INTERNATIONAL JOURNAL OF SCIENCE AND NATURE
© 2004 - 2017 Society For Science and Nature(SFSN). All Rights Reserved
www.scienceandnature.org

BT COTTON PRODUCTIVITY AND PROFITABILITY AS INFLUENCED BY NUTRIENT LEVELS AND NITROGEN SPLIT APPLICATION UNDER IRRIGATION

[1*]Basavanneppa M. A. [2]Angadi, V.V. [2]Biradar, D.P. and [3]Udikeri, S.S.
[1]Agricultural Research Station, Siruguppa-583121, UAS, Raichur, Karnataka
[2]Departments of Agronomy, University of Agricultural Sciences, Dharwad, Karnataka
[3]Departments of Entomology, University of Agricultural Sciences, Dharwad, Karnataka
*Corresponding authors email: basavanneppa6@gmail.com

ABSTRACT
A field experiment was conducted for two *kharif* seasons of 2007-08 and 2008-09 to study the "Productivity and profitability of Bt cotton as influenced by nutrient levels and split application under irrigation" in black soil with available nitrogen (337 kg ha^{-1}), P_2O_5 (16.5), K_2O (435 kg ha^{-1}) and organic carbon content (0.42%). The trial was laid out in split-split plot design with V_1: MECH-162 Bt, V_2: RCH-2 Bt, V_3: JK Durga Bt (BG-I) and V_4: MRC-7201 (BG-II) genotypes in main plots, nutrient levels F_1: 120:60:60 (Recommended), F_2:160:80:80 and F_3: 200:100:100 (Farmers' practice) N: P_2O_5: K_2O kg ha^{-1} in sub plots and nitrogen split application A: N 50% as basal + 50% N in three equal splits at 50, 80 and 110 DAS + foliar spray of urea @ 2% at 80 and 100 DAS and B: 12.5% N as basal and at 30, 90 and 120 DAS and 50% N at 60 DAS with foliar spray of urea @ 2% at 105 and 135 DAS as sub-sub plots. At sowing 100% recommended P and K were applied to all the treatments and N was applied as per treatments. All other practices were followed as per the recommended practices of UAS, Dharwad. Among genotypes MECH-162 Bt recorded significantly higher seed cotton (2537 kg ha^{-1}), gross return (Rs. 71040 ha^{-1}), net return (Rs. 48290 ha^{-1}) and B: C ratio (3.13) compared to rest of the genotypes. Among the nutrient levels, application of 200:100:100 N: P_2O_5: K_2O kg ha^{-1} produced significantly superior seed cotton yield (2515 kg ha^{-1}), gross return (Rs. 70410 ha^{-1}), net return (Rs. 46590 ha^{-1}) and B: C ratio (2.96) than other nutrient levels. Split application of N @ 12.50% as basal and at 30 , 90, 120 DAS and 50% at 60 DAS with foliar spray of urea @ 2% at 105 and 135 DAS produced significantly higher seed cotton yield (2397 kg ha^{-1}), gross return (Rs. 67209 ha^{-1}), net return (Rs. 44258 ha^{-1}) and B:C ratio (2.94). Among the interactions, V_1F_3B registered superior seed cotton yield (2736 kg ha^{-1}), net return (Rs. 52690 ha^{-1}) and B: C ratio (3.21).

KEYWORDS: Bt cotton, nutrients, nitrogen, split application, yield and economics.

INTRODUCTION

Transgenic cotton cultivation has attracted farming community worldwide due to its inherent toxicity against insect pests and monetary benefits. Now ten countries have already started commercial production of Bt-cotton. Among them, India stands first with 12.20 m ha followed by China (5.50 m ha), the USA (3.95 m ha) and Pakistan with 3.27 m ha (Anon, 2011). The state of Karnataka has also recorded a jump in productivity from 220 kg ha^{-1} in 1999-2000 to 434 kg ha^{-1} in 2011 owing to large scale Bt cotton cultivation. Performance of Bt-cotton varies from region to region with changing agro-climatic conditions, pest pressure and management. Besides bollworm management, the other 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 great importance. Nutrient recommendation varies with crop response, soil condition and hence different levels of nutrients needs to be study. Further, nitrogen is one of the key factors that directly influence vegetative growth and dry matter production. Decreased dry matter production was associated with boll shedding, which is also a reason of N deficiency (Jackson and Gerik, 1990). In Tunga Bhadra Command Area of Karnataka farmers are cultivating Bt cotton with unscientific nutrient management, which led to many environmental problems. In this context, present investigation was carried out at Agricultural Research Station, Siruguppa during 2007-08 and 2008-09 to study on productivity and profitability of Bt cotton as influenced by nutrient levels and N split application under irrigation.

MATERIALS & METHODS

A field experiment was conducted for two *kharif* seasons of 2007-08 and 2008-09 to study the "productivity and profitability of Bt cotton as influenced by nutrient levels and split application under irrigation" in black soil with available nitrogen (337 kg ha^{-1}), P_2O_5(16.5), K_2O (435 kg ha^{-1}) and organic carbon content (0.42%). The trial was laid out in split-split plot design with V_1: MECH-162 Bt, V_2: RCH-2 Bt, V_3: JK-Durga Bt (BG-I) and V_4: MRC-7201 (BG-II) genotypes as main plots, nutrient levels F_1: 120:60:60 (Recommended), F_2: 160:80:80 and F_3: 200:100:100 (Farmers' practice) N:P_2O_5: K_2O kg ha^{-1} in sub plots and nitrogen split application A: 50% N as basal + 50% N in three equal splits at 50, 80 and 110 DAS +

foliar spray of urea @ 2% at 80 and 100 DAS and B: 12.5% N as basal and at 30, 90 and 120 DAS and 50% N at 60 DAS with foliar spray of urea @ 2% at 105 and 135 DAS in sub-sub plots with three replications. At sowing 100% P and K were applied to all the treatments and N was applied as per treatments. All other practices were followed as per the recommended practices of UAS, Dharwad.

RESULTS & DISCUSSION

Performance of Bt cotton genotypes

Among the genotypes, significantly higher seed cotton yield was recorded with MECH-162 Bt (2537 kg ha^{-1}) and the low yield was observed in JK Durga Bt (2058 kg ha^{-1}). The extent of increase in MECH -162Bt was 3.6, 23.3 and 7.6% over RCH-2, JK Durga and MRC 7201 genotypes, respectively (Table 1). These results are in conformity with the findings of Venugopal *et al.* (2002) and Patil *et al.* (2004). Similarly, Halemani *et al.*, (2004) reported that among the Bt-cotton hybrids tested under trial, RCH-2Bt was top yielder, followed by RCH-144Bt, RCH-20Bt and MECH-184Bt at ARS, Dharwad. Whereas, Police Patil (2007), opined that performance of MRC-6322 was superior among the different Bt hybrids tested. In the present study, the higher boll weight recorded with MRC-7201 (4.92 g) and seed cotton yield per plant (137.7 g pl^{-1}) compared other genotypes. This higher yield in MECH-162Bt is attributed to more number of bolls harvested per plant (43.07) and was on par with RCH-2Bt (42.53). The extent of increase in number of harvested bolls with MECH-162Bt was 8.2 and 10.20% more than JK Durga and MRC-7201BGII respectively (Table 1). Similar results were observed by Hosmath *et al.* (2004) and Yenagi (2006).

Effect of nutrient levels on yield

Among the nutrient levels application of 200:100:100 N:P_2O_5:K_2O kg ha^{-1} produced significantly higher seed cotton yield (2515 kg ha^{-1}) compared to other nutrient levels (Table 1). Significantly low seed cotton yield was noticed in 120:60:60 N: P_2O_5: K_2O kg ha^{-1} (2187 kg ha^{-1}). The extent of increase in seed cotton yield with 200:100:100 N:P_2O_5: K_2O kg ha^{-1} was 7 and 15% over 120:60:60 and 160:80:80 N:P_2O_5:K_2O kg ha^{-1}, respectively. This higher yield in 200:100:100 N: P_2O_5: K_2O kg ha^{-1} was mainly attributed to boll weight (5.09g) and yield per plant (135.8g). Significantly low yield per plant (118.0g) was noticed with 120:60:60 N: P_2O_5: K_2O kg ha^{-1}. Similar findings were also reported by Police Patil (2007). Dustur 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. Accordingly in the present study significantly more number of bolls were recorded with 200:100:100 N: P_2O_5: K_2O kg ha^{-1} (43.30 pl^{-1}) compared to other nutrient levels. These results are also in line with reports made by Ganajaxi *et al*. (1996) and Jagvir Singh *et al*. (2003).

Effect of nitrogen split application

Among the N split application, Split application of N @ 12.5% as basal and at 30, 90, 120 DAS and 50% at 60 DAS with foliar spray of urea @ 2% at 105 and 135 DAS recorded significantly higher seed cotton yield (2397 kg ha^{-1}) compared to recommended N split application. Hosmath (2011) opined that seed cotton yield advantage was more with foliar application of KNO_3 @ 2%, soil and foliar application of $MgSO_4$ @ 25 kg ha^{-1} and @ 1% respectively than recommended package.

Interaction effects between genotypes, nutrient levels and N split application showed significant differences in the seed cotton yield (Table 1). V_1F_3B produced significantly higher seed cotton yield (2736 kg ha^{-1}) compared to rest of the interaction effects. This higher seed cotton yield was greatly influenced by yield per plant (147.70 g) and number of bolls harvest per plant (46.78).

Economics: Among the genotypes MECH-162Bt recorded significantly higher gross return (Rs. 71040 ha^{-1}), net return (Rs. 48290 ha^{-1}) and B:C ration (3.13) compared other genotypes. The extent of increase in net return with MECH-162Bt was to the tune of 8% over MRC-7201BGII. The low gross return (Rs. 57630 ha^{-1}), net return (34870 ha^{-1}) and B:C ratio (2.54) was observed with MRC -7201 BGII , Similar results are also reported by Patil *et al.* (2004). Among the nutrient levels, application of 200:100:100 N: P_2O_5: K_2O kg ha^{-1} recorded significantly higher gross return (Rs. 70410 ha^{-1}), net return (Rs. 46590 ha^{-1}) and B:C ratio (2.96) compared other nutrient levels. Significantly least net return (Rs. 39260 ha^{-1}) and B: C ratio(2.80) was recorded with 120:60:60 N:P_2O_5:K_2O kg ha^{-1}. Among the N split applications 12.5% N as basal and at 30, 90 and 120 DAS and 50% N at 60 DAS with foliar spray of urea @ 2% at 105 and 135 DAS showed that significantly higher gross return (Rs.67209 ha^{-1}), net return (Rs.44258 ha^{-1}) and B:C ratio (2.94) compared to recommended N split application. Brar *et al.* (2008) reported that foliar application of KNO_3 @ 2% yielded higher gross return, net return and B: C ratio in cotton than soil application of potassic nutrients.

Among the interaction effects, V_1F_3B recorded significantly higher gross return, net return and B:C ratio (Rs. 76600 ha^{-1}, Rs. 82690 ha^{-1} and 3.21, respectively) compared to rest of the interaction effects.

REFERENCES

Anonymous, (2011) Project Co-ordinator Report, *Annu, Group Meet. of AICCRP*, CICR, Coimbatore.

Brar, M.S., Gill, M.S., Sekhon, K.S., Sidhu, B.S., Sharma, P. and Singh, A. (2008) Effect of soil and foliar application of nutrients on yield and nutrient concentration in Bt cotton. *J. Res., Punjab Agric. Univ.,* 45 (3&4): 126-131.

Disturb, R.H. and Dabir, V.N. (1961) Effect of nitrogen phosphorus and potassium on growth and yield of American Cotton of Vidharba, *Indian Cotton Grow. Rev*., 16 (5): 24-281.

Ganajaxi, Math, K.K. and Gururaj Hunsagi (1996) Effect of nitrogen and potassium levels and yield of biomass and seed cotton yield of two cotton hybrids. *Karnataka J. Agric. Sci*., 9 (3): 516-519.

Halemani, H.L., Hallikeri, S.S., Nandagavi, R.A. and Nooli, S.S. (2004) Performance of Bt cotton hybrids at different levels of fertilizers under protection irrigation. In: *International Symposium on "Strategies for Sustainable*

Cotton Production –A Global Vision" 2. Crop Production, 23-25 November 2004, UAS, Dharwad, Karnataka, India, pp. 153-155.

Hosmath, J.A., Biradar, D.P., Deshpande, S.K., Dodamani, S.V., Rizwan Haris, M.D. and Nooli, S.S. (2004) Analysis of Bt toxin (Cry1Ac protein) under organics In: *Intl. Symp. on* "*Strategies for Sustainable Cotton Production –A Global Vision*" 2. Crop Production, 23-25 November 2004, Univ. Agric. Sci., Dharwad, Karnataka, India, pp. 133-134.

Hosmath, J.A. (2011) Evaluation of Bt cotton genotypes and nutrient management to control leaf reddening. *Ph. D. Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).

Jagvir Singh, Blaisc Rao, M.R.K., Mayec, C.D. and Deshmukh, M.S. (2003) Assessment of agronomic efficiency of Bt cotton in rainfed Vertisol. *J. Indian Soc. Cotton Improv*., 28 (3): 185-190.

Jackson, B.S. and Gerik, T.J. (1990) Boll shedding and boll load in nitrogen stressed cotton. *Agron. J*., 82 : 483-458.

.

Patil, B.V., Bheemanna, M., Hanchinal, S.G. and Kengegowda, N. (2004) Performance and economics of Bt cotton cultivation in irrigated ecosystem. In : *Intl. Symp. on* "*Strategies for Sustainable Cotton Production –A Global Vision*" 3 Crop Protection, 23-25 November 2004, Univ. Agric. Sci., Dharwad, Karnataka India, pp. 139-142.

Police Patil, (2007) Performance of Bt cotton hybrids as influenced by site specific nutrient management approach for realising target yields. *M. Sc. (Agri.)* Thesis, Univ. Agric, Sci., Dharwad, Karnataka (India).

Venugopal, K., Ramasami, M. and Thigarajan, C.P. (2002) Risk assessment and its management in Bt cotton in India. In : *National Seminar on Bt cotton Scenario with Special Reference to India*, 23rd May 2002, Univ. Agric. Sci., Dharwad, Karnataka, pp. 70-84.

Yenagi, B.S. (2006) Studies on performance of Bt cotton genotypes and evaluation of refuge crops/cropping system. *Ph. D. Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

TABLE 1. Seed cotton yield and yield parameters as influenced by genotypes, nutrient levels and N split application in Bt cotton

Treatments	Seed cotton yield(kg/ha)			Boll weight (g)			Seed cotton yield (g pl^{-1})			No. bolls per plant		
Genotypes	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
V_1: MECH - 162 Bt (BG-I)	2754 a**	2321 a	2537 a	4.94 a	4.74 b	4.85 a	148.7 a	125.3 a	137.7 a	45.84 a	40.28 a	43.07 a
V_2: RCH - 2 Bt (BG-I)	2592 a	2305 a	2448 ab	5.01 a	4.84 ab	4.92 a	140.7 a	124.5a	132.7 ab	45.62 a	39.43 a	42.53 a
V_3: JK Durga (BG-I)	2286 b	1830 c	2058 c	4.95 a	4.82 ab	4.89 a	123.3 b	98.8 c	111.1 c	43.03 b	36.56 b	39.80 b
V_4: MRC- 7201 Bt (G-II)	2623 a	2092 b	2358 b	5.09 a	4.90 a	4.99 a	141.7 b	112.9 b	127.3 b	42.04 b	36.07 b	38.96 b
S Em ±	58	50	43	0.06	0.04	0.07	3.13	2.69	2.26	0.70	0.35	0.474
C.D @ 5%	202	172	147	NS	NS	NS	10.84	9.32	7.82	2.09	1.07	1.58
Nutrient levels (N-P_2O_5-K_2O kg ha^{-1})												
F1: 120:60:60 (Recommended)	2422 c	1952 c	2187 c	4.89 b	4.49 c	4.69 c	130.8 c	105.3 c	118.0 c	41.37 c	36.07 c	38.72 c
F2: 160:80:80	2566 b	2143 b	2355 b	5.00 ab	4.92 b	4.96 b	138.5 b	115.8 b	127.1 b	44.37 b	38.10 b	41.24 b
F3: 200:100:100 (Farmers' practice)	2714 a	2315 a	2515 a	5.12 a	5.07 a	5.09 a	146.5 a	125.1a	135.8 a	46.66 a	40.08 a	43.30 a
S Em ±	43	31	27	0.05	0.03	0.04	2.33	1.69	1.46	0.44	0.39	0.336
C.D @ 5%	129	94	82	0.14	0.10	0.13	6.98	5.06	4.38	1.41	1.19	1.31
N split application*												
A: Basal (50% N) + 50 % N in three equal splits at 50, 80 and 110 DAS + foliar spray of Urea @ 2 % at 80 and 100 DAS	2521 b	2087 b	2304 b	4.96 b	4.74 b	4.85 b	136.08 b	112.8 b	124.42 b	43.23 b	37.36 b	40.31 b
B: 12.5% N as basal and at 30, 90 and 120 DAS and 50% N at 60 DAS with foliar spray of urea @ 2% at 105 and 135 DAS	2607 a	2187 a	2397a	5.04 a	4.91 a	5.01 a	141.11 a	118.0 a	129.58 a	45.03 a	38.78 a	41.86 a
S Em ±	23	17	18	0.02	0.02	0.02	1.23	0.92	1.01	0.29	0.26	0.18
C.D @ 5%	68	50	53	0.07	0.07	0.07	3.59	2.68	2.95	0.91	0.76	0.83
Interactions (VxFxTime)												
S Em ±	78.72	59.07	63.27	0.079	0.077	0.055	4.26	3.17	3.50	1.004	0.906	0.640
C.D @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

ISSN 2229 – 6441

TABLE 2. Gross returns, net returns and B:C ratio as influenced by genotypes, nutrient levels and N split application in Bt cotton

Treatments	Gross Return (Rs ha^{-1})			Net returns (Rs ha^{-1})			B:C		
Genotypes	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
V_1: MECH - 162 Bt (BG-I)	77110 a	64980 a	71040 a	55060 a	41520 a	48290 a	3.50 a	2.77 a	3.13a
V_2: RCH - 2 Bt (BG-I)	72990 a	64540 a	68770 ab	50950 a	41080 a	46010 ab	3.31 a	2.75 a	3.03 ab
V_3: JK Durga (BG-I)	64010 b	51240 c	57630 c	41960 b	27780 c	34870 c	2.90 b	2.18 c	2.54 c
V_4: MRC- 7201 Bt (G-II)	73450 a	58570 b	66010 b	51170 a	34880 b	43030 b	3.29 a	2.47 b	2.86 b
S Em ±	1630	1393	1194	1630	1394	1194	0.07	0.06	0.05
C.D @ 5%	4901	4180	3590	4901	4180	3590	0.20	0.19	0.16
Nutrient levels (N-P_2O_5-K_2O kg ha^{-1})									
F1: 120:60:60 (Recommended)	67820 c	54650 c	61240 c	46540 b	31980 c	39260 c	3.19 a	2.41 b	2.80 b
F2: 160:80:80	71860 b	60010 b	65930 b	49930 ab	36670 b	43300 b	3.28 a	2.57 a	2.92 a
F3: 200:100:100 (Farmers' practice)	76000 a	64830 a	70410 a	52880 a	40300 a	46590 a	3.29 a	2.64 a	2.96 a
S Em ±	1209	877	766	1209	877	766	0.05	0.04	0.03
C.D @ 5%	3506	2544	2310	3506	2544	2310	0.14	0.13	0.11
N split application									
A: Basal (50% N) + 50 % N in three equal splits at 50, 80 and 110 DAS + foliar spray of Urea @ 2 % at 80 and 100 DAS	70589 b	58440 b	65142 b	48614 b	35076 b	41845 b	3.21 a	2.50 b	2.85 b
B: 12.5% N as basal and at 30, 90 and 120 DAS and 50% N at 60 DAS with foliar spray of urea @ 2% at 105 and 135 DAS	73196 a	61223 a	67209 a	50957 a	37559 a	44258 a	3.29 a	2.58 a	2.94 a
S Em ±	636	477	511	636	477	511	0.03	0.02	0.02
C.D @ 5%	1910	1450	1550	1910	1450	1550	0.10	0.08	0.07
Interactions (VxFxTime)									
S Em ±	2204	1654	1771	2204	1654	1771	0.102	0.071	0.080
C.D @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS