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Effect of nitrogen levels and Mepiquat chloride on plant height of *Bt* cotton (*Gossypium hirsutum* L.)

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Abstract

The field experiment was conducted at National Seed Production area of CCS Haryana Agricultural University, Hisar, during *kharif* 2018. The experiment comprised of three levels of nitrogen (100%, 125% and 150% RDN) and three spray of mepiquat chloride (control, single spray at 60 DAS and two sprays at 60 and 75 DAS) was conducted in factorial randomized complete block design with three replication. Results reveal that plant height was statistically higher with 150% RDN, while with mepiquat chloride spray it was significantly higher in control. Highest plant height recorded at harvest with 150% RDN (154.78, 154.58 and 144.09 cm) followed by 125% and 100% RDN respectively. However application of mepiquat chloride reduces the plant height. Double spray of mepiquat chloride @ 20g a.i. per ha at 60 and 75 DAS significantly reduced plant height (114.66, 210.89 and 128.4 cm) compare to control, while it at par with single spray at 60 DAS respectively. The present study highlighted the practical importance of the different nitrogen levels and mepiquat chloride spray on plant height of *Bt* cotton.

Keywords: Nitrogen, mepiquat chloride, plant height, *Bt* cotton

1. Introduction

Cotton is one of the important cash crop in world. Cotton crop attains excessive vegetative growth mainly due to high soil fertility; coincidence of vegetative growth period with rainy season coupled with high humidity. Thick crop canopy prevents penetration of light besides shading of bolls and utilization of plant energy on the formation of vegetative stature which results in shedding of flower buds, flowers and immature bolls. Excessive vegetative growth often occurs at the expense of reproductive growth and a large fraction of squares and small bolls on the lower sympods either shed or open poorly resulting in low yield.

In India, cotton is grown on about 123 lakh hectares of land and it occupies first position in production with 377 lakh bales (each of 170 kg) among all cotton producing countries in the world. Whereas, in world area under this crop is 3335 lakh hectares with 1213.7 lakh bales production. Average productivity of cotton in India is 524 kg/ha, which is low as compared to world average of 792 kg/ha (Anonymous, 2018a) ^[1]. Cotton is cultivated on a large scale in Karnataka, Madhya Pradesh, Maharashtra, Gujarat, Punjab, Uttar Pradesh, Rajasthan, Haryana, and Tamilnadu. Maharashtra is the largest producer of cotton in India followed by Gujarat and Andhra Pradesh. In Haryana, area under the crop is 6.56 Lakh ha with production of 25 Lakh bales (170 kg) and lint yield is 648 kg/ha in 2017-18 (Anonymous, 2018b) ^[2].

Plant growth regulators (PGRs) may enhance yield by increasing the retention of photosynthates into developing bolls. PGRs have been widely used in developed nations for increasing cotton production by adjusting plant growth and to improve lint yield and fiber quality. Gwathmey and Clement (2010) ^[4] reported that source sink balance can be altered by using plant growth regulator such as mepiquat chloride (MC). Shekar *et al*, (2015) ^[12] reported that the use of mepiquat chloride increases the N uptake resulting into higher seed cotton yield. Growth retardants like mepiquat chloride (MC) are known to reduce inter nodal length, thereby, reducing plant height and stimulating the translocation of photosynthesis towards reproductive sinks (developing cotton bolls), all of which result in higher yields. Mepiquat chloride (MC) is used in cotton production across the globe to control plant growth and maximize yield and quality.

Application of MC at squaring stage or at both squaring and flowering stages significantly improved cotton quality parameters like fiber length (1.7%) and fiber strength (2.8%) without significant loss of yields (Ren *et al.*, 2013) [11]. Therefore, the present study was undertaken to evaluate the effect of growth retardant (Mepiquat chloride) and varying nitrogen levels on plant height of cotton.

2. Materials and Methods

The study was conducted at National Seed Production Area of Chaudhary Charan Singh Haryana Agricultural University, Hisar, during *kharif* season of 2018. Hisar is situated in the sub-tropics at longitude 75°46'E, latitude 29°10'N and altitude of 215.2 m above mean sea level in Haryana state of India. Hisar has semi-arid climate with very hot summer (temperature rises up to 45°C or more) and extremely cool winter (temperature falls up to 1-2°C or less than this). During summer season as well as winter season, the mean monthly temperature shows a wide range of fluctuation in minimum and maximum temperature. In December and January months, minimum temperature may fall to 0°C. Average annual rainfall of Hisar is 450 mm out of the total rainfall, around 80% is received in south-west monsoon during July to September. The experiment was laid out in factorial randomized block design. First factor was different levels of nitrogen i.e. N₁: 100% RDN, N₂: 125% RDN, N₃: 150% RDN and second was mepiquat chloride (G₁: Control, G₂: Mepiquat chloride application 20g a.i./ha at 60 DAS and G₃: Mepiquat chloride application 20g a.i./ha at 60 DAS and 75 DAS). All the treatments replicated three times. Recommended dose of fertilizer for *Bt* cotton was 175:60:60kg/ha applied in the field. One third quantity of nitrogen, full amount of phosphorus and potassium is supplied through urea; single superphosphate and muriate of potash, respectively at the time of sowing. Remaining 2/3 quantity of nitrogen was top dressed in two equal splits; at 30 and 60 days after sowing. RCH 650 genotype of *Bt* cotton were grown as per the recommended package of practices. The observations for plant height were recorded at 45, 75, 105, 135 days after

sowing and at maturity from an area of 6 m × 4.5m in each plot. In each plot, five plants were randomly selected and tagged for the recording of different observations till maturity of the crop. All the data obtained from *Bt* cotton were statistically analyzed using the *t*-test.

3. Result and Discussion

3.1 Effect of nitrogen

The data present in Table 1 revealed that higher doses of nitrogen increase plant height. At 45 DAS plant height (43.42, 40.62 and 40.69 cm respectively) was significantly higher with 150% RDN as compared to 125% and 100% RDN. The maximum plant height (84.51, 82 and 82.2 cm at 75 DAS; 125.73, 117.47 and 116.82 cm at 105 DAS; 152.93, 141.24 and 143.16 cm at 135 DAS; 154.78, 154.58 and 144.09 cm at harvest) was recorded with the 150% RDN. This might be due to balance N nutrition which increases photosynthetic processes (Omran *et al.*, 2018) [5]. The similar results recognized by Paul *et al.* (2016) and Rajpoot *et al.* (2016a, 2016b, 2018) [6, 7, 8, 9].

3.2 Effect of mepiquat chloride

Application of mepiquat chloride were imposed from 60 DAS, hence its effect was seen from 75 DAS onwards. Table 1 revealed the mepiquat chloride significant effect on the plant height at different growth stages. At 75 DAS, significantly higher plant height (102.82, 72.35 and 73.56 cm) was recorded in control as compared to single and double spray of mepiquat chloride. The same trend was observed at 105, 135 DAS and at harvest (176.18, 97.51 and 86.33 cm at 105 DAS; 209, 126.47 and 101.87 cm at 135 DAS; 210.89, 128.7 and 114.16 cm at harvest). This may be due to the interference of this chemical as growth regulator in gibberellic acid biosynthetic pathway. Because mepiquat chloride inhibits gibberellic acid producing enzymes, causing cells to be less longitudinally and transversally developed result of which plant height decreases. The same trend of results finds by Wang *et al.* (2012), Reddy *et al.* (1992) and Brar *et al.* (2000) [13, 10, 3].

Table 1: Effect of different nitrogen levels and mepiquat chloride dose on plant height (cm) of *Bt* cotton hybrid

Treatments	Days After Sowing				At
	45	75	105	135	Harvest
Nitrogen levels					
N ₁ (100% RDF)	40.69	82.2	116.82	143.16	144.09
N ₂ (125% RDF)	40.62	82	117.47	141.24	154.58
N ₃ (150% RDF)	43.42	84.51	125.73	152.93	154.78
S.Em±	0.68	2.50	2.73	8.31	10.31
CD at 5%	2.05	NS	NS	NS	NS
Mepiquat chloride dose					
G ₁ (Control)	42.2	102.82	176.18	209	210.89
G ₂ (MC@ 20g a.i./ha at 60 DAS)	40.51	72.35	97.51	126.47	128.4
G ₃ (MC@ 20g a.i./ha at 60 and 75 DAS)	42.02	73.56	86.33	101.87	114.16
S.Em±	0.68	2.50	2.73	8.31	10.31
CD at 5%	NS	7.56	8.27	25.15	30.64

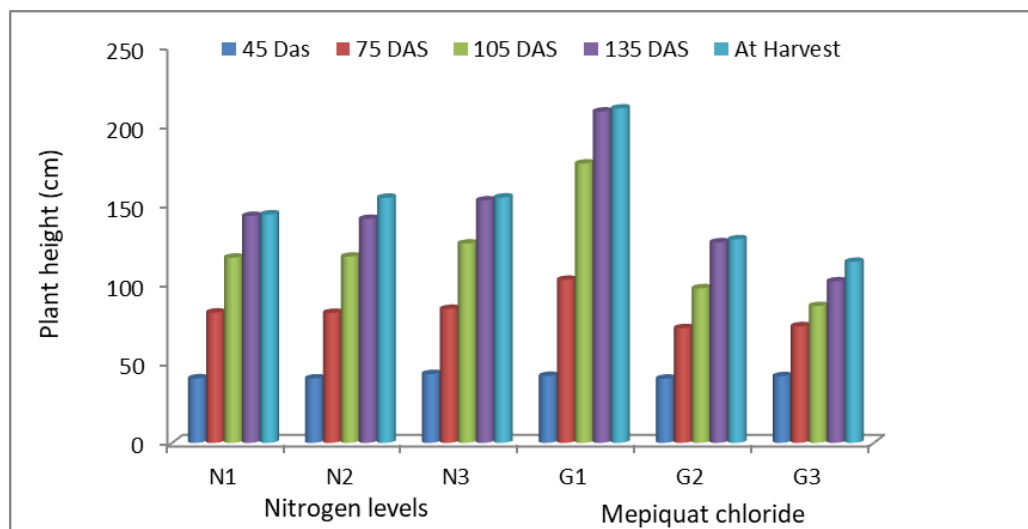


Fig 1: Effect of different nitrogen levels and mepiquat chloride dose on plant height (cm) of *Bt* cotton hybrid

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