The Andhra Agric. J 56(1):4-7, 2009

Response of Bt cotton in Synchronizing N and K Supply with Crop Demand to Enhance Nutrient Use Efficiency

E Narayana, D Aparna, Mridula George and Ch Mallikarjuna Rao
Acharya N.G Ranga Agricultural University, Regional Agricultural Research Station, Lam Farm
Guntur – 522 034

ABSTRACT

A field experiment was conducted during the year 2007-08 at Regional Agricultural Research Station, Lam to study synchronizing effect of N and K supply with crop demand to enhance Nutrient use efficiency. Growth and yield contributing characters differed significantly as time of application and number of splits differed. Plant height and number of bolls increased on application of N with K. The highest seed cotton yield and Benefit Cost Ration (BCR) was recorded by applying N with or without K in three splits *i.e* at 15, 45 and 75 DAS which was on par with T_4, T_5, T_8 and T_9 but significantly superior over the rest of the treatments. The highest seed index (9.4 g) has been recorded with three splits i.e at 15, 30 and 45 DAS. Application of N with or without K in three splits i.e at 15, 30 and 60 DAS recorded highest lint index. Ginning Out Turn (GOT) has been increased significantly on application of N with K and the magnitude of increase was to the tune of 8.6%. However, N and K application did not exert any significant impact on fiber quality

Key words : Cotton, Nitrogen, Potassium, Split application.

The farmers of Andhra Pradesh are growing mostly Bt cotton, which has a different plant canopy architecture by virtue of its resistance to boll worms and attaining maturity earlier than that of non Bt cotton. So there is a need to adjust N and K application so as to synchronize with crop demands for achieving good growth and development, which ultimately improves the production and quality of fiber. Farmers in this region hither to applied N and K in three splits at 30, 60 and 90 DAS to cotton hybrids. On introduction of Bt cotton, farmers are in confusion whether to apply N and K as such or to reduce the interval as cotton crop requires 2/3rd of its nutritional requirement before 60 days and Bt cotton attaining physiological maturity 20 – 30 days earlier than non Bt cotton. Hence, it is proposed to study N application with and without K at different intervals to find out the required number of split applications for synchronizing nutrient availability with crop demand to maximize seed cotton yield and to improve the fiber quality.

MATERIAL AND METHODS

A field experiment was conducted at Regional Agricultural Research Station, Lam farm, Guntur during the year 2007 - 08. The soil of the experimental field was clayey (vertisols) with (55.84 % clay), P^H of 7.84, medium organic carbon (0.59 %), low available N (268 kg ha^{-1}), Medium available P (20.69 kg ha^{-1}) and high available K (353 kg ha^{-1}). The total precipitation received during the year was 1011.9 mm in 54 rainy days. The experiment was laid out in Factorial Randomized Block Design having two factors *i.e.* N application with K and without K and the other factor is number of splits *viz*. 2 splits at 15 & 45 DAS (T_1), 3 splits (1/2-1/4-1/4) at 15, 45 & 75 DAS (T_2), 3 splits (1/3-1/3-1/3) at 15, 45 & 75 DAS (T_3), 3 splits at 15, 30 & 45 DAS (T_4), 3 splits at 15, 30 & 60 DAS (T_5), 3 splits at 15, 45 & 60 DAS (T_6), 3 splits at 15, 30 & 75 DAS (T_7), 4 splits (1/4-1/4-1/4-1/4) at 15, 30, 45 & 60 DAS (T_8), 4 splits (1/4-1/4-1/4-1/4) at 15, 30, 45 & 75 DAS (T_9). The crop was sown on 14th July, 2007 and uniform plant population was maintained by gap filling / thinning at appropriate time. Recommended dose of fertilizers (120-60-60 kg NPK ha^{-1}) were applied as per treatments. Observations on yield and yield attributing characters viz. plant height, monopodia, sympodia, boll number and boll weight were recorded in five randomly selected plants for each plot. Adequate plant protection measures were adopted as per standard recommendations. The data was analyzed statistically by adopting the standard procedures described by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Growth and yield contributing characters differed significantly as time of application and number of splits differed. Plant height and number of bolls were increased on application of N with K but the same was not reflected significantly on

Table 1. Growth and yield of Bt cotton as influenced by N & K application in different splits

Treatments	Plant Height (cm)	Monopodia	Sympodia	Bolls Plant^{-1}	Boll Weight (g)	Kapas Yield (t ha^{-1})
N Application						
With K	140.84	1.90	21.4	40.3	4.52	3.85
Without K	135.11	1.90	22.12	36.3	4.62	3.80
SEm ±	1.5	0.04	0.17	0.49	0.06	0.74
CD (P=0.05)	4.1	NS	0.48	1.4	NS	NS
No of Splits						
T_1	139.6	1.76	21.87	37.9	4.55	3.66
T_2	134.5	1.77	22.57	37.1	4.83	3.59
T_3	140.6	2.20	21.10	42.8	4.58	4.31
T_4	139.9	2.03	22.40	39.9	4.65	4.24
T_5	136.9	1.93	21.10	38.5	4.74	3.94
T_6	137.5	2.03	21.83	35.8	4.36	3.35
T_7	131.6	1.70	20.33	35.6	4.32	3.24
T_8	135.9	1.86	21.77	38.0	4.39	3.86
T_9	145.3	1.83	22.87	39.0	4.69	4.20
SEm ±	3.1	0.10	0.36	1.05	0.13	0.15
CD (P=0.05)	NS	0.29	1.03	3.0	NS	0.45
Interaction	NS	Sig	Sig	Sig	NS	NS

2 splits at 15 & 45 DAS (T_1), 3 splits (1/2-1/4-1/4) at 15, 45 & 75 DAS (T_2), 3 splits (1/3-1/3-1/3) at 15, 45 & 75 DAS (T_3), 3 splits at 15, 30 & 45 DAS (T_4), 3 splits at 15, 30 & 60 DAS (T_5), 3 splits at 15, 45 & 60 DAS (T_6), 3 splits at 15, 30 & 75 DAS (T_7), 4 splits (1/4-1/4-1/4-1/4) at 15, 30, 45 & 60 DAS (T_8), 4 splits (1/4-1/4-1/4-1/4) at 15, 30, 45 & 75 DAS (T_9).

Table 2. Kapas yield, net returns, and BCR of Bt cotton as influenced by N & K application in different splits

Treatments	Kapas Yield (t ha^{-1})	Net Returns (Rs)	BCR
N Application			
With K	3.85	54,700	2.82
Without K	3.80	53,600	2.78
No of Splits			
T_1	3.66	50,820	2.71
T_2	3.59	48,980	2.63
T_3	4.31	64,820	3.16
T_4	4.24	63,280	3.11
T_5	3.94	56,680	2.89
T_6	3.35	43,700	2.46
T_7	3.24	41,280	2.38
T_8	3.86	54,620	2.80
T_9	4.20	62,100	3.05

Sale Price of Cotton Rs 22,000 / ton

2 splits at 15 & 45 DAS (T_1), 3 splits (1/2-1/4-1/4) at 15, 45 & 75 DAS (T_2), 3 splits (1/3-1/3-1/3) at 15, 45 & 75 DAS (T_3), 3 splits at 15, 30 & 45 DAS (T_4), 3 splits at 15, 30 & 60 DAS (T_5), 3 splits at 15, 45 & 60 DAS (T_6), 3 splits at 15, 30 & 75 DAS (T_7), 4 splits (1/4-1/4-1/4-1/4) at 15, 30, 45 & 60 DAS (T_8), 4 splits (1/4-1/4-1/4-1/4) at 15, 30, 45 & 75 DAS (T_9).

Table 3. Seed index, lint index, GOT (%) and oil content of Bt cotton as influenced by N & K application in different splits

Treatments	Seed Index	Lint Index	GOT	Oil %
N Application				
With K	8.74	4.3	32.7	22.09
Without K	8.88	3.8	30.1	22.94
SEm ±	0.05	0.08	0.43	-
CD (P=0.05)	NS	0.23	1.24	-
No of Splits				
T_1	8.3	4.0	32.3	22.59
T_2	9.1	3.7	28.9	22.47
T_3	9.1	4.1	31.1	22.67
T_4	9.4	4.1	30.3	23.02
T_5	8.8	4.8	35.1	21.87
T_6	8.7	4.2	32.0	22.58
T_7	8.4	3.3	28.3	21.49
T_8	8.8	4.0	31.3	23.84
T_9	8.8	4.3	33.1	22.15
SEm ±	0.12	0.17	0.91	-
CD (P=0.05)	0.35	048	2.6	-
Interaction	NS	Sig	Sig	-

2 splits at 15 & 45 DAS (T_1), 3 splits (1/2-1/4-1/4) at 15, 45 & 75 DAS (T_2), 3 splits (1/3-1/3-1/3) at 15, 45 & 75 DAS (T_3), 3 splits at 15, 30 & 45 DAS (T_4), 3 splits at 15, 30 & 60 DAS (T_5), 3 splits at 15, 45 & 60 DAS (T_6), 3 splits at 15, 30 & 75 DAS (T_7), 4 splits (1/4-1/4-1/4-1/4) at 15, 30, 45 & 60 DAS (T_8), 4 splits (1/4-1/4-1/4-1/4) at 15, 30, 45 & 75 DAS (T_9).

Table 4. Quality of Bt cotton as influenced by N & K application in different splits

Treatments	2.5% Span Length (mm)	Strength (g tex^{-1})	Micronaire (10^6 g $inch^{-1}$)	Uniformity Ratio	Elongation (%)
N Application					
With K	29.03	22.51	3.72	43.88	5.58
Without K	29.09	22.48	3.56	43.77	5.56
SEm ±	0.25	0.24	0.05	0.29	0.008
CD (P=0.05)	NS	NS	NS	NS	NS
No of Splits					
T_1	28.39	22.5	3.62	43.78	5.56
T_2	29.17	22.72	3.66	43.85	5.58
T_3	29.59	22.95	3.54	42.37	5.58
T_4	30.07	22.68	3.70	44.10	5.58
T_5	28.99	22.32	3.64	42.52	5.56
T_6	28.68	22.78	3.47	44.38	5.56
T_7	28.91	21.83	3.67	44.42	5.56
T_8	28.81	22.33	3.64	44.58	5.56
T_9	28.98	22.37	3.83	44.47	5.56
SEm ±	0.54	0.73	0.12	0.62	0.017
CD (P=0.05)	NS	NS	NS	NS	NS
Interaction	NS	NS	NS	Sig	NS

kapas yield. Maninder Kaur *et al.,* (2007) reported that soil and foliar application of K recorded highest plant height and more number of bolls plant^{-1}. The highest seed cotton yield was recorded by applying N with or without K in three splits i.e at 15, 45 and 75 DAS but it was on par with T_4, T_5, T_8 and T_9 but significantly superior over the rest of the treatments. Similar results of higher seed cotton yield was obtained by applying N in three split doses viz., basal, 30 and 60 DAS (*Anonymous,* 2004). Application of N in three splits were significantly superior over two splits but it was on par with 4 splits (Table 1). Similarly Chandrashekara and Halemani (2004) reported that higher yield was obtained with application of N in three splits over two splits.

The highest (BCR) of 3.16 was recorded on application of N with or without K in three splits at 15, 45 and 75 DAS which was closely followed by T_4, when it was applied at 15, 30 and 45 DAS (Table 2). Therefore, application of N with or without K in three splits is good enough in black cotton soils under rainfed conditions.

The highest seed index (9.4 g) has been recorded with three splits *i.e.at* 15, 30 and 45 DAS, which was on par with T_2 and T_3 but significantly superior from the rest of the treatments. Lint index has been increased significantly on application of N with K as compared to without K. The magnitude of increase was 13.1%, which indicates the importance of K application along with N for balanced nutrition that ultimately helped in increasing the lint index. Application of N with or without K in three splits i.e at 15, 30 and 60 DAS recorded highest lint index which was significantly superior from rest of the treatments. The same has been reflected on GOT (Table 3).

GOT % has been increased significantly on application of N with K and the magnitude of increase was to the tune of 8.6%. The lowest GOT was recorded under T_2 and T_7 but the highest was recorded under T_5 which was significantly superior from the rest of the treatments except T_9. The interaction clearly indicated that application of N with K in three splits below 60 days (15, 30 and 60 DAS) helped in increasing lint index, whereas application of N without K needs four splits (T_9) which was on par with T_8, T_5, T_3 and T_1 but superior from rest of the treatments.

The oil content has been varied from 3 – 11 % under different treatments and the highest was recorded with four splits i.e at 15, 30, 45 and 60 DAS.

N and K application did not exert any significant impact on fibre quality under rainfed condition (Table 4). However, relatively higher strength (22.51 g tex^{-1}), micronaire (3.72), uniformity ratio (43.88) and elongation (5.58%) was observed on application of N with K as compared to application of N without K. Therefore, it can be concluded that Bt. cotton responded well for three splits of N application with or without K *i.e.* at 15, 45 and 75 DAS in black cotton soils of Andhra Pradesh.

ACKNOWLEDGEMENTS

The authors are thankful to ICAR, New Delhi for financial support provided under TMC MM 2.1 project at RARS, Lam Guntur for carrying out the experiment

LITERATURE CITED

Anonymous 2004. All India Coordinated Cotton Improvement Project. Annual Report. Central Institute for Cotton Research Regional Station, Coimbatore. pp 65.

Chandrashekara C P and Halemani H L 2004. Response of irrigated cotton to split application of nitrogen, phosphorus and potassium at GLBC area. International symposium on "Strategies for sustainable cotton production – A global vision" 2. Crop Production, 23 – 25 November 2004, University of Agricultural Sciences, Dharwad, Karnataka (INDIA). pp : 253.

Maninder Kaur, Mandeep Kaur and Brar A S 2007. Effect of potassium on the growth and yield of American cotton (Gossypium hirsutum L.). *Journal of Cotton Research and Development* 21(2) : 187 – 190.

Panse V G and Sukhatme P V 1967. Statistical methods for agricultural workers, ICAR, New Delhi, 2nd edition.

(Received on 14.10.2008 and revised on 29.12.2008)