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## Response of Cotton to Various Doses of NPK Fertilizers

A.W. Soomro, A.R. Soomro, A.S. Arain, G.H. Tunio, M.S. Chang, A.B. Leghari and M.R. Magsi  
Central Cotton Research institute Sakrand, Pakistan

**Abstract:** Cotton is an economically important crop and experiments to determine its response to rates of fertilizers have always been an important part of research. Thus a field experiment was laid out to assess the yield performance of cotton under ten fertilizer (NPK) treatments during 1997, 1998 and 1999 crop seasons. On an average, highest seedcotton yield of 2434 kg ha<sup>-1</sup> was obtained when the crop was fertilized with 75, 50 and 50 kg ha<sup>-1</sup> of N, P and K respectively followed by 100 nitrogen, 50 phosphorus and 50 potash kg ha<sup>-1</sup> where seedcotton yield of 2403 kg ha<sup>-1</sup> was obtained. The lowest yield of 1053 kg ha<sup>-1</sup> was produced from the control plot where no chemical fertilization was applied. The results reveal that balance use of above nutrient elements are essential for harvesting better yields.

**Key words:** Seedcotton, nitrogen, phosphorus, potash, NPK fertilizers, soil fertility

### Introduction

For a healthy growth and better yield cotton crop needs continuous supply of essential nutrient elements. Deficiency or toxicity of any one nutrient results in reduction of plant growth and ultimately yield. It is established fact that optimum nutritional requirement of cotton are of primary importance to boost up its production. Experiments to determine the response of cotton to various rates and fertilizers have always been an important part of research in Pakistan and a balanced supply of nutrients is essential to rise per hectare yields. The mineral nutrition of cotton depends on both the cotton root's ability to explore the soil and on the soil's ability to supply N, P and K nutrients (Bisson *et al.*, 1994). Varshney (1979) recommended the optimum dose of nitrogen as 131 kg ha<sup>-1</sup> and reported that further increase in application resulted in increase of seedcotton yield. Colakoglu (1980) recommended the optimum dose of 80-120 kg N ha<sup>-1</sup>; 60-90 kg P ha<sup>-1</sup> and 100-200 kg K ha<sup>-1</sup> for realizing optimum yield from cotton in Turkey. Suhag *et al.* (1981) in their experiment on fertilizer requirement of cotton under Sindh conditions, found that application of fertilizer at the rate of 112 kg N + 50 kg P per hectare proved better for getting good returns from cotton crop. Mithaiwala *et al.* (1981) studied response of cotton to various NPK combinations and opined that response due to phosphorus was not significant however; application of nitrogen alone was more profitable than combined with nitrogen and potash. Soil tests carried out in Pakistan showed a general lack of nitrogen, a wider spread deficiency of phosphorus and an occasional deficiency of potassium (Wahhab, 1985).

Khan *et al.* (1987) reported that phosphorus treatments did not help in increase yield of seedcotton and its components but application of nitrogen alone was more profitable than nitrogen-phosphorus combination. Khan *et al.* (1990) studied the combined effects of NPK fertilization and found that application of nitrogen alone at the rate of 100 kg ha<sup>-1</sup> was economical as compared to combine fertilization of NPK in Sakrand conditions. Setatou and Simonis (1994) conducted 56 fertilizer trials for 12 successive years and concluded that nitrogen affected seedcotton yield even at the very low application rate, while the effect of phosphorus was limited and that of potassium negligible. The increase in yield as a result of nitrogen fertilization was related to the number of bolls and the boll weight.

The present studies were carried out to determine the optimum N, P and K fertilizer requirement of cotton and summarize most recent data on NPK fertilization in Pakistan.

### Materials and Methods

An experiment was conducted to assess seedcotton yield response of newly evolved cotton variety CRIS-19 by Central Cotton Research Institute, Sakrand under ten fertilizer (NPK) treatments during 1997, 1998 and 1999 crop seasons. The sowing of the experiment was done in randomized complete block design with four replications. Nitrogen was given in split doses i.e. 1/3rd at sowing and 2/3rd at peak flowering. Full dose of phosphorus and potassium per treatment was given at the time of sowing. All the required agronomical practices and plant protection measures were carried out when required and were adopted when needed. The seedcotton was harvested plot-wise and finally calculated as kilograms per hectare. Ten plants from each treatment were selected at random for bolls per plant observation and 25 bolls were collected from each treatment for boll weight determination. Duncan's Multiple Range Test was applied to bring out the differences between the treatments. Treatment details were as under:

Treatments	Kilograms per hectare		
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
T1	0	0	0
T2	0	50	50
T3	75	0	0
T4	75	50	50
T5	100	50	50
T6	150	50	50
T7	100	0	50
T8	100	100	50
T9	100	50	0
T10	100	100	100

### Results and Discussion

Data recorded for seedcotton yield, bolls per plant and boll weight during year 1997 are depicted in Table 1 whereas for the year 1998 in Table 2 and 3 shows data for the year 1999. Average data for above three years under these studies are given in Table 4. Year wise results show that during 1997, significantly highest yield of 2885 kg ha<sup>-1</sup> was obtained when NPK was applied at the rate of 100-50-50 kg ha<sup>-1</sup> respectively followed by 150-50-50 where the yield of 2480 kg ha<sup>-1</sup> was achieved. Bolls per plant and boll weight data followed almost similar trend. The results for the year 1998, were not different from 1997, thus similar results were obtained from same NPK fertilizer treatments regarding all the yield parameters.

## Soomro *et al.*: Cotton response to various doses of NPK fertilizers

Table 1: Seedcotton yield and its components as affected by various rates of N, P and K fertilizers, during 1997

Detail of treatments			Seedcotton	Bolls	Boll
N	P	K	Yield (kg ha <sup>-1</sup> )	per plant	weight (g)
(kg ha <sup>-1</sup> )					
0	0	0	1572f	23g	2.2d
0	50	50	1747ef	24g	2.5c
75	0	0	1921de	26f	2.6bc
75	50	50	2026cd	27ef	2.6bc
100	50	50	2585a	35a	3.1a
150	50	50	2480ab	34a	3.2a
100	0	50	2096cd	28de	2.7bc
100	100	50	2201c	30bc	2.8b
100	50	0	2271bc	31ab	2.8b
100	100	100	2166td	29cd	2.8b

Means followed by similar letters are not significantly different at 5% level

Table 2: Seedcotton yield and its components as affected by various rates of N, P and K fertilizers, during 1998

Detail of treatments			Seedcotton	Bolls	Boll
N	P	K	Yield (kg ha <sup>-1</sup> )	per plant	weight (g)
(kg ha <sup>-1</sup> )					
0	0	0	664e	20f	2.2c
0	50	50	804d	21e	2.55
75	0	0	908d	22d	2.5b
75	50	50	1048c	24c	2.6b
100	50	50	2201a	31a	3.2a
150	50	50	1921b	30a	3.3a
100	0	50	1153c	25c	2.7b
100	100	50	1397c	27b	2.8b
100	50	0	1537c	285	2.8b
100	100	100	1258c	26bc	2.7b

Means followed by similar letters are not significantly different at 5% level

Table 3: Seedcotton yield and its components as affected by various rates of N, P and K fertilizers, during 1999

Detail of treatments			Seedcotton	Bolls	Boll
N	P	K	Yield (kg ha <sup>-1</sup> )	per plant	weight (g)
(kg ha <sup>-1</sup> )					
0	0	0	923g	13f	1.9f
0	50	50	1049g	14ef	2.2e
75	0	0	1216fg	15def	2.2e
75	50	50	1342ef	16cde	2.3de
100	50	50	2515ab	23ab	2.6b
150	50	50	2809a	25a	2.8a
100	0	50	1510def	17cde	2.4cd
100	100	50	1655cd	19c	2.6b
100	50	0	1537c	20bc	2.5bc
100	100	100	1594cde	18cd	2.5bc

Means followed by similar letters are not significantly different at 5% level

However, during 1999, treatment 150-50-50 gave yield of 2809 kg ha<sup>-1</sup> and proved better than 100-50-50 that yielded 2515 kg ha<sup>-1</sup>.

Average data for three years data (Table 4) showed almost similar trend and thus on average application of N, P and K at the rate of 100, 50 and 50 kg ha<sup>-1</sup> respectively was found the best balanced fertilizer doze for achieving better seedcotton yield. Treatment with 100-50-50 NPK remained on top with 2434 kg ha<sup>-1</sup> seedcotton yield followed by

Table 4: Seedcotton yield and its components as affected by various rates of N, P and K fertilizers (average of three years)

Detail of treatments			Seedcotton	Bolls	Boll
N	P	K	Yield (kg ha <sup>-1</sup> )	per plant	weight (g)
(kg ha <sup>-1</sup> )					
0	0	0	1053e	18.71	2.1g
0	50	50	1200de	19.7h	2.4f
75	0	0	1348cde	21.09	2.4f
75	50	50	1472bcd	22.3f	2.5e
100	50	50	2434a	29.7a	3.0b
150	50	50	2403a	29.7a	3.1a
100	0	50	1583bc	23.3e	2.6d
100	100	50	1751b	25.3c	2.7c
100	50	0	1782b	26.3b	2.7c
100	100	100	1673bc	24.3d	2.7c

Means followed by similar letters are not significantly different at 5% level

150-50-50 NPK that yielded 2403 kg ha<sup>-1</sup> of seedcotton. The results further revealed that yield contributing components i.e. bolls per plant and boll weight were significantly increased with the balance use of NPK fertilizers.

Our results have confirmed the previous studies of Varshney (1979) and Soomro *et al.* (1997) who observed that response of cotton to NPK fertilizers was significant and recommended for their application to get better yields. Our results are also in conformity with the results achieved by Suhag *et al.* (1981) who found 112 kg N + 50 kg P<sub>2</sub>O<sub>5</sub> per hectare fertilizer application better for getting good returns from cotton crop.

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