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 fineness 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 (Kid 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 experiment 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 distrib-
uted in the sub-plots. The sub-plot area was 10.5 m²
(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 technol-
ogical 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- Opening 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 Presely values were significantly variable from season to season. Higher mean values, except for the Presely, 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. Apparently, Giza 75 cultivar had the highest boll loading capacity per plant, the highest seedcotton yield per fad. and per plant, 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 presely 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 components of cotton.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of bolls/plant</th>
<th>% of open bolls</th>
<th>Weight of seed cotton bolls (g)</th>
<th>Seed cotton yield/plant (Kg)</th>
<th>Seed cotton yield/fad (kg)</th>
<th>Rel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>16.12a</td>
<td>65.94b</td>
<td>3.76a</td>
<td>29.35a</td>
<td>1035a</td>
<td>100</td>
</tr>
<tr>
<td>1985</td>
<td>13.93a</td>
<td>83.63a</td>
<td>2.73a</td>
<td>30.65a</td>
<td>1070a</td>
<td>103</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Lint % 2.5%</th>
<th>50% span length</th>
<th>Uniformity span ratio</th>
<th>Finenese (U.R)</th>
<th>Pressley Micronaire values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>38.57a</td>
<td>1.22a</td>
<td>0.641a 0.484a</td>
<td>52.56a</td>
<td>4.72a</td>
</tr>
<tr>
<td>1985</td>
<td>39.41a</td>
<td>1.22a</td>
<td>0.610a 0.476a</td>
<td>50.52b</td>
<td>4.10b</td>
</tr>
</tbody>
</table>

Mean in column followed 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).

<table>
<thead>
<tr>
<th>Varieties</th>
<th>No. of bolls/plant</th>
<th>% W. of opening bolls</th>
<th>W. of seed cotton</th>
<th>Seed cotton yield/fad</th>
</tr>
</thead>
</table>
| 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  | 91%

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).

<table>
<thead>
<tr>
<th>Varieties</th>
<th>2.5% Lint</th>
<th>50% Lint</th>
<th>66.7% Lint</th>
<th>Uniformity</th>
<th>Fiber length</th>
<th>Span length</th>
<th>Span ratio</th>
<th>Fineness</th>
<th>Pressley Micro-naire value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giza 75</td>
<td>38.08b</td>
<td>1.17b</td>
<td>0.609b</td>
<td>0.471b</td>
<td>52.04a</td>
<td>4.60a</td>
<td>8.954b</td>
<td>8.744b</td>
<td>9.730a</td>
</tr>
<tr>
<td>Giza 80</td>
<td>41.76a</td>
<td>1.14b</td>
<td>0.587b</td>
<td>0.454b</td>
<td>51.24a</td>
<td>4.45b</td>
<td>8.744b</td>
<td>9.730a</td>
<td>9.730a</td>
</tr>
<tr>
<td>Giza 70</td>
<td>37.13b</td>
<td>1.34a</td>
<td>0.682a</td>
<td>0.513a</td>
<td>51.34a</td>
<td>4.18c</td>
<td>9.730a</td>
<td>9.730a</td>
<td>9.730a</td>
</tr>
</tbody>
</table>

Means 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).

<table>
<thead>
<tr>
<th>Nitrogen levels kg/fad.</th>
<th>No. of bolls/plant</th>
<th>% of openi-</th>
<th>W. of bolls</th>
<th>Seed cotton yield/plant Kg.</th>
<th>Seed cotton yield/fad. Rel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12.69b</td>
<td>73.36a</td>
<td>2.66b</td>
<td>24.60b</td>
<td>910b 100</td>
</tr>
<tr>
<td>45</td>
<td>17.36a</td>
<td>74.63a</td>
<td>2.83a</td>
<td>35.39e</td>
<td>1188a 130</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>Nitrogen levels kg/fad.</th>
<th>Limit 2.5% span</th>
<th>50% span</th>
<th>66.7% span</th>
<th>Uniformity ratio</th>
<th>Fiber finnенее</th>
<th>Pressley Micronaire</th>
<th>Pressley Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>39.21a</td>
<td>1.20 b</td>
<td>0.611 b</td>
<td>0.470 a</td>
<td>51.57 a</td>
<td>4.381 a</td>
<td>9.013 a</td>
</tr>
<tr>
<td>45</td>
<td>38.77 a</td>
<td>1.24 a</td>
<td>0.641 a</td>
<td>0.489 a</td>
<td>51.51 a</td>
<td>4.432 a</td>
<td>9.265 a</td>
</tr>
</tbody>
</table>

Means in column followed 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 seed-cotton 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. Hafni et al. (1978), obtained the highest yield of seedcotton with 16 kg P₂O₅/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 phosphorus application on seed-cotton (Abo El-Ella and Baradei, 1958 and Eid 1969).

Thus the results obtained herein together with those previously reported by Hafni et al. (1978), El-Gabaly (1958) and Eid and Abd El-Samie (1958), necessitate the checking of soil native phosphorus before making any recommendation as to phosphorus 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. McKenzie 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 characters except boll weight (q). 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).

<table>
<thead>
<tr>
<th>Phosphorus levels Kg P₂O₅/fad</th>
<th>No. of bolls/plant</th>
<th>% of open ing bolls</th>
<th>W. of cotton bolls (g)</th>
<th>Seed Yield/ plant</th>
<th>Seed cotton yield/fad Kg</th>
<th>Rel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>13.88 b</td>
<td>72.69 b</td>
<td>2.70 b</td>
<td>27.38 b</td>
<td>990 b</td>
<td>100</td>
</tr>
<tr>
<td>45</td>
<td>16.18 a</td>
<td>75.34 a</td>
<td>2.79 a</td>
<td>32.62 a</td>
<td>1115 a</td>
<td>113</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>Phosphorus levels Kg P₂O₅/fad.</th>
<th>Lint %</th>
<th>2.5% span</th>
<th>50% span</th>
<th>66.7% span</th>
<th>Uniformity ratio</th>
<th>Fiber fineness</th>
<th>Peressley micronaire value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>39.09 a</td>
<td>1.216 a</td>
<td>0.624 a</td>
<td>0.482 a</td>
<td>51.58 a</td>
<td>4.385 a</td>
<td>9.21 a</td>
</tr>
<tr>
<td>32</td>
<td>38.89 a</td>
<td>1.216 a</td>
<td>0.628 a</td>
<td>0.477 a</td>
<td>51.50 a</td>
<td>4.452 a</td>
<td>9.08 a</td>
</tr>
</tbody>
</table>

Means in column followed by the same letter(s) are not significantly different (P= 5%).
Table (9): Effect of N x variety interaction on seedcotton yield per fad. (combined analysis of 1984 and 1985 seasons).

<table>
<thead>
<tr>
<th>Variety</th>
<th>N-levels kg/fad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giza 75</td>
<td>994 c 1354 a</td>
</tr>
<tr>
<td>Giza 80</td>
<td>894 d 1163 b</td>
</tr>
<tr>
<td>Giza 70</td>
<td>862 e 1048 c</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>P2O5 Kg/fad</th>
<th>N-Level(s) Kg/fad</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2.65 b 2.74 b</td>
</tr>
<tr>
<td>45</td>
<td>2.66 b 2.92 a</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>Variety</th>
<th>N-levels</th>
<th>P2O5 Kg/fad.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg/fad.</td>
<td>0</td>
</tr>
<tr>
<td>Giza 75</td>
<td>0</td>
<td>8.34 fg</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>9.83 c-e</td>
</tr>
<tr>
<td>Giza 80</td>
<td>0</td>
<td>7.84 fg</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>10.17 bd</td>
</tr>
<tr>
<td>Giza 70</td>
<td>0</td>
<td>7.47 g</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>10.96 he</td>
</tr>
</tbody>
</table>

Mean in column followed by same letter(s) are not significantly different (p = 5%).
with the addition of 45 kg. nitrogen and 32 kg. P₂O₅ (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. P₂O₅.

3- Effect of variety x N x P interaction:
The effect of this three way interaction yielded shee-cut increases in the number of bolls/plant in the three tested cultivars, (Table 11). Results also indicate the importance of phosphorus 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


