Effect of Shading at Different Stages of Growth of the Cotton Plant on Flowering and Fruiting, Boll Shedding, Yield of Seed Cotton and Earliness[1]

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ABSTRACT

This investigation was conducted to study the effect of shading at different stages of growth on flowering and fruiting, boll shedding, yield of seed cotton and earliness.

The effect of shading on flowering activity was more pronounced during the time of the start of flowering. Shading cotton plants at the start of flowering caused a reduction in flowering and complete boll shedding comparable with that resulting from continuous shading. Shading during 3 weeks before the start of flowering increased the number of flowers, but boll shedding percentage was increased and the number of bolls and yield of seed cotton were decreased.

Shading cotton plants six weeks before the start of flowering caused a significant reduction in flowering and fruiting.

The effects of shading during the different periods following the start of flowering were almost similar, and no significant differences were obtained between them in boll shedding, yield and yield components.

Earliness decreased to a large extent when shading was started before the start of flowering and was not much affected when it was carried out late after the time of the start of flowering.

INTRODUCTION

Previous studies carried out by Sorour *et al.* (6) showed that shading at flowering till the end of the growing season reduced fruiting efficiency of the cotton plant. The same result was found by Eaton and Rigler (3). They attributed much of the boll shedding in the shaded plants to limited carbohydrate supply. They found that the high-light receiving plants contained sugar and starch concentrations 2.7 times as high as the low-light plants. They believed that high light sets in motion some factors that depress carbohydrate utilization and that fruiting activity had a greater dominance over vegetative growth, under high light than under low light.

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Moursi and Abd El-Gawad (4) concluded that the decrease in flowering and fruiting under low light intensity was due to the decrease in fruiting branches and in the number of flowers. Dunlap (1,2) noted that the periods of cloudy weather during the fruiting period, or treatments involving similar low light intensities for a few days were followed by increased shedding.

Saad (5) studying the effect of shading on cotton growth and flowering found that when the period of shading exceeded 180 hours through the growing season plant height increased and flowering decreased.

The present work was conducted to study the effect of shading throughout the different stages of cotton growth on fruiting, shedding, yield and earliness.

MATERIALS AND METHODS

Cotton seeds of the Ashmouni variety were planted in the Agricultural Meteorology field in the Giza Agricultural Experiment Station on March 15, 1966. The distance between hills was 25 cms and between rows 60 cms. Two plants were left per hill after thinning. The plots were fertilized with calcium nitrate at the rate of 30 kg N per acre and they were irrigated every two weeks.

Shading was done by metal frames 2 × 2 × 2.5 m covered with muslin sheets one layer thick which result in 50 % reduction in light intensity (6). These frames were erected over the plants throughout the different stages of growth to give the following treatments:

1. Control (in the open).
2. Continuous shading after 45 days from planting.
3. Shading for 3 weeks after 45 days from planting.
4. Shading for 3 weeks after 66 days from planting.
5. Shading for 3 weeks after 87 days from planting.
6. Shading for 3 weeks after 108 days from planting.
7. Shading for 3 weeks after 129 days from planting.
8. Shading for 3 weeks after 150 days from planting.

Six plants from each of the above treatments were chosen at random from guarded hills and were tagged. The flowers were counted daily on these plants from the start of flowering until the end of the flowering season. The number of bolls set per plant was also recorded. Boll shedding percentage was determined from the total number of flowers produced and the total number of bolls set.

At the harvest time the yield of each plant was harvested separately. The average boll weight was obtained by dividing the yield per plant over the number of bolls per plant. Two harvests were obtained on September 12, and on October first. Earliness percentage was obtained by dividing the yield of seed cotton of the first picking over the total yield and multiplying by 100.

RESULTS AND DISCUSSION

Flowering

Data of Table 1 indicates that shading had a great effect on flowering. The effect of shading was more evident when it took place with the start of flowering (treatment 5). The effect of shading at this stage of growth in reducing flowering was similar to the effect of continuous shading, (treatment 2). Shading treatments during the different stages of growth following the period of start of flowering did not differ in their effect on number of

Table 1 Effect of shading at different stages of plant growth on the number of flowers produced per week per treatment from the start of flowering[1].

	Treatments							
Weeks	1	2	3	4	5	6	7	8
1	4	0	0	0	1	3	0	4
2	20	0	4	0	8	11	9	12
3	29	1	12	2	3	20	17	10
4	35	0	11	1	0	24	21	11
5	24	0	14	11	0	9	10	9
6	16	0	11	16	0	8	9	8
7	21	0	19	32	0	2	11	10
8	23	0	12	41	0	0	7	6
9	12	0	25	36	2	1	4	9
10	9	4	9	41	17	0	0	9
11	8	3	19	36	16	0	0	3
Total	201	8	136	216	47	78	98	91

[1]Each treatment consisted of six plants.

flowers. Eaton and Rigler (3) explained the effect of shading in decreasing the number of flowers produced on the basis of carbohydrate production and utilization. They found that plants grown in the open contained sugar and starch concentrations 2.7 times as high as the shaded plants. They suggested that high light induces some factors that depress carbohydrate utilization. Also, Moursi and Abd El-Gawad (4) found that shading decreased flower production through reducing the number of fruiting branches and the number of flowers.

Shedding, Yield and Yield Components

When light intensity was reduced by shading at the beginning of flowering, flower production decreased significantly and complete shedding was noted (Table 2). The effect of shading during that period was almost comparable with effect of continuous shading. When shading started six weeks before the start of flowering (treatment 3), flowering and fruiting were reduced significantly. The decrease in number of flowers and bolls per plant amounted to 33 % and 50 %, respectively. Percentage boll shedding was increased by 7 % and the yield of seed cotton per plant was decreased by 55 %.

Shading during the 3 weeks before the start of flowering (treatment 4) stimulated flowering and produced the highest number of flowers per plant. However, there was an association between this high flower production and the increased boll shedding which reached about 87 %. The number of bolls per plant was decreased by 39 % and the yield of seed cotton per plant by 37 % compared with the control. The data also shows that the effect of shading during the different periods following the start of flowering were almost the same in respect to boll shedding, yield and its components.

The control plants (treatment 1) gave the highest number of bolls and yield of seed cotton per plant. These results are in agreement with previous reports (1,2,3,4,5). Moursi and Abd El-Gawad (4) found a direct positive relationship between light intensity and the number of flowers and bolls produced per plant. They suggested that the decrease in flowering and fruiting was due to the decrease in the number of fruiting branches under

Table 2 Effect of shading at different stages of plant growth on flowering, fruiting, boll shedding, boll size and yield of seed cotton.

Treatment	Number of flowers per plant	Number of bolls per plant	Boll shedding percentage	Average boll weight gm	Average yield of seed cotton gm
1. Control (in the open)	35.5	8.2	75.9	2.04	17.10
2. Continuous shading after 45 days from planting.	1.3	0.0	100.0	0.00	0.00
3. Shading for 3 weeks after 45 days from planting.	22.7	4.3	81.2	1.81	7.77
4. Shading for 3 weeks after 66 days	36.0	5.0	87.4	2.16	10.65
5. Shading for 3 weeks after 87 days	8.2	0.0	100.0	0.00	0.00
6. Shading for 3 weeks after 108 days	13.3	3.7	72.6	1.65	6.25
7. Shading for 3 weeks after 129 days	16.7	4.3	74.3	1.59	7.73
8. Shading for 3 weeks after 150 days	15.2	3.2	78.7	1.72	5.11
L.S.D. 05	9.2	2.9	11.2	0.65	5.89
L.S.S. 01	12.3	3.9	15.0	0.89	7.89

low light intensity. In their experiment shading started with the start of flowering and their results agree very well with the results of this study for similar treatment.

Earliness

Results in Table 3 indicate that when shading started early before the start of flowering (treatments 2,3,4), earliness was decreased by 100%, 77% and 36%, respectively. On the

Table 3 Effect of shading at different stages of plant growth on earliness.

Treatment	Yield of Seed Cotton of the 1st picking (gm)	Yield of Seed Cotton of the 2nd picking (gm)	Total Yield of Seed cotton (gm)	Earliness percent
1. Control (in the open).	102.6	0.0	102.6	100.0
2. Continuous shading after 45 days from planting	0.0	0.0	0.0	0.0
3. Shading for 3 weeks after 45 days from planting	8.5	28.1	36.6	23.2
4. Shading for 3 weeks after 66 days from planting	41.0	22.9	63.9	64.1
5. Shading for 3 weeks after 87 days from planting	0.0	0.0	0.0	0.0
6. Shading for 3 weeks 108 days from planting	35.6	1.9	37.5	94.3
7. Shading for 3 weeks after 129 days from planting	40.5	2.9	43.4	93.3
8. Shading for 3 weeks after 150 days from planting	28.9	1.8	30.7	94.1

other hand, earliness was not decreased markedly when shading started late after the period of the start of flowering (treatments 6,7,8). Shading at the time of the start of flowering (treatment 5) exerted the same effect as that of the continuous shading (treatment 2) and earliness was decreased by 100%. This was because hundred percent shedding occurred at this treatment.

LITERATURE CITED

1. Dunlap, A. A. 1943. Low light intensity and cotton boll shedding. Science 98 : 568–569.
2. Dunlap, A. A. 1945. Fruiting and shedding of cotton in relation to light and other limiting factors. Texas Agr. Exp. Sta. Bull. 677.
3. Eaton, F. M, and N. E. Rigler 1945. Effect of light intensity, nitrogen supply and fruiting on carbohydrate utilization by the cotton plant. Plant Physiol. 20:380–411.
4. Moursi, M. A., and A. A. Abd El-Gawad. 1962. Interrelation between the growth of the cotton plant, light intensity and distance between plants. The 3rd. Cotton Conference, Egypt : 997–1014. (in Arabic).
5. Saad, S. I. 1951. Effect of shading, defoliation and debudding on development flowering and shedding of the cotton plant. Proc. Eg. Acad. Sci. 7:59–74.
6. Sorour, F. A., S. A. Farrag, G. A. Abu-Elleil, and A. M. Badawi. 1971. Fruiting and shedding of cotton as affected by shading and nitrogen level. Abstracts of the Mineral Fertilization Convention. Faculty of Agriculture. Ein Shams University. Page 7. (in Arabic).