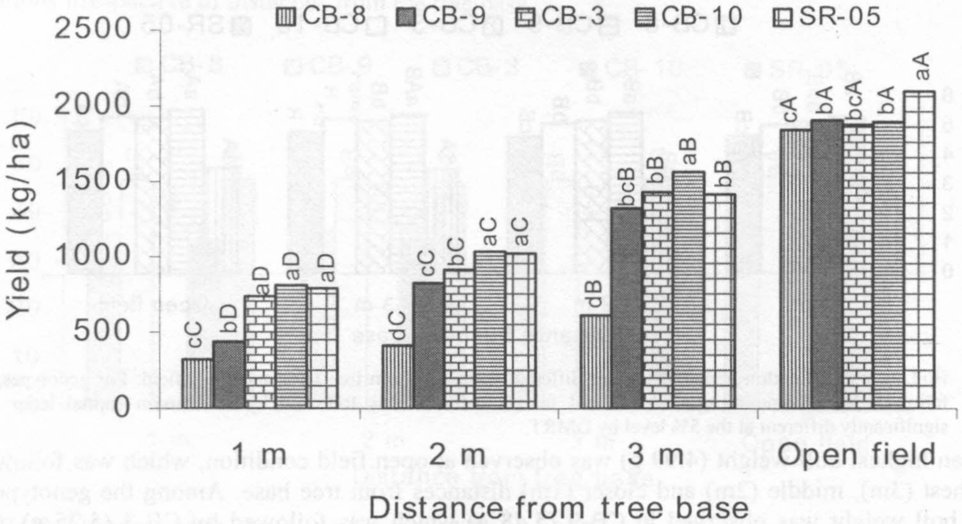

Figure 7. Yield of cotton genotypes grown under different distances from tree base and in open field. For genotypes, means followed by a common small letter and for distances, means followed by a common capital letter are not significantly different at the 5% level by DMRT.

Seed cotton yield of cotton genotypes decreased with the decrease of distance from tree base. The highest seed yield (1927.85 kg ha^{-1}) was recorded at open field condition and the lowest yield (620.85 kg ha^{-1}) was recorded at closer distance (1m) from tree base. Seed cotton yield obtained at 3 m and 2 m distances from tree base was 1271.95 kg ha^{-1} and 843.75 kg ha^{-1}, respectively. Among the genotypes, SR-05 produced the highest yield (1334.00 kg ha^{-1}) which was followed by CB-3 (1334.00 kg ha^{-1}), CB-10 (1242.00 kg ha^{-1}) and CB-9 (1125.81 kg ha^{-1}). The lowest seed cotton yield was recorded in CB-8 genotype (798.94 kg ha^{-1}).

CONCLUSION

Yield components of cotton genotypes were significantly affected by different distances from tree base. Better yield attributes were found under open filed condition regardless of characters. The highest number of boll per plant was observed under open field condition while 1m distance from tree base produced significantly the lowest number of boll per plant in all cotton genotypes. Among the cotton genotypes at different distances from the tree base, SR-05 and CB-10 produced the highest number of boll per plant. The lowest boll per plant was observed in CB-9. Cotton grown under open field condition produced the highest seed yield irrespective of genotypes, while cotton grown in the closest row (1 m) from the jackfruit tree produced the lowest seed yield. Among the genotypes, SR-05 produced significantly the highest yield, which was followed by CB-10 and CB-3. Among the distances from tree base, the highest yield was observed in CB-10 and the lowest yield was observed in CB-8 at all distances. It may be concluded that cotton can be grown in association with Jackfruit tree.

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