EFFECT OF PHOSPHORUS LEVELS AND TOPPING DATES ON YIELD OF TRANSPLANTED COTTON CULTIVAR GIZA 83

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Abstract

Two series of experiments were carried out at Mallawi Agricultural Research Station during 1993, 1994 and 1995 seasons on cotton cultivar Giza 83 to study: the effect of phosphorus fertilizer rates on transplanted cotton (zero, 15, 22.5 and 30 kg P_2O_5/fed), and (2) the effect of topping dates on transplanted cotton at formation of, 6, 8, 10 and 12 branches/plant. A randomized complete block design with four replications was used for each experiment.

The results indicated that higher phosphorus fertilizer rate of 30 kg P_2O_5/fed increased final plant height, number of sympodia/plant, yield components per plant, and yield earliness and produced the first sympodia/plant at lower node on the main stem, while lint percentage and seed index were not significantly affected by phosphorus fertilizer. Seed cotton yield/fed. was significantly increased in favour of higher phosphorus rate of 30 kg P_2O_5/fed. Early topping date at formation of 6 fruiting branches/plant decreased final plant height, number of fruiting branches/plant, while later topping date at formation of 10 or 12 fruiting branches/plant increased number of open bolls/plant, seed cotton yield/per plant and per fed. Yield earliness and boll weight were slightly affected by topping dates, while lint percentage and seed index were not affected by topping dates.

INTRODUCTION

Transplanted cotton plant tends to grow vegertatively, delayes flowering and boll loading as a result of the considerable time required for root regrowth compared with direct sowing at normal planting date or at the time of transplanting (Radwan and Eid, 1995). In this respect, applying phosphorus fertilizer or topping cotton plants are two of the common practices used to encourage the fruiting growth and to

decrease the excessive vegetative growth period.

With respect to the effect of phosphorus fertilizer levels on cotton, Hamissa *et al.* (1980) reported that it is not advisable to apply more than 15 kg P_2O_5/fed. Girgis *et al.* (1993) stated that phosphorus application increased number of bolls/plant, boll weight, earliness, seed cotton yield per plant and per feddan. Radwan and Abdel-Malak (1995) reported that Giza 75 transplanted cotton which was fertilized with 60 kg N + 30 kg P_2O_5/fed produced the highest seed cotton yield/fed., yield components/plant, lint percentage and seed index than other transplanting treatments which have the other doses of N and P. Abd El-Aal *et al.* (1996) found that increasing phosphorus fertilizer level from zero to 30 kg P_2O_5/fed. had insignificant effect on final plant height at harvest, yield/fed and yield components/plant for transplanted cotton of Giza 75 cultivar. Ali *et al.* (1996) showed that plant height, seed cotton yield/fed., yield components, seed index and lint percentage were significantly increased as P_2O_5 level was increased.

Concerning the effect of topping dates on cotton plants, Abdallah and Shalaby (1981) found that topping cotton plants at early stages on June 5th significantly decreased plant height, number of nodes and fruiting branches/plant while the highest seed cotton yield/fed. and seed index were obtained from plants topped on July 5th. El-Ganayni *et al.* (1984) observed that the highest seed cotton yield was produced from plants topped on August 1st while plants topped on mid June produced highest seed index and lint percentage. Ghaly *et al.* (1988) indicated that cotton plants topped at 105 days age gave the highest values of seed cotton yield/fed, number of open bolls, total number of bolls/plant and boll weight. The same result was observed by Wassel (1990). Abd El-Aal *et al.* (1996) showed that transplanted cotton plants topped at formation of 8 to 10 fruiting branches/plant gave the highest values of seed cotton yield/fed. and yield components, while heavier bolls and shorter plants were obtained from plants topped at formation of 6 fruiting branches/plant.

The objective of this investigation was to study : (1) the effect of phosphorus fertilizer levels, and (2) the appropriate date for topping the transplanted cotton plants of Giza 83.

MATERIALS AND METHODS

Two series of experiments were conducted at Mallawi Agricultural Research Station during 1993, 1994 and 1995 seasons using the Egyptian cotton cultivar Giza

83 (G. barbadense L.).

The first series of experiments was assigned to study the effect of phosphorus fertilizer levels on growth, earliness, yield and its components of transplanted cotton. The experimental design was the randomized complete blocks with four replications. Each experiment included four phosphorus level treatments :

Zero kg P_2O_5/fed., 15.0 kg P_2O_5/fed., 22.5 kg P_2O_5/fed., and 30.0 kg P_2O_5/fed.

The second series of experiments was devoted to study the effect of topping dates on growth, earliness, yield and its components of transplanted cotton. The experimental design was the randomized complete blocks with four replications. Each experiment included five topping date treatments, which were : control without topping, topping at the formation of 6, 8, 10, and 12 fruiting branches per plant.

For the two series of experiments, the plot size was 19.5 m2 (3.9 x 5 m) including 6 ridges, which were 65 cm apart and 5 m long. Nurseries of plastic sheet technique were sown on 4th, 8th and 8th of April in 1993, 1994 and 1995 seasons, respectively. After 30 days from nursery sowing, two healthy seedlings were transplanted in each hill spaced 20 cm apart, and irrigated. The second irrigation was applied after 5-7 days from transplanting and the consequent irrigation was applied at 15 days intervals as usual. Nitrogen fertilizer, in the form of ammonium nitrate (33.5 % N) at a rate of 60 kg N/fed was applied in two equal doses before the second and third irrigations. Superphosphate (15% P2O5) was added before the first irrigation for the first series of experiments according to treatments of phosphorus levels and at a rate of 150 kg/fed superphosphate for the second series of experiments. Potassium fertilizer in the form of potassium sulphate (48% K_2O) at a rate of 24 kg K_2O/fed was added before the third irrigation. Other cultural practices were done as usual.

A random sample of five representative hills was taken from each plot to record growth, earliness and yield components while seed cotton yield/fed was determined from the four inner ridges from each plot .

The chemical and physical analysis of the soil for the three growing seasons was as follows :

Chemical and physical analysis	Season		
	1993	1994	1995
Available N (ppm)	23.00	25.00	28.00
Available P (ppm)	10.00	13.00	11.00
Available K (ppm)	280.00	290.0	310.0
pH (1 : 2.5)	7.90	8.00	8.00

Statistical analysis was done according to the procedures outlined by Snedecor and Cochran (1967), while for comparisons between means, Duncan's Multiple Range Test was used.

RESULTS AND DISCUSSION

1- Effect of phosphorus levels on transplanted cotton :

The data presented in Table 1 show the effect of phosphorus levels on plant growth, seed cotton yield/fed and its components, earliness, lint percentage and seed index during 1993, 1994 and 1995 seasons. It is clear that final plant height at harvest was insignificantly affected by phosphorus levels during the three growing seasons. Number of fruiting branches/plant was significantly affected by phosphorus doses in 1995 season only. However, the means of plant height and number of fruiting branches/plant tended to increase with the higher levels of phosphorus in the three growing seasons. This may be due to the role of phosphorus on plant metabolism and development, (Epestein, 1971) besides medium content of available phosphorus in the experimental soil. Similar results were obtained by Hamisa *et al.* (1980), Radwan and Abdel-Malak (1995), Abd El-Aal *et al.* (1996) and Ali *et al.* (1996).

Both number of open bolls/plant and seed cotton yield per plant were significantly increased in favour of higher phosphorus levels in 1994 and 1995 seasons, while boll weight was significantly affected by P_2O_5 levels in 1995 season. However, the higher number of open bolls/plant, highert seed cotton yield/plant and heavier bolls were detected from higher phosphorus levels, i.e. 30 kg P_2O_5/fed in 1993 and 1995 seasons, and from 22.5 kg P_2O_5/fed in 1994 season. The increase in cotton yield/plant at higher dose of P_2O_5 was due to the increases in number of open bolls/splant and boll weight (Table 1). These results may be due to that the higher doses of phosphorus encourage plant growth as a result of increasing photosynthesis

Table 1. Effect of phosphorus rates on plant growth, seed cotton yield, yield components, earliness, lint percentage and seed index of transplanted cotton cultivar Giza 83 during 1993, 1994 and 1995 seasons.

Traits	1993				1994				1995			
	Phosphorus rates, P_2O_5 kg/fed.				Phosphorus rates, P_2O_5 kg/fed.				Phosphorus rates, P_2O_5 kg/fed.			
	Zero	15.0	22.5	30.0	Zero	15.0	22.5	30.0	Zero	15.0	22.5	30.0
Final plant height (cm.)	114.00	112.88	116.9	117.13	105.50	101.88	106.75	106.00	115.50	120.50	113.25	122.25
No. of sympodia/plant	7.40	7.65	7.69	8.58	8.93	9.03	11.38	10.53	9.70b	10.18ab	10.73ab	11.6a
No. of open bolls/plant	13.73	13.80	13.65	15.83	10.55b	13.93a	15.53a	13.60a	12.13c	14.05b	13.88b	15.95a
Seed cotton yield/plant (gm)	25.44	25.65	25.69	29.81	23.19c	29.53b	32.61a	28.88b	24.35c	28.92b	28.92b	33.63a
Boll weight (gm)	1.86	1.86	1.88	1.89	2.09	2.12	2.13	2.12	2.01b	2.07ab	2.09ab	2.11a
Seed cotton yield/fed. (kentars)	6.64b	7.12b	7.35b	9.55a	9.12bc	8.89c	9.16b	9.89a	7.11c	7.41b	7.18bc	7.71a
Node number of first sympodia	7.60a	7.43ab	7.03bc	6.80c	7.18	7.08	7.10	6.88	8.25	8.55	8.70	8.05
% First picking to total yield	60.7d	62.3c	63.4bc	64.6a	65.5	66.8	66.9	67.1	67.0c	68.8bc	67.6bc	70.1a
Lint percentage	40.03	40.11	40.22	40.26	39.62	39.63	39.78	39.88	39.93	40.08	40.26	40.32
Seed index (gm).	9.20	9.25	9.19	9.27	9.36	9.30	9.34	9.56	8.39	8.61	8.58	8.66

and plant metabolism. Also, phosphorus acts as an activator of some enzymes which may affect boll formation and stability (Epestein, 1971). These results are in line with those obtained by, Girgis *et al.* (1993), Radwan and Abdel-Malak (1995) and Ali *et al.* (1996).

Increasing phosphorus fertilizer doses from zero up to 30 kg P_2O_5/fed significantly lowered the first sympodia/plant in 1993 season. However, the same trend was found in 1994 and 1995 seasons. These results may be due to the role of phosphorus of encouraging fruiting branches to grow early at a lower node. Phosphorus fertilizer significantly increased yield earliness as percentage of first picking to total yield in 1993 and 1995 seasons. The same trend was observed in 1994 season. This may be due to that the first sympodia grow at a lower node on the main stem. Similar results were obtained by Girgis *et al.* (1993), Radwan and Abdel-Malak (1995) Ali *et al.* (1996).

Seed cotton yield/fed was significantly increased in favour of the highest phosphorus fertilization dose, i.e. 30 kg P_2O_5/fed in the three growing seasons compared with the other treatments (Table 1). These results may be due to the increase in seed cotton yield per plant. Similar results were obtained by Girgis *et al.* (1993). Radwan and Abdel-Malak (1995) and Ali *et al.* (1996).

Lint percentage and seed index were not significantly affected by phosphorus levels in 1993, 1994 and 1995 seasons. The same trend was observed by Radwan and Abdel-Malak (1995) and Abd El-Aal *et al.* (1996).

2- Effect of topping dates on transplanted cotton :

The data presented in Table 2 show the effect of topping dates on plant growth, seed cotton yield/fed. and its components, earliness, earliness, lint percentage and seed index during 1993, 1994 and 1995 seasons.

Topping dates significantly affected plant height at harvest in 1993 and 1995 seasons, and number of fruiting branches per plant in the three growing seasons. The lower value of plant height and number of fruiting branches/plant was produced from earlier dates i.e. cotton transplanted plants were topped after formation of 6 fruiting branches/plant during the three growing seasons compared with later topping date at formation of 12 fruiting branches/plant, which produced higher values in this respect, or control treatment with the exception number of fruiting branches/plant in 1994 season. These results are mainly due to the fact that the removal of apical meristem immediately stunts the apical growth and prevents initiation of new nodes or fruiting branches on the main stem. This result are mainly due to the

Table 2. Effect of topping dates on plant growth, seed cotton yield and its components, earliness, lint percentage and seed index of transplanted cotton cultivar Giza 83 during 1993, 1994 and 1995 seasons .

Traits	1993					1994					1995				
	Number of fruiting branches/plant at time of topping														
	Control	6	8	10	12	Control	6	8	10	12	Controol	6	8	10	12
Final plant height (cm.)	130.7ab	108.9b	120.3ab	119.5ab	136.3a	102.9	93.9	94.0	98.3	102.0	113.4a	72.1d	80.1cd	90.0bc	101.3a
No. of sympodia/plant	11.60a	5.95d	8.13c	10.03b	12.05a	13.20a	6.20e	8.30c	10.10c	12.2b	12.73a	6.15d	7.95d	9.90b	12.05a
No. of open bolls/plant	17.10a	12.35c	13.85bc	17.45bc	18.88a	17.58	16.43	17.05	15.4	20.3	14.53bc	12.32c	14.00c	16.15ab	17.2a
Seed cotton yield/plant (gm)	29.59c	23.25c	25.25cd	32.74ab	35.39a	33.48	31.16	30.20	28.79	40.68	26.15b	24.14b	26.66v	30.69a	33.11a
Boll weight (gm)	1.73	1.88	1.82	1.88	1.87	1.92a	1.94a	1.79b	1.89b	2.00a	1.80b	1.96a	1.90a	1.90a	1.93a
Seed cotton yield/fed. (kentars)	6.08b	5.22c	5.59c	6.71a	6.56a	6.15	5.90	5.57	5.90	5.95	5.47	5.66	5.60	6.42	6.15
% First pick to total yield	60.80	63.9	62.5	62.1	61.7	64.1	66.7	66.1	64.8	63.9	66.6	69.9	67.4	67.3	97.1
Lint percentage	39.99	40.39	40.18	40.31	40.29	39.09	38.97	39.0	39.13	38.89	40.11	40.19	40.10	40.04	40.06
Seed index (gm)	7.56	7.52	7.54	7.53	7.58	8.93	9.03	9.00	9.05	9.03	7.66	7.61	7.57	7.71	7.62

fact that the removal of apical meristem immediately stunts the apical growth and prevents initiation of new nodes or fruiting branches on the main stem. This result indicated that the earlier topping practice was most effective on cotton plant growth compared with the later topping dates. Similar results were obtained by Abdallah and Shalaby (1981), El-Halawany *et al.* (1989) and Abd El-Aal *et al.* (1996).

Number of open bolls/plant and seed cotton yield/plant were significantly affected by topping dates in 1993 and 1995 seasons. However, number of open bolls, boll weight and seed cotton yield/plant were increased in favour of transpanted cotton plants topped at formation of 10 or 12 fruiting branches/plant compared with early topped plants at formation of 6 fruiting branches/plant or control treatment (untopped plants) in the three growing seasons (Table 2). These results may be due to the absence of apical dominance which resulted in stimulating the lateral branches to grow strongly and carry more bolls and consequently increases seed cotton yield/plant. These results are in line with those obtained by Abdallah and Shalaby (1981), El-Ganayni *et al.* (1984), Ghaly *et al.* (1988) and Abd El-Aal *et al.* (1996).

Seed cotton yield/fed. was significantly increased in favour of topping transplanted cotton plants at formation of 10 or 12 fruiting branches/plant compared with topping at formation of 6 and 8 fruiting branches/plant or untopped plants in 1993 season. The same trend was detected in 1995 season, while in 1994 season the control untopped plants was superior in this trait. At the same time, combined analysis over 1993, 1994 and 1995 seasons showed that seed cotton yield/fed was significantly increased in favour of cotton plants topped at formation of 10 or 12 fruiting branches/plant compared with the other treatments under study (Table 3). These results are due to the increases in seed cotton yield/plant, and are in agreement with those obtained by Abdallah and Shalaby (1981), El-Ganayni *et al.* (1984), Ghaly *et al.* (1988), Wassel (1990) and Abd El-Aal *et al.* (1996).

Table 3. Combined analysis of topping dates effect on seed cotton yield/fed. over 1993, 1994 and 1995 seasons.

Trait	Topping at the formation of the mean number of fruiting branches/plant				
	Control	6	8	10	12
Seed cotton yield per fed. (kentar)	5.9 b	5.59 c	5.59 c	6.34 a	6.22 a

Earliness percentage as the ratio of first pick to total yield was slightly affected by topping dates in the three growing seasons (Table 2). However, earliness percentage was increased in favour of early topping, i.e. at formation of 6 to 8 fruiting branches/plant compared with the other treatments. These results are in line with those obtained by Wassel (1990).

Lint percentage and seed index were not significantly affected by topping dates in 1993, 1994 and 1995 seasons. In this respect, Wassel (1990) and Abd El-Aal *et al.* (1996) reported that lint percentage and seed index were not affected by topping.

From this study it is clear that : (1) Applying phosphorus fertilizer level of 30 kg P_2O_5/fed, and (2) Topping the contton plants at formation of 10 or 12 fruiting branches/plant are important in order to achieve a higher yield from transplanted cotton plants of Giza 83 cultivar under the coditions of Mallawi Agricultural Research Station, Minia Governorate.

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تأثير التسميد الفوسفاتى وميعاد التطويش على محصول القطن جيزة ٨٣ المنزرع شتلا

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أجريت مجموعة من التجارب بمحطة البحوث الزراعية خلال مواسم ١٩٩٣ ، ١٩٩٤ ، ١٩٩٥ وذلك لدراسة (١) تأثير مستويات التسميد الفوسفاتى (صفر ، ١٥ ، ٢٢,٥ ، ٣٠ كجم فو ٢ أ ٥ فدان) وكذلك (٢) تأثير ميعاد التطويش (عند تكوين ٦ ، ٨ ، ١٠ ، ١٢ فرع ثمرى / نبات بالاضافة الى معاملة مقارنة بدون تطويش) وذلك على القطن المشتول صنف جيزة ٨٣ . ولقد أوضحت النتائج :

١- أدى التسميد الفوسفاتى بمعدل ٣٠ كجم فو ٢ أ٥ / فدان الى زيادة طول النبات النهائى ، عدد الأفرع الثمرية للنبات ، مكونات محصول النبات الواحد ، محصول القطن الزهر للفدان والنسبة المئوية للتبكير، والى تكوين أول فرع ثمرى على عقدة منخفضة ، ولم توثر معاملات التسميد الفوسفاتى تأثيرا معنوياً على تصافى الحليج و معامل البذرة.

٢- أدى تطويش نباتات القطن المشتولة عند تكوين ٦ أفرع ثمرية على النبات الى نقص معنوى لطول النبات النهائى وعدد الأفرع الثمرية للنبات ، وقد أدى التطويش عند تكوين ١٠ - ١٢ فرع ثمرى على النبات إلي زيادة عدد اللوز المتفتح علي النبات ومحصول القطن للنبات ومحصول القطن الزهر للفدان، وكان لميعاد التطويش تأثيرا طفيفاً على وزن اللوزة والنسبة المئوية للتبكير وتأثيرا غير معنوى على تصافى الحليج ومعامل البذرة.