

Response of Varying Levels of Nitrogen on Growth of Different Inbred Lines of Cotton

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ABSTRACT

Response of varying levels of nitrogen viz 50, 100, 150 and 200 kg ha⁻¹ to different inbred lines of cotton namely CIM-499, CIM-511 and CIM-707 was studied at Agronomic Research Area, Central Cotton Research Institute, Multan. Growth was significantly influenced by different nitrogen levels. N applied at the rate of 150 and 200 kg ha⁻¹ showed the maximum plant height, number of monopodial and sympodial branches per plant, number of main stem nodes per plant as compared to the other levels. Lowest values of these parameters were observed at 50 kg N ha⁻¹.

Key Words: Cotton; Nitrogen; Inbred lines; Growth

INTRODUCTION

Pakistan ranks fourth in cotton production and third as an exporter of raw cotton in the world (Ahmed, 1999). In Pakistan, the average seed cotton yield (621 kg ha⁻¹) is very low as compared to the other countries. This is due to the unpredictable weather, diseases particularly cotton leaf curl virus (CLCV) and non-availability of pure cottonseed. The other cause that should be seriously considered is the imbalanced application of nutrient elements as fertilizers. We can increase the total yield of cotton by extending the area of cultivation and improving average production per hectare by using improved, CLCV resistant and high yielding varieties. It necessitates serious consideration to determine the optimum level of nitrogen for increase in average yield per hectare. Nitrogen plays a dominant role in plant growth processes. It is an integral part of chlorophyll molecule, protein and nucleic acid (Marschner, 1986). Nitrogen fertilizer requirement depends on many factors including yield, nitrogen concentration in soil and mineralization, soil type and numerous environmental factors (Power & Schepers, 1989).

Abuldahab and Hassanin (1991) applied N at the rates of 0, 50, 100, 150 and 200 kg ha⁻¹ on cotton cv. Giza-81 and found that seed cotton yield ha⁻¹, number of nodes plant⁻¹, number of bolls plant⁻¹ and number of open bolls plant⁻¹ increased with the application of 150 kg N ha⁻¹. Boquet *et al.* (1993) observed that number of sympodial branches increased with increased nitrogen rates. Similar results were found by Brar *et al.* (1993). They indicated that nitrogen increased plant height, number of bolls plant⁻¹.

In Pakistan, different cultivars of cotton with different growth habits are grown. Tall and medium cultivars vary in relation to maturity and morphological characters such as leaf area and plant size. These cultivars respond differently to various agro-management practices especially sowing time, plant population and fertilizer management. This study

was conducted to observe the effect of varying levels of nitrogen to growth of the different inbred lines of cotton under agro-climatic conditions of Multan.

MATERIALS AND METHODS

The study was carried out to determine the optimum level of nitrogen fertilizer in cotton inbred lines at the Agronomic Research Area, Central Cotton Research Institute, Multan during the year 2002 on the silty clay loam soil. Experiment was laid out in randomized complete block design with split plot arrangement with three repeats, four nitrogen levels (50, 100, 150 and 200 kg ha⁻¹), and three inbred lines (CIM-499, CIM-511 and CIM-707) were tested by using a net plot size of 9m x 15m (135m²). Nitrogen levels were randomized in main plots and Inbred lines in sub plots. Cotton inbred lines were sown on well-prepared seedbed with 75 cm row to row and 30 cm plant to plant distance. All the nitrogen applications were completed before 15th of August *i.e.* at 1st irrigation, 3rd irrigation, flowering and boll formation stages. All other agronomic practices were uniform and normal for all the treatments. The growth and yield parameters studied were plant population, plant height, number of monopodial branches, sympodial branches, nodes, buds, white flowers plant⁻¹. Data were statistically analyzed using the Fisher's analysis of variance techniques and least significant difference (LSD) test at 5% probability was applied to compare the significant treatment means (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Final data on plant height recorded on 13th September indicated that both nitrogen levels and inbred lines show significant difference on plant height. Maximum plant height 98.60 and 99.40 cm was observed in 150 and 200 kg N ha⁻¹ respectively, which was statistically non-significant

(Table I). Inbred line showed the plant heights of 84.60 cm in CIM-499, 97.60 cm in CIM-511 and 102.60 cm in CIM-707. On the average 150 kg N ha⁻¹ and 200 kg N ha⁻¹ gave 12% more plant height than 50 kg N ha⁻¹ where as CIM-707 gave 18 and 5% more taller plants than CIM-499 and CIM-511, respectively. The interactive effect of these factors was also found to be non-significant. Increase in plant height was accordingly to the increase in nitrogen level, as well as genetic makeup of inbred lines was always evident. These results are supported by the findings of Brar *et al.* (1993) and Sawaji *et al.* (1994) who also reported similar effect of nitrogen on plant height.

Data regarding number of monopodial branches per plant showed that nitrogen levels have significant effect on number of monopodial branches plant⁻¹ (Table II). The maximum and similar number of monopodial branches were produced by 150 and 200 kg N ha⁻¹ (2.00) and this was followed by the application of 100 kg (1.11) and 50 kg N ha⁻¹ (0.11). N applied at 150 and 200 kg N ha⁻¹ gave 95% and 45% more monopodial branches than 50 and 100 kg N ha⁻¹ respectively. Number of monopodial branches per plant did not differ significantly among inbred lines and their interaction effect was also found to be non-significant.

Greater number of sympodial branches per plant is an indication of potential for higher production of cotton. Data showed significant difference in nitrogen levels and inbred lines (Table III). The average number of sympodial branches plant per was 34.83 in CIM-499, 36.00 in CIM-511, 32.33 in CIM-707. Results also indicate significant increase in the number of sympodial branches per plant. N applied at 200 kg N ha⁻¹ rate gave 51% more sympodia than 50 kg N ha⁻¹. Similarly CIM-511 gave 3.25 and 10% more sympodial branches than CIM-499 and CIM-707 respectively. The interaction effect was also found to be non-significant. These results are in line with those of Boquet *et al.* (1993) and Sawaji *et al.* (1994).

Final data recorded on 28th August (Table IV) show the significant affect of interaction with nitrogen levels and inbred lines. On the average CIM-511 with 150 kg N ha⁻¹ (25.33) gave maximum number of nodes per plant that was 21% more than CIM-499 with 50 kg N ha⁻¹ (20.00), 150 kg N ha⁻¹ with CIM-499 (22.33) and CIM-707 (21.33) showing statistically no significant difference, but different from CIM-511 (25.33) on same treatment. Lowest number of nodes per plant was observed by 50 kg N ha⁻¹ with CIM-499 (20.00). The results showed that number of nodes per plant was increased as nitrogen level is enhanced up to 150 kg N ha⁻¹. These results are in accordance with those of Abuldahab and Hassanin (1991).

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Table I. Effect of different nitrogen levels on final plant height at maturity on three inbred lines of cotton

Nitrogen Level (kg ha ⁻¹)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
50	75.2	89.3	96.3	87.1 ^b
100	85.1	98.6	100.0	94.6 ^{ab}
150	88.9	100.9	106.0	98.6 ^a
200	89.3	101.0	108.0	99.4 ^a
Mean	84.6 ^c	97.6 ^b	102.6 ^a	

Table II. Effect of different nitrogen levels on monopodia on three inbred lines of cotton

Nitrogen Level (kg ha ⁻¹)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
50	0.00	0.33	0.00	0.11 ^c
100	1.00	1.00	1.00	1.00 ^b
150	2.00	2.00	2.00	2.00 ^a
200	2.00	2.00	2.00	2.00 ^a
Mean	1.25 ^{ns}	1.333	1.25	

Table III. Effect of different nitrogen levels on sympodia on three inbred lines of cotton

Nitrogen Level (kg ha ⁻¹)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
50	20	23	20	21 ^c
100	30	32	29	30 ^b
150	43	45	39	42 ^a
200	46	44	41	44 ^a
Mean	35 ^a	36 ^a	32 ^b	

Table IV. Effect of different nitrogen levels on nodes on three inbred lines of cotton

Nitrogen Level (kg ha ⁻¹)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
50	20.00 ^c	22.33 ^{bc}	23.00 ^{ab}	21.67 ^{ns}
100	21.67 ^{bc}	20.67 ^{bc}	22.67 ^b	22.67
150	22.33 ^{bc}	25.33 ^a	21.33 ^{bc}	22.67
200	22.33 ^{bc}	22.67 ^b	21.33 ^{bc}	22.00
Mean	22.00 ^{ns}	22.75	22.00	

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