EFFECT OF FERTILIZATION ON YIELD AND FIBER PROPERTIES OF SOME COTTON CULTIVARS

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ABSTRACT

The effect of N and P on seedcotton yield, boll and fiber properties of three cultivars were studied during 1984 and 1985 seasons. The results showed that N is an important factor affecting seedcotton yield/fad., number of open bolls/plant, boll weight and length parameters. P applied had a significant effect on seedcotton yield and its macrocomponents given above. Differences among cultivars were significant for number of open bolls/plant, boll weight lint percent, staple length, fiber finess and strength. Fiber properties were not affected by applied P in the three studied cultivars. A significant cultivar x N interaction was detected for seedcotton yield/fad. for all cultivars. And significant N x P x cultivar interaction was detected for the number of boll/plant.

INTRODUCTION

Efforts to determine varietal requirements of nitrogenous fertilization are superfluous. Nitrogen rates as 45 to 60 kg./fad. were regarded by many investigators as adequate to support growth, yield, fiber development and quality, Rizk (1974), Kerallah (1979), Yassen (1979) and Shahine (1980). Less attention, however, has been devoted to fertilization with phosphorous in its relation with nitrogen. In addition, contradictory results were reported. Excess phosphorous was reported to cause rapid growth and earlier than usual cut-out (Eid and Abd El-Samie, 1958). Others reported increases in seedcotton yield with addition of phosphorous (Allam et al., 1957 and El-Gabaly, 1958). Yet, others found no beneficial effect as a result of phosphorous application on seedcotton yield, Abo El-Ella and El-Baradeiy (1958). Hefni et al. (1978), reported favorable response of Giza 69 to phosphorous fertilization.

With the rapid run-out of cotton varieties and appearance of new and dissimilar ones into cotton growing areas, the optimum growing practices are not always the same.

Thus, this investigation was designed to elucidate the effect of nitrogen and phosphorous fertilization on the differential response of several Egyptian cotton cultivars.

MATERIALS AND METHODS

Two field experiments were conducted at the Research and Experimental Center of the Faculty of Agriculture at Moshtohor, Kalubia Governorate during 1984 and 1985 seasons to determine the response of three Egyptian cotton cultivars to nitrogen and phosphorous fertilization. The Egyptian cultivars Giza 75, Giza 80 and Giza 70 were used in this study. Nitrogen levels utilized were 0 and 45 kg./fad. in the form of Urea (46% N). Rates of phosphorous utilized were: 0 and 32 kg./fad. of calcium superphosphate (15.5% P_2O_5). Each exeperiment included twelve treatments which were the combination of the three cultivars, the two levels of nitrogen and the two levels of phosphorous. Each treatment was replicated four times. The two experiments were laid out in a split-plots design where cultivars were allotted to the main plots and fertilization treatments were distributed in the sub-plots. The sub-plot area was 10.5 m^2 (3x3.5 m.). Planting took place on the 25th of March in both seasons. Nitrogen and phosphorous fertilizers were added prior to the second irrigation (i.e. after 30 days from planting). The normal cultural practices for growing cotton were followed as recommended for the region.

At harvest, 10-guarded random plants from each subplot were taken to determine the yield components and technological properties of fibers. Seedcotton yield and the number of bolls were calculated on the whole plot basis. Data recorded included the following:

1- Seedcotton yield per fad. in kg.
2- Seedcotton yield per plant (g.).
3- Boll weight (g).
4- Number of bolls per plant.
5- Openning bolls percentage.
6- Lint per cent.
7- Staple length parameters including the 2.5% S.L. 50% S.L. 66.7 S.L. and uniformity ratio (UR.).
8- Fiber strength estimated in pressley.
9- Fiber fineness in Micronaire units.

Data of the two seasons were subjected to a combined analysis. Comparisons among means were carried out by using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

A- Effect of season:

Results in Tables (1 and 2) represent averages of the two seasons of the study. From the results it is evident that some characters such as the number of immature bolls, uniformity ratio, fiber fineness and Pressely values were significantly variable from season to season. Higher mean values, except for the Pressely, occurred in the first season. Other characters, however, were not subjected to seasonal variations.

B- Effect of varieties:

Tables (3 and 4) includes data on yield, yield components and various technological properties of the three tested cultivars. Differences among cultivars in seedcotton yield (kg/fad.), seedcotton (g./plant), and number of open boll/plant, boll weight, lint percent, staple length, fiber fineness and strength are existent and significant, other properties, nonetheless, did not vary considerably among cultivars. Apparantly, Giza 75 cultivar had the highest boll loading capacity per plant, the highest seedcotton yield per fad. and per palnt, the greatest boll weight and greater Micronaire values. These characteristics are typical of Giza 75 cultivar that is known as a high yielding cultivar with large-than-average boll size in proportion to other cultivars.

Interestingly, Giza 80, although known as a high yielding cultivar in Upper Egypt, yet it ranked second to Giza 75 in the amount of seedcotton yield in this study. Still, Giza 80 surpassed the other two varieties in lint percent. Giza 70 cultivar excelled its two counterparts in length parameters, the pressely values and fineness. This varietal order held true in this study regardless of the N and P levels.

C- Effect of nitrogen fertilizer:

Seedcotton yield/fad., seedcotton yield/plant and their yield components, namely, number of bolls per plant and boll weight were significantly increased with the addition of 45 kg. N/fad. As for fiber properties, most of the characters were not affected by the addition of 45 kg./fad. nitrogen. Exception from that were the two length parameters, namely, 2.5 and 50% staple lengths (Table 5 and 6). Data obtained in this study are in harmony with those reported by Kerallah (1979), Shahine (1980), Salem (1980) and Yasseen (1979). They have reported similar

Table (1): Average performance of year effect on yield and yield componets of cotton.

Year	No. of bolls/plant	% of openning bolls	W. of bolls (g)	Seed cotton yield/ plant	Seed cotton yield/fad	
					Kg	Rel.
1984	16.12a	65.94b	3.76a	29.35a	1035a	100
1985	13.93a	83.63a	2.73a	30.65a	1070a	103

Means in column followed by the same letter (s) are not significantly different (P= 5%).

Table (2): Average performance of year effect on fiber properties of varieties.

Year	Lint %	2.5% span length	50% span length	66.7% span length	Uniformity ratio (U.R)	Fiber finenese Micronaire	Pressley values
1984	38.57a	1.22a	0.641a	0.484a	52.56a	4.72a	8.92b
1985	39.41a	1.22a	0.610a	0.476a	50.52b	4.10b	9.38a

Mean in column pollowed by the same letter (s) are not significantly different (P= 5%).

Table (3): Effect of varieties on yield and yield components of cotton (combined analysis of 1984 and 1985 seasons).

Varieties	No. of bolls/plant	% of openning bolls	W. of bolls (g)	Seed cotton yield/ plant	Seed cotton yield/fad	
					kg	Rel.
Giza 75	16.79a	73.62a	2.85a	33.03a	1174a	100
Giza 80	15.31b	74.19a	2.71b	32.91a	1028b	88
Giza 70	12.74c	74.02a	2.67c	24.05b	955c	81

Means in column followed by the same letter (s) are not significantly different (P= 5%).

Table (4): Effect of varieties on fiber properties of cotton (combined analysis of 1984 and 1985 seasons).

Varieties	Lint %	2.5% span length	50% span length	66.7% span length	Uniformity ratio U.R.	Fiber fineness Micro-naire	Pressley value
Giza 75	38.08b	1.17b	0.609b	0.471b	52.04a	4.60a	8.954b
Giza 80	41.76a	1.14b	0.587b	0.454b	51.24a	4.45b	8.744b
Giza 70	37.13b	1.34a	0.682a	0.513a	51.34a	4.18c	9.730a

Mean in column followed by the same letter (s) are not significantly different (P= 5%).

Table (5): Effect of N-levels on yield and yield components of cotton (combined analysis of 1984 and 1985 seasons).

Nitrogen levels kg/fad.	No. of bolls/plant	% of openning bolls	W. of bolls (g)	Seed cotton yield/ plant	Seed cotton yield/fad.	
					Kg.	Rel.
0	12.69b	73.36a	2.66b	24.60b	910b	100
45	17.38a	74.63a	2.83a	35.39a	1188a	130

Means in column followed by same the letter (s) are not significantly different (P= 5%).

Table (6): Effect of N-levels on fiber properties of cotton (combined analysis of 1984 and 1985 seasons).

Nitrogen levels kg/fad.	Linit %	2.5% span length	50% span length	66.7% span length	Uniformity ratio U.R.	Fiber finenese Micronaire	Pressley value
0	39.21a	1.20 b	0.611 b	0.470 a	51.57 a	4.381 a	9.013 a
45	38.77 a	1.24 a	0.641 a	0.489 a	51.51 a	4.432 a	9.285 a

Means in column folowed by the same letter (s) are not significantly different (P= 5%).

results. Scarsbrook et al. (1959) and Perkins and Douglas (1964), found that the length of lint was increased by increasing the level of nitrogen.

D- Effect of phosphorous fertilizer:

Results in Tables (7 and 8) reveal that fertilization with phosphorous had significant effects on yield of seedcotton and its components. However, technological properties were not affected by the application of the treatment. With regard to seedcotton yield, the yield obtained with the addition of P was significantly higher than the void treatment. Yield components, namely, seedcotton/plant, number of boll/plant and weight of boll were significantly altered by the addition of P over the control treatment. Hefni et al. (1978), obtained the highest yield of seedcotton with 16 kg P_2O_5/fad. in the two seasons of their study. However, the amount required to increase the amount of bolls was variable from season to season. Thus they concluded that 48 kg/fad. was the optimum rate for cotton. In contrast, other investigators found no beneficial effect whatsoever as a result of phosphorous application on seedcotton (Abo El-Ella and Baradeiy, 1958 and Eid 1969).

Thus the results obtained herein together with those previously reported by Hefni et al. (1978), El-Gabaly (1958) and Eid and Abd El-Samie (1958), necessitate the checking of soil native phosphorous before making any recommendation as to phosphorous fertilization.

E- Effect of the interactions:

1- Effect of N and varieties interaction:

The effect of this interaction was statistically significant only on seedcotton yield/fad in the combined analysis of the two years of the study (P=0.05), as is shown in Table (9). From data in Table (9), it is apparent that this first order interaction increased seedcotton yield/Fad. in all three genotypes tested. However, Giza 75 cultivar responded more favorably than its two respective cultivars to the higher rate of nitrogen (i.e. 45 kg/fad.) The significance of N x variety interaction apparent in Table (9) was due principally to different degrees of varietal response in essentially the same direction. MacKenzie and Van Schaik (1963), studied the response of varieties to nitrogen alone under normal irrigation. They found both variety and nitrogen to be important factors influencing cotton yield.

2- Effect of N and P interaction:

This effect was not significant on all cahracters except boll weight (g). Again, data of other characters do not appear here. The heaviest boll weight was obtained

Table (7): Effect of P-levels on yield and yield components of cotton (combined analysis of 1984 and 1985 seasons).

Phosphorus levels Kg P_2O_5/fad	No. of bolls/plant	% of openning bolls	W. of bolls (g)	Seed cotton Yield/plant	Seed cotton yield/fad.	
					Kg.	Rel.
0	13.88 b	72.69 b	2.70 b	27.38 b	990 b	100
45	16.18 a	75.34 a	2.79 a	32.62 a	1115 a	113

Means in column followed by the same letter (s) are not significantly different (P= 5%).

Table (8): Effect of P-levels on fiber properties of cotton (combined analysis of 1984 and 1985 seasons).

Phosphorus levels Kg P_2O_5/fad.	Lint %	2.5% span length	50% span length	66.7% span length	Uniformity ratio U.R.	Fiber finenes Micronaire	Peressley value
0	39.09 a	1.216 a	0.624 a	0.482 a	51.58 a	4.385 a	9.21 a
32	38.89 a	1.216 a	0.628 a	0.477 a	51.50 a	4.452 a	9.08 a

Means in column followed by thesame letter (s) are not significntly different (P= 5%).

Table (9): Effect of N x variety interaction on seedcotton yield per fad. (combined analysis of 1984 and 1985 seasons).

Variety	N-levels kg/fd.	
	0	45
Giza 75	994 c	1354 a
Giza 80	894 d	1163 b
Giza 70	862 e	1048 c

Var. x N x year **

Means in column followed by same letter (s) are not significantly different (P= 5%).

Table (10): Effect of N x P interaction on boll weight (combined analysis of 1984 and 1985 seasons).

P_2O_5 Kg/fad	N-Levels Kg/fad	
	0	45
0	2.65 b	2.74 b
45	2.66 b	2.92 a

N x P x Year **

Mean in column followed by same letter (s) are not significantly different (P= 5%).

Table (11): Effect of variety x N x P interaction on number of bolls/plant (combined analysis of 1984 and 1985 seasons).

Variety	N-levels kg/fad.	P_2O_5 Kg/fad. 0	P_2O_5 Kg/fad. 32
Giza 75	0	8.34 fg	8.69 e-g
	45	9.83 c-e	12.56 a
Giza 80	0	7.84 fg	9.09 d-f
	45	10.17 bd	10.60 bc
Giza 70	0	7.47 g	8.78 e-g
	45	10.96 be	11.47 b

Mean in column followed by same letter (s) are not significantly different (p= 5%).

with the addition of 45 kg. nitrogen and 32 kg. P_2O_5 (Table 10). Henfi et al. (1978), found that the maximum expression of boll weight was under the higher rate of phosphorous i.e., 45 kg. P_2O_5.

3- **Effect of variety x N x P interaction:**

The effect of this three way interaction yielded sheer-cut increases in the number of bolls/plant in the three tested cultivars, (Table 11). Results also indicate the importance of phosphorous in upgrading the number of open boll/plant. Varietal differential response to N x P assimilation is also suggested by the data, though in the same direction.

REFERENCES

Abo El-Ella, M.M. and El-Baradeiy, M.E.A. (1958): Primary report on the effect of main fertilizers elements on cotton yield. Alex. Fac. of Agric. farm. 2nd. Cott. Conf. Higher Council of Sci., Cairo. pp. 397-399. (in Arabic).

Allam, F.; Hinedi, M. and Rhiza, A. (1957): The effect of chemical fertilizers and Baladi manure on cotton yield through 24 yrs. (Permanent experiment plots at Giza) 1st. Conf. (Higher Council of Sci.) Cairo, pp: 256-266. (in Arabic).

Eid, E.T. and Abd El-Samie, M. (1958): Cotton vegetative growth as an index of nitrogenous and phosphatic fertilizers in a pot experiment. 2nd. Conf. of Cott., Higher Council of Sci. 42. (in Arabic).

Eid, E.T. (1969): Nitrogen and phosphorous effects on growth and yield of Ashmouni cotton. M.Sc. Thesis. Fac. Agric., Cairo Univ.

El-Gabaly, M.M. (1958): The influence of fertilizers and their interaction with spacing and irrigation on the yield of Karnak cotton. Higher council of of Sci., Cairo, pp: 404-415. (in Arabic).

Hefni, El-S., H.M.; Samra, A.M. and Abd El-Salam, M.E. (1978): Effect of hill spacing and nitrogen fertilization on some agronomic and fiber characteristics of Egyptian cotton. Egypt. Jour. Agron. 3(1), pp: 75-84.

Kerallah, M.I.Z. (1979): Response of some Egyptian cotton cultivars to nitrogen fertilization. M.Sc. Thesis, Fac., Agric., Cairo Univ.

MacKenzie, A.J. and Van Schaik, P.H. (1963): Effect of nitrogen on yield, boll, and fiber properties of four varieties of cotton. Agron. Jour. 55(4): 245-247.

Perkins, H.F. and Douglas, A.G. (1964): Effect of nitrogen on the yield and certain properties of cotton. Agron. Jour. 57: 383-384.

Rizk, M.A.M. (1974): Effect of rate and time of nitrogen fertilizer application on yield, chemical constitution of fiber and seeds and some other agronomic characters in Egyptian cotton. Ph.D. Thesis, Fac. Agric., Al-Azhar Univ.

Salem, K.A. (1980): Studies on effect of some agronomic practices on growth, flowering and bolling of certain new varieties of Egyptian cotton. M.Sc. Thesis, Cairo Univ.

Scarsbrook, C.E.; Bunnet, O.L. and Pearson, R.W. (1959): The interaction of nitrogen and moisture on cotton yield and other chracteristics. Agron. Jour. 53: 56-57.

Shahine, I.M.M. (1980): Effect of different levels of nitrogen fertilizer on the yield and yield components of cotton plant. M.Sc. Thesis, Fac. of Agric., Sci. Moshtohor, Zagazig Univ.

Yasseen, A.F.I. (1979): Effect of date of sowing, thinning, and N fertilization on growth and yield of cotton. M.Sc. Thesis. Fac. of Agric., Zagazig Univ.