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Effect of Quantity and Time of Application of Nitrogen and Potassium on Growth Parameters and Yield of Cotton (MCU.5)*

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To determine the effect of level of N and K and their times of application on growth and yield of cotton, a field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore. The results indicated that the growth components viz. plant height, LAI and dry matter production and growth analysis parameters such as NAR, CGR and RGR were not influenced by either N and K levels. However, time of application of N and K had a marked influence on LAI, NAR and CGR, split application proving to be better than single basal application. Yield responses were obtained upto 60 kg N and 40 kg K_2O/ha. Time of application had no significant effect on seed cotton yield.

The growth components of cotton have been reported to be favourably influenced by use of N, in many instances (Sirsook *et al.*, 1973; Sinha, 1974). However, N had no influence on growth parameters like RGR, NAR and CGR (Dastur and Kanwar Singh, 1956). In general, K had no marked influence on growth characters of cotton (Verma *et. al.*, 1965). Increased rate of vegetative growth is not always accompanied by greater yield in cotton, owing to the restricted movement of metabolites from the sources to the sink. The information on the influence of K in the presence of N and their split application on the growth parameters of cotton is limited. Hence an experiment was conducted in Tamil Nadu Agricultural University, Coimbatore.

MATERIAL AND METHODS

The experiment was conducted in summer season of 1977, in factorial randomised block design with four replications. The soil of the experimental field was clay loam type with a fertility status of low available N, medium available P and high available K. The variety taken up was the popular *hirsutum* variety, MCU. 5. The crop was sown on Feb. 15, 1977 and final picking was done on July 23, 1977. During the crop period, 316.6 mm rainfall was received distributed in 16 rainy doys. The treatment details are as follows :

(a) Nitrogen

(i) 60 kg N/ha (ii) 120 kg N/ha

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(b) Potassium

(i)	40 kg K_2O/ha	K_{40}
(ii)	80 kg K_2O/ha	K_{80}
(iii)	120 kg K_2O/ha	K_{120}

(c) Time of application

(i)	All N and K basal	M_1
(ii)	$\frac{1}{2}$ NK basal + $\frac{1}{2}$ NK at square formation (45th day)	M_2
(iii)	1/3 NK basal + 1/3 NK at square + 1/3 NK. 25 days after square formation (70th day)	M_3

In addition to above 18 treatments, one control (N_0K_0) was included and 19 treatments were tried.

A uniform dose of 30 kg P_2O_5/ha was basally applied to all the plots.

Growth characters viz. plant height and dry matter production were recorded on 120th day. Leaf area was measured and calculated by the method suggested by Rhoads and Bloodworth (1964) on 60th day. NAR, CGR and RGR were computed using the formula suggested by Gregory (1926), Watson (1947) and Enyi (1962) respectively at an interval of 30 days.

RESULTS AND DISCUSSION

A. Growth Components

1. *Height*

The treatments failed to exhibit any difference in plant height. Narayanan et *al.* (1974) and Verma et *al.* (1965) obtained no response in plant height for N and K respectively. Wankhede (1971) found that time of application of N also did not influence the plant height.

2. *Leaf area index* (LAI)

The influence of N, K and their times of application on LAI at 60th day is presented in Table I.

The data revealed that there was no marked difference in LAI between control and fertilizer treatments. Nitrogen and potassium and their interactions showed no influence on LAI. Shanmugasundaram and Sankaran (1977) reported that N had no significant influence on LAI in early stages of cotton. LAI at 60th day was not influenced by K application (Chandrasekaran, 1977). However, time of application of N and K showed a marked influence. Application of N and K in two splits (M_2) or in 3 splits (M_3) significantly increased the LAI over single application (M_1). This is because the nutrients were applied at the time of peak requirement. This resulted in increased growth and leaf production. There was no significant difference between M_2 and M_3. In M_3 the third split was applied on 70th day, i.e. 10 days after observation and so its effect could not be noticed. The interaction between K and N indicated that when the K fertilizer was applied in small quantities at critical stages of growth, the effect on growth was more pronounced.

TABLE I LAI on 60th day

	K_{40}	K_{80}	K_{120}	M_1	M_2	M_3	Mean
N_{60}	2.67	2.61	2.64	2.35	2.71	2.86	2.64
N_{120}	2.76	2.78	2.63	2.31	3.06	2.79	2.72
M_1	2.36	3.20	2.58				2.33
M_2	2.18	2.71	3.19				2.89
M_3	2.46	2.76	2.70				2.82
Mean	2.71	2.69	2.64				2.68

Control (N_0K_0) : 2.46

Source	SE_D	CD (P=0.05)
Control Vs. Rest	0.19	N.S.
N	0.08	N.S.
K	0.09	N.S.
M	0.09	0.21
NK	0.14	N.S.
NM	0.14	N.S.
KM	0.18	0.37

TABLE II Yield of kapas (q/ha)

	K_{40}	K_{80}	K_{120}	M_1	M_2	M_3	Mean
N_{60}	22.87	22.10	23.51	22.58	21.83	24.07	22.84
N_{120}	20.42	23.80	19.93	20.21	22.46	21.27	21.33
M_1	19.82	22.72	21.65				21.40
M_2	22.67	23.27	20.51				22.15
M_3	22.44	22.57	23.01				22.67
Mean	21.65	22.86	21.73				22.07

Control (N_0K_0) : 15.09

Source	SE_D	CD (P=0.05)
Control Vs. Rest	1.70	3.43
N	0.77	N.S.
K	0.95	N.S.
M	0.95	N.S.
NK	1.35	2.72
NM	1.35	N.S.
KM	1.66	N.S.

3. *Dry matter production*

The influence of fertilizers and their times of application on dry matter production was found to be nonsignificant. This was because, N and K did not influence the plant height and LAI, which mainly determine the dry matter production. Hunsigi *et al.* (1971) indicated that application of N had no influence on dry matter production of cotton. Similarly K had no effect on dry matter production (Chandrasekaran, 1977).

B. Growth analysis

Net assimilation rate (NAR), crop growth rate (CGR) and relative growth rate (RGR), as influenced by N, K and their times of application computed at an interval of 30 days are shown in Fig. 1

1. *Net assimilation rate (NAR)*

NAR decreased as the crop advanced in age. Similar results were reported by Basinski *et al.* (1975). Application of N and K showed no marked influence on NAR. This is in line with the findings of Dastur and Mukhtar Singh (1943). However, time of application of N and K influenced NAR between 90 and 120 days. Application of N and K in two splits (M_2) or in three splits (M_3) decreased the NAR compared to single application at the time of sowing (M_1). This is due to the fact that between 90 and 120 days, the LAI was increased by split application of fertilizers, which reduced the NAR due to shading of lower leaves which became parasitic. This result is in conformity with the findings of Basinski *et al.* (1975).

2. *Crop growth rate (CGR)*

CGR gradually increased with the age of the crop, as a result of increase in LAI. Iruthayaraj (1975) also recorded higher CGR values at later stages of crop growth in rice. CGR was not markedly influenced by N and K application. Hunsigi (1973) observed no difference in CGR due to fertilizer application. However, time of application of N and K markedly influenced the CGR. Application of N and K in two splits (M_2) or in three splits (M_3) recorded higher CGR values between 60 and 90 days of growth. This is due fact that M_2 and M_3 significantly increased LAI compared to M_1 on 60th day. After 90 days, application of N and K in single nose at sowing (M_1) recorded higher CGR than split application (M_2 and M_3) This is because, of reduction in NAR observed in split application (M_2 and M_3) after 90 days.

3. *Relative growth rate* (RGR)

Fig. shows that RGR decreases with the age of the crop, irrespective of the treatments. This can be explained by stating that the amount of dry matter produced per unit time decreases with increase in age. Similar results were

obtained in maize by Krishnamurthy *et al.* (1974). There was no marked difference among the treatments. Dastur and Narasimhachar (1962) indicated that RGR remained unchanged by N application.

C. Yield of seed cotton

The yield of seed cotton obtained in different treatments is shown in Table II.

The results showed that N and K application markedly increased the seed cotton yield over control. Yield responses were obtained upto 60 kg N and 40 kg K_2O/ha. Time of application had on significant effect on seed cotton yield. However, significant N and K interaction was observed. Similar results were obtained by Selvaraj *et al.* (1977) At N_{60} level, there was no difference among K levels. But at N_{120}, K_{80} was superior to both K_{40} and K_{120}. Similar results were obtained by Bhatt and Appukuttan (1976). Comparison of N levels at different K levels revealed that at any levels of K, the performance of 60 kg N level was better Further, at 120 kg K_2O level, application of 60 kg N was significantly superior to that of 120 kg N, indicating the possibility of reducing the N application at higher levels of K application. This was because, at lower level of N, application of higher dose K increased the N uptake. K application has been found to reduce the fixation of NH_4+ and thereby increase the utilization of this form of N by the growing plants (Sen Gupta *et al.*, 1971).

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