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Response of Bt-cotton hybrids for targated yield under northern transitional zone of Karnataka

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ABSTRACT

A field experiment was carried out at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, during the growing season of 2006-07 to assess the performance of 'Bollgard' Bt cotton hybrids under northern transitional zone. The field trial was laid out in randomized complete block design with four (MRC-6322, MRC-6918, MRC-7351 and MRC-7201) Bt cotton hybrids and three target yield (2.0, 2.5 and 3.0 t ha^{-1}) levels. Among the different Bt cotton genotypes, MRC-6322 recorded significantly higher yield (3286 kg ha^{-1}) over MRC-6918 (2578 kg ha^{-1}), and MRC-7351 (3051 kg ha^{-1}) and MRC-7201 (2881 kg ha^{-1}) was at par with it. MRC-6322 cotton hybrid recorded significantly higher gross returns, net returns and B:C ratio.

Key words : Bt cotton, Leaf area index (LAI)

INTRODUCTION

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 (Ashok *et al.*, 2004). 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. Therefore, it is necessary to test validity of Bt cotton production technology for a location to harvesting its full potential.

MATERIALS AND METHODS

The field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, during growing season of 2006-07 (one year study). 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

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observations were recorded on five tagged plants selected randomly in each plot.

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented in Table 1, 2 and 3.

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 at 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 (Table 1). Dastur and Dabir, (1961) reasoned that such an improvement in yield due to higher fertilizer application is due to improvement in yield attributes as a consequence of overall improved growth. Higher seed cotton yield observed in MRC-6322 at all the level of NPK application.

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}	-
	S.E.±		S.D. (P=0.05)	
Hybrid (G)	80.23		407.60	
Fertilizer (F)	69.48		353.00	
G x F	138.96		705.90	

Note : 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}

Significantly variation 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 line with reports made by Ganajaxi *et al*.(1996) and Singh *et al*.(2003). Significant difference noted in sympodial branches may be due to genetic potential of genotypes to produce fruiting bodies. Similar results obtained with respect to monopodial branches where MRC-6322 recorded significantly higher number of monopodial branches (3.49). However, lowest numbers of monopodial branches were recorded with MRC-7201 and MRC-7351. Sympodial branches with MRC-7351 and MRC-7201 and number of bolls per plant with MRC-7201.

In the present investigation among different genotypes studied, MRC-6322 recorded significantly higher dry matter production (430.04 g plant^{-1}) consequent upon higher leaf area (223.04 dm^2 plant^{-1}) and leaf area index (4.13) in comparision to other hybrids. MRC-7351 and MRC-7201 were next to in the line. While, MRC-6918 recorded lowest leaf area per plant as well as leaf area index (3.92). Significantly higher dry matter

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}	-
	S.E.±		S.D. (P=0.05)		S.E.±		S.D. (P=0.05)		S.E.±		S.D. (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	

Note : 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 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				Leaf area per plant				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}	-
	S.E.±		S.D. (P=0.05)		S.E.±		S.D. (P=0.05)		S.E.±		S.D. (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	

Note : 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}

production, leaf area, lead area index 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.

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