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EFFECT OF DIFFERENT DOSES OF NITROGEN ON THE YIELD OF DIFFERENT COTTON VARIETIES

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ABSTRACT

An investigation to study the effect of nitrogen @ (100, 150 and 200 kg ha^{-1}) and cotton approved varieties (viz. CIM-506, CIM-496, NIAB-111 and BH-160) on the yield and yield components was conducted at Adaptive Research Farm, Rahim Yar Khan during 2005-2007 for three years. The levels of nitrogen and cotton varieties significantly affected the plant height, number of mature bolls $plant^{-1}$, seed cotton weight $boll^{-1}$, and seed cotton yield ha^{-1}. The interaction between nitrogen levels and cotton varieties was non-significant for plant height and number of mature bolls $plant^{-1}$ while it was significant for boll weight and seed cotton yield ha^{-1}. Application of nitrogen @ 200 kg ha^{-1} gave the highest and significant increase in seed cotton yield (2455 kg ha^{-1}) over 100 and 150 nitrogen ha^{-1}. The cotton variety CIM-506 produced the highest seed cotton yield (2568 kg ha^{-1}).
Keywords: Nitrogen, Cotton yield, CIM-506, CIM-496, NIAB-111, BH-160

INTRODUCTION

Cotton (*Gossypium hirsutum* L) is an important cash crop of Pakistan and plays significant role in Agriculture industrial development, employment generation and economic development of the country. It provides raw material to 1263 ginning units, 503 textile mills, 8.1 million spindles and 2622 oil-expelling units. In Pakistan cotton is grown on an area of 3.22 million hectares with total production of 14.61 million bales and average seed cotton yields of 722 kg ha^{-1} (Anonymous, 2005).

Cotton has played a significant role in agriculture, industrial development, employment, financial stability and economic viability ever since the country attained the independence. It is the most beneficial fiber and cash crop of Pakistan and earns a good fortune for the country in the form of foreign exchange (Ahmed *et al.,* 2009). The use of fertilizers on the responsive varieties has played a pivotal role in boosting the agricultural productivity, and nitrogen is apparently the most contributing fertilizer (Touchton, 1987). Nitrogen has been reported to increase plant height, number of monopodial / sympodial branches $plant^{-1}$ and number of matured bolls $plant^{-1}$ in cotton (Soomro and Waring, 1987; Mukand *et al*., 1989). Seed cotton weight $boll^{-1}$ and seed cotton yield ha^{-1} have been found affected by nitrogen application at various doses (Nehra *et al*., 1986; Khan *et al*., 1993). Gomaa *et al*., (1981) reported a decrease in seed oil contents by increasing nitrogen application rate. The release of new cotton varieties has increased dramatically during the past few years. The genetic variability among these varieties indicates that the management practices must be amended to achieve optimum yield. Optimizing nitrogen fertilization of individual cotton varieties could be a possible way of tailoring production practices for individual variety.

To satisfy the required level of plant nutrients, farmers in Pakistan are indispensably inclined to use commercial fertilizers. During the last few years, the price of fertilizers in most developing countries, including Pakistan has reached unprecedented highs whilst supply has been limited when it is needed most (Shah *et al.,* 1995). In most developed countries, adequate N is supplied as chemical fertilizer; however, in majority of the developing countries including Pakistan, it is not possible due to high cost of fertilizers, low per capita income and limited credit facilities available to most farmers. As a consequence, farmer either uses the available organic sources or the crop remains un-fertilized (Herridge *et al*., 1995).

In crops like cotton, excesses of N delay maturity, promote vegetative tendencies, and usually result in lower yields (McConnell *et al*., 1996). Increased nitrogen rate reduces the lint percentage by 0.16%, increase in boll weight may be due to increase in N rate and increases mineral uptake, photosynthetic assimilation and accumulation in sinks Sawan *et al.* (2006).

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However, Hussain *et al.,* (2000) reported that nitrogen rate had no effect on fiber uniformity. Excess application of N than the required for optimum crop performance can reduce yield or fiber quality.

Keeping in view the above mentioned facts, the present study was carried out to investigate the effect of different doses of nitrogen on the yield of different approved cotton varieties.

MATERIALS AND METHODS

This experiment was conducted at Adaptive Research Farm during 2005-2007 for three years. The experiment was laid out in RCBD with three replications having 9 net plot size of 7.5 × 25.21m. Three levels of nitrogen 100, 150 and 200 kg ha^{-1} and four approved cotton varieties (CIM-506, CIM-496, NIAB-111 and BH-160) were tested with plant population of 58058 plant ha^{-1}. The crop was sown in the month of May with bed and furrow method to achieve the require plant population. The seed of cotton varieties i.e. CIM-506, CIM-496, NIAB-111 and BH-160 was delinted with commercial H_2SO_4 before sowing. The total supply of nitrogen fertilizer was split into two equal doses at 1st irrigation and at flowering. Thinning was done to maintain the desired plant population when plant attained the height of 15cm. All other agronomic and plant protection practices were kept similar for all the treatments. Ten plants from each treatment were selected at random to record number of matured bolls $plant^{-1}$ and plant height at maturity. Ten bolls were picked randomly from each treatment, weighed and averaged to record the seed cotton weight $boll^{-1}$. Two pickings from the whole plot for about 75 and second about 200 days after sowing were done to obtain the seed cotton yield. The seed cotton $plant^{-1}$ (kg) was calculated after the last picking and converted to seed cotton yield ha^{-1}. Data collected was analyzed statistically by using Fisher's analysis of variance technique. LSD test 0.05 at probability means (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Yield related parameters

Plant height (cm): Fertilizer doses significantly increased plant height. Subsequent increase in N levels from 100 to 200 kg ha^{-1} resulted in proportionate increase in the plant height in different cotton varieties as mentioned in Table-1. The taller plants (151.74cm) were recorded in CIM-496 cotton variety where 200 kg N ha^{-1} was applied. It is well known fact that nitrogen application boosts crop growth and development. The increased plant height is the result of flamboyant and vigorous plant growth. These results are in agreement with those of Rochester *et al*. (2001) that plant height in cotton is related to nitrogen application.

Table-1: Effect of different nitrogen doses on plant height (cm) on four varieties of cotton during 2005-2007.

Nitrogen level (kg ha^{-1})	Cotton varieties				Mean
	CIM-506	CIM-496	N-111	BH-160	
N_1=100	133.29	146.79	139.00	136.18	138.82c
N_2=150	138.81	150.99	142.55	142.87	143.81b
N_3=200	143.01	157.45	147.33	147.80	148.98a
Mean	138.37d	151.74a	143.07b	142.28c	

Number of mature bolls $plant^{-1}$: The number of mature bolls $plant^{-1}$ was significantly different under various level of nitrogen application in different cotton varieties as mentioned in Table-2. The highest number of mature boll $plant^{-1}$ (25.89) on CIM-496 cotton variety was observed when nitrogen was applied @ 200 kg N ha^{-1}. Significant differences were observed among cotton varieties for number of mature bolls $plant^{-1}$ (25.26) and all other varieties were at par.

These results are similar as described by Khan *et al.,* 1993.

Table-2: Effect of different nitrogen doses on number of mature bolls plant^{-1} on four varieties of cotton during 2005-2007.

Nitrogen level (kg ha^{-1})	Cotton varieties				Mean
	CIM-506	CIM-496	N-111	BH-160	
N_1=100	19.75	24.60	20.12	19.78	21.06c
N_2=150	23.31	24.31	22.25	23.46	23.33b
N_3=200	27.07	26.88	25.16	24.47	25.89a
Mean	23.38d	25.26a	22.51b	22.57c	

Boll weight (g): Average boll weight is one of the major components of seed cotton yield in cotton. Data given in Table-3 indicate that nitrogen rates significantly influenced boll weight. Maximum boll weight (2.84 g) was recorded in NIAB-111 cotton variety where nitrogen was applied at the rate of 200 kg ha^{-1}. Cotton variety CIM-506 showed the lowest seed cotton weight boll^{-1}. The findings from our study agree with those of Sawan *et al.* (2006); who recorded increase in boll weight by increasing N rate from 95 to 143 kg ha^{-i}.

Table-3: Effect of different nitrogen doses on seed cotton weight bolls^{-1}(g) on four varieties of cotton during 2005-2007.

Nitrogen level (kg ha^{-1})	Cotton varieties				Mean
	CIM-506	CIM-496	N-111	BH-160	
N_1=100	2.41fg	2.43fg	2.31g	2.41fg	2.39c
N_2=150	2.49ef	2.68d	2.90bc	2.85c	2.73b
N_3=200	2.61d	2.90a	3.30b	3.00c	2.95a
Mean	2.50d	2.67c	2.84a	2.75b	

Seed cotton yield kg per hectare: Data pertaining to seed cotton yield per hectare as influenced by nitrogen and varieties Table- 4 indicated that nitrogen had significant effect on the seed cotton yield per hectare. Maximum seed cotton yield per hectare (2455kg ha^{-1}) was recorded for nitrogen at a rate of 200 kg ha^{-1} in CIM-506 cotton variety. The lowest seed cotton yield (1981kg ha^{-1}) was obtained from BH-160 cotton variety when nitrogen was applied @ 100 kg ha^{-1}. These findings agree with the findings of Howard *et al.* (2001).These results are supported by Elayan (1992) who reported that nitrogen influenced seed cotton yield ha^{-1} and decrease in seed cotton yield ha^{-1} was recorded when nitrogen was applied beyond the optimum level.

Table-4 Effect of different nitrogen doses on seed cotton yield (kg ha^{-1}) on four varieties of cotton during 2005-2007.

Nitrogen level (kg ha^{-1})	Cotton varieties				Mean
	CIM-506	CIM-496	N-111	BH-160	
N_1=100	2098.1de	1816.00f	1939.60def	1868.72ef	1931c
N_2=150	2785.89a	2380.20bc	2027.40def	1904.16ef	2274b
N_3=200	2820.97a	2397.83bc	2433.09b	2168.62cd	2455a
Mean	2568a	2198b	2133b	1981c	

CONCLUSIONS

Application of 200 kg ha^{-1} nitrogen and cotton variety CIM-506 may be preferred over other level of nitrogen and cotton varieties due to higher seed cotton yield.

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