

RESPONSE OF GIZA 87 COTTON CULTIVAR TO MEPIQUAT CHLORIDE (PIX) AND NITROGEN FERTILIZATION LEVELS

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(Manuscript received 17 November, 1999)

Abstract

Three levels of nitrogen 40,60 and 80 kg/fed. were employed with two doses of Pix [1,1-dimethylpiperidinium chloride] (250 and 500 ml/fed.) plus a non-treated check (water) in 1997 and 1998 seasons. Giza 87 cultivar was used and Pix was sprayed twice at the beginning of flowering stage and 15 days later.

Combined data revealed that increasing N level from 40 up to 80 kg/fed. increased final plant height, number of main stem internodes, sympodia, boll set percentage, earliness percentage, number of open bolls, boll weight, lint percentage and seed cotton yield (kintar/fed), while it decreased main stem internodal length, aborted sites percentage and number of unopen bolls. N level had no effect on number of monopodia, nodal position of the 1st sympodium and seed index.

Comparing with untreated check plants, spraying Pix resulted in decreasing final plant height, number of main stem internodes, monopodia, sympodia, aborted sites percentage and number of unopen bolls/plant while it increased boll set percentage, earliness percentage, number of open bolls, boll weight, seed index and seed cotton yield (kintar/fed.). The obtained reductions or increments resulted from Pix spraying were further strengthened as its dose increased from 250 to 500 ml/fed. Pix treatment had insignificant effect on main stem internodal length and nodal position of the 1st sympodium. The interaction of nitrogen level by Pix treatment was not significant for all criteria studied except for seed cotton yield.

INTRODUCTION

One of the earliest observations was that cotton tends to be growthy, i.e. taller, wider and have larger leaves when it grows in fertile soil and/or under exceeded water supply and N rates, then yield reduction may occur. This yield reduction is usually an indirect result of excessive vegetative growth which leads to greater fruit shedding, delayed maturity and increased boll rot. Reductions in canopy height, width, and leaf area can be obtained with application of the plant growth regulator mepiquat chloride (1, 1-dimethylpiperidinium chloride) (York, 1983, Reddy et al., 1992 and 1995 and Abd El-Aal, 1998). The use of mepiquat chloride has apparent effects in reducing boll infestation (Chambers et al., 1978), monopodial and sympodial branches, No. of main stem in-

ternodes and main stem internodal length (Reddy *et al.*, 1990). Mepiquate chloride may also increase earliness, No. of open bolls and boll weight (Abd El-Aal, 1998), lint % (York, 1983) and yield (Azab *et al.*, 1993, Shumway, 1995 and Abd El-Aal, 1998). Many investigators have reported that higher nitrogen rates could be applied in combination with mepiquate chloride without fear of excessive vegetative growth (York, 1983). The effect of N on earliness and yield will be discussed later.

The objective of this study was to evaluate the responses of Giza 87 cotton cultivar to mepiquate chloride (Pix) under different nitrogen levels.

MATERIALS AND METHODS

Two field experiments were carried out at Sakha Agricultural Research Station during 1997 and 1998 seasons using nitrogen rates of 40, 60 and 80 kg/fed. as main plots and Pix (mepiquate chloride) treatment i.e. zero (water), 250 and 500 ml per feddan as subplots in split plot experimental design with four replications. Pix spraying took place at the beginning of flower initiation twice with 15 days interval using hand operated compressed air sprayer at the rate of 200 L-water per feddan. Each plot consisted of 6 rows 5 m long and 3.6m width. Cotton seeds of Giza 87 cultivar were planted at the last week of March in both seasons in hills spaced 20 cm apart. Nitrogen fertilizer was added in two equal doses at thinning and two weeks later while phosphorus and potassium were applied as 15 kg P_2O_5 and 24 kg K_2O during soil preparation and before the fourth irrigation, respectively. All other cultural practices were done as recommended in cultivating cotton. Ten plants from 5 guarded hills were randomly chosen from each plot at picking to estimate the following characters:

Growth characters:

Final plant height (cm), number of main stem internodes, main stem internodal, main stem internodal length (cm), number of monopodia and sympodia/plant.

Earliness measurements

Nodal position of the 1st sympodium, percentages of boll set, aborted sites and earliness: (First picking / 1st + 2nd picking) x 100

Seed cotton yield and its components:

Numbers of open and unopen bolls/plant, boll weight/plant, lint percentage, seed index (g/100 seeds) and seed cotton yield of all plants/plot and then trans-

formed to its corresponding values in kintar per feddan.

All the data obtained were subjected to normal statistical and combined analysis of the two seasons according to Little and Hills (1978). The mean values were compared using the L.S.D. at 5% level (Snedecor and Cochran, 1967).

Table 1. Mechanical and chemical analysis of soil sampled at 0-30 cm depth from surface in 1997 and 1998 seasons.

Soil characters	1997	1998
pH (1:2.5 suspension)	8.20	8.00
Organic matter %	1.50	1.60
Soil structure %	Clay	Clay
Total 5.5 %	0.68	0.64
Bicarbonate %	2.00	1.90
Chloride %	8.61	8.20
Sulfuric %	6.40	6.16
Ca %	2.00	1.80
Mg %	1.70	1.50
Na %	4.50	4.55
Available N (ppm)	8.20	8.00
Available P (ppm)	8.40	8.30
Available K (ppm)	670.00	680.00

RESULTS AND DISCUSSION

A. Growth characters:

Data presented in Table 2 revealed the influence of N levels and mepiquat chloride (Pix) and their interaction on some growth characters in 1997, 1998 and its combined.

Nitrogen levels

It is well noticed that final plant height, number of main stem internodes and sympodia were significantly increased in favour of nitrogen increase up to 80 kg/feddan. Reversely, increasing N level decreased main stem internodal length. The later trend may be due to that the magnitude of plant height increase was less than that of main stem internode number as N level increased. There were no monopodia differences, however, with the three N levels. The increment in most growth characters studied

Table 2. Means of Some characters as affected by N level, pix treatment and their interaction (combined data both 1997 and 1998 seasons) of Giza 87 cotton cultivar.

Treatments Growth characters	Nitrogen levels (kg/fed.)[N]					Pix treatments [P]			NXP Interaction Sig.	
	Seasons	Sig.	40	60	80	Sig.	Untreated check	250 ml/ fed.X 2 times		500 ml/ fed.X 2 times
Final plant height (cm)	1997	N.S.	155.88	158.69	160.12	**	173.37 a	156.74 b	144.58 c	N.S.
	1998	**	105.89 c	114.89 b	119.22 a	**	125.67 a	108.67 b	105.67 c	N.S.
	Comb.	*	130.89 b	136.79 a	139.67a	**	149.52 a	132.71 b	125.13 c	N.S.
No. of main stem internodes/plant	1997	**	23.84 c	26.62 b	27.72a	**	28.27 a	25.86 b	24.07 c	N.S.
	1998	**	22.61 c	24.53b	26.78 a	**	26.26 a	24.64 b	23.02 c	N.S.
	Comb.	**	23.23 c	25.58b	27.25 a	**	27.27 a	25.25 b	23.54 c	N.S.
Main stem internodal length (cm) / plant	1997	**	6.55 a	5.97 b	5.77 c	NS	6.15	6.10	6.03	N.S.
	1998	**	5.27 a	4.69 b	3.95 c	NS	4.83	4.45	4.62	N.S.
	Comb.	**	5.91 a	5.33 b	4.86 c	NS	6.42	5.24	4.52	N.S.
No. of mono-dia / plant	1997	NS	1.30	1.67	1.73	NS	1.80	1.53	1.37 c	N.S.
	1998	NS	0.61	0.68	0.76	**	0.83 a	0.68 b	0.53 c	N.S.
	Comb.	NS	0.96	1.18	1.25	*	1.32 a	1.11 b	0.95 b	N.S.
No. of sympo dia / plant	1997	**	15.33 c	18.11b	19.22a	**	19.89 a	17.33 b	15.44 c	N.S.
	1998	**	13.87 c	15.90b	18.00a	**	17.54 a	15.91b	14.31 c	*
	Comb.	**	14.60 c	17.01b	18.61 a	**	18.72 a	16.62 b	14.88 c	N.S.

In each row, means designated the same letter are not significantly different at 0.05 level according to L.S.D. test.
 *, **, and N.S. indicate $P < 0.05$, 0.01 and not significant, respectively.

herein may be due to lower level of organic matter and available N in the soil (Table 1) whereas nitrogen often plays a major role in determining the expression of a wide range of plant variables including plant size, fruiting intensity, boll retention rate, boll size and total boll number per plant. Similar results were obtained by Azab et al. (1993), El-Shahawy et al. (1994), El-Debaby et al. (1995), El-Gahel et al. (1995) and Abd El-Malik and Abd El-Aal (1998).

Mepiquat chloride (Pix)

Combined data clear that Pix treatment significantly reduced plant height, numbers of main stem internodes, monopodia and sympodia/plant. These reductions in growth characters were further strengthened with higher concentration of 500 ml/fed. compared to untreated control. Pix treatment failed to exert a pronounced effect on main stem internodal length. The above reduction due to Pix application could be explained on the basis that Pix partially inhibits one of the enzymes that is involved in Gibberellic acid biosynthesis which is an important plant hormone for cell elongation. These trends of results are in harmony with those obtained by Azab et al. (1993), McCarty and Hedin (1994), Reddy et al. (1995), Ramachandra et al. (1996) and Abd El-Aal (1998).

B. Earliness measurements

The effect of nitrogen level, Pix treatment and their interaction on some earliness measurements is presented in Table 3.

Nitrogen levels

Earliness measured as percentages of boll set aborted sites and first picking related to both first and second picking was increased by increasing nitrogen level from 40 up to 80 kg/fed. N level had no effect on nodal position of the 1st sympodium. Delayed maturity with lower nitrogen level may be primarily attributed to inadequate nutrition for boll formation and secondarily due to more shedding. For Giza 87 cotton cultivar which characterized with a compact canopy, there appeared to be a trend toward decreased early mature bolls as N rates were decreased. Similar result was obtained by El-Gahel et al. (1995) concerning boll set percentage and nodal position of the first sympodium. The results regarding percentages of aborted sites and earliness disagreed with those obtained by Azab et al. (1993), El-Gahel et al. (1995) and El-Shahawy et al. (1997).

Table 3. Means of some earliness measurements as affected by N level, pix treatment and their interaction (combined data both 1997 and 1998 seasons) of Giza 87 cotton cultivar.

Treatments Earliness measurement	Season	Nitrogen levels (kg/fed.) [N]						Pix treatments [P]			N X P Interaction Sig.
		Sig.	40	60	80	80	Sig.	Untreated check	250 ml/ fed.X 2 times	500 ml/ fed.X 2 times	
Nodal position of the 1 st sympodium	1997	N.S.	7.51	7.51	7.50	7.50	N.S.	7.38	7.52	7.62	N.S.
	1998	N.S.	7.74	7.63	7.78	7.78	N.S.	7.71	7.73	7.73	N.S.
	Comb.	N.S.	7.63	7.57	7.64	7.64	N.S.	7.55	7.63	7.68	N.S.
Boll set percentage	1997	**	59.76 c	62.52 b	65.13 a	65.13 a	**	57.57 c	63.47 b	66.37 a	N.S.
	1998	*	54.61 b	55.57 b	56.99 a	56.99 a	**	53.90 c	56.04 b	57.24 a	N.S.
	Comb.	**	57.19 c	59.05 b	61.06 a	61.06 a	**	55.74 a	59.76 b	61.81 a	N.S.
Aborted sites percentage	1997	**	40.24 a	37.48 b	34.87 c	34.87 c	**	42.43 a	36.53 b	33.62 c	N.S.
	1998	*	45.39 a	44.43 b	43.01 c	43.01 c	**	46.10 a	43.96 b	42.76 c	N.S.
	Comb.	**	42.82 a	40.96 b	38.94 c	38.94 c	**	44.27 a	40.25 b	38.19 a	N.S.
Earliness percentage	1997	**	63.67 c	67.22 b	70.91 a	70.91 a	**	63.27 c	66.54 b	66.54 b	N.S.
	1998	**	61.74 c	65.28 b	70.80 a	70.80 a	**	59.42 c	66.38 b	72.00 a	*
	Comb.	**	62.71 c	66.25 b	70.86 a	70.86 a	**	61.35 c	66.46 b	72.01 a	N.S.

In each row, means designated by the same letter are not significantly different at 0.05 level according to L.S.D. test. **, * and N.S. indicate $P < 0.05$, 0.01 and not significant, respectively.

Mepiquat chloride(Pix):

Data of earliness measurements indicated that plants treated with Pix significantly tended to be earlier in maturation comparable to untreated plants. Higher percentages of boll set and earliness associated with lower aborted sites resulted from plants received two Pix sprays of 500 ml/Fed. however, nodal position of the first sympodium was not affected by Pix treatment. The effect of Pix on enhancing early maturation and boll set may be explained on two hypotheses. One possibility is improved light penetration into the lower canopy due to smaller leaves. A second possible explanation for improved boll set is an enhanced supply of carbohydrates for bolls when Pix limits the growth of leaves and stems. These results also agreed with those obtained by Azab et al. (1993) and Munier et al. (1993).

C. Seed cotton yield and its components:

Data presented in Table (4) show the effect of nitrogen level, Pix treatment and their interaction on seed cotton yield and its components.

Nitrogen levels:

It is obvious that nitrogen level positively affected number of open bolls, boll weight, lint percentage, seed index and yield (kintar/fed.), while number of unopen bolls had a reverse trend. In combined data, increasing N level from 40 to 60 and to 80 kg/fed. increased yield by about 7% and 18.5%, respectively. These results may be ascribed on the basis that the greater amount of seed cotton yield was primarily due to higher number of open bolls, heavier lint per boll and lower unopen bolls, and secondarily due to lack of feeding nutrients in the soil (Table 1) magnified the effect of the additional doses of nitrogen. Such results were obtained by El-Shahawy et al. (1994), El-Debaby et al. (1995), El-Gahel et al. (1995) and Abd El-Malik and Abd El-Aal (1998).

Mepiquat chloride (Pix):

It is evident that spraying Pix whether with lower (250 ml/fed.) or higher (500 ml/fed.) concentration resulted in higher number of open bolls, boll weight, lint percentage, seed index and seed cotton yield (kintar/fed.), while decreased number of unopen bolls comparing with untreated control. The increase in yield may be due to the increase of early maturity that combined with increased open bolls related to boll set specially at the lower sympodia, where Pix acts as a reducer to abscisic acid and ethylene hormones. Similar results were obtained by Makram (1988), McCarty and Hedin

Table 4. Means of seed cotton yield and yield components as affected by N level, pix treatment and their interaction (combined data both 1997 and 1998 seasons) of Giza 87 cotton cultivar.

Treatments Growth characters	Season	Nitrogen levels (kg/fed.) [N]					Pix treatments [P]		NXP Interaction	
		Sig.	40	60	80	Sig.	Untreated check	250 ml/ fed.X 2 times	500 ml/ fed.X 2 times	Sig.
No. of open bolls/plant	1997	**	20.58 c	24.32 b	27.03 a	**	19.67 c	23.39 b	28.88 a	N.S.
	1998	**	13.71 b	13.48 c	15.16 a	**	12.67 c	13.84 b	15.83 a	N.S.
	Comb.	**	17.15 c	18.90 b	21.10 a	**	16.17 c	18.62 b	22.36 a	N.S.
No. of unopen bolls/plant	1997	N.S.	2.10	1.69	2.07	**	2.61 a	1.89 b	1.36 c	N.S.
	1998	*	2.77 a	2.69 a	2.49 b	**	3.01 a	2.60 b	2.33 b	N.S.
Boll weight (g)	Comb.	*	2.44 a	2.19 b	2.28 b	**	2.81 a	2.25 b	1.80 c	N.S.
	1997	*	2.73 b	2.83 b	3.00 a	**	2.47 c	2.89 b	3.21 a	N.S.
Lint percentage	1998	**	1.76 c	1.93 b	2.04 a	**	1.69 c	1.95 b	2.08 a	N.S.
	Comb.	**	2.25 c	2.38 b	2.52 a	**	2.08 c	2.42 b	2.65 a	N.S.
	1997	N.S.	32.88	32.96 b	33.53	**	32.77 c	33.12 b	33.48 a	N.S.
Seed index (g/100 seeds)	1998	*	30.22 b	30.58 b	31.23 a	**	29.86 c	30.74 b	31.43 a	N.S.
	Comb.	*	31.55 b	31.77 b	32.38 a	**	31.32 c	31.93 b	32.46 a	N.S.
	1997	N.S.	10.39	10.24	10.17	*	10.13 b	10.23 b	10.44 a	N.S.
Seed yield (Kintar/fed)	1998	N.S.	11.77	11.70	11.69	**	11.41 c	11.71 b	12.04 a	N.S.
	Comb.	N.S.	11.08	10.97	10.93	*	10.77 c	10.97 b	11.24 a	N.S.
	1997	**	8.77 b	9.01 b	9.61 a	**	8.02 c	9.15 b	10.21 a	N.S.
Seed yield (Kintar/fed)	1998	**	8.42 c	9.34 b	10.76 a	**	7.57 c	9.98 b	10.97 a	**
	Comb.	**	8.60 c	9.18 b	10.19 a	**	7.80 c	9.57 b	10.59 a	*

In each row, means designated the same letter are not significantly different at 0.05 level according to L.S.D. test. ***, ** and N.S. indicate $P < 0.05$, 0.01 and not significant, respectively.

(1994), Shumway (1995) and Abd El-Aal (1998).

D. Effect of nitrogen level x Pix treatment interaction:

It is clear that no nitrogen level by Pix treatment interactions were found for all traits studied herein except for seed cotton yield in 1998 season and combined data. Table (5) revealed that the highest yield was obtained from applying both 80 kg N/ fed. and 500 ml Pix/fed., while the lowest values resulted from plants without spraying Pix and fertilized with 40 kg N/fed.

Table 5. Means of seed cotton yield (kintar /fed.) as significantly affected by the interaction between nitrogen level and pix treatment and (combined data of both 1997 and 1998 seasons)

Pix	Untreated	250 ml/fed.	500 ml/fed.
N levels	check	two sprays	two sprays
40 kg /fed.	6.39 e	7.45 d	8.79 bc
60 kg/fed.	6.47 e	8.46 c	9.10 b
80 kg/fed.	7.70 d	9.06 b	9.76 a

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استجابة صنف القطن جيزه ٨٧ للمستويات المختلفة من كلوريد المبيكوت (البيكس) والتسميد الأزوتي

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قسم بحوث المعاملات الزراعية للقطن، معهد بحوث القطن - مركز البحوث الزراعية

في تصميم قطع منشقة إستخدمت ثلاثة معدلات من التسميد الأزوتي ٤٠، ٦٠، ٨٠، كجم/فدان من تركيزين من البيكس ٢٥٠، ٥٠٠ ملليتر للفدان بالإضافة للمقارنة المعاملة بالماء في موسمي ١٩٩٧، ١٩٩٨. واستخدم صنف القطن جيزه ٨٧ وتم رش البيكس عند بداية مرحلة التزهير.

وتظهر نتائج المشترك مايلي:

أدت زيادة التسميد الأزوتي من ٤٠ إلى ٨٠ كجم/ف إلى زيادة ارتفاع النبات النهائي وعدد سلاميات الساق الرئيسي والأفرع الثمرية والنسبة المئوية لكل من اللوز العاقد والتبكير وعدد اللوز المتفتح ووزن اللوزة وتصافي الحليج ومحصول القطن الزهر (قنطار/ف)، بينما أدت إلى نقص طول السلاميات والنسبة المئوية للمواقع الثمرية الغائبة وعدد اللوز غير المتفتح/نبات. لم تؤثر مستويات التسميد الأزوتي علي عدد الأفرع الخضرية وموقع أول فرع ثمري ومعامل البذرة.

أدي الرش بمادة البيكس - بالنسبة للمقارنة - إلى نقص ارتفاع النبات النهائي وعدد سلاميات الساق الرئيسي والأفرع الخضرية والثمرية والنسبة المئوية للمواقع الغائبة وعدد اللوز غير المتفتح/نبات بينما أدت إلى زيادة النسبة المئوية لكل من اللوز العاقد والتبكير وعدد اللوز المتفتح ووزن اللوزة ومعامل البذرة والمحصول القطن الزهر (قنطار/ف).

ووجد أن النقص أو الزيادة الناتجة عن رش البيكس تكون أكثر بزيادة التركيز من ٢٥٠ إلى ٥٠٠ ملليتر للفدان. أيضا لم يكن للرش بالبيكس تأثير معنوي علي طول السلامة وموقع أول فرع ثمري.

ولم يكن للتفاعل بين معدلات التسميد الأزوتي والرش بمادة البيكس تأثير معنوي علي كل الصفات ماعدا محصول القطن الزهر.