EFFECT OF SOWING DATE AND PIX (MEPIQUATE CHLORIDE) TREATMENT ON GROWTH, EARLINESS AND YIELD OF GIZA 87 COTTON CULTIVAR (*GOSSYPIUM BARBADENSE* L.)

M.I.M. EL-SHAHAWY

Cotton Research Institute, Agricultural Research Centre, Giza, Egypt.

(Manuscript received 14 July, 1998)

Abstract

Two field experiments were carried out at Sakha Agric. Res. Station during 1996 and 1997 seasons to study the effect of sowing dates (early: the last week of March and late:the last week of April) and Pix treatment [untreated (control); 2 sprays of 250 ml/fed; 2sprays of 500 ml/fed; 4 sprays of 250 ml/fed and 4 sprays of 500 ml/fed.] on growth characters, earliness measurements and seed cotton yield and its components of Giza 87 cotton cultivar.

Results indicated that early sowing significantly increased plant height, number of sympodia, total dry matter, number of main stem internodes, percentage of boll retention, earliness%, number of open bolls, boll weight, lint %, seed index, percentage of plant losses at harvest/fed. and seed cotton yield (Kentar/fed.), while it decreased main stem internodal length. Sowing date did not affect number of monopodia, number of aborted sites, nodal position of the 1st sympodium and number of unopen bolls/plant.

Spraying Pix 2 or 4 times with 250 or 500 cm/fed. increased number of sympodia, total dry matter, number of main-stem internodes, percentage of boll retention, earliness%; number of open bolls, boll weight, lint%, seed index and seed cotton yield while it decreased plant height; main-stem internodal length and number of aborted sites/plant, compared with untreated plants. Pix application did not exert any significant effect on number of monopodia, nodal position of the 1st sympodium; number of unopen bolls and percentage of plant losses at harvest/fed. The interaction between sowing date and Pix treatment had no significant effect on any character in this study.

Best results were obtained when cotton plants were sown early in the season (through March) and sprayed with Pix at squaring and bud initiation.

INTRODUCTION

In the last few decades, the pronounced reduction in cotton yield mainly occured from applying unproper cultural practices in growing cotton, such as late sowing, excessive nitrogenous fertilization and unsuitable plant population density, etc.,

which almost lead to more growth, late maturation, higher boll damage and subsequently lower seed cotton yield. So that, early sown cotton, usually gives high yield and this may be due to the following reasons: (a) fitting cotton cultivar to full season in order to obtain complete thermal units requirements (Young *et al.*, 1980); (b) exposure of cotton plant at early stage of growth to lower night temperature (not less than 15°C) promote flowering early and bring the crop to harvest in suitable times (McMahon and Low, 1972). In this respect, early sowing increased seed cotton yield (El-Shahawy *et al.*, 1994 and Makram *et al.*, 1994) and earliness (Hammouda, 1984). On the other hand, delaying sowing increased final plant height and internode length, while it decreased number of sympodia per plant (Shalaby, 1972).

Regarding Pix (mepiquate chloride), many investigators found that applying this growth regulator suppressed vegetative growth of cotton (Hoskinosn *et al.*, 1981 and York, 1983), plant height, both number and length of internodes; number of sympodia (Bader, 1986; Eid *et al.*, 1986; Kerby *et al*, 1986 and Devendra and Sahay, 1989), lint % (York, 1983 and Azab *et al.*, 1988) and seed cotton yield (York, 1983; Hedin *et al* 1988 and Devendra and Sahay, 1989). While others indicated that Pix application increased boll weight and seed index (York, 1983 and Azab *et al.*, 1988), number of open bolls (Abd El-Aal *et al.*, 1986 and Azab *et al.*, 1988) earliness (York, 1983 and Abd El-Aal *et al.*, 1986) and seed cotton yield (Pol and Thombre, 1985; Abd El-Aal *et al.*, 1986 and Makram, 1988).

This investigation was carried out to study the effect of sowing date and pix application on the productivity of the new cotton variety Giza 87.

MATERIALS AND METHODS

Two field experiments were conducted at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, during the two successive seasons, 1996 and 1997 on the new cotton cultivar Giza 87. The experimental design was split-plot with four replications. The plot size was 18 m^2 including 6 rows, 5 m long and 60 cm width. Cotton seeds were sown in the last week of March (early sowing) and in the last week of April (late sowing) in hills spaced 20 cm leaving two seedlings at thinning time.

The main plots were occupied by planting date while the sub plots were assigned for Pix (Mepiquate chloride) spraying treatments i.e.,

1) Control (without Pix spraying).

2) Two Pix sprayings (250 ml/fed), at square and flower initiation, respectively.

3) Two Pix sprayings (500 ml/fed), at square and flower initiation.

4) Four Pix sprayings (250 ml/fed) at square initiation and every 15 days.

5) Four Pix sprayings (500 ml/fed) at square initiation and every 15 days.

Spraying pix was done using hand operated compressed air at the rate of 200L water/fed.

Other cultural practices were carried out as recommended in cotton production. A sample of ten guarded plants were chosen from each plot to determine the following characters:

A. Growth characters:

Final plant height (cm), No. of main stem internodes, main stem internodal length, No. of vegetative branches, No. of fruiting branches and total dry matter (gm/plant).

B. Earliness parameters:

No. of aborted sites per plant, percentage of boll retention/plant, nodal position of the first sympodium/plant and earliness % $\frac{\text{First picking}}{\text{1st + 2nd picking}} \times 100$

C. Yield and yield components:

No. of open bolls, No. of unopen bolls, boll weight, seed index; lint %, and percentage of plant losses at harvest/fed., while seed cotton yield was estimated from picking all plants of the four inner rows of each plot and transformed in Kentars per feddan.

Statistical analysis was perfomed according to Snedecor and Cochran (1981) and means were compared by Duncan's multiple range test (1955).

RESULTS AND DISCUSSION

A. Growth characters:

Data presented in Table (1) show that early sowing significantly increased plant height, number of fruiting branches, total dry matter and number of main stem

internodes per plant while it decreased main stem internodal length. However, number of vegetative branches was not affected by sowing date in both seasons. These results may be due to that sowing cotton early in the season (March) fit cotton plants to full season in order to obtain complete thermal units requirements for good growth (Young *et al.*, 1980). Similar results were obtained by El-Shahawy *et al.* (1994); Makram *et al.* (1994) and Shalaby (1972). Also, Table (1) shows the effect of mepiquate chloride (Pix) on some growth characters. It is clear that all pix treatments significantly stunted plant height and main stem internodal length while it increased number of fruiting branches, total dry matter and number of main stem internodes as compared with untreated cotton plants. Generally, the previous trend was strengthened as pix was sprayed four times with the rate of 500 ml/feddan. On the other hand, any of Pix treatments exerted a significant effect on number of vegetative branches. Although Pix treatments resulted in an increment in number of main stem internodes by accelerating cell division, main stem internodal length was markedly shortened reflecting a pronunced decrease in plant height and this reduction may be due to the corresponding reduction in gibberellic acid production and consequently decrease in cell elongation (Husman *et al.*, 1992). Also, the increment of dry matter may be attributed to the effect of Pix in delaying leaf chlorophyll degradation and increasing its content in cotton leaf which enhances photoynthesis rate (Gausman *et al.*, 1981). Such results are in line with those obtained by Bartles *et al.* (1992) and Abd El-Aal (1997).

B. Earliness measurements:

Results presented in Table (2) show that early sown cotton plants had early maturation based on the higher percentages of both boll retention and earliness. On the other hand, number of aborted sites/plant and nodal position of the first sympodium were not affected by sowing date. Similar results were obtained by El-Shahawy *et al.* (1994), Makram *et al.* (1994) and Hammouda (1984).

All earliness traits studied were significantly affected by Pix treatments except nodal position of the first sympodium in both seasons. In general, increasing Pix application from 2 to 4 sprays either with 250 or 500 cm/fed. decreased number of aborted sites while it increased boll retention and earliness percentage. However, early mature Pix-treated cottons may be due to greater bolls retention specially on the lower sympodia (York, 1983). These results are in agreement with those obtained by Abd El-Aal *et al.* (1986) and Azab *et al.* (1993).

Table 1. Means of some growth characters as affected by sowing date, Pix treatment and their interactions in 1996 and 1997 seasons.

Treatments / Growth characters	Season	Sowing dates (S)			Pix treatments (P)						SxP interaction sig.
		Sig.	Early	Late	Sig.	Untreated (control)	2 sprays of Pix 250 ml/fed.	2 sprays of Pix 500 ml/fed.	4 sprays of Pix 250 ml/fed.	4 sprays of Pix 500 ml/fed.	
Plant height (cm)	1996	*	109.37a	97.75b	*	111.36a	96.97ab	93.85b	91.40b	88.89c	N.S
	1997	*	124.93a	117.31b	**	130.66a	122.66b	117.6c	116.90c	113.20d	N.S
Number of vegetative	1996	N.S	0.86	0.71	N.S	1.02	0.84	0.72	0.76	0.99	N.S
branches/plant	1997	N.S	0.59	0.45	N.S	0.64	0.63	0.45	0.50	0.35	N.S
Number of fruiting	1996	*	10.72a	8.83b	**	7.20d	8.38c	8.40c	9.58b	10.76a	N.S
branches/plant	1997	**	13.61a	11.83b	**	10.97c	12.47b	14.48a	14.38a	14.87a	N.S
Total dry matter	1996	**	110.90a	88.801b	**	71.28e	80.00d	100.47c	117.78b	129.78a	N.S
(gm/plant)	1997	**	137.01a	111.07b	**	91.70e	105.63d	123.72c	139.87b	159.28a	N.S
Number of main stem	1996	*	19.12a	17.71b	*	17.18e	17.77d	18.35c	18.92b	19.43a	N.S
internodes/plant	1997	*	21.81a	19.37b	**	18.56e	19.90d	20.68c	21.82b	21.97a	N.S
Main stem internodal	1996	*	4.99b	5.54a	**	4.21a	3.39b	3.36b	3.28b	3.03c	N.S
length (cm)	1997	*	5.73b	6.53a	**	6.55a	6.12b	5.65c	5.40cd	5.16d	N.S

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

Table 2. Means of some growth earliness measurements as affected by sowing date, Pix treatment and their interactions in 1996 and 1997 seasons.

Treatments / Earliness measurements	Season	Sowing dates (S)			Pix treatments (P)						SxP interaction sig.
		Sig.	Early	Late	Sig.	Untreated (control)	2 sprays of Pix 250 ml/fed.	2 sprays of Pix 500 ml/fed.	4 sprays of Pix 250 ml/fed.	4 sprays of Pix 500 ml/fed.	
Number of aborted	1996	N.S	15.87	16.27	*	16.62a	14.86b	11.86c	11.37	10.12c	N.S
sites/plant	1997	N.S	23.27	22.40	**	26.70a	24.33b	21.83c	21.00c	20.12d	N.S
Pecentage of boll	1996	*	44.76a	38.67b	**	28.11d	44.47c	44.61c	49.75b	52.27a	N.S
retention/plant	1997	*	33.40a	27.90b	**	22.17e	28.39d	30.83c	34.28b	36.30a	N.S
Nodal position of the	1996	N.S	8.28	8.55	N.S	8.47	8.47	8.42	8.28	8.23	N.S
1st sympodium	1997	N.S	7.55	7.23	N.S	7.28	7.43	7.17	7.17	7.14	N.S
Earliness percentage	1996	*	70.62a	61.44b	**	54.30e	58.90d	64.30c	70.50b	74.10a	N.S
	1997	*	65.75a	58.93b	**	42.50d	48.90c	50.40b	67.24a	67.40a	N.S

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

C. Seed cotton yield and its components:

From Table (3) it is evident that sowing date had a significant effect on seed cotton yield and its components except number of unopen bolls in both seasons. Cotton plants grown in early date (March) produced higher number of open bolls, boll weight, lint percentage, seed index, percentage of plant losses at harvest and yield (Kentar/feddan). These results could be ascribed on the basis that early sowing allows longer growing season and gave available time to develop a complete boll load with mature lint and large seeds (Yong *et al.*, 1980). Similar results were obtained by Yasseen (1988) as for unopen bolls; Makram *et al.* (1982); El-Shahawy *et al.* (1994) and Markram *et al.* (1994) with respect of the other traits.

Regarding Pix application, the results shown in Table (3) indicate the significant effect of this growth regulator on these group of characters except number of unopen bolls and percentage of plant losses at harvest in both seasons. The important conclusions from Table 3 are that the seed cotton yield (Kentar/feddan) and its components i.e. open bolls, boll weight, lint % and seed index were almost increased as number of sprays increased from 2 to 4 times either with 250 or 500 gm/fed. compared with the untreated plants (control). The above results could be ascribed to the fact that Pix acts as a reducer to abscisic acid and ethylene hormones which in turn increases boll retention and consequently more open and heavier bolls. Such findings were obtained by Abd El-Aal *et al.* (1986) and Azab *et al.* (1988) as for number of open bolls, York, (1983) and Azab *et al.* (1988) for boll weight and seed index, Devendra and Sahey (1989) for lint % and Pol and Thombre (1985), Abd El-Aal *et al.* (1986) and Makram (1988) and Azab *et al.* (1993) for seed cotton yield.

The interaction between sowing date and Pix treatments had insignificant effect on all traits studied in this investigation, revealing an independent effect for each factor under this study.

Generally it is recommended to grow cotton early in March and spraying of Pix at squaring and bud initiation.

Table 3. Means of seed coton yield and its components as affected by sowing date, Pix treatment and their interactions in 1996 and 1997 seasons.

Treatments yield & yield components	Season	Sowing dates (S)			Pix treatments (P)						SxP interaction sig.
		Sig.	Early	Late	Sig.	Untreated (control)	2 sprays of Pix 250 ml/fed.	2 sprays of Pix 500 ml/fed.	4 sprays of Pix 250 ml/fed.	4 sprays of Pix 500 ml/fed.	
Number of open bolls	1996	*	14.72a	11.93b	**	11.77b	13.50a	13.93a	13.72a	13.74a	N.S
per plant	1997	**	13.46a	9.97b	**	8.92c	11.57b	11.80b	12.89a	13.42a	N.S
Number of unopen	1996	N.S	2.30	2.70	N.S	2.50	2.00	2.20	2.50	2.30	N.S
bolls/plant	1997	N.S	3.57	4.43	N.S	4.80	4.85	4.07	3.55	3.23	N.S
Boll weight (g)	1996	*	2.53a	2.13b	**	1.94d	2.12c	2.22bc	2.36b	2.54a	N.S
	1997	*	2.38a	2.04b	**	1.97d	2.05c	2.07bc	2.08bc	2.16a	N.S
Lint percentage	1996	*	31.79a	30.52b	*	29.43c	30.61b	31.14ab	31.50a	32.16a	N.S
	1997	*	33.70a	32.81b	*	33.42c	33.59b	33.72ab	33.74ab	33.87a	N.S
Seed index (g)/100	1996	*	10.29a	9.63b	*	9.08c	9.69b	9.97ab	10.45a	10.60a	N.S
seeds	1997	*	10.61a	9.57b	*	9.58b	9.73b	9.95ab	10.44a	10.60a	N.S
Percentage of plant	1996	**	36.11a	28.55b	N.S	32.08	32.33	32.76	32.12	32.40	N.S
losses at harvest/fed.	1997	**	35.71a	27.92b	N.S	31.75	31.80	31.85	31.80	31.87	N.S
Seed cotton yield	1996	*	9.60a	7.40b	**	7.55c	9.12b	9.17b	9.62ab	9.69a	N.S
(kentar/fed.)	1997	*	8.21a	6.53b	**	5.86d	7.23c	7.45c	8.17b	8.86a	N.S

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

REFERENCES

1 . Abdel-Aal, M.A.H., E.T. Eid., M.S. Ismail, M.H. El-Akkad and A.A.T. Hega. 1986 Response of Egyptian cotton plants to mepiquate chloride with varying concentrations and the time of application. Ann. Agric. Sci., Fac. Agric. Ain Shams Univ., 31, 20:1063-1076.

2 . Abd El-Aal, S.A. 1997. Response of Giza 86 cotton cultivar to sowing date and Pix (mepiquate chloride) application. J. Agric. Sci. Mansoura Univ., Egypt 22 (12): 4187-4195.

3 . Azab, A.S.M., SH.H.M. El-Halawany and H.M.H. Mohamed. 1988. Effect of mepiquate chloride on growth and yield of cotton plants cv. Giza 80. Ann. Agric. Sci., Fac. Agric. Ain Shams Univ. 33, 10: 189-199.

4 . Azab, A.S.M., S.H.H.M. El-Halawany, Fatma, M.M. Ahmed. 1993. Effect of mepiquate chloride under high nitrogen rates on productivity of cotton plants. Assuit J. of Agric. Sci. 24 (1): 238-295.

5 . Bader, R.F. 1986. Response of short and full season cotton cultivars to mepiquate chloride. Dissertation Abstracts International, 13 (Sciences and Engineering) 47 (1) : 2b 151 pp.

6 . Bartles, P.G., J. Easly and J. Nelson. 1992. Effect of Pix (Mepiquate chloride) on the growth development and yield of Pima S. 7 (p. 69) and Deltapine (90) cotton. Exten. Agric. Exp. Sta. Az Univ.

7 . Devendra, S. and R.K. Sahay. 1989. Effect of Pix and Kaolin on the yield of upland cotton (*Gossypium hirsutum*). Indian J. of Agric. Sci. 54 (4): 247-250.

8. Duncan, B.D. 1955. Multiple range and multiple F. Test. Biometrics, 11: 1-42.

9. Eid, E.T., M.S. Ismail, M.H. Abd El All, M.H. El-Akkad and A.F.M. Yousf. 1986. Effect of mepiquate chloride on McNair 200 cotton variety (*Goyssypium hirsutum L.*) under Egyptian conditions. Ann. Agric. Sci., Fac. Agric., Ain Shams Univ., 31 (2): 107-1087.

10. El-Shahawy, M.I., S.M. El-Gahel and E.A. Makram. 1994. Effect of planting dates, Hill spacings and nitrogen level on Giza 76 cotton cultivar. J. Agric. Res. Tanta Univ., 20 (4): 631-641.

11. Gausman, H.W., D.E. Escober and R.R. Rodriguez. 1981. Reflectance measurements of cotton leaf senescence attired by mepiquate chloride. Plant Growth Regulator Bulletin 9 (4): 6-8 (C.F. Field Crop Abst. 36 (3): 2574.

12. Hammouda, M.M. 1984. Effect of planting date, nitrogen rate and its time of application on yield and earliness of Egyptian cotton. Ph.D. Thesis, Fac. Agric, Al-Azhar Univ. Cairo, Egypt, pp. 65-66.

13. Hedin, P.A., J.C. McCarthy, A.C. Thompson; J.N. Jenkins; D.H. Smith, R. Shephered and W.I. Parott. 1988. Plant bioregulator induced increases in the protein content of cotton plant tissues. J. of Agric. and Food Chemis. 36 (4): 742-745.

14. Hoskinson, P.E. W.A. Krugeger, T.C. Mecuehen, S. Connell and M. Smith. 1981. Effect of Pix growth regulator on cotton. Tennesse Farm and Home Science No. 119: 24-27 (C.F. Field Crop. Abst. 36 (6) 4903).

15. Husman, S.H., J.C. Silvertootle and C. Ramsey. 1992. The effect of Pix application timing on lint yield and growth and development parameters. Cotton. A College of Agric. Report, Series p. 91: 25-32 Cooperative Extension. Agric. Exp. Sta. Az Univ.

16. Kerby, T.A., K. Hake and M. Keeley. 1986. Cotton fruiting modification with mepiquate chloride. Agron. J. 78 (5); 907-912.

17. Makram, E.A. 1988. Cotton response to mepiquate chloride in the Republic of Burundi Ann. Agric. Sci., Fac. Agric. Ain Shams Univ. 33 (20: 981-940).

18. Makram, E.A., M.I. El-Shahawy, S.F. El-Gahel and R.R. Abdel Malik. 1994. Effect of bill spacing soil fertilization and its interaction on growth, yield and earliness in Egyptian Cotton cultivars, 1-Giza 70. J. Agric. Sc. Mansoura Univ., Egypt, 19:13pp.

19. McMahon, J. and A. Low. 1972. Growing degree days as a measure of temperature effects on cotton. Cotton Grow. Rev 49: 39-49.

20. Pol, K.M. and M.V. Thomber, 1985. Effect of Pix (1, 1-dimethyl piperdinium chloride) growth regulator in boosting cotton yield. current Research Report, I (2): 171-173.

21. Shalaby, E.M. 1972. Physiological response of cotton plants to planting dates and population density. Ph.D. Thesis Fac. Agric. Ain shams Univ., Cairo, Egypt pp. 323-340.

22. Snedecor, G.W. and W.G. Cochran. 1981. Statistical analysis methods. Seventh Edition, Iowa Stat. Univ. Ames. Iowa, U.S.A.

23. York, A.C. 1983. Cotton cultivar response to mepiquate chloride. Agron. J. 75: 663-667.

24. Young, E.F., R.M. Taylor Jr and H.D. Peterse 1980. Days degree unit and time in relation to vegetative developmet and fruiting for three cultivars of cotton Crop. Sci., 20: 320-375.

تأثير ميعاد الزراعة والرش بمادة البيكس على نمو وتبكير ومحصول صنف القطن جيزة ٨٧

محمد إبراهيم محمد الشهاوى

معهد بحوث القطن ، مركز البحوث الزراعية ، الجيزه.

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بسخا عامى ١٩٩٦ / ١٩٩٧ لدراسة تأثير مواعيد الزراعة (مبكر الأسبوع الأخير من مارس، متأخر : الاسبوع الأخير من إبريل) ومعاملات الرش بمادة البيكس (بدون معاملة، رشتان بمعدل ٢٥٠ سم٣ / فدان، رشتان بمعدل ٥٠٠ سم٣ / فدان، ٤ رشات بمعدل ٢٥٠ سم٣ / فدان، ٤ رشات بمعدل ٥٠٠ سم٣ / فدان) على النمو والتبكير والمحصول لصنف القطن جيزة ٨٧.

ويمكن تلخيص النتائج المتحصل عليها فيمايلى:

١. أدت الزراعة فى الميعاد المبكر إلى زيادة معنوية فى ارتفاع النبات وعدد الأفرع الثمرية والوزن الجاف الكلى وعدد سلاميات الساق الرئيسية والنسبة المئوية لعقد اللوز والتبكير وعدد اللوز المتفتح ووزن اللوزة وتصافى الحليج ومعامل البذرة والنسبة المئوية للفقد فى عدد النباتات فى نهاية الموسم وكذلك محصول القطن الزهر (قنطار/ فدان) بينما أدت الزراعة المبكرة إلى نقص طول السلامية للساق الرئيسى.

٢. لم يؤثر ميعاد الزراعة على عدد الأفرع الخضرية، وعدد المواقع الثمرية الخالية وعقدة أول فرع ثمرى وعدد اللوز الغير متفتح.

٣. أدى الرش بمادة البيكس إلى زيادة عدد الافرع الثمرية والوزن الجاف الكلى للنبات وعدد سلاميات الساق الرئيسية والنسبة المئوية للوز العاقد والتبكير وعدد اللوز المتفتح، ووزن اللوزة، وتصافى الحليج ومعامل البذرة وأيضا محصول القطن الزهر (قنطار/فدان) بينما أدى إلى نقص طول النبات وطول سلاميات الساق الرئيسى وعدد المواقع الثمرية الخالية وذلك بالمقارنة بالنباتات التى لم ترش بالبيكس.

٤. لم يؤثر الرش بمادة البيكس على كل من عدد الأفرع الخضرية وموقع أول فرع ثمرى وعدد اللوز غير المتفتح والنسبة المئوية للفقد فى عدد النباتات فى نهاية الموسم.

٥. لم يؤثر التفاعل بين مواعيد الزراعة والمعاملة بالبيكس على أى من الصفات تحت الدراسة.

٦. للحصول على افضل النتائج يمكن التوصية بزراعة القطن مبكرا خلال شهر مارس والرش بالبيكس خلال مرحلة تكوين البراعم والازهار.