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Effect of nitrogen levels, split application of nitrogen on yield and fibre quality of *Bt* cotton in vertisols

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ABSTRACT : To find out the requirement of nitrogen, schedule of nitrogen application on cotton hybrids to assess their effects on growth, yield and fibre quality parameters, field experiment was conducted at Regional Agriculture Research Station, Lam, Guntur for two consecutive years (2009-2010 and 2010-2011) under rainfed conditions. Results indicated that increased level of nitrogen from 120 to 150 kg/ha significantly increased seed cotton yield. Application of N with recommended method of 3 splits (2115, 2093 kg/ha) was similar to application in 4 splits (2093, 2150kg/ha), respectively, during 2009-2010 and 2010-2011.

Key words: *Bt* cotton, nitrogen levels, split application

Production and productivity of cotton increased after the introduction of *Bt* cotton in vertisols of Krishna zone. Research on cotton under varied soil and climatic conditions has revealed beneficial effect of nitrogen application on the growth, yield and quality of seed cotton. Nitrogen, the most essential nutrient for plant growth needs to be supplied in proper time and quantities. A positive correlation between vegetative growth and the number of fruiting points produced by cotton is well established. Split application of nitrogen has acquired prime importance in *Bt* cotton cultivation to supply the required quantity of nutrients at appropriate time. *Bt* cotton differs in its requirement either by total or part of it in different stages of crop growth. Through split application of nitrogen there is possibility to increase the fertilizer use efficiency, in addition to higher productivity. The information on critical stages of N management in *Bt* cotton can also be obtained. Keeping this in view, the present study was conducted to identify the dose and time of split application of nitrogen in *Bt* cotton .

MATERIALS AND METHODS

The field experiment was conducted at Regional Agricultural Research Station, Lam, Guntur during *kharif* 2010 and 2011. The soil of the experimental site is clay loam in texture, slightly alkaline with pH 7.8, low in available organic carbon (0.38 %), low in available nitrogen (188 kg /ha), medium in available phosphorus (28 kg /ha) and high in available potassium (856 kg /ha). The trial was laid out in randomized block design with factorial concept with 3 replications. The treatments consisted of 3 cotton hybrids *i.e.,* NCS 145 BG II (V_1) NCS 145 BG I (V_2) and NCS 145 (Bunny) (V_3), with two levels of nitrogen 120 kg N/ ha (N_1) and 150 kg N/ha (N_2)and two schedules of nitrogen application *i.e.,* 30,60 and 90 DAS (S_1) 20,40,60 and 80 DAS (S_2) and the crop was raised following standard package of practices with a spacing of 90 x 45 cm. Growth and yield parameters like monopodia, sympodia and bolls/plant, boll weight, seed cotton yield, seed index, lint index, GOT (%) and fibre quality and the economics was calculated accordingly.

RESULS AND DISCUSSION

The results of the two years study revealed that during 2009-2010 there was no significant difference in growth and yield

Table 1. Response of cotton hybrids to nitrogen levels and split application of nitrogen

Treatments	Plant height (cm)		Monopods/ plant		Sympods/ plant		Bolls/ plant		Boll weight (g)		Seed index		Lint index		GOT		Seed cotton yield (kg/ha)		Net returns (Rs)		BCR	
	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-	2010-	2009-	2010-
Hybrids (v)																						
V_1-NCS 145 (BG II)	77.6	102.7	0.69	1.2	16.7	22.1	25.6	26.6	3.98	4.98	9.73	10.90	4.68	6.13	32.47	35.85	2119	2376	54472	33529	2.33	1.62
V_2-NCS 145 (BG I)	80.8	99.8	0.83	1.3	16.8	22.5	21.7	27.6	4.03	5.10	9.74	10.01	5.27	5.69	34.87	36.14	2151	2201	55912	29432	2.36	1.57
V_3-NCS 145	82.0	106.8	0.73	1.2	16.6	22.7	20.9	25.5	3.95	4.65	9.55	10.76	4.84	6.27	33.65	36.53	2082	1788	52807	17216	2.29	1.35
SEm+	1.42	2.77	0.07	0.01	0.30	0.81	1.09	0.9	0.07	0.24	0.31	0.10	0.16	0.09	0.53	1.80	119.5	100				
CD (p=0.05)	NS	NS	NS	NS	NS	NS	3.15	NS	NS	NS	NS	NS	NS	NS	1.55	NS	NS	293				
Nitrogen Levels(kg/ha)																						
N_1-120	79.7	101.2	0.71	1.1	16.0	20.9	20.2	23.9	3.93	4.78	9.69	10.32	4.81	5.77	33.41	35.86	1940	1966	47300	20409	2.18	1.39
N_2-150	80.6	105.0	0.79	1.4	17.4	24.0	23.9	29.1	4.05	4.82	9.66	10.80	5.04	5.97	33.91	35.59	2294	2278	62347	30146	2.52	1.56
SEm+	1.16	2.27	0.06	0.1	0.25	0.67	0.89	0.74	0.06	0.18	0.26	0.25	0.13	0.13	0.44	1.20	108.2	82				
CD (p=0.05)	NS	NS	NS	0.28	0.72	1.86	2.56	2.05	NS	NS	NS	NS	NS	NS	NS	NS	290	240				
Split doses (DAS)																						
30-60-90	79.8	102.1	0.68	1.2	16.9	22.0	22.1	25.9	3.98	4.85	9.60	10.18	4.78	5.31	33.10	34.27	2115	2093	54292	24226	2.32	1.46
20-40-60-80	80.6	104.0	0.82	1.3	16.4	22.9	22.0	27.2	3.99	4.83	9.75	10.41	5.08	5.35	34.23	34.98	2120	2150	54517	26050	2.34	1.49
SEm+	1.2	2.27	0.06	0.1	0.25	0.67	0.89	0.74	0.06	0.18	0.26	0.25	0.13	0.13	0.44	1.20	108.2	82				
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS				

Table 2. Economics of cotton hybrids in response to nitrogen levels and split application of nitrogen

Treatments	*Kapas* yield (kg/ha)	
	2009-2010	2010-2011
Hybrids (V)		
V_1-NCS 145 (BG II)	2119	2376
V_2-NCS 145 (BG I)	2151	2201
V_3-NCS 145	2082	1788
Nitrogen Levels(kg/ha)		
N_1-120	1940	1966
N_2-150	2294	2278
Split doses (DAS)		
S_1-30-60-90	2115	2093
S_2-20-40-60-80	2120	2150

Sale price of cotton 4500/q ((2009-2010) 3700/q (2010-2011)

contribution characters and seed cotton yield as well in between the *Bt* and non *Bt* versions of the cotton hybrid NCS 145, whereas, during 2010-2011 highest seed cotton yield was recorded with NCS 145 BG II which was significantly superior to NCS 145 and it was *on a par* with NCS BG I. The increased seed cotton yield in NCS 145 BG II was associated with higher bolls/plant (Table1).

Nitrogen fertilization studies made in the present investigation on cotton hybrids during both the years of study, indicated that seed cotton yields differed significantly due to application of different nitrogen levels. Application of 150 kg N/ha recorded significantly superior seed cotton yield than the recommended dose of nitrogen 120 kg N /ha and the higher seed cotton yield was associated with higher number of sympodia/ plant and higher bolls/plant (Table 1). Similar results were reported by Yasar and Fatih Killi (2004) and Hallikeri *et al.,* (2011). Positive influence of nitrogen application on seed cotton yield was due to its contribution to new plant growth, nutrient uptake and in preventing abscission of squares and bolls there by retaining higher number of fruiting bodies.

Nitrogen requirement of cotton in the present investigation was met through split applications of different quantities of nitrogen at different times after sowing as per the treatments. Results indicated that seed cotton yield was not significantly affected due to more number of splits. Split application of nitrogen at 30, 60 and 90 DAS (3 splits) was on *a par* with application at 20, 40, 60 and 80 DAS(4 splits). Similar trend was followed with total number of bolls harvested/plant. The present recommended practice of application of nitrogen fertilizer in 3 equal splits at 30,60 and 90 DAS coincide with the peak vegetative to squaring, flowering and boll development stages which are the critical stages for nutrient requirement in cotton crop. Therefore, supplementation of nitrogen at these stages may be ideal to meet the requirements even for *Bt*-cotton (Srinivasan, 2003). Interaction effects were non significant. No significant variations were observed regarding seed index, lint index and GOT. Different fertilizer levels and splits did not exert any significant improvement in quality of fiber in black cotton soils under rainfed condition (Table 2) and these findings were in accordance with Sawan *et al.*, (2006). Highest benefit cost ratio was recorded in NCS BG II. Application of

Table 3. Effect of nitrogen levels and split application on fibre quality in cotton hybrids. (Mean data 2009-2011)

Treatments	2.5 per cent span length	Strength (g/tex)	Micro-naire value (10^6 g/inch)	Uni-formity ratio	Elon-gation (%)
Hybrids (V)					
V_1-Bunny (BG I)	30.26	23.23	4.31	54.24	6.0
V_2-Bunny (BG II)	29.72	22.40	4.28	53.06	5.8
V_3-Bunny	29.86	23.20	4.26	53.26	6.0
SEm+	0.08	1.20	0.05	1.50	0.08
CD (p=0.05)	NS	NS	NS	NS	NS
Nitrogen Levels(N kg/ha)					
N_1 - 120	30.37	22.55	4.25	53.94	5.9
N_2 - 150	29.70	23.01	4.38	54.07	5.8
SEm+	0.24	0.21	0.04	0.41	0.05
CD (p=0.05)	NS	NS	NS	NS	NS
Split doses (S - DAS)					
S_1- 30-60-90	30.23	22.85	4.25	53.54	5.9
S_2- 20-40-60-80	29.85	22.70	4.35	53.56	6.0
SEm+	0.24	0.21	0.04	0.41	0.05
CD (p=0.05)	NS	NS	NS	NS	NS

150 kg N /ha has given superior benefit cost ratio than the recommended dose of nitrogen 120 kg N /ha during both the years of the study.

CONCLUSIONS

Based on the present investigation, it can be concluded that the application of 150 kg N /ha is required in *Bt* cotton for realizing significantly higher seed cotton yield with present recommended practice of nitrogen application in 3 equal splits at 30,60 and 90 DAS without any adverse affect on fibre quality.

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