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Research Article

EFFECT OF MACRONUTRIENT ON YIELD AND ECONOMICS OF BT COTTON HYBRID (GTHH-49 BGII)

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Abstract: The field experiment was carried out at Cotton Research Station, Sardarkrushinagar Agricultural University, Talod (Gujarat) for three consecutive years (2014-15, 2015-16 and 2016-17) to find the Nutrient requirements of newly developed Bt cotton hybrid GTHH 49 BGII. The experiment was laid out in Factorial Randomized Block Design with three replications. Three nitrogen levels *viz*., N_1: 160 kg N/ha, N_2: 240 kg N/ha and N_3:320 kg N/ha, two Phosphorus levels *i.e*., P_1: 0 kg P_2O_5/ha & P_2: 80 kg P_2O_5/ha and three potassium levels *i.e*., K_1: 0 kg K_2O/ha, K_2: 60 kg K_2O/ha and 120 kg K_2O/ha. The results indicated that significantly higher seed cotton yield (3029 kg/ha), higher gross returns (Rs. 151450 /ha), net returns (Rs. 85628 /ha) and B:C ratio (2.30) was recorded in application of 320 kg N/ha over other nitrogen levels. Application of 120 kg K_2O/ha produce significantly higher seed cotton yield (4079 kg), higher gross returns (Rs. 166750/ha), net returns (Rs. 100238 /ha) and B:C ratio (2.50) over other potassium levels. It was also observed that application of phosphorus was found not advantageous to the cotton crop. There is no interaction effect was recorded with nitrogen and potassium on cotton. Application of 320 kg N/ha along with potassium 120 kg/ha in Bt cotton hybrid GTHH-49 BGII gave significantly higher seed cotton yield and maximum net returns.

Keywords: Economics, Nitrogen, Phosphorus, Potassium, Bt, GTHH-49

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Introduction

Cotton (*Gossypium hirsutum* L.) the white gold, is one of the most important commercial and industrial crops. It plays a key role in economical and social affairs of the world. It is considered as "King" of fibres and being important cash crop of the country, benefits several million people who are engaged in its cultivation, trade, processing, manufacturing, etc. India ranks first in global cotton cultivation with an area of 12.84 m ha accounting 33% of the world cotton area and stands second in production (386 lakh bales) next to China. However, the average productivity (511 kg lint/ha) is low compared to the world average of 725 kg lint/ha [1]. Many constraints have been highlighted the complexities of cotton farming in India. The important issues in cotton production are moisture stress during the growth period, nutrient management and insect pest incidence. Due to these constraints cotton yield sharply declined for the last half a decade thus reducing the area in distinct way year after year. Among yield sustaining factors, balanced crop nutrition is of great significance. Nutrients are absorbed by the plants both through roots and foliage and the foliar application has an advantage as it overcomes the losses of fertilizers through leaching, volatilization, fixation, *etc*. There is ample scope to boost the yield by nutrient management. The cotton production is influenced by various components of production technologies. Among them a significant role is played by fertilizer treatments. Magare *et al*., 2018 who reported that the beneficial effect of potassium on cotton. Adequate nutritional supply is essential for the cotton, particularly potassium is necessary for reducing the physiological diseases to facilitate normal development, maturity of bolls and to improve quality of fibre. Nitrogenous and phosphorus fertilizers are more frequently used by the farmers from several years leading to an imbalanced nutrient supply ratio. As a result, potassium status in soil was depleted remarkably from high to medium status. Potassium is an essential nutrient in crop nutrition and play important role in production and improving the quality.

Hence, the present study was undertaken to know the nutrient requirements like N, P and K at different levels on newly developed cotton hybrid GTHH-49 BG-II.

Varietal Characteristics of cotton hybrid GTHH-49 BG-II

Characters	Description
Days of flowering	(45 to 53 DAS)
Days to maturity	150 to 175 (Medium)
Plant height (cm)	120 to 180 cm
Boll Size	Medium sized
Reaction of major pest	Resistance to Jassids & thrips and tolerant to other sucking pest
Yield (average)	3500 kg/ha

Materials and Methods

The present experiment was conducted at Cotton Research Station, Talod, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, 385506, Gujarat, India in during kharif seasons of 2014-15, 2015-16 and 2016-17, respectively. Three levels of Nitrogen (160, 240 and 320 kg N/ha), two levels of Phosphorus (0 and 80 kg P_2O_5/ha) and three levels of Potassium (0, 60 and 120 kg K_2O/ha) with 18th different combinations, each replicated thrice. The composite surface soil sample (0 to 30 cm depth) was collected from experimental site prior to start of field experiment. After harvest of crop treatment wise samples (0-20 cm) were collected and dried in shade and ground in mortar and wooden pestle and then passed through 2 mm sieve, labeled properly and preserved in polythene bags for subsequent analysis. The sieved samples were further passed through 0.5 mm sieve for estimation of organic carbon. The fertilizer application was given as per the treatments. Doses of nitrogen, phosphorus and potassium were applied through urea, single super phosphate and murate of potash as per the treatments.

Table-1 Seed cotton yield (kg/ha) as affected by different levels of Nitrogen, Phosphorus and Potassium

Treatments	2014-15	2015-16	2016-17	Pooled	Interaction
Nitrogen Levels					
N1 (160 kg N/ha)	2736	3433	2230	2800	
N2 (240 kg N/ha)	2897	3441	2219	2852	
N3 (320 kg N/ha)	3213	3565	2308	3029	
S. Em. ±	57	106	55	51	
CD @ 5%	164	NS	NS	125	
Phosphorus levels					
P1	2901	3441	2206	2849	
P2	2997	3519	2299	2938	
S. Em. ±	46	86	45	42	
CD @ 5%	NS	NS	NS	-	
Potassium Levels					
K1	2316	2707	2021	2348	YXK*
K2	3078	3653	2262	2998	
K3	3452	4079	2474	3335	
S. Em. ±	57	106	55	51	88
CD @ 5%	164	303	158	125	347
CV %	8.2	12.9	10.3	11.2	
Interaction	-	-			

Table-2 Economics as affected by different treatments (Pooled basis)

Treatments	Total cost of cultivation (Rs/ha)	Seed cotton yield (kg/ha)	Gross returns (Rs /ha)	Net returns (Rs /ha)	B:C Ratio
N1	62052	2800	140000	77948	2.25
N2	63468	2852	142600	79132	2.24
N3	65822	3029	151450	85628	2.3
P1	60368	2849	142450	82082	2.35
P2	64835	2938	146900	82065	1.79
K0	56610	2348	117400	60790	2.07
K1	62735	2988	149900	87165	2.38
K2	66513	3335	166750	100238	2.5

Table-3 Relative Seed cotton yield as affected by cost of Nitrogen (pooled)

Treatment	Total cost of cultivation (Rs /ha (except picking)	Seed cotton yield (kg/ha)	Additional cost of N		Increase yield (kg/ha)	
			As compared to N1	As compared to N2	As compared to N1	As compared to N2
N1 (160 kg/ha)	41052	2800	--	--	--	--
N2 (240 kg/ha)	42078	2852	1026		52	--
N3 (320 kg/ha)	43104	3029	2052	1026	229	177

Table-4 Relative Seed cotton yield as affected by cost of Potassium (pooled)

Treatment	Total cost of cultivation (Rs /ha (except picking)	Seed cotton yield (kg/ha)	Additional cost of K		Increase yield (kg/ha)	
			As compared to K1	As compared to K2	As compared to K1	As compared to K2
K1 (0kg/ha)	39000	2348	--	--	--	--
K2 (60kg/ha)	40250	2988	1250	--	650	--
K3 (120 kg/ha)	41500	3335	2500	1250	987	337

Two to three seeds (Cotton GTHH-49 BG-II) were dibbled per hill @ a distance of 120 x 45 cm. Thinning and gap filling operations were undertaken at 15 days after sowing to maintain uniform population. The observations on the seed cotton yield t different levels of N, P and K were recorded during 2014-15, 2015-16 and 2016-17, respectively and pooled data were presented in the tables. The pooled data on relative seed cotton yield in nitrogen and potassium were worked out. Finally, cost economics and B:C ratios were calculated for different levels of fertilizers.

Results and Discussion

Yield

The pooled data pertaining to seed cotton yield during three years of experimentation are presented in [Table-1]. The results of the pooled data indicated that the effect of different levels of nitrogen on seed cotton yield was found significant. Application of 320 kg N/ha has significantly increased the seed cotton yield (3029 kg) over 240 kg (2852 kg) and 160 kg N/ha (2800 kg), respectively. No significant effect of P2O5 application on seed cotton yield was found. However, in 2015-15 and 2016-17 the effect of different levels of nitrogen and P2O5 on seed cotton yield was found non-significant. This might be due to nitrogen is an essential element for canopy area development and photosynthesis. Providing the right amount during the plant growth will provide healthy leaves with the photosynthetic capacity needed to support the growing of the reproductive components (Nour Ali, 2015). Positive effect of nitrogen on yield could be attributed to the fact that it controls new growth, nutrient uptake and preventing abscission of squares and bolls there by retaining higher bolls [2]. The present findings are in agreement with results of Manjunatha *et al*., (2017) who reported that increased nitrogen fertilizer level increased photosynthetic rate which might have resulted in higher accumulation of metabolites thus impacted on mean boll weight [3]. Different levels of K_2O produce significantly different seed cotton yield. Application of 120 kg K_2O/ha produce significantly higher seed cotton yield (3335 kg) as compared to 60 kg K_2O/ha (2998 kg), likewise application of 60 kg K_2O/ha recorded significantly higher seed cotton yield as compared to no application of K_2O (2348 kg). In pooled analysis, Y X K interaction was found significant. Similar trend was also observed during 2014-15. Whereas, Different levels of K_2O produce significantly different seed cotton yield. Application of 120 kg K_2O/ha produce significantly higher seed cotton yield (4079 kg) as compared to 60 kg K_2O/ha (3653 kg), likewise application of 60 kg K_2O/ha recorded significantly higher seed cotton yield as compared to no application of K_2O (2707 kg) in 2015-16. Similar trend was also observed during 2016-17.

Lowest seed cotton yield was recorded in control treatment. The positive effect of potassium on yield might be due to pronounced role of potassium in transport of photosynthates, photosynthesis and cell elongation. Increase in seed cotton yield with increasing levels of potassium in soil because potassium is readily mobile nutrient within the plant tissue, its utilization is concerned with the formation of carbohydrate and proteins, synthesis of nucleic acid, chlorophyll and translocation of solutes which might have helped in increasing seed cotton yield Similar studies were found out by Magare *et al*., 2018 who reported that increased K_2O application results in increased yield [4,5].

Economics

The benefit cost ratio of cotton was influenced by various treatments and presented in [Table-2]. The B:C ratio (2.30) and net returns was found significantly higher in the treatment N3 application of nitrogen @ 320 Kg/ha. The lowest B: C ratio was recorded in treatment N1 application of nitrogen 160 kg/ha. Additional cost of nitrogen Rs 1026 (240 kg N/ha) and 2052 (320 kg N/ha) as compared to cost of recommended dose of N (160 kg N/ha) increase the seed cotton yield by 52 and 229 kg /ha, likewise, additional cost of nitrogen Rs 1026 (320 kg N/ha) as compared to cost of 240 kg N/ha, increase the seed cotton yield by 177 kg/ha [Table-3]. Similarly, The B: C ratio (2.50) and net returns was found significantly higher in the treatment K_2 application of Potassium @ 120 Kg/ha. The lowest B: C ratio was recorded in treatment K0 application of Potassium @ 0 Kg/ha [Table-2]. Additional cost of Potassium Rs 1250 (60 kg K_2O/ha) and 2500 (120 kg K_2O /ha) as compared to cost of 0 kg K_2O/ha increase the seed cotton yield by 650 and 987 kg/ha, likewise additional cost of Potassium Rs. 1250 (120 kg K_2O/ha) as compared to cost of 60 kg K_2O/ha, increase the seed cotton yield by 337 kg/ha [Table-4].

Conclusion

From the three years of study, it could be concluded that, application of 320 kg N/ha along with potassium 120 kg/ha in Bt cotton hybrid GTHH-49 BGII gave significantly higher seed cotton yield and maximum net returns. Application of phosphorus at different levels found not advantageous in the Bt cotton hybrid GTHH-49 BGII. There is no interaction effect of nitrogen and potassium on cotton crop.

Application of research: Role of macronutrient is more importance for better crop yield and quality.

Research Category: Agronomy

Abbreviations:

BCR: Benefit cost ratio
@: at the rate

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