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Growth and yield response of cotton varieties under different methods of fertilizer application

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Abstract

The cotton crop field experiment was conducted during khraif season 2012 in Soil Chemistry Section, at Agriculture Research Institute, Tandojam Sindh Pakistan. Objective of this study to evaluate the two cotton varieties (CRIS-234 and NIAB-78) were checked for the best performance against two fertilizer application methods (broadcasting method and strip method) in a three replicated randomized complete block design having net plot size of 424m^2. It was noted that all the growth and yield contributing characters of cotton crop were significantly ($P<0.05$) affected without the exception of monopodial branches plant^{-1}which showed non-significant ($P>0.05$) response to different fertilizer application methods but significant results shows ($P<0.05$) to varieties. It was concluded that that strip method of fertilizer application is most effective where the cotton plants utilized nutrients more efficiently and resulted higher seed cotton yields as compared to broadcasting method; whereas, cultivar NIAB-78 proved its superiority in terms of seed cotton yield and lint quality traits over its companion variety CRIS-234. It is suggested that for maximization of seed cotton yield and lint quality, the crop may be fertilized through strip fertilizer application method; and variety NIAB-78 may preferably be adopted over CRIS-234. The data thus collected were subjected to statistical analysis using Analysis of variance technique and LSD (Least Significant Test) to determine the superiority of treatment means using MSTAT-C Computer Statistical Software, following Gomez and Gomez (1984).

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Introduction

Cotton (*Gossypium hirsutum* L.) is consider as a soft, fluffy staple fiber plant of the genus Gossypium; and belongs to family Malvaceae (Dorothy and Stolton, 1999). This plant is known as shrub native to tropical and subtropical regions around the world, including the Americas, Africa, India, and Pakistan. Cotton is one of the important cash crops and a fiber crop most widely grown and the highest yielding is used as fiber, woven to be the fabrics commonly used in our daily life due to its excellent performance and great production (Nour, 2015). This crop is grown in more than 80 countries resulting in an annual production of about 20 million tones. But, Pakistan plays key role as important cash crop (Imran *et al.*, 2011) and (Stephen, 2004). The cotton production in Pakistan for the marketing year 2014-2015 was 13983 thousand bales as compared to 12769 thousand bales in 2013-1014 and registered an increase 9.5 percent (GOP 1014). The government of Pakistan has approved nine biotech cotton varieties marking the first legal introduction of agricultural biotechnology into Pakistan. The approval provides legal cover for farmers using pirated cotton seeds cultivated with unknown parentage.

All Nutrients are essential must be sufficient quantity for obtained high quality, growth and much yield. Both plant growth and its yield are negatively affected by deficiency of nutrient elements and lint quality is decreased. Proper amount of plant nutrient elements taken by cotton from soil are varies depending on many factors such as the species of *Gossypium hirsutum* L. takes more nutrients from the soil under irrigation conditions, the nutrients are calcium (Ca) at most from unit area among micro nutrient elements, nitrogen (N) and potassium (K) follow it. Macro nutrients are Nitrogen (N), phosphorus (P) and potash (K) are known as essential nutrient elements for plant growth which need to be supplied in proper time and sufficient quantities (Don Eckert Dr. 2010) (Milford *et al.*, 2000). A positive correlation between vegetative growth and the number of fruiting points produced by cotton is well known by fertilizer supplement with split application becomes important as it is supplied ideally in a time when crop reached at critical stages (Setatou and Simonis, 1996).

Mostly management of fertilizer are more essential are controlled by generally three different methods are mainly include broadcasting, placement and foliar application (Ebelhar *et al.*, 1996; Moore, 1998). Broadcasting is the uniform distribution of fertilizers over the whole cropped field and placement method is application of fertilizers in bands or in pockets near the plants or plant rows. However, foliar application is using low or high volume sprayers, the fertilizers are sprayed covering the plants. The method of application has selected by particular nutrient, the crop, as well as method of cultivation. Nitrogen is generally applied as broadcast to irrigated crops and Potassium is also applied as broadcast but, Phosphorus needs to be placed near the plant rows (Sawan *et al.* 2006). The Aims of this study to evaluate the effect of fertilizer application methods on the growth and yield of cotton and to examine the varietal response of cotton to different fertilizer application method.

Materials and methods

The experiment was conducted in research experimental field of Soil Chemistry Section, Agriculture Research Institute, Tandojam, Pakistan, during year 2012. To evaluate the effect of fertilizer application methods on the growth and seed cotton yield of two cotton varieties. The experiment was laid out in a four replicated randomized complete block design, having net plot size of 24m x 26m ($624m^2$). The experimental soil was prepared initially with disc plow to break down the hard pan, followed by leveling and planking. After the irrigation, when the land came in optimum condition, the seedbed was prepared by using disc harrow, followed by rotavator. The total of 16 plots were prepared and the treatments were managed in such a way to separate the plots of treatments and replications easily, while the channels and bunds were prepared to facilitate the application of irrigation water and other agronomic cultural operations Sowing of cotton was done on 11^{th}May 2012 by means of single counter hand drill. The row to row spacing was maintained at 75 cm and plant to plant distance was 30 cm.

Treatments Methods of fertilizer application 2
Varieties 2
V_1 = CRIS-234
M_1 = Broadcast M_2 = Strip
V_2 = NIAB-78

Treatment combination
$V_1 = V_1M_1$
$V_2 = V_1M_2$
$V_3 = V_2M_1$
$V_4 = V_2M_2$

Whole Phosphorus in the form of SSP (18 $\%P_2O_5$) was applied at the time of sowing with first dose of nitrogen in the form of Urea (46%). Remaining two nitrogen splits was applied at the time flowering and boll formation. The recommended cultural practices were performed in all the subplots. Five plants in each treatment were selected at random to record observations. These sample plants were labeled and numbered for differentiation. The experimental cotton crop was sprayed against sucking complex and bollworms as per the recommendations of Entomologist, Agriculture Research Institute, Tandojam.

The observations were recorded on the following parameters: Plant height (cm), Monopodial branches plant^{-1}, Sympodial branches plant^{-1}, Bolls plant^{-1}, Open bolls plant^{-1}, Seed cotton weight plot^{-1}, (kg) Seed cotton yield (kg ha^{-1}) and G.O.T.(%)Staple length (mm).

All the quantitative characters of the experimental crop were measured in the field, while for G.O.T. and staple length, the cotton samples from each tagged plant were brought to the laboratory for qualitative analysis. The data thus collected were subjected to statistical analysis using Analysis of variance technique and LSD (Least Significant Test) to determine the superiority of treatment means using MSTAT-C Computer Statistical Software, following Gomez and Gomez (1984).

Results and discussion

Plant height (cm)

Plant height is considered as essential growth character in cotton which is generally influenced by varieties and soil fertility status. The results related to plant height of cotton cultivar as affected by fertilizer application methods is presented in Table-1 and its analysis of variance as Appendix-I. The after analysis of variance results showed that plant height was significantly ($P<0.05$) affected by fertilizer application methods and varieties, while non-significantly ($P>0.05$) by their interaction.

The significantly higher plant height (110.13cm) was noted in strip method as compared to broadcasting method of fertilizer application, where the plant height was 101.00 cm. This indicates described that under strip method of fertilizer application, the plants utilized the nutrients more efficiently as compared to broadcasting method and hence improved plant height. In case of varieties CRIS-234 showed its tall growing habit and irrespective of fertilizer application method, the plant height was markedly higher (115.12cm) in variety CRIS-234 than NIAB-78 having average plant height of 96.00 cm. This indicates that genetically, the variety CRIS-234 is taller growing as compared to NIAB-78. Treatment interaction showed that the plant height was maximum (120cm) under Strip method x CRIS-234 interaction and lowest (92.50 cm) under Broadcasting method x NIAB-78.

Table 1. Plant height (cm) of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	109.50	92.50	101.00 b
Strip method	120.75	99.50	110.13 a
Mean for varieties	115.12 a	96.00 b	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	1.6388	1.6589	2.3459
LSD 0.05	3.7525	3.7524	-
LSD 0.01	5.3909	5.3910	-

Number of monopodial branches plant^{-1}

The monopodial branches are helpful to obtaining the highest yield, generally associated with the genetic influence of parental material of a variety, but the influence of various inputs is also well recognized. The data pertaining to monopodial branches plant^{-1} of cotton varieties as affected by different fertilizer application methods are shown in Table-2 and its analysis of variance as Appendix-II. The analysis of variance indicated that the effect of fertilizer application methods, varieties as well as their interaction on the number of monopodial branches plant^{-1} was non-significant (P>0.05).

The results from the Table-2 are described that the number of monopodial branches in cotton was relatively higher (2.17 plant^{-1}) under strip method of fertilizer but (1.70 plant^{-1}) recorded under broadcast-ting method of fertilizer application.

In case of varieties NIAB-78 proved its superiority having maximum number of monopodial branches (2.15) plant^{-1}, while in CRIS-234, the number of monopodial branches was 1.71 plant^{-1}. This indicates that genetically NIAB-78 keeps the quality of having more monopodial branches as compared to CRIS-234. The interaction between verities showed that monopodial branches were maximum (2.50 plant^{-1}) under Strip method x NIAB-78 interaction and lowest was recorded (1.60 plant^{-1}) under Broadcasting method x CRIS-234.

Table 2. Monopodial branches plant^{-1} of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	1.60	1.80	1.70
Strip method	1.85	2.50	2.17
Mean for varieties	1.72	2.15	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	0.3010	0.3010	0.4257
LSD 0.05	-	-	-
LSD 0.01	-	-	-

Number of sympodial branches plant^{-1}

Apart from the plant biology of cotton, the branches that bear fruiting bodies are generally considered as the sympodial branches having positive linear effect on the number of bolls plant^{-1}.

The table 3 presented that results in relation to sympodial branches plant^{-1} of cotton varieties are affected by various fertilize doses and with different methods its analysis of variance as show in Appendix-III.

The analysis of variance was significant (P<0.05) the response of fertilizer application methods and varieties as well as their interaction on the number of sympodial branches plant^{-1}. The results from table-3 showed that the number of fruiting sympodial branches in cotton crop was significantly higher (25.00 plant^{-1}) under strip method of fertilizer application when compute with sympodial branches (21.87 plant^{-1}) was noted under broadcasting method.

These results demonstrated that crop utilize more nutrients under strip method when compared with broadcasting method of fertilizer application. The NIAB-78 is cotton cultivar proved its superiority having lowest number of sympodial branches (26.00) plant^{-1}, while 20.87 plant^{-1} was counted n CRIS-234.

Treatment interaction was noted less value but proved good results (25.00 plant^{-1}) under Strip method x NIAB-78 when compute with highest value (18.75 plant^{-1}) under Broadcasting method x CRIS-234.

Table 3. Sympodial branches plant^{-1} of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	18.75	25.00	21.87 b
Strip method	23.00	27.00	25.00 a
Mean for varieties	20.87 b	26.00 a	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	0.4270	0.4271	0.6038
LSD 0.05	0.9658	0.9657	1.3659

Number of bolls plant^{-1}

The more number of bolls plant^{-1} are good source of contributed its higher seed cotton yield. The results are appeared from table-4 and its analysis of variance as Appendix-IV described that no of bolls plant^{-1} of cotton varieties are affected by different fertilizer application methods. The analysis of variance indicated that the effect of fertilizer application methods, varieties as well as their interaction on the number of bolls plant^{-1} was significant (P<0.05).

It is obvious from the results (Table-4) that the number of bolls in cotton was remarkably higher (47.00 plant^{-1}) under strip method of fertilizer application as compared the number of bolls (40.62 plant^{-1}) observed under broadcasting method of fertilizer application. This advocates that under strip method of fertilizer application, the plants utilized nutrients adequately, while in broadcasting method of fertilizer application, the fertilizer was spread widely and instead of crop plants, the nutrients were also shared by the weeds like plants. In case of varieties NIAB-78 showed its dominance over its companion variety with maximum number of bolls (48.87) plant^{-1}, while in CRIS-234, the number of bolls was considerably lower (38.75 plant^{-1}). This specified that NIAB-78 surpassed CRIS-234 in relation to the number of bolls plant^{-1}. Treatment interaction suggested that the number of bolls were maximum (53.25 plant^{-1}) under Strip method x NIAB-78 interaction and lowest (36.75 plant^{-1}) under Broadcasting method x CRIS-234.

Table 4. Bolls plant^{-1} of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	36.75	44.50	40.62 b
Strip method	40.75	53.25	47.00 a
Mean for varieties	38.75 b	48.87 a	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	0.8750	0.8755	1.2374
LSD 0.05	1.9794	1.9798	2.7993
LSD 0.01	2.8436	2.8439	-

Number of open bolls plant^{-1}

Number of open bolls plant^{-1} is most important trait definitely contribute to increased seed cotton yield plant^{-1}. The table-5 and its analysis of variance as Appendix-V shows pertaining to open bolls plant^{-1} of cotton varieties as affected by different applying fertilizer methods. The analysis of variance suggested significant (P<0.05) influence of fertilizer application methods, varieties as well as their interaction on the number of open bolls plant^{-1}.

The number of open bolls plant^{-1} in cotton was significantly higher (41.12 plant^{-1}) under strip method of fertilizer application than the number of open bolls (35.62 plant^{-1}) recorded under broadcasting method of fertilizer application. This indicates that under strip method of fertilizer application, adequate quantities of nutrients were available for the plants around their root zone, while in broadcasting method of fertilizer application, due to more spreading of fertilizer,

the plants could not receive whole the applied fertilizers. Among varieties NIAB-78 surpassed variety CRIS-234 in case of number of open bolls (43.25) plant^{-1}, and in variety CRIS-234, the number of open bolls was 33.50 plant^{-1}.

It was observed that interaction between Strip method x NIAB-78 resulted maximum number of open bolls (47.75 plant^{-1}) and lowest (32.50 plant^{-1}) under Broadcasting method x CRIS-234.

Table 5. Open bolls plant^{-1} of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	32.50	38.78	35.62 b
Strip method	34.50	47.75	41.12 a
Mean for varieties	33.50 b	43.25 a	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	0.5336	0.5333	0.7546
LSD 0.05	1.2071	1.2073	1.7071
LSD 0.01	1.7441	1.7466	2.4524

Seed cotton yield plot^{-1} (kg)

The results regarding the seed cotton yield plot^{-1} of cotton varieties as affected by different fertilizer application methods are shown in Table-6 and its analysis of variance as Appendix-VI. The analysis of variance demonstrated significant (P<0.05) influence of fertilizer application methods and varieties on the seed cotton yield plot^{-1}, while non-significant (P>0.05) due to their interaction. It can be seen from the results (Table-6) that seed cotton yield plot^{-1} was significantly higher (155.69 kg) under strip method of fertilizer application as compared to the seed cotton yield of 135.15 kg plot^{-1} under broadcasting method of fertilizer application.

This suggested that under strip method of fertilizer application, the plants utilized the nutrients more efficiently as compared to those planted under broadcasting method of fertilizer application. In case of cotton varieties, NIAB-78 surpassed variety CRIS-234 in seed cotton yield (156.58 kg) plot^{-1}, and in variety CRIS-234, the seed cotton yield was 134.27 kg plot^{-1}.

It was noted that interaction between Strip method x NIAB-78 resulted maximum seed cotton yield of 165.04 kg plot^{-1} and lowest (122.19 kg plot^{-1}) under Broadcasting method x CRIS-234. The results further showed that strip method of fertilizer application and variety NIAB-78 would be a beneficial interaction for obtaining higher seed cotton yield.

Table 6. Seed cotton yield plot^{-1} (kg) of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	122.19	148.11	135.15 b
Strip method	146.34	165.04	155.69 a
Mean for varieties	134.27 b	156.58 a	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	2.3331	2.3333	3.2995
LSD 0.05	5.2779	5.2774	-
LSD 0.01	7.5822	7.8866	-

Seed cotton yield (kg ha^{-1})

The data in relation to seed cotton yield ha^{-1} of cotton varieties as influenced by different fertilizer application methods are presented in Table-7 and its analysis of variance as Appendix-VII.

The analysis of variance described significant (P<0.05) impact of fertilizer application methods and varieties on the seed cotton yield ha^{-1}, while non-significant (P>0.05) due to their interaction.

It is apparent from the data (Table-7) that seed cotton yield ha^{-1} was markedly higher (3672 kg) under strip method when compared to the seed cotton yield of 3187.50 kg ha^{-1} under broadcasting method of fertilizer application. These results are showed that the strip method of fertilizer application was more effective in supplying the nutrients to plants as compared to broadcasting method of fertilizer application. In case of cotton varieties, NIAB-78 exceeded in seed cotton yield (3692 kg) ha^{-1} over variety CRIS-234 which produced average seed cotton yield of 3166.60 kg ha^{-1}. The results further showed that interaction between Strip method x NIAB-78 resulted maximum seed cotton yield of 3892.50 kg ha^{-1} and minimum (2881.80 kg ha^{-1}) under interaction of broadcasting method x CRIS-234. The results suggested that the farmer could adopt strip method of fertilizer application using variety NIAB-78 for obtaining desired seed cotton yield.

Table 7. Seed cotton yield (kg ha^{-1}) of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	2881.80	3493.30	3187.50 b
Strip method	3451.50	3892.50	3672.00 a
Mean for varieties	3166.60 b	3692.00 a	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	55.005	55.005	77.788
LSD 0.05	124.43	123.55	175.97
LSD 0.01	178.76	180.55	252.80

G.O.T. (%)

Ginning Out-Turn (G.O.T) is the percentage of lint from the total seed cotton yield and this quality trait has great importance in the criterion for cotton variety development. The data in relation to G.O.T. of cotton varieties are affected by different fertilizer application methods are presented in Table-8 and its analysis of variance in Appendix-VIII.

The analysis of variance displayed significant ($P<0.05$) impact of varieties on the G.O.T percentage while non-significant ($P>0.05$) due to fertilizer application methods and interaction between fertilizer application methods and varieties.

The ginning out-turn (G.O.T) was relatively higher (35.02%) under strip method of fertilizer application as compared to the G.O.T. (34.54%) under broadcasting method. This suggested that the strip method of fertilizer application was more effective to produce healthy plants and subsequently good quality seed cotton as compared to broadcasting method of fertilizer application. In varieties, NIAB-78 surpassed CRIS-234 and produced 35.67% G.O.T. against 33.90% G.O.T. in variety CRIS-234. The results further indicated that interaction between Strip method x NIAB-78 resulted higher G.O.T. (35.92%) and lower (33.66%) in interaction of broadcasting method x CRIS-234.

Table 8. Ginning Out-Turn (G.O.T.%) of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	33.66	35.41	34.54
Strip method	34.13	35.92	35.02
Mean for varieties	33.90 b	35.67 a	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	0.3828	0.3830	0.5414
LSD 0.05	-	0.8661	-
LSD 0.01	-	1.3152	-

Staple length (mm)

Staple length is also known as Upper Half Mean Length (UHML) and cotton fiber with greater staple length is considered as higher quality lint. The results regarding staple length of cotton varieties as affected by different fertilizer application methods are shown (Table-9) and its analysis of variance Appendix-IX. The analysis of variance exhibited significant ($P<0.05$) impact of varieties and fertilizer application methods on the staple length, while non-significant ($P>0.05$) due to their interaction.

The staple length in cotton was remarkably higher (25.31 mm) under strip method of fertilizer application as compared to the staple length of (24.64 mm) under broadcasting method. In varieties, staple length was significantly higher in case of variety NIAB-78 (25.65 mm) as compared to CRIS-234 (24.31 mm). The results further indicated that interaction between Strip method x NIAB-78 resulted higher staple length (26.02 mm) and lower (24.01 mm) in interaction of broadcasting method x CRIS-234. The results suggested that for obtaining higher quality seed cotton in relation to staple length, the cotton may be fertilized by strip application method in variety NIAB-78.

Table 9. Staple length (mm) of cotton varieties as influenced by fertilizer application methods.

Fertilizer application methods	Varieties		Mean Fertilizer Application Methods
	CRIS-234	NIAB-78	
Broadcasting method	24.01	25.27	24.64 b
Strip method	24.61	26.02	25.31 a
Mean for varieties	24.31 b	25.65 a	-
	Fertilizer Application Methods (M)	Varieties (V)	M x V
S.E.±	0.1289	0.1291	0.1824
LSD 0.05	0.2917	0.2920	0.4125
LSD 0.01	0.4191	0.4205	0.5926

Conclusion

Cotton crop is the king of fiber crops and best source of economic exchange is crucial role in the economy of Pakistan. It can be determined from this study, maximum cotton yield in variety CRIS-243 under strip application method when comparison with NIAB-78 under broad costing method. Therefore the cotton growers in Pakistan are advised to adopt this kind of method is helpful to management and efficiently utilization of nutrients and obtained highest cotton seed yield.

References

Don Eckert DR. 2010. Efficient Fertilizer Use of Nitrogen Pp. 1-19.

Dorothy M. Stolton S. 1999. Organic cotton: From field to final product pp. 1-21.

Ebelhar MW, Welch RA. 1996. Cotton response to multiple split applications of nitrogen. p. 1345–1348. In P. Dugger and D. Richter (Ed.) 1996 Proc. Belt wide Cotton Conf. Nashville, TN. 9-12 Jan. 1996. Nat. Cotton Counc. Am. Memphis TN.

Gomes AK, Gomez AA. 1984. Statiscial procedures for agricultural research (2nd Edition). John Wiley and Sones. New yark.

Go P. 2015. Agricultural statistics of Pakistan 2014-2015. Government of Pakistan, Minstry of food, Agriculture and livestock, economic wing, Islamabad Pkistan.

Imran M, Shakeel A, Farooq J, Saeed A, Faroo A, Riaz M. 2011. Gentetic studies of fiber quality parameter and earlines related traits in upland cotton (*Gossypium hirstum* L.). AAB Bioflex **3(3),** 151-159.

Milford GFJ, Armstrong MJ, Jarvis PJ, Houghton BJ, Bellett-Travers DM, Jones J, Leigh RA. 2000. Effects of potassium fertilizer on the yield, quality and potassium of ftake of sugar beet crops grown on soils of different potassium status. Journal of Agricultural Science **135,** 1-10.

Moore SH. 1998. Optimum soil-applied nitrogen levels on a high pH alluvial soil. J. Plant Nutr **21(6),** 1139-1144.

Nour A. 2015. Review nitrogen utilization features in cotton crop. 10.4236/ajps.67105 987-1002.

Sawan ZM, Mahmoud H. El-Guibali AH. 2006. Response of yield, yield components and fibre properties of Egyptian cotton (*Gossypium barbadense* L.) to Nitrogen fertilization and foliar applied potassium and mepiquat chloride. J. Cotton Sci **10,** 224-234.

Setatou HB, Simonis AD. 1996. Effect of time and rate of nitrogen application on cotton. Fertilizer Res **43,** 49-53.