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

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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 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 cotton yield and quality to different plant spacings, concentration and time of application of mepiquat chloride (MC) growth regulator. The maximum seeds boll^{-1} (119.61) was recorded at spacing 75 cm × 30 cm and lowest seeds boll^{-1} (116.92) was marked from spacing 45 × 30 cm. in respect of MC, the highest seeds boll^{-1} (122) was obtained from foliar sprayed at 3.0 ml L^{-1} water at 75 DAE and the lowest (109.33) was observed in 1.0 ml MC L^{-1} water at 25 DAE. Considering combined action, seeds boll^{-1} was marked highest (122.67) from 3 ml MC L^{-1} water at 75 DAE with 60 cm × 30 cm spacing and became lowest (106.42) at 1 ml MC L^{-1} water sprayed at 50 DAE with 45 cm × 30 cm spacing. So, plant spacing of 60 cm x 30 cm can be practiced for profitable cotton production in Sreepur areas of Bangladesh.

Key words: Plant spacing, growth regulator, time of foliar, seed boll, 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 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 mepiquat chloride (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 mepiquat chloride (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). 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 DAE, Mepiquat Chloride spray @ 1.0, 2.0, 3.0 and 4.0 ml L^{-1} water at 50 DAE and Mepiquat Chloride spray @ 1.0, 2.0, 3.0 and 4.0 ml L^{-1} water at 75 DAE respectively. MC was sprayed around the crop canopy on 20 September (25 DAE), 20 October (50 DAE) and 14 November, 2017 (75 DAE). The crop was finally harvested on 28 February, 2018. Seeds boll^{-1} of cotton was 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: Seeds boll^{-1} of cotton had considerable variation among the plant spacing (Table1). The maximum seeds boll^{-1} (119.61) was recorded at spacing 75 cm × 30 cm and it was significantly different from all other spacings (Table 1). The lowest seeds boll^{-1} (116.92) was marked from spacing 45 cm × 30 cm. Omadewu *et al.* (2019) reported that plant density had a positive effect on number of seeds boll^{-1} in cotton. Similar result was reported by Khalil *et al.* (2010) in faba bean. On the contrary, Pitombeira (1972) reported that seed boll^{-1} was not significantly affected by plant population in cotton.

Table 1. Effect of plant spacing on seeds boll of cotton

Treatments	Seeds boll^{-1} (no.)
60 cm × 30 cm	118.23 b
45 cm × 30 cm	116.92 c
75 cm × 30 cm	119.61 a
LSD	0.467
CV (%)	5.93

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 sprayed had significant effect on seeds boll^{-1} of cotton over no growth regulator (Table 2). Seeds boll^{-1} increased progressively over time of MC sprayed attaining the highest at 75 DAE. The highest seeds boll^{-1} (122) was obtained from foliar sprayed at 3.0 ml L^{-1} water at 75 DAE and the lowest (109.33) was observed in 1.0 ml MC L^{-1} water at 25 DAE.

Combined effect of plant spacing and time of application and concentration of MC growth regulator: The combined effect of different times and concentrations of MC sprayed from 25 to 75 days after emergence and different spacing increased significantly the number of seeds boll^{-1} in some treatment combinations compared to control (Table 3). Seeds boll^{-1} was marked highest (122.67) from 3 ml MC L^{-1} water at 75 DAE with 60 cm × 30 cm spacing and it became lowest (106.42) at 4 ml MC L^{-1} water sprayed

at 50 DAE with 45 cm × 30 cm spacing. Omadewu *et al.* (2019) reported that plant density and variety had a positive effect on cotton seed yield, lint yield and number of seeds boll^{-1}. Khalil *et al.* (2010) found that planting dates and population density significantly affected grain yield ha^{-1}. Plant density of 450,000 plants ha^{-1} of faba bean took more grain pod^{-1} (3.2). Pitombeira (1972) also reported that seed boll^{-1} was not significantly affected by plant population.

Table 2. Effect of MC level along with application time on seeds boll of cotton

Treatments	Seeds boll^{-1} (no.)
Control (water spray)	118.82 f
1.0 ml L^{-1} MC spray at 25 DAE	109.33 i
2.0 ml L^{-1} MC spray at 25 DAE	121.00 b
3.0 ml L^{-1} MC spray at 25 DAE	120.00 cd
4.0 ml L^{-1} MC spray at 25 DAE	120.67 bc
1.0 ml L^{-1} MC spray at 50 DAE	119.78 de
2.0 ml L^{-1} MC spray at 50 DAE	120.11 cd
3.0 ml L^{-1} MC spray at 50 DAE	119.56 d-f
4.0 ml L^{-1} MC spray at 50 DAE	114.23 g
1.0 ml L^{-1} MC spray at 75 DAE	112.00 h
2.0 ml L^{-1} MC spray at 75 DAE	120.67 bc
3.0 ml L^{-1} MC spray at 75 DAE	122.00 a
4.0 ml L^{-1} MC spray at 75 DAE	119.11 ef
LSD	0.746
CV (%)	5.93

Table 3. Combined effect of plant spacing and MC level along with application time on seeds boll of cotton

Treatments	Seeds boll^{-1} (no.)		
	60 cm × 30 cm	45 cm × 30 cm	75 cm × 30 cm
Control (water spray)	120.63 d-h	116.83 no	119.00 j-m
1.0 ml L^{-1} MC spray at 25 DAE	110.67 p	108.00 r	109.33 q
2.0 ml L^{-1} MC spray at 25 DAE	118.33 lm	121.67 a-d	121.00 c-f
3.0 ml L^{-1} MC spray at 25 DAE	120.00 f-j	120.00 f-j	120.00 f-j
4.0 ml L^{-1} MC spray at 25 DAE	119.33 h-l	122.00 a-c	119.67 g-k
1.0 ml L^{-1} MC spray at 50 DAE	120.00 f-j	118.67 k-m	118.67 k-m
2.0 ml L^{-1} MC spray at 50 DAE	118.67 c-f	120.33 e-i	119.33 h-l
3.0 ml L^{-1} MC spray at 50 DAE	121.67 a-d	116.33 o	120.67 d-g
4.0 ml L^{-1} MC spray at 50 DAE	119.27 i-m	106.42 s	117.00 no
1.0 ml L^{-1} MC spray at 75 DAE	121.00 c-f	107.33 rs	107.67 rs
2.0 ml L^{-1} MC spray at 75 DAE	120.00 f-j	121.33 b-e	120.67 d-g
3.0 ml L^{-1} MC spray at 75 DAE	122.67 a	120.00 f-j	122.33 ab
4.0 ml L^{-1} MC spray at 75 DAE	118.67 k-m	118.00 mn	118.67 k-m
LSD		1.32	
CV (%)		5.93	

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

Conclusion

Seeds boll^{-1} was marked highest (122.67) from 3 ml MC L^{-1} water at 75 DAE with 60 cm × 30 cm spacing and became lowest (106.42) at 4 ml MC L^{-1} water sprayed at 50 DAE with 45 cm × 30 cm spacing. So, plant spacing of 60 cm x 30 cm can be practiced for profitable cotton production in Sreepur, Gazipur areas of Bangladesh.

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