Response of Bt cotton hybrids for targeted yield under Northern transitional zone of Karnataka

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Cotton (*Gossypium* spp), the queen of fibres or white gold, enjoys a predominant position amongst cash crops in India and world as well. Cotton is an important raw material for the Indian textile industry contributing about 65 per cent of its requirements. The Indian textile industry occupies a significant place in the Indian economy with over 1500 mills, 1.7 million power looms, and thousands of garments, hosiery and processing units, providing an employment directly or indirectly to around 35 million people. In India, around 45 per cent of pesticides used in agriculture are on cotton only even though its share in gross cropped area ever exceeded five per cent. The transgenic cotton era has dawned in our country with the approval accorded by GEAC for the commercial cultivation of Bt cotton hybrids in southern and central zones form 2002 crop season onwards. Today, Bt cotton is becoming popular among the forming community because of its ability to ward-off bollworm menace. The area under transgenic cotton in India has already exceeded 90 lakh ha (James, 2006). Performance of Bt-cotton also varies from region to region with changing agro-climatic conditions, nutrient requirement, pest pressure and management.

The important issue that needs to be addressed in crop production is nutrient usage. Cotton, particularly hybrids being exhaustive, draw plenty of soil nutrients and thus under continuous cropping pattern nutrient management assumes importance. Nutrient recommendation varies with crop response, soil condition and hence targeted yield levels to be realized. There fore it is necessary to test validity of Bt cotton production technology for a location to harvesting its full potential.

The field experiment was conducted at main agricultural research rtation, University of Agricultural Sciences, Dharwad, during growing season of 2006-07. The soil of experimental plot was medium deep black soil. Maize crop was taken up during kharif-2005, while in Rabi the land was fallow. The experiment consists of four Bt cotton (MRC-6322, MRC-6918, MRC-7351 and MRC-7201) hybrids and three fertilizer levels. The field experiment was laid out in a Randomized Complete Block Design, with three replications. The land was ploughed once before commencement of experiment with mould board plough and later harrowed twice to bring the soil to fine tilth. The different cotton genotypes were dibbled at 90 cm apart with intra row spacing of 60 cm on 29th June 2006, two seeds per hill dibbled to a depth of 4 cm on flat bed. Gap filling was done 10 days after sowing. Different fertilizer levels calculated based on soil nutrient availability (F_1 - 145:39:99 NPK kg ha^{-1}, F_2 -181:49:124 NPK kg ha^{-1} and F_3 - 217:59:148 NPK kg ha^{-1}). The 50 per cent of recommended dose of nitrogen and full dose of P_2O_5 and K_2O were applied at the time of sowing and the remaining 50 per cent of N was top dressed at 45 DAS. Biometric observations were recorded on five tagged plants selected randomly in each plot.

Among different hybrids, MRC-6322, Bollgard cotton recorded significantly higher seed cotton yield (3286 kg ha^{-1}) than the other Bollgard hybrid, MRC-6918. The improvement in the yield in MRC-6322 over MRC-6918 was to the tune of 28 per cent (Table1). Cotton hybrids MRC-7351 and MRC-7201 belonging to Bollgard-II performed statistically at par with MRC-6322. Performance of MRC-6322 was superior among the Bt hybrids during the year of study.

Seed cotton yield increased progressively with increase in fertilizer levels from F_1 to F_3 level. Significantly higher yield (3219 kg ha^{-1}) recorded in F_3 level over F_1 (2738 kg ha^{-1}) and F_2 (2891 kg ha^{-1}) level was on par with it. Improvement in yield was in the order of 36.90 15.64 and 7.30 per cent over their respective fertilizer levels. Higher seed cotton yield observed in MRC-6322 at all the level of NPK application.

Significant variations were observed in yield attributes in general and number of fruiting bodies in cotton could be attributed to variation in plant vigour, number of monopodial branches, number of sympodial branches and number of bolls per plant. MRC-6322 hybrid recorded significantly higher number of sympodial branches and number of bolls (67.69) per plant over other hybrids (Table 2). In the present study more number of bolls per plant was recorded with F_3 (61.32) level, these results are also in good conformity with Singh *et al*., (2003). Significant difference noted in sympodial branches may be due to genetic potential of genotypes to produce fruiting bodies. MRC-6322 recorded significantly higher number of monopodial branches (3.49). as compared to MRC-7351.

Among different genotypes studied, MRC-6322 recorded significantly higher dry matter production

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(430.69 g plant^{-1}) higher leaf area (223 dm^2 plant^{-1}) and leaf area index (4.13) in comparision to other hybrids. MRC-6918 recorded lowest leaf area per plant as well as leaf area index (3.92). Significantly higher dry matter production, leaf area, lead area index were recorded with F_3 level of fertilizer application. While, F_1 level recorded significantly lower values of these parameters (Table 3).MRC-6322 recorded significantly higher leaf area , particularly at the higher level of nutrition, and LAI and dry matter production values followed by Bollgard-II.

Among different hybrids, MRC-6322 produced significantly higher seed cotton yield (3286 kg ha^{-1}) followed by MRC-7351 (3051 kg ha^{-1}). Seed cotton yield differed significantly due to different levels of fertilizer for targeted yield. Significantly higher available NPK (232, 54.93 and 373 kg ha^{-1}) were recorded in MRC-6918 and higher uptake was observed in MRC-6322.

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Table 1: Seed cotton yield (kg ha^{-1}) of cotton hybrids as influenced by different nutrient levels

Treatments	**Fertilizer levels**			
Bt Hybrid	**F_1**	**F_2**	**F_3**	**Mean**
MRC-6322	3062^{ab}	3067^{ab}	3730^{a}	3286^{a}
MRC-6918	2472^{b}	2494^{b}	2769^{b}	2578^{b}
MRC-7351	2857^{b}	3006^{ab}	3290^{ab}	3051^{a}
MRC-7201	2561^{b}	2997^{ab}	3086^{ab}	2881^{ab}
Mean	**2738^{b}**	**2891^{ab}**	**3219^{a}**	**-**
	SEm(±)		LSD(P=0.05)	
Hybrid (G)	**80.23**		**407.60**	
Fertilizer (F)	**69.48**		**353.00**	
G X F	**138.96**		**705.90**	

F_1: 145:39:99 NPK kgha^{-1} F_2: 181:49:124 NPK kg ha^{-1} F_3: 217:59:148 NPK kg ha^{-1}

Table 2: Monopodial branches, sympodial branches and bolls per plant of different Bt cotton genotypes as influenced by nutrient levels

Treatments	Monopodial branches				Sympodial branches				Bolls per plant			
Bt Hybrid	Fertilizer levels				Fertilizer levels				Fertilizer levels			
	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean
MRC-6322	3.33^{b}	3.27^{b}	3.87^{a}	3.49^{a}	20.40^{ab}	21.07^{a}	20.60^{ab}	20.69^{a}	63.27^{ab}	68.53^{a}	71.27^{a}	67.69^{a}
MRC-6918	3.13^{b}	3.13^{b}	3.27^{b}	3.18^{b}	19.53^{ab}	19.53^{ab}	21.20^{a}	20.09^{ab}	51.00^{bcd}	49.27^{cd}	60.20^{abc}	53.49^{b}
MRC-7351	2.87^{b}	3.13^{b}	3.13^{b}	3.04^{b}	19.27^{b}	18.93^{b}	19.70^{b}	19.09^{c}	52.13^{bcd}	55.73^{bcd}	54.13^{bcd}	54.00^{b}
MRC-7201	2.80^{b}	3.07^{b}	3.27^{b}	3.04^{b}	18.93^{b}	19.60^{ab}	20.00^{ab}	19.51^{bc}	43.67^{d}	55.40^{bcd}	59.67^{abc}	52.91^{b}
Mean	**3.03^{b}**	**3.15^{ab}**	**3.38^{a}**	**-**	**19.53^{a}**	**19.78^{a}**	**20.22^{a}**	**-**	**52.52^{b}**	**57.23^{ab}**	**61.32^{a}**	**-**
	SEm(±)		LSD (P=0.05)		SEm(±)		LSD (P=0.05)		SEm(±)		LSD (P=0.05)	
Hybrid (G)	**0.05**		**0.27**		**0.18**		**0.89**		**1.26**		**2.01**	
Fertilizer (F)	**0.05**		**0.24**		**0.16**		**NS**		**1.09**		**5.55**	
G X F	**0.10**		**0.48**		**0.32**		**1.53**		**2.18**		**11.10**	

F_1: 145:39:99 NPK kg ha^{-1} F_2: 181:49:124 NPK kg ha^{-1} F_3: 217:59:148 NPK kg ha^{-1}

Table 3: Dry matter production (g $plant^{-1}$), leaf area and Leaf area index (LAI) of different Bt cotton genotypes as influenced by nutrient levels

Treatments	Dry matter production (g $plant^{-1}$)				Leaf area per plant (dm^2 $plant^{-1}$)				Leaf area index			
(Bt Hybrid)	Fertilizer levels				Fertilizer levels				Fertilizer levels			
	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean
MRC-6322	399.33^{c}	434.05^{b}	456.75^{a}	430.04^{a}	209.34^{de}	225.35^{bc}	234.42^{a}	223.04^{a}	3.87^{g}	4.17^{d}	4.34^{a}	4.13^{a}
MRC-6918	389.08^{c}	421.92^{b}	435.25^{b}	415.42^{b}	203.31^{e}	211.50^{d}	220.91^{c}	211.91^{c}	3.76^{j}	3.92^{f}	4.09^{de}	3.92^{c}
MRC-7351	394.63^{c}	430.05^{b}	438.75^{b}	421.15^{ab}	207.77^{de}	220.70^{c}	228.58^{ab}	219.02^{b}	3.85^{g}	4.08^{e}	4.23^{b}	4.05^{b}
MRC-7201	390.01^{c}	425.70^{b}	431.7^{7b}	415.83^{b}	205.54^{de}	222.13^{bc}	26.21^{bc}	217.96^{b}	3.81^{h}	4.11^{de}	4.19^{c}	4.04^{b}
Mean	**393.26^{c}**	**427.9^{3b}**	**440.63^{a}**	**-**	**206.44^{c}**	**219.92^{b}**	**227.53^{a}**	**-**	**3.82^{c}**	**4.07^{b}**	**4.21^{a}**	**-**
	SEm(±)		**LSD (P=0.05)**		**SEm(±)**		**LSD (P=0.05)**		**SEm(±)**		**LSD(P=0.05)**	
Hybrid (G)	**1.81**		**9.24**		**0.74**		**3.78**		**0.01**		**0.02**	
Fertilizer (F)	**1.57**		**8.00**		**0.64**		**3.27**		**0.02**		**0.02**	
G X F	**3.15**		**16.01**		**1.29**		**6.54**		**0.02**		**0.04**	

F_1: 145:39:99 NPK kgha^{-1} F_2: 181:49:124 NPK kg ha^{-1} F_3: 217:59:148 NPK kg ha^{-1}