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RESPONSE OF GIZA 80 COTTON CULTIVAR TO SOME CULTURAL PRACTICES TO CONTROL EXCESSIVE VEGETATIVE GROWTH

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Abstract

Two field experiments were conducted at Sids Agricultural Research Station during 1996 and 1997 seasons, to study the response of cotton plants to some cultural practices, i.e. the time of first irrigation, fresh foliar application of 1.55% P_2O_5 and soil application of N fertilizers and topping after 105 days after sowing date, to control the excessive vegetative growth and its effects on some growth characters, yield and yield components and some fiber properties of Giza 80 cotton cultivar plants.

The obtained results showed that applying the first irrigation after 21 days from sowing date increased the number of open bolls/plant, boll weight, seed cotton yield/fed. and earliness percentage. While, plant height, length of inter-node and number of fruiting branches/plant were decreased. Seed index, lint percentage and fiber properties were not affected. Results also indicated that excessive vegetative growth of plants that occurs in case of applying high amount of N fertilizer (75 kg N/fed) can be controlled by some cultural practices such as applying foliar application of 1.55% P_2O_5 or topping the plants after 105 days from sowing date and these traits consequently led to increased stimulation of yield components characters and caused high seed cotton yield.

All characters were not affected by interaction between time of first irrigation and all treatments in both seasons.

INTRODUCTION

Excessive vegetative growth in cotton plants grown in fertile soils, may lead the plants to produce late bolls and cause substantial losses in both yield and quality. Some cultural practices could help in overcoming this problem.

Water stress produced by flooding – due to filling the soil pore spaces with water – inhibits proper functioning of the plant. On the other hand, in soils under deficiency of water, the plants suffer and expend extra energy to obtain water (Israelson and

Hanson (1962), Abdel-Rahman *et al.* (1980), Baslious and Abdel-Malak (1992) and Ibrahim (1995), found that applying the first irrigation at 21 days after sowing increased plant height, number of sympodia/plant, number of open bolls/plant, seed index, earliness percentage and seed cotton yield/fed, while it reduced the node number of the first fruiting branch, boll weight and lint percentage.

N and P nutrients maintain high productivity and good quality of cotton plants. These elements were fundamental constituents in all living cells. They also have an important role in a large number of enzymatic reactions particularly that dealing with phosphoration processes. Mohamed *et al.* (1988), Abdel-Al *et al.* (1996) and Abdel-Malak *et al.* (1997) found that the foliar application of P levels up to 30 kg P_2O_5 increased seed cotton yield/fed. Moreover, Girgis *et al.* (1984), reported that combining soil and foliar application of P increased seed cotton yield/fed.

Concerning the effect of N fertilization, Ali (1970), Girgis (1972) and Kherallah (1979), reported that nitrogen (N) application had insignificant effect on fiber properties, i.e., micronaire reading and Pressley index. Amer *et al.* (1964), and Genaidy *et al.* (1991), found that the optimum yield and economic rate of N fertilizer was 45 kg N/fed for fertile soils. On the other hand, Breitenbeck and Boquet (1993), found that excessive N fertilization may delay maturity and produce large plant with reduced harvesting efficiency. Makram *et al.* (1996), found that increasing N levels up to 75 kg N/fed increased boll weight, number of opened bolls/plant, seed cotton yield per feddan and earliness.

Topping is a common practice used to encourage the fruiting growth period. Topping, causes absence of the apical dominance which results in stimulating the lateral fruiting branches to grow strongly and carry more heavy bolls. Ghaly *et al.* (1988), Wassel (1990), Abdel-Al *et al.* (1996) and Abdel-Malak *et al.* (1997), illustrated that topping plants at 105 days increased seed cotton yield and its components.

Further studies are needed to elucidate the capability of using some cultural practices to minimize and to control the excessive vegetative growth of cotton plants. Thus, this investigation was carried out to study the response of cotton plants to some cultural practices, i.e., the time of first irrigation, foliar application of P, soil application of N and topping for the control of excessive vegetative growth.

MATERIALS AND METHODS

This investigation was carried out at Sids Agricultural Research Station, during two successive seasons (1996 and 1997) on Giza 80 Egyptian cotton cultivar (*G. barbadense* L.).

Seeds were sown on March 24 and March 27 in 1996 and 1997 seasons, respectively and seedlings were thinned to two plants per hill. The experimental design was factorial complete randomized blocks with four replications, plot size was 12 m^2. To study the effect of time of first irrigation, two main treatments were fulfilled, either after 21 days from sowing or after 36 days from sowing.

N fertilizer treatments were applied at the rate of 45 kg N/fed (the recommended level for semi-fertile soil – Table 1), used as control. The other treatments received 75 kg N/fed (to show the effect of the excessive amount of N on plant growth). P fertilizer at the rate of 1.55% P_2O_5 as fresh foliar spray at the peak of flowering and topping after 105 days from sowing were performed to control the predicted vegetative growth and to improve the productivity of the treated cotton plants. The other normal cultural practices were followed as recommended.

At the end of season, five hills plants were chosen randomly, from each plot to determine the following characters:

Growth characters: Plant height (cm), length of inter-node, node number of first sympodium and number of fruiting branches.

Yield and yield components: Number of total bolls/plant, number of open bolls/plant, average of boll weight (gm), seed index (gm), lint percentage, earliness percentage of the first pick to total yield, and seed cotton yield/fed (in kentars).

Fiber properties: Lint quality, i.e. micronaire reading and Pressley index.

The physical and chemical characters of the soil before sowing presented in Table (1) as follows:

Table 1. The physical and chemical analysis of the soil before sowing (at the depth of 30 cm).

Soil property	1996	1997
Mechanical analysis		
Coarse sand %	0.49	0.45
Fine sand %	10.98	12.05
Silt %	28.38	29.55
Clay %	52.15	57.85
Textural class	clay loam	clay loam
Chemical analysis		
Organic matter %	2.4	2.48
Available nitrogen (ppm)	35	34.1
Available phosphorus (ppm)	13.3	12.2
Available potassium (ppm)	259	278
$CaCO_3$	3.12	2.49
E.C. (m mhos/cm at 25°c)	0.63	0.68
pH	7.7	7.8

Analysis of variance was performed on all collected data according to Snedecor and Cochran (1981), and treatment averages compared at 0.05 level of probability using L.S.D.

RESULTS AND DISCUSSION

Growth characters:

It is clear from data presented in Table (2) that applying the first irrigation after 36 days from sowing increased significantly plant height, length of internode and node number of the first branch, while it decreased the number of fruiting branches (at harvest). The results emphasized that decreasing the time of the first irrigation to 21 days after sowing may control the excessive vegetative growth. These results are in agreement with those obtained by Israelson and Hanson (1962), Abdel Rahman *et al.* (1980), Baslious and Abdel-Malak (1992) and Ibrahim (1995), who reported that applying the first irrigation at 21 days after sowing increased number of fruiting branches/plant, while it decreased plant height and node of first fruiting branch.

The results also showed that applying 75 kg N/fed or 75 kg N/fed accompanied with foliar spray of 1.55% P_2O_5 increased significantly plant height, length of internodes and number of fruiting branches as compared with the control, but, it did not affect the node of the first fruiting branch, as long as these treatments were done after

the complete initiation of first fruiting branch.

Table 2. Effect of time of first irrigation, N and P application and topping on cotton growth characters.

Time of first Irrigation (A) / Treatments (B)	Plant height (cm)		Length of inter-node (cm)		Node number of first branch		Number of fruiting branch	
	1996	1997	1996	1997	1996	1997	1996	1997
After 21days								
45kg N/fed (control)	110.0	110.8	4.8	5.0	8.9	8.4	9.9	12.3
75kg N/fed	129.2	136.7	5.3	5.1	9.7	9.4	11.1	13.7
75kg N/fed+Spray 1.5%P_2O_5	113.3	116.8	5.2	4.7	9.5	9.1	10.5	12.8
75kg N/fed+Topping	101.2	91.7	4.2	4.0	9.2	8.5	9.3	12.0
Mean	**113.4**	**114.0**	**4.8**	**4.7**	**9.3**	**8.8**	**10.2**	**12.7**
After 36days								
45kg N/fed (control)	116.3	122.8	5.5	5.1	8.6	9.0	8.8	11.0
75kg N/fed	138.0	140.2	5.6	5.2	10.0	9.5	9.4	12.0
75kg N/fed+Spray 1.5%P_2O_5	121.3	124.5	4.5	4.8	9.8	9.3	9.0	11.5
75kg N/fed+Topping	103.7	98.7	4.8	4.4	9.5	8.7	8.4	10.3
Mean	**119.7**	**121.6**	**5.3**	**4.8**	**9.7**	**8.7**	**8.9**	**11.2**
Means of								
45kg N/fed (control)	113.2	116.8	5.2	5.0	8.7	8.4	9.1	11.9
75kg N/fed	133.6	138.5	5.5	5.1	9.8	9.4	9.2	11.2
75kg N/fed+Spray 1.5%P_2O_5	117.1	120.7	5.3	4.7	9.6	9.1	9.6	12.8
75kg N/fed+Topping	102.4	95.2	4.5	4.3	9.5	8.4	10.2	11.9
L.S.D. 0.05								
Irrigation A	**2.79**	**2.41**	**0.16**	**N.S.**	**N.S.**	**N.S.**	**0.55**	**0.66**
Treatments B	**3.93**	**3.40**	**0.23**	**0.14**	**N.S.**	**N.S.**	**0.77**	**0.94**
I x T A X B	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Topping after 105 days from sowing under the high level of N/fed (75 kg N/fed) showed the best results to control the excessive vegetative growth as compared with the control treatment (the level of 45 kg N/fed), it reduced plant height, length of internodes, while increased the number of fruiting branches. These results may be attributed to the decrease in number of stem internodes and/or average of internodes length, which may happen as a result of the retardant effect of topping on growth (Wassel, 1990).

These results are in conformance with those obtained by Ali *et al.* (1996) and Abdel-Malak *et al.* (1997).

All growth characters were not affected significantly by the interaction between time of first irrigation and the other treatments.

Yield components:

Table 3. Effect of time of first irrigation, N and P application and topping on yield components of cotton variety Giza 80.

Time of first Irrigation (A)	Treatment (B)	Number of total bolls/plant		Number of open bolls/p		boll weight (gm)		seed index (gm)	
		1996	1997	1996	1997	1996	1997	1996	1997
After 21days									
45kg N/fed (control)		10.3	13.0	10.1	12.1	2.88	3.30	11.70	11.85
75kg N/fed		9.5	12.0	8.2	11.2	3.01	3.24	12.21	12.19
75kg N/fed+Spray 1.5%P_2O_5		11.6	14.0	9.8	11.8	3.05	3.39	11.90	12.29
75kg N/fed+Topping		11.1	13.6	12.0	12.5	3.08	3.44	11.60	11.72
Mean		**10.4**	**13.2**	**9.5**	**11.9**	**3.00**	**3.34**	**11.81**	**11.75**
After 36days									
45kg N/fed (control)		9.6	12.3	8.9	11.4	2.70	3.21	11.48	11.72
75kg N/fed		8.3	11.3	7.6	9.9	2.77	3.14	11.08	11.07
75kg N/fed+Spray 1.5%P_2O_5		9.7	12.6	8.7	11.2	2.96	3.22	11.85	11.09
75kg N/fed+Topping		9.8	12.8	9.4	11.5	2.87	3.31	11.68	11.53
Mean		**9.3**	**12.2**	**8.6**	**11.1**	**2.82**	**3.24**	**11.51**	**11.55**
Means of									
45kg N/fed (control)		9.9	12.6	9.0	11.7	2.79	3.20	11.54	11.78
75kg N/fed		8.9	11.6	7.9	10.5	2.89	3.19	11.65	11.63
75kg N/fed+Spray 1.5%P_2O_5		10.6	13.3	9.2	11.5	3.00	3.30	11.87	12.14
75kg N/fed+Topping		10.4	13.2	10.7	12.0	2.97	3.37	11.64	11.62
L.S.D. 0.05									
Irrigation	A	**0.36**	**0.53**	**0.35**	**0.45**	**0.05**	**0.06**	**N.S.**	**N.S.**
Treatments	B	**0.52**	**0.75**	**0.56**	**0.64**	**0.07**	**0.08**	**N.S.**	**N.S.**
I x T	A XB	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**

The data in Table (3) indicated that the studied irrigation regime affected significantly the number of open bolls/plant and boll weight with a slight increase in seed index. Applying the first irrigation after 21 days from sowing gave the best results. These results may be due to the fact that indeterminate cotton varieties (such as Giza 80) were less subjected to water stress as compared with determinate varieties. Ibrahim (1995), reported that number of open bolls/plant and boll weight were increased by applying the first irrigation treatments.

Table (3) also revealed that fresh superphosphate as foliar application of 1.55% P_2O_5 under the high level of N/fed encouraged fruiting growth as a result of increasing photosynthesis and plant metabolism and acted as an activator of some enzymes which may affect boll formation and stability. These results are in agreement with those obtained by Girgis *et al.* (1993), Radwan and Abdel-Malak (1995) and Ali *et al.* (1996).

Removing the terminal bud of cotton plants after 105 days from sowing under the excessive level of N/fed (75 kg N/fed) gave significant control of the excessive vegetative growth. It led to a significant increase in number of open bolls/plant and boll weight, while seed index was slightly affected by topping. These results may be due to the absence of apical dominance which results in stimulating the lateral branches to grow strongly and carry more heavy bolls. Similar results were obtained by Wassel (1990).

Seed cotton yield:

Table 4. Effect of time of first irrigation, N and P application and topping on seed cotton yield, earliness percentage and lint percentage of cotton variety Giza 80.

Time of first Irrigation (A)	Treatment (B)	Seed cotton yield (ken./fed)		Earliness percentage		Lint percentage	
		1996	1997	1996	1997	1996	1997
After 21days							
45kg N/fed (control)		9.10	11.05	75.03	89.10	39.80	39.58
75kg N/fed		8.41	9.41	68.73	83.42	39.17	39.09
75kg N/fed+Spray 1.5%P_2O_5		8.75	10.75	73.63	86.70	39.18	39.79
75kg N/fed+Topping		9.48	11.48	71.60	87.85	40.10	39.91
Mean		**8.93**	**10.67**	**71.63**	**87.27**	**39.55**	**39.63**
After 36days							
45kg N/fed (control)		8.33	10.26	71.78	87.52	39.90	39.71
75kg N/fed		7.71	9.08	63.90	80.90	39.60	38.39
75kg N/fed+Spray 1.5%P_2O_5		8.15	10.19	70.90	85.17	39.78	39.78
75kg N/fed+Topping		8.52	10.32	66.65	86.17	40.30	40.16
Mean		**8.17**	**9.96**	**68.25**	**85.27**	**39.97**	**39.72**
Means of							
45kg N/fed (control)		8.71	10.65	72.73	88.30	39.85	39.64
75kg N/fed		8.06	9.24	66.31	82.16	39.38	39.43
75kg N/fed+Spray 1.5%P_2O_5		8.45	10.47	72.26	85.94	39.42	39.78
75kg N/fed+Topping		9.50	10.90	69.12	87.06	42.20	40.04
L.S.D. 0.05							
Irrigation	**A**	**0.35**	**0.38**	**1.14**	**1.29**	**N.S.**	**N.S.**
Treatments	**B**	**0.50**	**0.54**	**1.61**	**1.83**	**N.S.**	**N.S.**
I x T	**A XB**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Data presented in Table (4) showed clearly that applying the first irrigation after 21 days from sowing surpassed that after 36 days in seed cotton yield. The lower seed cotton yield due to delaying first irrigation might be attributed to water stress and its effect on lowering number of open bolls/plant. These results are in harmony with those obtained by Ali (1970), Baslious and Abdel-Malak (1992) and Ibrahim (1995), who reported that seed cotton yield increased significantly by applying the first irrigation af-

ter 21 days from sowing.

Concerning N application, the high level of N fertilization (75 kg N/fed), especially in soils that have more than 2% organic matter (Table1), enhanced the vegetative growth and inhibited the fruiting growth and produced low values of yield components, which in turn decreased seed cotton yield. Similar results were obtained by Brietenbeck and Boquet (1993).

Therefore, minimizing the level of N application to 45 kg N/fed as a proper level for such soil (the control treatment), led to an increase in seed cotton yield as compared with applying high level of N/fed (75 kg N/fed). These results are in agreement with those obtained by Amer *et al.* (1964). Foliar application of 1.55% P_2O_5, exerted some control on the excessive vegetative growth by increasing the number of open bolls/plant and boll weight as presented in Tables 2 and 3. Similar results were obtained by Mohamed *et al.* (1988), Genaidy *et al.* (1991), Girgis *et al.* (1993), Radwan and Abdel-Malak (1995), Abdel-Al *et al.* (1999) and Abdel-Malak *et al.* (1997).

Topping after 105 days from sowing under the high level of N application expressed the best treatment to control the excessive vegetative growth and significantly increased seed cotton yield/fed. These results may be due to the fact that topping at the suitable time produced shorter plants which enhanced the number of open bolls/plant, fastened boll maturity and allowed light penetration and air circulation to increase, in the meantime, the humidity decreased within the plant canopy. The same results were obtained by Ghaly *et al.* (1988), Wassel (1990) and Abdel-Al *et al.* (1996).

Earliness and lint percentage:

Data presented in Table (4) revealed that earliness was significantly increased by applying the first irrigation after 21 days from sowing, while the date of applying the first irrigation failed to affect significantly lint percentage.

On the other hand, applying the proper amount of N fertilizer (45 kg N/fed) seemed to be the best treatment which affected the earliness percentage. All tested cultural practices did not reach the level of significant difference. These results may be due to the fact that high N application/fed (75 kg N/fed) caused plants need for more time to reach maturity, and the majority of bolls/plant were gained at the second picking. The decrease in the weight of the first picking to the total weight of seed cotton yield minimized the percentage of earliness.

Regarding lint percentage, Table (4) data show that all cultural treatments did

not affect lint percentage, since all treatments did not affect seed index (Table 3). In this respect, Abdel-Malak *et al.* (1997) reported that lint percentage was not affected by phosphorus application and topping. Abdel-Gawad *et al.* (1985) found that nitrogen application did not affect lint percentage. On the other hand, Abdel-Al and Syiam (1990), reported that higher nitrogen doses caused significant decrease in lint percentage.

Fiber properties:

Table 5. Effect of time of first irrigation, N and P application and topping on cotton fiber properties, of cotton variety Giza 80.

Time of first Irrigation (A)	Treatment (B)	Fiber fineness Micronaire reading		Lint Pressley index	
		1996	1997	1996	1997
After 21days					
45kg N/fed (control)		4.8	4.7	9.6	9.8
75kg N/fed		4.6	4.5	9.8	9.7
75kg N/fed+Spray 1.5%P_2O_5		4.7	4.6	10.2	10.3
75kg N/fed+Topping		4.7	4.6	10.0	10.0
Mean		**4.6**	**4.7**	**10.0**	**9.9**
After 36days					
45kg N/fed (control)		4.8	4.8	9.8	9.7
75kg N/fed		4.7	4.7	9.7	9.6
75kg N/fed+Spray 1.5%P_2O_5		4.8	4.7	10.0	10.1
75kg N/fed+Topping		4.7	4.8	9.9	9.8
Mean		**4.7**	**4.8**	**9.9**	**9.8**
Means of					
45kg N/fed (control)		4.8	4.7	9.8	9.6
75kg N/fed		4.6	4.6	9.7	9.7
75kg N/fed+Spray 1.5%P_2O_5		4.7	4.7	10.2	10.3
75kg N/fed+Topping		4.7	4.7	10.1	9.9
L.S.D. 0.05					
Irrigation	**A**	**N.S.**	**N.S.**	**N.S.**	**N.S.**
Treatments	**B**	**N.S.**	**N.S.**	**N.S.**	**N.S.**
I x T	**A XB**	**N.S.**	**N.S.**	**N.S.**	**N.S.**

Results presented in Table (5) showed that neither the date of applying the first irrigation nor the tested cultural practices had an effect on fiber properties i.e., micronaire reading (fiber maturity and fineness) and Pressley index (fiber strength) in both seasons. The results obtained are in line with those obtained by Ali (1970), Girgis (1972), Kherallah (1979) and Zakaria *et al.* (1997), who stated that nitrogen application had no effect on fiber properties. Wassel (1990), found that fiber properties were

less affected by environmental factors and more affected by genetic factors.

From previous results it can be concluded that using some cultural practices i.e., foliar application of phosphorus or topping after 105 days, under some circumstances of high vegetative growth of plants, can control excessive vegetative growth and overcome the problem of late boll opening.

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استجابة صنف القطن جيزة ٨٠ لبعض المعاملات الزراعية للحد من زيادة النمو الخضرى

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أجريت تجربتان حقليتان بمحطة البحوث الزراعية بسدس موسمى ١٩٩٦، ١٩٩٧ لدراسة استجابة نباتات القطن لبعض المعاملات الزراعية وهى موعد أول رية (المحاياة) بعد ٢١، ٣٦ يوماً من الزراعة وتأثير الرش براشح منقوع طازج من السوبر فوسفات بتركيز ١,٥٥ ٪ فو٢ا٥ /فدان وتطويش النباتات (بعد ١٠٥ يوم من الزراعة) تحت مستوى إضافة نيتروجينية عالية (٧٥ كجم نيتروجين/فدان) مقارنة بمستوى منخفض من الإضافة النيتروجينية (٤٥ كجم نيتروجين / فدان) بغرض التحكم فى النمو الخضرى الزائد للنباتات، وأثر ذلك على بعض صفات النمو والمحصول ومكوناته، وبعض صفات الألياف لنباتات الصنف جيزة ٨٠ .

وتشير النتائج إلى أن إعطاء الرية الأولى للزراعة بعد ٢١ يوماً، أدت إلى زيادة عدد اللوز المتفتح على النبات، ووزن اللوزة، والمحصول الكلى للقطن الزهر بالقنطار للفدان، ومعدل التبكير. بينما نقص كل من طول النبات بالسم، وطول السلامية، وعدد الأفرع الثمرية. ولم تؤثر معنوياً على معامل البذرة، والنسبة المئوية للشعر، وصفات الألياف التكنولوجية.

وأوضحت النتائج أيضاً أن زيادة النمو الخضرى للنباتات نتيجة الإضافة العالية من النيتروجين (٧٥ كج نيتروجين / فدان) أمكن التحكم فيه عن طريق إما إضافة راشح منقوع طازج من سماد السوبر فوسفات بتركيز ١,٥٥ ٪ فو٢ا٥ / فدان أو إجراء تطويش للنباتات بعد ١٠٥ يوم من الزراعة. وهذه المعاملات أدت بالتالى إلى زيادة تمثيل مكونات المحصول، وسببت زيادة فى محصول القطن الزهر/فدان.

وأخيراً، لم يكن لأى من التفاعل بين المعاملات أى تأثير معنوى على الصفات المدروسة فى كلا الموسمين.