Bangladesh J. Environ. Sci., Vol. 43, 130-133, 2022 @ BAED ISSN 1561-9206

EFFECT OF DIFFERENT PLANT SPACING ALONG WITH CONCENTRATIONS OF GROWTH REGULATOR (MEPIQUAT CHLORIDE) AND TIME OF FOLIAR APPLICATION ON LINT INDEX OF COTTON

M. S. Ahmed*
CDB, Rangpur (*Corresponding author's email: shaheen01743229987@gmail.com)

ABSTRACT

Plant growth regulators (PGRs) are used in cotton production to optimize yield and quality and even suppressing excess growth whenever necessary. Experiments were conducted in 2017 at Cotton Seed Multiplication, Training and Research Farm, Sreepur, Bangladesh to study the response of lint index of cotton to different plant spacings, concentration and time of application of mepiquat chloride (MC) growth regulator. Plant spacings like 45 cm × 30 cm, 60 cm × 30 cm and 75 cm × 30 cm; MC spray @ 1.0, 2.0, 3.0 and 4.0 ml L^{-1} water at 25, 50 and 75 DAE for each concentration along with water spray as control, were the treatment variables. Lint index (LI) of cotton was maximum (8.74 g) at spacing 60 cm × 30 cm and the lowest lint index (7.71 g) was recorded from spacing 45 cm × 30 cm. In respect of mepiquat chloride (MC), the highest lint index (9.99 g) was from 3 ml MC L^{-1} water at 25 DAE and the lowest (7.04 g) with 4 ml MC L^{-1} water at 25 DAE. Considering treatment combination, LI observed highest (10.30 g) at 4 ml MC L^{-1} water at 50 DAE with 45 cm × 30 cm spacing and marked lowest (7.00 g) at 4 ml MC L^{-1} water at 25 DAE with 75 cm × 30 cm spacing treatment combinations.

Key words: Plant spacing, growth regulator, time of foliar, lint index, cotton.

Introduction

Upland cotton (*Gossypium hirsutum* L.) is a leading cash crop in many countries of the world. Bangladesh produces 156,509 bale or 28,328 ton lint and 28484 ton seed cotton from 43050 hectare of land per year (CDB, 2018). Higher demand of cotton could be met up by increasing per hectare yield following appropriate crop management techniques and using short durated quality seeds. Higher plant populations adversely affect yield per unit area simultaneously vegetative and reproductive growth of plants but is important to compensate yield loss due to short canopy of plant (Wright *et al*., 2008; Silvertooth, 1999 and Hake *et al.*, 1991). Baumhardt *et al.* (2018) reported that plant height increased significantly with increased row spacing in cotton. While Jahedi *et al.* (2013) obtained reduced plant height, number sympodia and total bolls $plant^{-1}$ in cotton having narrow row spacing. Sowmiya and Sakthivel (2018) noted that sympodial branches $plant^{-1}$ and bolls $plant^{-1}$ were found significant in wider spacing (75 cm x 30 cm) in cotton. Xiao-yu *et al.* (2016) opined that the number of bolls increased while boll weight decreased as plant density rosed in cotton. Application of plant growth regulator (either auxin or retardant) can also lead to improve the growth, flowering and yield of many crops. Plant growth regulators are organic compounds, other than nutrients, that affect physiological processes of plants when applied in small concentrations. These compounds represent diverse chemistries and modes of action and provide numerous possibilities for altering crop growth and development. Their time of use extends from early season when they are applied in-furrow or as seed treatments at planting to late season in preparing the crop for harvest. Timing the first application of mepiquat chloride (MC) has caused concerns among cotton producers. Copur *et al.* (2010) studied that the applied PGRs had significant positive effects on the seed cotton yield, plant height, average number of open bolls, number of sympodia, boll weight, lint percentage and seed index. Amit *et al.* (2015) revealed that foliar application of MC growth retardant @ 300 ppm yielded more seed cotton by improving the setting percentage and therefore, increased bolls $plant^{-1}$ without exhibiting any adverse effect on quality traits while plant was shortened. Chaplot (2015) obtained that foliar application of NAA at 100 ppm brought about significantly higher mean seed cotton, cotton seed and lint yield by 57.3, 53.3 and 67.6 percent, respectively over water spray which resulted due to better, balanced plant growth and greater partitioning of assimilates towards yield formation as evidenced by higher flowers plant^{-1}, bolls plant^{-1}, mature bolls plant^{-1}, per cent boll setting, seed cotton weight boll^{-1} and cotton weight boll^{-1}. Systematic and comprehensive research effort on blending plant spacing, concentration and time of application of MC in order to increase yield of cotton are inadequate or absent at home or abroad. Keeping these views in mind, the present research programme was undertaken to study the effect of plant spacing and MC concentration along with time of application on seed traits.

Materials and Methods

The experimental field belongs to the agro-ecological zone of Modhupur Tract (AEZ-28) of Bangladesh. Cotton inbred cultivar CB 14 was selected as it is early maturing (short duration) and high yielding cultivar. A factorial experiment with three levels of plant spacing and thirteen different concentrated MC foliar applications along with time of spraying was as Factor A: level of Plant spacings (3): 60 cm × 30 cm (55,555 plants ha^{-1}) as check selected from first year experiment as promising treatment, 45 cm × 30 cm (74,074 plants ha^{-1}), 75 cm × 30 cm (44,444 plants ha^{-1}); and Factor B: MC concentrations along with time of spraying (13): Water spray (control), Mepiquat Chloride spray @ 1.0, 2.0, 3.0 and 4.0 ml L^{-1} water at 25, 50 & 75 DAE. MC was sprayed around the crop canopy on 20 September, 2017 (25 DAE); 20 October, 2017 (50 DAE) and 14 November, 2017 (75 DAE). The crop was finally harvested on 28 February, 2018. Lint index of cotton were analyzed with the help of computer package MSTAT-C. Least Significant Difference (LSD) was used for mean separation at 5% level of probability (Gomez and Gomez, 1984).

Results and Discussion

Effect of plant spacing: Lint index of cotton had considerable variation among the plant spacings. The maximum lint index (8.74 g) was recorded at spacing 60 cm × 30 cm and the lowest lint index (7.71 g) was marked from spacing 45 cm × 30 cm (Table 1). Darawsheh *et al*. (2009a) and Darawsheh *et al*. (2009b) reported that lint percentage significantly reduced by increasing plant stands or by narrow rows in cotton.

Table 1. Effect of plant spacing and MC level along with application time on lint index of cotton

Treatments	lint index (g)
Effect of different levels of spacing	
60 cm × 30 cm	8.74 a
45 cm × 30 cm	7.71 c
75 cm × 30 cm	8.29 b
LSD	0.16
CV (%)	1.54
Effect of different application times and concentrations of MC	
Control (water spray)	9.24 bc
1.0 ml L^{-1} MC spray at 25 DAE	8.93 c-e
2.0 ml L^{-1} MC spray at 25 DAE	7.67 f
3.0 ml L^{-1} MC spray at 25 DAE	9.99 a
4.0 ml L^{-1} MC spray at 25 DAE	8.93 c-e
1.0 ml L^{-1} MC spray at 50 DAE	7.89 f
2.0 ml L^{-1} MC spray at 50 DAE	8.72 de
3.0 ml L^{-1} MC spray at 50 DAE	9.70 ab
4.0 ml L^{-1} MC spray at 50 DAE	7.66 f
1.0 ml L^{-1} MC spray at 75 DAE	8.56 e
2.0 ml L^{-1} MC spray at 75 DAE	7.54 fg
3.0 ml L^{-1} MC spray at 75 DAE	9.22 b-d
4.0 ml L^{-1} MC spray at 75 DAE	7.04 g
LSD	0.51
CV (%)	1.54

In a column, figure(s) followed by same letter do not differ significantly at 5% level.

Effect of time of application and concentration of MC growth regulator: MC had significant effect on lint index of cotton (Table 1). The highest lint index (9.99) was obtained from foliar sprayed at 3 ml MC L^{-1} water at 25 DAE which was statistically similar with 3 ml MC L^{-1} water at 50 DAE and the lowest (7.04) at 4 ml MC L^{-1} water at 75 DAE. Zakaria *et al*. (2016) also observed that both Cycocel and Alar increased lint indices in cotton.

Combined effect of plant spacing and time of application and concentration of MC growth regulator: The combined effect among different times and concentrations of MC sprayed from 25 to 75 days after emergence and different spacing significantly increased the lint index of cotton than control (Table 2). LI was marked highest (10.30 g) from 4 ml MC L^{-1} water sprayed at 50 DAE with 45 cm × 30 cm spacing and it became lowest (7 g) at 4 ml MC L^{-1} water at 25 DAE with 75 cm × 30 cm spacing treatment combinations. Pitombeira (1972) reported that lint index was not significantly affected by plant population. Zakaria *et al*. (2016) also observed that both Cycocel and Alar increased lint indices.

Table 2. Combined effect of plant spacing and MC level along with application time on lint index of cotton

Treatments	lint index (g)		
	60 cm × 30 cm	45 cm × 30 cm	75 cm × 30 cm
Control (water spray)	9.27 c-h	7.88 j-m	8.23 i-l
1.0 ml L^{-1} MC spray at 25 DAE	10.29 a	8.45 h-k	8.64 f-j
2.0 ml L^{-1} MC spray at 25 DAE	9.50 a-f	10.10 a-c	8.44 h-k
3.0 ml L^{-1} MC spray at 25 DAE	9.46 a-f	7.10 mn	9.82 a-e
4.0 ml L^{-1} MC spray at 25 DAE	7.08 mn	8.21i-l	7.00 n
1.0 ml L^{-1} MC spray at 50 DAE	7.78 f-j	9.35 b-g	8.49 g-k
2.0 ml L^{-1} MC spray at 50 DAE	8.46 h-k	7.74 k-n	9.26 c-h
3.0 ml L^{-1} MC spray at 50 DAE	7.47 l-n	9.25 c-h	7.70 k-n
4.0 ml L^{-1} MC spray at 50 DAE	9.95 a-d	10.30 a	9.12 d-h
1.0 ml L^{-1} MC spray at 75 DAE	8.89 f-i	7.33 mn	10.01a-c
2.0 ml L^{-1} MC spray at 75 DAE	10.21ab	8.56 g-k	7.32 m
3.0 ml L^{-1} MC spray at 75 DAE	7.02 mn	9.46 a-f	9.88 a-d
4.0 ml L^{-1} MC spray at 75 DAE	7.78 j-n	10.07 a-c	9.01 e-i
LSD		0.862	
CV (%)		1.54	

In a column, figure(s) followed by same letter do not differ significantly at 5% level.

References

Amit, K., Deol, J. S. and Brar, A. S. 2016. Response of different *Bt* cotton (*Gossypium hirsutum* L.) hybrids to canopy modification practices. *J. Appl. Nat. Sci.*, 8 (3): 1188- 1197.

Baumhardt, R. L., Schwartz, R. C., Marek, G. W. and Bell, J. M. 2018. Planting geometry efects on the growth and yield of dryland cotton. *Agric. Sci*., 9: 99-116.

CDB. 2018. Cotton Extension and Research Report. Cotton Development Board, Khamarbari, Farmgate, Dhaka, Bangladesh. pp. 10-125.

Chaplot, P. C. 2015. Response of cotton, *Gossipium hirsutum* L. to plant growth regulators, Directorate of Extension Education. *Int. J. Farm Sci.*, 4(4): 59-63.

Copur, O., Demirel, U. and Karakus, M. 2010. Effects of several plant growth regulators on the yield and fiber quality of cotton (*Gossypium hirsutum* L.). *Not. Bot. Hort. Agrobot. Cluj.*, 38(3): 104-110.

Darawsheh, M. K., Khah, E. M., Aivalakis, G., Chachalis, D. and Sallaku, F. 2009. Cotton row spacing and plant density cropping systems I. Effects on accumulation and allocation of dry mass and LAI. *J. Food Agric. Environ.*, 7(3 and 4): 258-261.

Gomez, K. A. and Gomez, A. A. 1984. Statistical Procedures for Agricultural Research. 2nd Edn., pp. 13-175.

Hake, K., Burch, T., Harvey, L., Kerby, T. and Supak, J. 1991. Plant population In: Cotton Physiology. Today Newsletter. *Natl. Cotton Counc. Am., Memphis, TN.* 2: 4.

Jahedi, M. B., Vazin, F. and Ramezani, M. R. 2013. Effect of row spacing on the yield of cotton cultivars. *Cercetari Agronomice in Moldova*. XLVI (4): 156.

Pitombeira, J. B. 1972. Effect of plant population on agronomic characteristics and yield of cotton and grain sorghum, A Thesis Submitted to the Faculty of the department of agronomy and plant genetics, Degree of master of science with a major in agronomy, In the Graduate College, The university of Arizona.USA.

Silvertooth, J. C. 1999. Row spacing, plant population, and yield relationships. Arizona cotton comments. Cooperative Extension, The University of Arizona. USA.

Sowmiya, R. and Sakthivel, N. 2018. Effect of planting geometry on growth and yield of cotton. *Madras Agric., J.* 105(1-3): 30-32.

Wright, D. L., Marois, J. J., Sprenkel, R. K. and Rich, J. R. 2008. Production of ultra narrow row cotton. Publ. SS-AGR-83, Inst, Food And Agric. Sci. Agron. Deptt. Florida Cooperative Extension Service, Univ. Florida. USA.

Xiao-yu, Z., Ying-chun, H., Ya-bing, L., Guo-ping, W., Wen-li, D., Xiao-xin, L., Shu-chun, M. and Feng, L. 2016. Effects of plant density on cotton yield components and quality. *J. Int. Agric.*, 15(7): 1469-1479.

Zakaria, M. S. 2016. Cotton seed yield and its quality as affected by mineral nutrients and plant growth retardants. *Cogent Biol.*, 2: 1-29.

Zhao, W., Yan, Q., Hongkun, Y., Xiaoni, Y., Leran, W., Binglin, C., Yali, M. and Zhou, Z. 2019. Effects of mepiquat chloride on yield and main properties of cotton seed under different plant densities. *J. Cotton Res.*, 2: 1-10.