OPTIMISATION OF PLANT GEOMETRY AND NITROGEN REQUIREMENT FOR Bt COTTON

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ABSTRACT

A field experiment was conducted at Regional Agricultural Research Station, Acharya N. G. Ranga Agricultural University, Nandyal, Andhra Pradesh, during kharif 2011-12 on vertisols to optimize plant geometry and nitrogen requirement for Bt cotton for maximizing the productivity under rainfed condition. The experiment was laid out in split plot design having eighteen treatments combinations of plant geometry, Bt cotton hybrids and nitrogen levels replicated thrice. Significantly higher seed cotton yield (2026 kg/ha) and higher number of bolls per m^2 (47.0) were recorded due to plant geometry of 90 cm x 45 cm. Among hybrids, higher seed cotton yield (1983 kg/ha) and higher number of bolls per m^2 (40.7) were recorded in Bunny and it was at par with Mallika (1969 kg/ha and 37.7, respectively). Application of 150 % RDFN (180 kg N/ha) recorded higher seed cotton yield (1863 kg/ha) and higher number of bolls per m^2 (40.2) and it was at par with 125 % RDFN (150 kg N/ha) (1750 kg/ha and 37.8, respectively).

KEY WORDS: Bt cotton, nitrogen, plant geometry, seed cotton yield

INTRODUCTION

India has the largest area in the world under cotton at 12.18 M ha and is the second largest producer in the world with 35.32 M bales. However, India's average cotton productivity is 493 kg lint/ha combining both irrigated and rainfed areas and is low as compared to other countries (Anonymous, 2013). Maximum yield potential of *Bt* cotton hybrids can only be realized with suitable agronomic practices like plant geometry and balanced fertilizer application for selected hybrids over the years. *Bt* cotton hybrids have shown changes in vegetative and reproductive characteristics specifying to develop agronomic management practices. Most often, soils in rainfed areas are not only thirsty, but also hungry (Dehua *et al.* 2004). It is a well established fact that adequate quantities of nutrients are to be supplied for achieving higher yields. The nutrient management especially nitrogen in cotton is a complex phenomenon due to its long duration and indeterminate growth habit, where simultaneous production of vegetative and reproductive structures during the active growth phase takes place. Cotton plant being a heavy feeder, needs proper supply of plant nutrients for its successive cultivation

(Tayade and Dhoble, 2010). In this direction, research conducted on optimum plant geometry and nitrogen requirement for popularly grown *Bt* cotton hybrids in scarce rainfall zone of Andhra Pradesh for maximizing the productivity under rainfed condition.

MATERIALS AND METHODS

A field experiment was conducted at Regional Agricultural Research Station, Acharya N. G. Ranga Agricultural University Nandyal, Andhra Pradesh during *kharif* 2011-16 on vertisols to optimize plant geometry and nitrogen requirement for popularly grown *Bt* cotton hybrids in scarce rainfall zone of Andhra Pradesh for maximizing the productivity under rainfed condition. The soil was deep black, moderately alkaline with a pH 8.2, low in available nitrogen (195 kg/ha), high in available phosphorous (74 kg/ha) and potassium (425 kg/ha). The experiment was laid out in split split plot design having eighteen treatments of plant geometry, Bt cotton hybrids and nitrogen levels and replicated thrice. The main plot treatments comprised of plant geometry of 120 cm × 60 cm and 90 cm × 45 cm, where as sub plot treatments comprised of *Bt* cotton hybrids i.e. Bunny, Rasi and Mallika with nitrogen levels: 100 % RDFN (120 kg N/ha), 125 % RDFN (150 kg N/ha), and 150 % RDFN (180 kg N/ha) under sub-sub plots. Sowing was done on 7.2 x 5.4 m plots by dibbling of seeds. Fertilizers were applied as per the protocol. 60 kg P/ha was applied as basal. The recommended N and K (60 kg/ha) were applied in 3 splits at 30 days interval starting from 30 DAS. The observations on final plant population per hectare, plant height (cm) number of monopodia and sympodia per plant, number of bolls per m, boll weight (g) and seed cotton yield (kg/ha) were recorded. The data were subjected to statistical analysis as outlined by Gomez and Gomez (2010).

RESULTS AND DISCUSSION

The plant population varied significantly with different plant geometry and higher population being observed in 90 cm × 45 cm (23,700 per ha) and lower in 120 cm × 60 cm (13,181 per ha) (Table 1). However, no significant difference on plant population was observed with hybrids and nitrogen levels. Plant height differs significantly among plant geometry. Higher plant height (79.16 cm) was observed in 90 cm × 45 cm and lower (74.94 cm) was observed in 120 cm × 60 cm. Plant height was observed the highest in closer intra row spacing by Narayana *et al*., 2007. Significantly taller plants (80.18 cm) were observed in Bunny and are at par with Mallika (78.81 cm). Application of 150 % RDFN recorded higher plant height (78.63 cm) and it was at par with 125 % RDFN (77.15 cm). Significantly higher monopodia per plant were observed in 90 cm × 45 cm spacing (1.34) and in Rasi hybrid (2.01). There was no significant effect of sympodia per plant due to different treatments. Plant geometry of 90 cm × 45 cm recorded higher bolls per m (47.0), boll weight (3.82 gm) and seed cotton yield (2026 kg/ha). Higher seed cotton yields recorded with closer plant geometry also reported earlier by Sankarnarayana, 2004; Buttar and Singh, 2007; and Singh *et al.*, 2007. Planting *Bt* cotton at 90 cm x 45 cm with 150-75-75 kg NPK/ha gave higher seed cotton yield reported by Aruna and Reddy, 2009. Seed cotton yield of *Bt* cotton was significantly higher in plant geometry of 90 cm x 60 cm than 120 cm x 45 cm and 180 cm x 30 cm, which recorded 23 % and 21 % higher over 120 cm x 45 cm and 180 cm x 30 cm, respectively (Ghule *et al.*, 2013). Bunny hybrids recorded significantly higher bolls per m^2 (40.7) and seed cotton yield (1983 kg/ha) and it was at par with Mallika (37.7 and 1969 kg/ha, respectively). Application of 150 % RDFN (180 kg N/ha) recorded

higher seed cotton yield (1863 kg/ha) and higher number of bolls per m^2 (40.2) and it was at par with 125 % RDFN (150 kg N/ha) (1750 kg/ha and 37.8, respectively). This might be due to more availability of nutrients because of higher level of fertilizer dose *i.e.* 180:60:60 kg NPK/ha, which might have increased all the vital physiological processes and facilitated translocation of photosynthates to growing meristematic tissues. Ram and Giri (2006) also reported similar results. Significant improvement in seed cotton yield with increasing nitrogen levels among *Bt* cotton hybrids (Singh *et al.,* 2007). Higher seed cotton yield might be due more number of bolls per unit area (Sisodia and Khamparia, 2007; Bhalerao *et al.,* 2010; Sunitha *et al.,* 2010; and Shukla *et al.,* 2013).

CONCLUSION

Bt cotton hybrids Bunny, Mallika can be cultivated at plant geometry of 90 x 45 cm with application of 180-60-60 NPK kg/ha for maximizing productivity on vertisols of Andhra Pradesh under rainfed condition.

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Table 1: Effect of plant geometry and nitrogen levels on growth and yield parameters of *Bt* cotton hybrids

Treatment	Final Plant Population per Hcectare	Plant Height (cm)	Number of Monopodia per Plant	Number of Sympodia per Plant	Bolls per m^2	Boll Weight (g)	Seed Cotton Yield (kg/ha)
Plant geometry							
120 cm × 60 cm	13181	74.94	1.23	14.48	28.7	3.82	1516
90 cm × 45 cm	23700	79.16	1.34	14.08	47.0	4.32	2026
S. Em±	270	0.30	0.015	0.51	2.5	0.08	16
C.D. (P=0.05)	1643	1.87	0.095	NS	14.9	0.50	97
Hybrids							
Bunny	18346	80.18	0.96	15.07	40.7	4.14	1983
Rasi	18388	72.17	2.01	12.9	35.1	3.25	1361
Mallika	18587	78.81	0.90	14.87	37.7	4.82	1969
S. Em±	239	1.99	0.08	0.72	1.2	0.14	121
C.D. (P=0.05)	NS	6.94	0.26	NS	3.9	0.46	393
Nitrogen levels							
100% RDFN (120 kg N /ha)	18300	75.37	1.23	14.24	35.4	4.06	1701
125% RDFN(150 kg N/ha)	18465	77.15	1.34	14.33	37.8	4.08	1750
150% RDFN(180 kg N/ha)	18556	78.63	1.30	14.27	40.2	4.06	1863
S. Em±	219	1.01	0.79	0.41	1.1	0.08	55
C.D. (P=0.05)	NS	2.96	NS	NS	3.3	NS	161
CV (%)	5.0	9.6	15.9	12.2	13.1	9.1	13.2

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