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Influence of Plant Geometry, Growth Regulator and Nutrient Management on Performance of BT Cotton under Irrigated Condition

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ABSTRACT: *A field experiment was conducted at Research Farm, Department of Agronomy, Marathwada Krishi Vidyapeeth, Parbhani during* kharif, *seasons of 2010-11 and 2011-12 to work out optimum plant geometry, growth regulator and fertility levels for cotton hybrid Bunny Bt (NCS-145 Bt). The plant geometry 150 x 36 cm recorded significantly higher seed cotton yield (q/ha) during both the years. Seed cotton yield (q/ha) improved significantly in growth regulator treatment NAA and GA_3 during both the years. Application of fertilizer level 200 : 100 : 100 NPK kg/ha produced the higher seed cotton yield (q/ha) during individual years and in pooled data analysis.*

Key words: *Cotton, spacing, growth regulator, nutrient management*

Cotton is said to be "King of cash crop". In fact it is true because cotton has a great importance in global economy. Spacing is an important factor which influenced the yield as well as plant stand. There is a positive relationship between optimum plant population and yield (Rao, 1982). The productivity of cotton can be obtained with suitable agronomic practices like maintance of optimum plant density, use of growth regulator and use of optimum dose of fertilizer. Hence, keeping this in view, the present study was carried out to find out the suitable spacing, growth regulator and fertilizer levels.

METHODS AND MATERIALS

The field experiment was conducted at the Research Farm, Department of Agronomy, Marathwada Krishi Vidyapeeth, Parbhani during *kharif* , seasons of 2010-11 and 2011-12. The soil of the experimental site is clayey in texture, slightly alkaline in reaction (pH 8.10), medium in organic carbon (0.50%), low in available nitrogen (162.72 kg/ha) and phosphorus (11.78 kg/ha) and rich in available potash (489 kg/ha). The trial was laid out in split plot design with three replications. The treatments consiststed of twenty-four treatment combinations comprising of plant geometry (S_1: 90 cm x 60 cm, S_2: 120 cm x 45 cm, S_3: 150 cm x 36 cm & S_4: 180 cm x 30 cm)in main plot treatments, two growth regulators (G_1: Control & G_2 : NAA and GA_3)treatment in sub plot treatment and three fertilizer levels (F_1: 100 : 50 : 50 NPK kg ha^{-1}, F_2:150 : 75 : 75 NPK kg ha^{-1}, F_3: 200 : 100 : 100 NPK kg ha^{-1}) in sub-sub plot treatments. The fertilizers were applied as per treatments. Half dose of nitrogen and full dose of phosphorus and potash were applied as basal application at the time of sowing. Top dressing of remaining half dose of nitrogen was given after 30 and 60 days after sowing through urea. The sources of nutrients were urea (46% N), Di-ammonium phosphate (18% N, 46% P_2O_5) and Muriate of potash (60 % K_2O). All other recommended agronomic practices were followed uniformly. The total precipitation received during the crop season was 1152 mm in 60 rainy days during 2010-11 and 685 mm in 50 rainy days during 2011-12.

RESULTS AND DISCUSSION

Effect of Plant geometry:

Data in table 1 revealed that the 150 x 36 cm plant geometry recorded significantly taller plant height as compared to 90 x 60 cm, 120 x 45 cm and 180 x 30 cm plant geometries during both the years of

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Table 1
Influence of spacing, growth regulator and fertility levels on growth attributing characters during 2010-11 and 2011-12

Treatments	*Plant height (cm)*		*Monopodia/plant*		*Sympodia/plant*		*Mean dry matter plant^{-1} (g)*		*No. of functional leaves plant^{-1}*	
	2010-11	*2011-12*	*2010-11*	*2011-12*	*2010-11*	*2011-12*	*2010-11*	*2011-12*	*2010-11*	*2011-12*
Plant geometries (cm)										
S_1 - 90 x 60	117.46	119.60	2.44	2.60	27.77	34.33	271.01	288.59	71.54	82.92
S_2 - 120 x 45	121.06	128.90	2.50	2.69	28.05	34.88	274.25	292.44	74.01	85.63
S_3 – 150 x 36	127.53	137.60	2.65	2.87	30.93	37.46	279.54	299.81	79.04	90.29
S_4 – 180 x 30	123.55	132.62	2.50	2.43	25.89	30.73	268.51	282.89	68.13	77.24
S.E. ±	0.88	0.90	0.06	0.07	0.67	0.65	0.74	1.82	0.74	0.70
C.D. at 5%	***2.68***	***3.10***	***0.20***	***0.23***	**2.33**	***2.24***	***2.56***	***6.30***	***2.56***	***2.42***
Growth regulator										
G_1 – Control	121.45	127.10	2.54	2.59	27.24	33.78	270.74	286.33	71.36	81.77
G_2 – NAA and GA_3	123.35	132.28	2.50	2.70	29.07	34.72	275.92	295.54	75.00	86.27
S.E. ±	0.62	0.74	0.02	0.03	0.35	0.24	0.98	1.36	0.49	0.87
C.D. at 5%	**1.89**	**2.30**	**NS**	**NS**	**1.13**	**0.77**	**3.20**	**4.44**	**1.61**	**2.85**
Fertility levels										
F_1– 100:50:50	118.72	123.29	2.40	2.53	25.23	31.82	270.26	287.61	69.24	81.90
F_2– 150:75:75	122.38	131.16	2.51	2.61	28.47	34.52	273.46	290.05	73.36	80.85
F_3–200:100:100	126.10	134.61	2.66	2.80	30.77	36.41	276.27	295.13	76.94	86.31
S.E. ±	0.60	0.70	0.05	0.04	0.38	0.32	1.10	1.75	0.99	0.86
C.D. at 5%	***1.67***	***2.24***	***0.14***	***0.11***	***1.10***	***0.93***	***3.18***	***5.05***	***2.85***	***2.48***

experimentation. Similar differences in plant height due to plant geometries were reported by Wankhede *et al.* (2003) and Bhalerao *et al.* (2008). The different plant geometries showed significant influence on monopodial branches per plant at harvest at 150 x 36 cm plant geometry recorded significant as compared to rest of the plant geometries during both the years of experimentation. The observations are in confirmity with Reddy and Gopinath (2008).

The sympodial branches per plant was effectively improves by 150 x 36 cm plant geometries and it was significantly superior over rest of the plant geometries at all the growth stages during both the years of experimentation. The increase in number of sympodia in wider intra spacing and inter row spacing 150 x 36 cm was mainly due to availability of adequate amount of nutrients, moisture and light interception for optimum growth and development leading to production of more number of sympodia. Availability of space for lateral expanding of branches and chance to enhance auxiliary buds of plant as compared to closer plant and row spacing recorded more competition for space, light and nutrient. These observations are in conformity with Bhalerao *et al.* (2008) and Kalaichelvi (2009).

It was observed from Table 2 that average boll weight (g) and bolls per plant was influenced significantly due to plant geometries during 2010-11 and 2011-12. Plant geometry 150 x 36 cm was recorded the higher bolls per plant and bigger bolls compared with other plant geometries during both the years. This might be due to the maximum interception of solar radiation, maximum utilization of available nutrient, least competition for moisture and adequate aeration resulted in synthesis of higher photosynthesis and ultimately produced higher seed cotton yield under wider plant spacing such type of findings were also successively reported by Sharma and Dungarwal (2003). 150 x 36 cm plant geometry recorded significantly higher number of functional leaves and dry matter production per plant during both the years.

Regarding spacing, 150 x 36 cm recorded significantly more seed cotton yield of 36.23, 36.51 and 36.36 q/ha, higher growth and yield contributing characters during 2010-11, 2011-12 and in pooled analysis as compared to other plant geometries. The results are in conformity with those obtained earlier by Sankarnarayanan (2011) and Katore *et al.* (2008).

Effect of Growth regulator

The growth regulator treatment G_2 (NAA and GA_3) recorded maximum plant height as compared to controlled treatment during both the years. This may be due to maximum cell elongation due to the application of growth regulator GA_3 .It was observed that application of growth regulators was found that not significant effect of monopodial branches per plant during both the years. These observations are in conformity with Sharma *et al.* (2004). But the sympodia per plant was found to be significant during both the years.

Table 2
Influence of spacing, growth regulator and fertility levels on yield and yield attributing characters during 2010-11 and 2011-12

Treatments	*Boll weight (g)*		*Bolls/plant*		*Seed cotton yield (q/ha)*		
	2010-11	*2011-12*	*2010-11*	*2011-12*	*2010-11*	*2011-12*	*Mean*
Plant geometries (cm)							
S_1 - 90 x 60	3.24	3.47	57.89	60.06	33.05	33.76	33.40
S_2 - 120 x 45	3.28	3.50	59.56	62.91	34.36	34.11	34.23
S_3 – 150 x 36	3.46	3.65	64.06	66.66	36.23	36.51	36.36
S_4 – 180 x 30	3.10	3.16	56.22	55.65	31.26	31.69	31.11
S.E. $\pm$	0.04	0.09	1.29	1.05	0.48	0.57	0.52
C.D. at 5%	***0.13***	***0.30***	***4.46***	***3.65***	***1.67***	***1.97***	***1.82***
Growth regulator							
G_1 – Control	3.19	3.37	57.69	58.91	32.34	32.50	32.42
G_2– NAA and GA_3	3.35	3.52	61.17	63.72	35.11	35.53	35.18
S.E. $\pm$	0.04	0.04	0.49	0.82	0.36	0.65	0.50
C.D. at 5%	**0.11**	**0.14**	**1.60**	**2.68**	**1.18**	**2.11**	**1.64**
Fertility levels							
F_1– 100:50:50	3.10	3.30	57.58	58.78	32.71	32.40	32.34
F_2– 150:75:75	3.24	3.40	59.88	60.86	33.51	34.00	33.75
F_3–200:100:100	3.47	3.64	60.83	64.31	34.96	35.65	35.30
S.E. $\pm$	0.04	0.05	0.75	0.95	0.35	0.51	0.43
C.D. at 5%	***0.11***	***0.14***	***2.15***	***2.73***	***1.01***	***1.48***	***1.24***

The number of functional leaves and dry matter per plant were influenced significantly due to different growth regulator treatments during both the years of experimentation application growth regulator G_2 (NAA and GA_3) was found significantly superior over controlled treatment during both the years.

The boll weight (g) and picked bolls per plant was influenced significantly due to growth regulator treatment G_2 (NAA and GA_3) during both the years. Growth regulator treatment G_2 (NAA and GA_3) produced bigger bolls as compared to controlled treatment during both the years. This might be due to application of GA_3 which enhances cell elongation which in tern reflected in higher boll weight and seed cotton yield per plant.

The results revealed that seed cotton yield (q/ha) was influenced significantly due to growth regulator treatment during both the years and in pooled data. Growth regulator treatment G_2 (NAA and GA_3) produced higher seed cotton yield of 35.11, 35.53 and 35.18 q/ha during 2010-11, 2011-12 and pooled data respectively and was found significantly superior over growth regulator treatment G_1 (controlled). The increased seed cotton yield (q/ha) might be due to better fruiting efficiency, vegetative growth, maximum retention of squares per plant and bigger boll size which ultimately reflected in higher seed cotton yield (q/ha) in growth regulator treatment G_2 (NAA and GA_3). These observations are in conformity with Kler *et al.* (1991) and Sharma *et al.* (2004).

Effect of fertilizer levels

The application of 200 : 100 : 100 NPK kg/ha produced the taller plant and recorded maximum height at all growth stages during both the years. It was significantly superior over application of fertilizer 150 : 75 : 75 and 100 : 50 : 50 NPK kg/ha during both the years.

The number of monopodial and sympodial branches per plant differed significantly due to fertilizer management at harvest during both the years. Among the nutrient management levels, the application of 200 : 100 : 100 NPK kg/ha increasing number of monopodial and sympodial branches per plant which was significantly superior over rest of the fertilizer level during both the years. The higher nutrient availability through graded levels of fertilizer might have increased number of levels and production of photosynthates and reflected in more number of monopodial branches per plant. The observation are in conformity with Bhalerao *et al.* (2007).

Application of fertilizer level 200 : 100 : 100 NPK kg/ha were found significantly higher number of picked bolls per plant and boll weight (g). It was recorded significantly superior over fertilizer level 150 : 75 : 75 NPK kg/ha and 100 : 50 : 50 NPK kg/ha during both the years of experimentation. Application of fertilizer level 200 : 100 : 100 NPK kg/ha was found significantly superior over fertilizer level F_2 150 : 75 : 75 NPK kg/ha and fertilizer level F_1 100 : 50 : 50 during both the years.

Among fertility levels, Application of 200: 100: 100 NPK kg/ha to cotton produced higher seed cotton yield over fertilizer level 100: 50: 50 and 150: 75: 75 NPK kg/ha during both the year and in pooled data. It may be due to increased availability of nutrients which helped the plant to attain its maximum yield potential. The above findings are in accordance to the results reported earlier by Khamparia *et al.* (2009).

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