RESPONSE OF COTTON (*GOSSYPIUM HIRSUTUM* L.) TO VARIOUS LEVELS AND TIMES OF POTASH APPLICATION IN SEMI-ARID REGION OF PUNJAB

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ABSTRACT

A study was conducted in three successive seasons during 2004-06 on loam soil at three different sites in tehsil Faisalabad. The objective was to investigate the response of cotton (cv. NIAB-111) to different levels and times of K-application. The treatments comprised three potassium doses (0, 62.5 and 125 kg/ha) and its application on three times (full at sowing, full at first irrigation and ½ at sowing + ½ at first irrigation). The results indicated that potassium doses and application times significantly affected seed cotton yield. On an average, the highest seed cotton yield (2418.55 kg/ha) was obtained when crop was fertilized @ 125 kg K (full at sowing) closely followed by 62.5 kg (full at sowing) (2409.77 kg/ha). However, both these doses were statistically at par. The lowest yield was noted in control (2192.98 kg/ha) where no potassium fertilizer was applied. Hence application of K at economical dose of 62.5 kg per hectare is recommended in tehsil Faisalabad.

KEYWORDS: ***Gossypium hirsutum;*** **potash fertilizers; split dressings; yields; Punjab; Pakistan.**

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) plays a vital role in the economy of Pakistan. It contributes more than 60 percent to total foreign exchange earnings and about 8.5 percent to domestic edible oil needs (2).

In Pakistan cotton growers use a desirable amount of N (125 kg/ha) but use of K is negligible (0.7 kg/ha) (13). The less use of K fertilizer in cotton may have serious consequences. Cotton appears to be more sensitive to K deficiencies than many other crops, as the root system of cotton is less

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dense than that of other crops (17, 18, 1, 12). Colakoglu (4) recommended optimum dose of 80-120 kg N, 60-90 kg P and 100-200 kg K per hectare for optimum seed cotton yield in Turkey. Mithaiwala *et al.* (12) observed non-significant response of cotton to K and application of nitrogen alone was more profitable than combined with 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 (20). Khan *et al.* (6) studied combined effects of NPK fertilization and found that application of nitrogen alone @ 100 kg per hectare was economical as compared to combined NPK in Sakrand conditions. Setatou and Simonis (16) conducted 56 fertilizer trials for 12 successive years and concluded that nitrogen affected seed cotton yield even at very low application rate, while effect of phosphorus was limited and that of potassium negligible.

Potassium is one of the most important elements in plant nutrition. All living organisms require its large amounts for normal growth and development. Biochemical pathways in plants are attributed to the role of K. Potassium increases the photosynthetic rates of crop leaves, CO_2 assimilation and facilitates carbon movement (14). The experiments conducted in Indian Punjab showed that cotton crop absorbed a large quantity of potassium indicating that it was more than both nitrogen and phosphorus intake (3). The trend of potassium removal by cotton crop indicates its heavy drain from Pakistani soils. The exploitation of soils is likely to lead to severe depletion of potassium which would eventually limit the efficiency of other nutrients (8). It has been earlier (9) reported that cotton crop could benefit from higher doses of potassium fertilizers when applied at different times after sowing. This may be attributed to equilibria between various forms of potassium and degree of potassium fixation in soil (11).

Keeping in view the significance of cotton in Pakistan this study was conducted to see cotton response to varying levels of potash at different application times.

MATERIALS AND METHODS

This study was conducted at farmers' fields in tehsil Faisalabad (Chak No. 243 RB, 254 RB and 61 JB) during 2004-06. Layout system was RCBD with three replications. The treatments comprised three K levels (0, 62.5 and 125 kg/ha) and three application times (full at sowing, full at first irrigation and ½ at sowing + ½ at first irrigation). The soil samples were collected from 0-15 cm and 15-30 cm depth before fertilizer application during each season. The

samples were analysed for physical and chemical characteristics of soil as given below:-

Particulars	Chak 243/RB (2004)	Chak 254/RB (2005)	Chak 61/RB (2006)
pH:	7.8	7.8-8.10	8.1-8.5
EC dS/m	0.43-0.48	0.72-0.91	0.38-2.56
Organic matter (%)	0.72-0.83	0.93-1.103	0.62-0.93
Available P (ppm)	2.09-5.70	2.09-5.70	4.54-6.29
Available K (ppm)	180-210	150-180	140-170
Texture	Loam	Loam	Loam

The yield data were statistically analysed through computer using MSTAT-C programme as suggested by Steel *et al.* (7).

RESULTS AND DISCUSSION

The individual and average data of three years (Table) revealed significant differences among the treatments. During 2004, maximum seed cotton yield (2250.63 kg/ha) was produced when 125 kg K was applied at sowing. However, it was statistically at par with 62.5 kg K when applied full at sowing (2234.34 kg/ha), 125 kg K by splitting ½ at sowing + ½ at first irrigation (2210.53 kg/ha) and 62.5 kg K by spliting ½ at sowing + ½ with 1st irrigation (2200.50 kg/ha). During next year (2005) application of 62.5 kg K at sowing gave significantly maximum seed cotton yield (2809.52 kg/ha). However, potassium @ 125 kg at sowing and its split application i.e. ½ at sowing + ½ at 1st irrigation also produced statistically at par seed cotton yields (2798.25 and 2785.71 kg). Delaying K application with first irrigation and splitting K @ 62.5 and 125 kg gave significantly lower seed cotton yields. The lowest seed cotton yield (2602.76 kg) was produced by control (no potash applied).

Table. Effect of different doses of potash and times of application on seed cotton yield during 2004-06.

K doses (kg/ha) with times of application	Seed cotton yield (kg/ha)			
	2004	2005	2006	Average kg/ha)
Control (No K application)	2088.97c	2602.76b	1887.22d	2192.98d
62.5 (Full at sowing)	2234.34ab	2809.52a	2185.46a	2409.77a
62.5 (Full at 1st irrigation)	2101.50c	2645.36b	2132.58b	2259.40c
62.5 (½ at sowing + ½ at 1st irrigation)	2200.50ab	2690.48b	2110.28b	2333.33b
125 (Full at sowing)	2250.63a	2798.25a	2073.93ab	2418.55
125 (Full at 1st irrigation)	2186.72b	2669.17b	2182.96a	2309.52b
125 (½ at sowing + ½ at 1st irrigation)	2210.53ab	2785.71a	2182.96a	2393.48a
LSD at 0.05	59.40	92.456	72.581	40.802

Means in a column sharing similar letter(s) do not differ significantly.

During last year of the experiment (2006), application of 125 kg K at sowing produced maximum seed cotton yield (2205.51 kg/ha). Maximum yield was also reported at higher levels by Colakoglu (4), Makhdum (7) and Malik *et al.* (9). However, application of 62.5 kg K at sowing (2185.46 kg/ha) and 125 kg K (½ at sowing + ½ at Ist irrigation) were statistically similar (2182.96 kg/ha) with maximum yield producing treatment. On the basis of average of three years, data revealed similar trend as depicted in individual years.

It can be concluded that although higher dose of K (125 kg) produced maximum seed cotton yield when applied at sowing, yet K application at lower dose i.e. 62.5 kg K full at sowing and splitting 125 kg K i.e. ½ at sowing and ½ at 1st irrigation, were statistically at par with it for seed cotton yield. So it is recommended that for obtaining higher yield of seed cotton, K @ 62.5 kg per hectare at sowing may be applied. K application at lower dose without scarifying yield is economical and a better option in tehsil Faisalabad. As the potash level in soils of experimental sites is appropriate, its application at lower dose is recommended because of its high uptake rate as has also been reported earlier (8).

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