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Research Note

Optimum Spatial and Nutritional Requirements of *Bt* Cotton Hybrid (Mallika) under Irrigation

Key words: *Bt* cotton, Nutrition, Spacing.

Cotton is the most important commercial crop of India, cultivated over an area of 9 million hectares with a production of 23 million bales. The average productivity was 440 kg lint ha^{-1} during 2004 (Sreenivasan, 2006). Andhra Pradesh is one of the premier states in the country ranking third in area (11.78 lakh ha) and production (21.9 lakh bales). The productivity was 316 kg lint ha^{-1} (CMIE, 2005). The area under Bt cotton hybrids leaped by 43 times in India and more than four times in Andhra Pradesh during last four years (control of Biotech crops, 2006). The phenomenal increase in area was mainly due to resistance of Bt cotton hybrids to *Helicoverpa armigera.*

The Bt cotton hybrids have shown distinguishable vegetative and reproductive growth characteristics (Chen *et at.,* 2004). To exploit yield potential of Bt cotton, it is necessary to determine optimum spacing and nutrition. In this context, the present experiment was conducted.

Field experiment was conducted in the kharif season under irrigation during 2005 at Regional Agricultural Research Station, Warangal. The crop was sown on 25-6-2005 in the alfisols. The experimental soil was low in organic carbon (0.40%), nitrogen (242 kg ha^{-1}), high in phosphorus (31 kg ha^{-1}) and medium in potash (240 kg ha^{-1}) content.

The experiment was laid out in a randomized block design with factorial concept in three replications. The treatment combinations comprised of three inter row spacings (90 cm, 60cm and 30 cm) and three nutritional levels (120:60:60; 150:75:75 and 180:90:90 kg N, P_20_5 and K_2O kg ha^{-1}) with common intra row spacing of 90 cm. The general spacing adopted by farmers is 90 x 90cm in this region and the recommended dose of fertilizer (RDF) is 120:60:60 kg N, P_2O_5 and K_2O kg ha^{-1}. The test hybrid was Mallika Bt of M/s Nuziveedu seeds (Private) Limited, Hyderabad. Entire phosphorus was applied basally as per treatments. Nitrogen and potash as per levels in 3 equal splits were applied at 20 day interval from sowing by pocketing. All the recommended crop management practices were followed. The pickings were taken up from 120 days after sowing and completed by 175 days.

Number of monopodia per plant

Adoption of various inter row spacings significantly influenced Number of monopodia per plant. With the decrease in spacing from 90 cm to 60 cm and to further 30 cm significantly lowered the Number of monopodia per plant from 1.77 to 1.34 and to 0.62 indicating early shift of crop to reproductive phase with closer spacing. Similar results of increase in monopodial branches with wider row spacing in non Bt cotton hybrids was earlier reported by Kasap and Killi (2004). Nutritional levels are not having any significant influence on Number of monopodia per plant.

Number of sympodia per plant

Number of sympodia per plant were not influenced by treatmental effects. Numerically higher Number of sympodia per plant were observed in 90 x 30 cm (25.35), when compared to 90 x 60 cm (24.31) and 90 x 90 cm (24.88). These results are incontrast to the finding of Sarkar and Malik (2004) in non Bt cotton

Boll number per plant

Significantly higher Boll number per plant was recorded with wider spacing of 90 x 90 cm (49.84) over 90 x 60 cm (39.40) and 90 x 30 cm (30.84). When cotton plants are grown wide apart, it produced more Boll number per plant due to wider geometry of plant. Similar results in non Bt cotton hybrids was also earlier reported by Yadav *et al*., (1991). However, nutritional levels have not influenced BNPP.

Seed cotton weight per boll

Higher Seed cotton weight per boll was recorded with wider spacing (90 x 90 cm) over closer spacing (90 x 30 cm). Seed cotton weight per boll was not influenced by nutritional levels. These results are in contrast to the findings of Brar *et al* (2000), who recorded more boll weight with higher nitrogen levels in non Bt hybrids.

Table 1. Yield and yield attributing characters as Influenced by plant spacings and Nutritional levels in *Bt* Cotton (Mallika)

Treatment	No. of monompodia plant^{-1}	No. of Sympodia plant^{-1}	Boll number Plant^{-1}	Boll weight (g)	Seed cotton yield (kg ha^{-1})
Plant Spacings					
90 x 90 cm	1.77	24.88	49.84	4.95	2623
90 x 60 cm	1.34	24.31	39.40	4.85	2993
90 x 30 cm	0.62	25.35	30.84	4.77	3248
S Em±	0.09	0.88	2.01	0.04	89.96
CD (P = 0.05)	0.28	NS	6.04	0.12	269
Nutritional levels					
Reco.dose of Fertilizer (RDF)	1.07	26.33	40.53	4.83	2939
25% higher than RDF	1.26	23.75	40.91	4.85	2945
50% higher than RDF	1.40	24.46	38.64	4.86	2981
S Em±	0.09	0.88	2.01	0.04	89.96
CD (P=0.05)	NS	NS	NS	NS	NS
Interaction					
S Em±	0.16	1.53	3.48	0.06	155.82
CD(P=0.05)	NS	NS	NS	NS	NS

Table 2. Economics of Bt Cotton (Mallika) as influenced by plant spacings and Nutritional levels.

Treatment	Cost of cultivation (Rs ha^{-1})	Gross Returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	Benefit Cost Ratio (BCR)
Plant Spacings				
90 x 90 cm	17176	47220	30044	1.75
90 x 60 cm	18913	53976	35063	1.85
90 x 30 cm	22287	58476	36189	1.62
Nutritional levels				
Rec.dose of Fertilizer (RDF)	18659	52902	34243	1.84
25% higher than RDF	19442	53016	33574	1.73
50% higher than RDF	20275	53754	33479	1.65

Seed cotton yield (kg ha^{-1})

Adoption of different nutrient management practices, have not influenced seed cotton yield. Mean seed cotton yield of 3248 kg ha^{-1} was recorded with spacing of 90 x 30 cm, which was significantly superior to 90 x 90 cm (2623 kg ha^{-1}) and at par with 90 x 60 cm (2993 kg ha^{-1}). The increase in seed cotton yield was due to higher plant population. Ahlawat *et al*., (1973) Yadav *et al*., (1991), Kasap and Killi (2004) also reported higher seed-cotton yield under closer spacing in non-Bt cotton.

Ginning percentage

Ginning percentage was influenced by neither spacings nor nutritional levels.

Economics

Higher gross returns (Rs. 58476 ha^{-1}) as well as net return (36189 ha^{-1}) were realised with closer spacing of 90 x 30 cm, where as net return rupee per rupee was found to be higher with 90 x 60 cm (1.85) and lowest with 90 x 30 cm (1.62).

With the increased nutrient application because of higher chemical fertilizer costs, the net returns as well as net return per rupee reduced.

Adoption of a spacing of 90 x 30 cm with application of 120:60:60 kg N, P_2O_5 and K_2O ha^{-1} was found to be optimum for Mallika Bt hybrid under irrigation.

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