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Fertilizer Effect on Fiber Characteristics of Short Duration Varieties of Cotton

Javeed Shabbir Dar and Bismillah Khan
Department of Agronomy, B.Z.U. Multan-Pakistan

Abstract

Response of varying levels of nitrogen viz 50, 100, 150 and 200 kg ha^{-1} to different varieties of cotton namely CIM-499, CIM-511 and CIM-707 was studied at Agronomic Research Area, Central Cotton Research Institute, Multan. Different nitrogen levels non-significantly influenced fiber characteristics, whereas different varieties had significant effect on fiber characteristics (fiber strength, elongation percentage and uniformity index). Highest fiber strength (28.27), elongation percentage (6.84 %) and uniformity index (83.41) were recoded in CIM-499. The maximum staple length (1.12 inch) was found in CIM-707, whereas maximum micronaire (4.86) was observed in CIM-511.

Key words: Cotton, Nitrogen, Varieties, Growth and yield component

Introduction

Cotton crop meets the increasing demands of domestic agro-based industries but also fetches a substantial amount of foreign exchange 11.7 % through exportable surplus of cotton fiber and fiber made products and about 2.9 % of GDP (Anonymous, 2002). The average seed cotton yield (621 kg ha^{-1}) is very low as compare to the other countries this is due to the unpredictable weather, viral disease like cotton leaf curl virus (CLCV) and non-availability of pure cottonseed. The other cause that should be taken into account seriously is the imbalance 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, virus resistant and high yielding varieties. It necessitates giving serious consideration to determine the optimum level of nitrogen for increase in average yield per hectare.

Corresponding author: Javeed Shabbir
Department of Agronomy, B.Z. University, Multan - Pakistan

Nitrogen plays a dominant role in 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, Nitrogen mineralization, soil type and numerous environmental factors (Power and Schepers, 1989).

Elayan (1992) found that increasing nitrogen levels up to 113-150 kg ha^{-1} also increased yield and its component but not lint percentage, seed index or fiber properties. Godoy *et al.* (1994) observed that fiber quality was similar when nitrogen was supplied at rates of 80, 120, 160 and 200 kg N ha^{-1}. The highest seed cotton yield was obtained with the highest nitrogen rate. Abuldahab and Hassanin (1991) found that fiber quality and lint percentage remained unaffected, when nitrogen was applied at the rates of 0, 50, 100, 150 and 200 kg ha^{-1} on cotton cv. Giza-81.

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. The present study was, therefore, planned to observe the effect of varying levels of nitrogen to fiber characteristics of the different varieties 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 varieties 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 and three repeats, four Nitrogen levels (50, 100, 150 and 200 kg ha^{-1}) and three varieties (CIM-499, CIM-511 and CIM-707) were tested by using a net plot size of 9m x 15m (135m^2). Nitrogen levels were randomized in main plots and Varieties in sub plots. Cotton varieties were sown on well-prepared seedbed with 75 cm R x R (Row to Row) and 30 cm P x P (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. Fiber characteristics, i.e. staple length, fiber strength, elongation percentage, uniformity index and micronaire were recorded. Data collected were statistically analyzed by 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 and Torrie, 1984).

Results and Discussion

Staple length measured to check the length of fiber made by the cotton varieties. Data present in table 1 indicates that varieties show significant difference of 1.01 to 1.12 inch where as varieties showed maximum staple length of 1.11 inch in CIM-499, and this followed by 1.01 in CIM-511 and 1.12 in CIM-707 which was significantly different to each other. Nitrogen levels and their interaction effect also found to be non-significant. It does not seem to be affected by application of fertilizer and is probably controlled by genetic potential. These results are supported by that of Abuldahab and Hassanin (1991), Elayan (1992) and Godoy *et al*. (1994).

Table 1: Effect of different nitrogen levels on staple length on three varieties of cotton.

Nitrogen Level ($Kgha^{-1}$)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
$N_1 = 50$	1.1	1.01	1.123	1.07 ^{ns}
$N_2 = 100$	1.11	1.01	1.11	1.077
$N_3 = 150$	1.12	1.01	1.122	1.084
$N_4 = 200$	1.107	1.02	1.113	1.080
Mean	1.109 ^{b}	1.013 ^{c}	1.117 ^{a}	

Data given on table 2 indicates that Varieties gave significant difference on fiber strength. Variety show the fiber strength of 58.27 in CIM-499, 25.89 in CIM-511and 26.19 in CIM-707. Maximum fiber strength observed in CIM-499 (28.27) while minimum fiber strength was observed in CIM-511 (25.89). This factor is controlled by the genetic make up of the varieties. Nitrogen levels gave non-significant difference on fiber strength, the interaction effect also found to be non-significant. These results are in accordance with those of Abuldahab and Hassanin (1991), Elayan (1992) and Godoy *et al*. (1994).

Table 3 show the data of elongation percentage, Varieties show significant difference. On over all average basis maximum elongation percentage observed in CIM-499 that was 6.84 and minimum recorded in CIM-511 that was 5.75. This data indicates that there was no significant effect of nitrogen levels, while the genetic make up of varieties show significant difference. Nitrogen levels gave non-significant difference on elongation percentage while their interaction between nitrogen levels and varieties also found to be non-significant. Data related to the findings of Abuldahab and Hassanin (1991), Elayan (1992) and Godoy *et al*. (1994).

Table 2: Effect of different nitrogen levels on fiber strength on three varieties of cotton.

Nitrogen Level ($Kgha^{-1}$)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
$N_1 = 50$	28.7	25.8	26.5	27.0 ^{ns}
$N_2 = 100$	27.3	26.1	28.9	27.4
$N_3 = 150$	28.4	25.8	25.1	26.4
$N_4 = 200$	28.4	25.3	27.2	27.0
Mean	28.2 ^{a}	25.8 ^{b}	26.9 ^{b}	

Uniformity index show the uniform length of fiber from different genotypes. Data pertaining in table 4 indicates the significant difference between the interaction of different varieties and nitrogen levels. Maximum uniformity observed in CIM-499 (84.03 %) where 200 kg N ha^{-1} applied. Minimum uniformity index recorded in CIM-707 of 82.33, 82.17, 81.83, 82.00 with 50, 100, 150 and 200 kg N ha^{-1} respectively. CIM-499 show the uniformity index of 83.03, 83.43, 83.13 and 84.03 with 50, 100, 150 and 200 kg N ha^{-1} respectively. Similarly CIM-511 gave 83.80, 83.53, 81.83 and 82.50 with 50, 100, 150 and 200 kg N ha^{-1} respectively. On over all average basis CIM-499 and CIM-511 gave statistically same results but different from CIM-707. These results are supported by the findings made by others Abuldahab and Hassanin (1991), Elayan (1992) and Godoy *et al*. (1994).

Micro naire show the level of fine quality of the fiber produced by the cotton. Data present in table 5 indicates that varieties show significant difference. Varieties show micro naire of 4.58 in CIM-499, 4.86 in CIM-511 and 4.32 in CIM-707 which was significantly different to each other, maximum micro naire observed in CIM-511 (4.86). It does not seem to be affected by application of fertilizer and is probably controlled genetically. There was non significant difference between different nitrogen levels and their interaction. These results are supported by that of Abuldahab and Hassanin (1991), Elayan (1992) and Godoy *et al*. (1994).

Table 3: Effect of different nitrogen levels on elongation % on three varieties of cotton.

Nitrogen Level ($Kgha^{-1}$)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
N_1 = 50	6.683	5.600	5.300	5.86 ^{ns}
N_2 = 100	6.167	5.867	5.700	6.245
N_3 = 150	6.467	5.800	5.667	6.311
N_4 = 200	7.033	5.733	6.000	6.255
Mean	6.838 ^{a}	5.750 ^{b}	5.917 ^{b}	

Table 4: Effect of different nitrogen levels on uniformity index on three varieties of cotton.

Nitrogen Level ($Kgha^{-1}$)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
N_1 = 50	83.03 ^{cde}	83.33 ^{abc}	82.33 ^{ef}	82.9 ^{ns}
N_2 = 100	83.43 ^{abc}	83.80 ^{ab}	82.17 ^{f}	83.1
N_3 = 150	83.13 ^{bcd}	83.53 ^{abc}	81.83 ^{f}	82.8
N_4 = 200	84.03 ^{a}	82.50 ^{def}	82.00 ^{f}	82.8
Mean	83.41 ^{a}	83.29 ^{a}	82.08 ^{b}	

Table 5: Effect of different nitrogen levels on Micro Naire on three varieties of cotton.

Nitrogen Level ($Kgha^{-1}$)	Variety			Mean
	CIM-499	CIM-511	CIM-707	
N_1 = 50	4.6	4.8	4.4	4.6 ^{ns}
N_2 = 100	4.5	4.7	4.6	4.6
N_3 = 150	4.8	4.7	4.3	4.6
N_4 = 200	4.6	4.9	4.1	4.5
Mean	4.6 ^{b}	4.8 ^{a}	4.3 ^{c}	

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