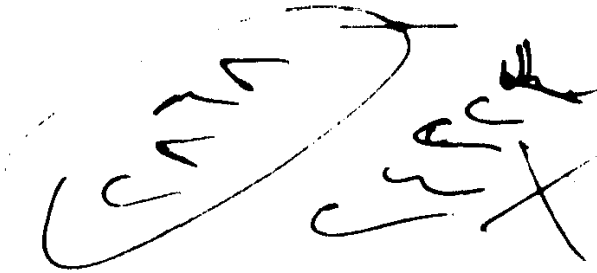


YIELD AND PHYSIOLOGICAL RESPONSE OF COTTON PLANT TO SOME CULTURAL TREATMENTS



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B. Sc. Agr. (1959) Ain Shams University

Thesis

Submitted in Partial Fulfilment of the
Requirements for the Degree of

**MASTER OF SCIENCE
IN
AGRONOMY**



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1971

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I. ACKNOWLEDGEMENT

The author wishes to express his deep gratitude to Professor Dr. M.A. Moursi, Head of the Department of Agronomy for his willing help, encouragement and criticism. The constructive ideas were invaluable during the study and preparation of the manuscript.

Sincere thanks are also due to Dr. Nemat Nour El Din, Assistant Professor in Agronomy Department for her fruitful guidance, invaluable criticism and sincere advice.

The writer is thankful to Dr. A.A. Abd El-Gawad, Assistant Professor in Agronomy Department under whom this thesis began before his travelling to Libya for his willing help and encouragement.

11. INTRODUCTION

Cotton is one of the most important crops grown in Egypt. Its acreage amounts to about 33 % of the total cultivated area. The yield of seed cotton per faddan is governed by many factors among which plant population and fertilization is one of the most important factors. Although many studies were carried out on cultural treatments on the yield of cotton crop, yet more information is required concerning the effect of plant population and fertilization on the growth, chemical contents and yield of cotton plants.

This work was performed to investigate the effect of distance between hills, number of plants per hill, plant distribution and amount of nitrogen fertilizer on the growth, chemical contents and yield of cotton plants.

III. REVIEW OF LITERATURE

Egyptian farmers used to regulate cotton plant population through one or more of the following factors; ridge width, distance between hills and number of plants per hill.

The plant population undergoes marked changes during the growth of cotton plant. When thinning was carried out at a rate of two plants per hill, the decrease in the plant stand at harvest amounted to 40, 33 and 20 % for 15, 20 and 25 cm. between hills respectively (60).

The yield of seed cotton per faddan depends on :

1. number of plants per faddan at harvest; 2. average number of open bolls per plant and 3. average boll weight.

These three variables are the most important yield components of seed cotton per faddan and each of these variables for any strain of cotton is much affected by environmental conditions. In some fields, the number of plants per faddan at harvest may reach 72 thousand plants, while in others it may not reach 20 thousand plants. The number of open bolls per plant may vary from zero to over 40 in the same strain. Boll weight also varies not only according to position on the plant

but is also seriously affected by environment and may range from 1.0 gm. to 5.5 gm. in some strains of Egyptian cotton. The actual average number of plants in the growers fields is by far less than the desirable average number. The loss in number of plants was about 32 % for the variety Menoufi and 26 % for the variety Giza 47 in 1954 while in 1955 the loss was about 42 % for the varieties Giza 47 and Giza 67. Avoiding the loss in the number of plants is the main factor in reaching the most important objective of raising the yield of cotton not only immediately but also with very little extra cost (1). Most of the studies carried out in U.A.R. regarding the effect of distance between hills or number of plants per hill on the growth or yield of cotton plant neglected the loss in number of plants during their growth.

Number of plants per hill :

The effect of number of plants per hill on the growth and yield of cotton plants has been thoroughly investigated. There was a reduction in plant height with increase in number of plants per hill (2,31,52,63). On the contrary, Choudhry (16) found that the number of plants per hill failed to impose any significant effect on the final height of Ashmouni variety.

The reduction in number of plants per hill caused an increase in the number of fruiting branches of cotton plants (2,44,46).

Nour El-Din et al found that the increase in number of plants per hill without thinning suppressed the growth of the lower fruiting branches. The lateral branches on sides facing neighbour plants in case of high number of plants per hill caused absence of lateral branches (44).

There was a significant increase in the number of open bolls per plant as the number of plants per hill decreased (16,31,59).

The number of plants per hill did not exert marked effect on earliness in 1957, whereas in 1956 high number of plants per hill accelerated plant ripening (63).

The number of plants per hill had no marked effect on boll weight (59). Two plants per hill gave higher seed cotton yield than one as well as three plants per hill (16,31). On the contrary, Sourour (63) found that three plants per hill produced greater seed cotton yield than two plants per hill. In addition, two plants per hill outyielded one plant per hill (10,12).

Shalaby (59) found that low number of plants per hill favoured slightly the lint percentage, whereas other investigators found no effect (11,16,52,63).

1- Distance between hills :

Widening the distance between plants stimulated the vegetative growth (18,20,42) and increased the height of cotton plant (2,24,25,31,33,36). On the contrary, Alot (5) showed that spacing had no effect on plant height.

The spacing between plants had no effect on the position of the first sympodium (33). There was no pertinence between the date of appearance of the first flower and spacing between cotton plants (10).

Wide spacing increased the number of flowers per plant (2,3,9,21,33,57) and the number of bolls per plant (9,21,24,33). Boll weight was not affected by spacing between hills of cotton plants (10,21,24,33,41).

The best yield of seed cotton was obtained by growing cotton plants in hills 15 cm. apart (12,33,53), 15-20 cm. apart (23,35), 15-25 cm. apart (37), 15 cm. apart (70) and 20 cm. apart (5,22,31).

Brown (13) reported that close spacing would not allow perfect hoeing to control weeds with the result that the expected increase of the yield might be overcome by the competition of the weeds and recommended the spacing of more than 20 cm. between hills.

Crowther and Mahmoud (22) and Abed (5) found increase in ginning out-turn by reducing spacing between hills, whereas El-Kadi (35), Sourour (63), Cotton and Brown (19), McNamara (47), Jankaran (57) and El-Wakil (36) found no effect for spacing on lint percentage.

Balls and Holton (10), Dastur and Gopani (24) and Harvey et al (41) found no marked effect for spacing between hills on boll weight.

Nitrogen fertilizer :

Nitrogen fertilizer exerts a marked effect on the growth of cotton plant. The height of cotton plants became great with adding nitrogen fertilizer (2,20,26,58,60). The increase in plant height with adding nitrogen fertilizer was linear (52).

Adding nitrogen fertilizer increased the number of fruiting branches (21,55). The increase in number of fruiting branches, number of flowers per plant and number of bolls per plant with applying calcium nitrate up to the greatest amount, i.e. 300 Kg. per faddan was linear (52).

Excessive nitrogen fertilizer produced excessive vegetative growth and few bolls (61). Nitrogen prolonged the fruiting period (52,69) and delayed the date of

caused increases in yield which were equal to 40 % than unfertilized treatments at Giza in Egypt (32). The application of nitrogen fertilizers up to 150 Kg. per faddan increased the yield of seed cotton profitably (6). The economic amount of nitrogen was 10 Kg. per faddan if the cotton grown after fallow, but 15 Kg. per faddan seemed adequate if the previous crop was corn or rice (27). In Egypt, the addition of further amount of nitrogen up to 160 Kg. per faddan resulted in vigorous vegetative growth and the yield did not increase significantly (28). There was no significant difference in the yield of seed cotton between plants receiving 300 Kg. of nitrate and those receiving 200 Kg. per faddan (4). El-Gabaly (29) recommended 48 Kg. nitrogen per faddan for the best yield of Karnak variety. There was an increase in seed cotton per plant with increase in nitrogen supply to plants (49). Zanati (71), in Egypt, found that nitrogen application increased cotton yield significantly when compared with yields of unfertilized plots. There was no significant difference due to the rate of 15.5, 31.0, 45.5 Kg. N/faddan. Nour El-Din et al (52) found that the greatest seed cotton yield was obtained by applying calcium nitrate at a rate of 200 Kg. per faddan. The relationship between seed cotton yield and calcium nitrate was curvilinear. Heavy doses of nitrogen depressed the yield of seed cotton (39,56).

IV. MATERIALS AND METHODS

The materials and methods of this work is divided into two parts.

First Part

Effect of plant density and time of thinning on the growth and yield of cotton plant.

Two experiments were performed to investigate the effect of plant density and time of thinning on the growth and yield of cotton plants at Ain Shams University Agricultural Experimental Farm at Abozabal. The first experiment was in 1965 and the second one in 1966. Every experiment included 27 treatments which are the combinations of three distances between hills, three numbers of plants per hill and three times of thinning. The levels of these factors were as follows :

A- Distances between hills

- 1- 10 cm.
- 2- 20 cm.
- 3- 30 cm.

B- Number of plants per hill

- One
- Two
- Three

2- Time of thinning

- 1- 15 days after sowing
- 2- 30 " " "
- 3- 45 " " "

The normal cultural treatments of growing cotton were practised. The soil was sandy loam.

The design of the experiment was a split plot design in six replications. One replication was used for the growth studies and the other five replications for yield determination. The size of the plot was 24.42 sq.m. of ridges, each 7.40 meters in length and 0.60 meter in width.

The 9 treatments which are the combinations of three number of plants per hill and three distances between hills were arranged at random in the whole plots, whereas the three treatments of time of thinning were assigned at random within every whole plot.

Growth studies :

A random sample of five hills was obtained four times during the growth period of cotton plants at 15 days by interval beginning 60 days after sowing. The following data were recorded :

- 1- Plant height
- 2- Number of leaves

- 3- Number of vegetative branches
- 4- Number of fruiting branches
- 5- Number of bolls
- 6- Nitrogen, phosphorus and potassium content of the different parts of cotton plant namely leaves, branches and bolls.

Yield studies :

Plants were harvested two times in every season, i.e. on 9-9-1965 and on 13-10-1965 in the first experiment and on 29-8-1966 and on 22-9-1966 in second experiment. At time of harvest, the yield of every plot of the experiment in five replications in both 1965 and 1966 was recorded. The lint percentage of every treatment was determined.

Second Part

Effect of the interaction of nitrogen fertilizer and plant distribution on the growth and yield of cotton plants.

Two experiments were carried out to investigate the effect of level of nitrogen fertilizer and plant distribution on the growth and yield of cotton plants at Ain Shams University Agricultural Experimental Farm at Abozabal. The first experiment was in 1965 and the second one in 1966. Every experiment included twelve treatments which are the combinations of four levels of nitrogen fertilizer and three