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# Effect of Planting Patterns and Nk Fertilizers Levels under Two Planting Date on Yield and Fiber Properties of Egyptian cotton In Middle Egypt

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**Abstract**

Two separate field experiments were conducted during 2019 and 2020 seasons, at Mallawi region, Minia Governorate, Egypt, to study the effect of two planting date, four planting patterns and three NK fertilizer levels on yield and fiber properties of Egyptian cotton (*Gossypium barbadense*, L.) promising hybrid cotton (CB58 X Giza 90). The results could be summarized as follows was observed: Planting date significantly affect seed cotton yield fed$^{-1}$ and lint index in the both seasons and micronaire reading, 2.5 % span length and length uniformity ratio in the first season only. Regarding planting patterns significant effect on seed cotton yield fed$^{-1}$ and lint index in the both season. NK fertilizer levels had a significant effect on seed cotton yield fed$^{-1}$ and lint index in both seasons and fiber strength and 2.5 % span length in the first season only. Seed cotton yield fed$^{-1}$ was affected by the interaction between planting date and planting patterns in the first season. It can be concluded that early planting, 130 cm bed width and 30 cm hill space planted in two sides and fertilized by 75 kg N + 48 kg $K_2$ O fed$^{-1}$ under the conditions in middle Egypt.

**Key Words:** *Planting dates, Planting patterns, NK fertilizer levels, Fiber properties, Egyptian cotton*

## Introduction

Egyptian cotton (*Gossypium barbadense, L.*) is the most important commercial fiber crop in Egypt. Cotton plays a key role in the economy. It is the oldest among the commercial crops and is known as white gold. Egyptian cotton is preferred around the world because it is a long fiber that makes it softer and stronger at the same time. For many years, it was so valuable that most of the crop was exported to European countries. Cotton seed meal is used in food products for animal feed due to its high protein and energetic values. So, it is necessary to increase cotton cultivation area and productivity. Cotton is not only the most important fiber crop of the world but also the second best source for plant proteins after soybean and the oil ranking fifth in the world use among edible oils **(Sawan et al, 2006)**. Economic characters are influenced by the various agronomic treatments especially planting date, planting patterns and the amount of fertilizers.

In this connection, planting dates differ in affect cotton yield and fiber properties as reported by **Elhamamsey *et al* (2016), Khan *et al* (2017), Emara *et al* (2018b), Anwar, *et al* (2020).**

Planting patterns is one of the management practices which require attention as far as optimum yield is concerned in cotton production. The suitable plant population fed$^{-1}$ resulting in higher yield and earlier maturity. Such findings are in harmony with those obtained by **Wang *et al* (2016), Kumar *et al* (2017), Ghoprial *et al* (2018), Anwar, *et a*l (2020).**

Consequently, many workers reported that NK fertilizer levels are the most limiting factor to increase cotton yield and fiber properties by **Dewdar and Rady (2013), Ghoprial *et al* (2018), Zakzok *et al* (2018), Deshish (2021b).**

This study aimed to investigate the suitable agricultural management practices such as planting dates and patterns and NK fertilizer levels of new promising hybrid cotton (CB58X Giza 90).

## Materials and Methods

Two field experiments were carried out in Mallawi region, Minia Governorate, during 2019 and 2020 seasons to study the effect of two planting date (20$^{th}$ March and 20$^{th}$ April), four planting patterns **{**65 cm ridges width +25 cm hills space **($P_1$)**, 65 cm ridges width + 30 cm hill space **($P_2$)**, 130 cm bed width + 25 cm hill space planted in two sides **($P_3$)**, 130 cm bed width + 30 cm hill space planted in two sides **($P_4$)}** and three NK fertilizer levels {45 N + 24 $K_2$ O kg fed$^{-1}$ **($NK_1$)**, 60 N + 36 $K_2$ O kg fed$^{-1}$ **($NK_2$),** 75 N + 48 $K_2$O kg fed$^{-1}$ **($NK_3$)}** on yield and fiber properties of Egyptian cotton (*Gossypium barbadense*, L.) promising hybrid cotton (CB58 X Giza 90). The soil was clay in texture with a pH value of 8.14 and 8.23, an organic matter content of 1.99 and 2.05%, available N of 0.112 and 0.125% and available K of 0.330 and 0.335% during the first and second seasons, respectively. It should be noted that the preceding crop was corn in the two seasons. Data in **Table 1** showed the measured climatic factors (maximum air temperature **°C** (Max. Temp.), minimum air temperature **°C** (Min. Temp.), Average relative humidity % (Avg. RH) and Soil Temp. °C (Min. Temp.) during the experimental period (March till October during 2019 and 2020 seasons). These data

collected from automated weather station of Mallawi location.

The variables in each experiment were distributed as randomized complete block design (RCBD) using split split-plot arrangement with 4 replicates. Two sowing dates were arranged in the main plots, the sub plots were assigned random by to the four planting patterns randomly and the three NK fertilizers levels were arranged random by in the sub sub-plots. The area of each sub sub-plot was 23.4 $m^2$ (including 6 ridges width of ridge was 65 cm and the length of ridge was 6 m).

**Table 1.** Average monthly climatic data of Mallawi location during the two studied seasons of 2019 & 2020.

| Month | Max. Temp. °C | Min. Temp. °C | Ave. RH % | Soil Temp. °C |
|---|---|---|---|---|
| | | **First season (2019)** | | |
| **March** | 46.2 | 19.0 | 50.8 | 37.9 |
| **April** | 36.7 | 18.8 | 57.4 | 29.6 |
| **May** | 46.1 | 15.9 | 38.5 | 31.6 |
| **June** | 46.3 | 19.1 | 39.2 | 35.9 |
| **July** | 45.9 | 19.5 | 46.2 | 37.2 |
| **August** | 46.2 | 19.0 | 50.0 | 38.3 |
| **September** | 42.6 | 17.1 | 47.9 | 39.2 |
| **October** | 33.7 | 18.2 | 47.4 | 38.5 |
| | | **Second season (2020)** | | |
| **March** | 47.1 | 20.1 | 49.2 | 38.7 |
| **April** | 36.9 | 19.4 | 58.2 | 28.8 |
| **May** | 44.9 | 16..9 | 39.3 | 32.0 |
| **June** | 46.8 | 19.5 | 37.9 | 36.4 |
| **July** | 44.7 | 20.0 | 45.6 | 38.3 |
| **August** | 47.7 | 19.7 | 49.1 | 38.3 |
| **September** | 44 | 18.1 | 48.7 | 39.4 |
| **October** | 35.9 | 18.0 | 48.0 | 39.1 |

Phosphorus fertilizer was added at a level of 22.5 kg after ridging and before planting in both seasons. Each season contained two separate experiments represented the two planting dates, i.e. 20$^{th}$ March and 20$^{th}$ April. Nitrogen fertilizer in the form of ammonium nitrate (33.5 % N) at the tested levels was applied before the second and third irrigations in two equal doses, Potassium fertilizers in the form of potassium sulfate (48 % $K_2O$) at the tested levels was applied before third irrigation in one doses. Other agricultural practices were done as recommended in region.

At harvest, seed cotton yield (kentar fed$^{-1}$) was estimated as the weight of seed cotton yield (kg) picked from the whole plot in each experimental unit collected from two picks, then converted to yield fed$^{-1}$in kentar (1 Kentar = 157.5 kg seed cotton).

Samples of lint were collected from each treatment at each replicate to determine the following characters at the laboratories of Cotton Research Institute, ARC, under standard conditions of test by using High Volume Instrument (HVI) according to **(A.S.T.M., 1986)**, for the following traits: micronaire reading, fiber strength (g/tex), 2.5 % span length (mm), length uniformity ratio (%), lint index. Data collected on different parameters were analyzed statistically by using MSTAT-C programme **(Anonymous, 1986)** for analysis of variance. Whenever, the results were found to be significant, the treatments means were compared using LSD at 0.05 level of probability **(Steel et al., 1997).**

## Results and Discussion

***-Effect of planting dates:***

Planting date was significantly effect of seed cotton yield fed$^{-1}$ and lint index in the both seasons and micronaire reading, 2.5 % span length and length uniformity ratio in the first season only as shown Table 2. Planting date at 20$^{th}$ March was significantly increase of seed cotton yield fed$^{-1}$ and lint index in the both seasons and 2.5 % span length and length uniformity ratio in the first season only. Whereas, planting date at 20$^{th}$ April were significantly increase of micronaire reading in the second season only, Fiber strength is no significant effect in the two seasons. This may be attributed to the high genetic stability of these characters. The present results are in general accordance with those obtained by **Said (2011), Awan *et al* (2011), Elayan *et al* (2015), Emara *et al* (2018b) and Anwar *et al* (2020).**

**Table 2.** Yield and fiber properties of Egyptian cotton as affected by planting date in 2019 and 2020 seasons

| Characters | 2019 season | | LSD at 5% | 2020 season | | LSD at 5% |
|---|---|---|---|---|---|---|
| | 20th March | 20th April | | 20th March | 20th April | |
| **Seed cotton yield fed$^{-1}$ (kentar)** | 11.74 | 8.10 | 0.23 | 8.12 | 6.76 | 0.73 |
| **Micronaire reading** | 5.07 | 5.18 | 0.10 | 4.97 | 5.08 | NS |
| **Fiber strength (g/tex)** | 9.37 | 9.31 | NS | 9.45 | 9.43 | NS |
| **2.5 % span length (mm)** | 31.58 | 30.93 | 0.11 | 31.81 | 31.63 | NS |
| **Length uniformity ratio (%)** | 83.85 | 82.99 | 0.34 | 84.09 | 83.93 | NS |
| **Lint index (g)** | 6.67 | 6.08 | 0.12 | 7.24 | 6.63 | 0.29 |

**NS=**No significance

***-Effect of planting patterns:***

Data in Table 3 showed that seed cotton yield fed$^{-1}$ and lint index were significantly affected by planting patterns in two seasons. The highest values of seed cotton yield fed$^{-1}$ (10.16 and 7.94 kentar) and lint index (6.71 and 7.29 g) in the first and second seasons, respectively obtained by P4 treatment. On the other hand, the micronaire reading, fiber strength, 2.5 % span length and length uniformity ratio were no significant in the two seasons. This results are in harmony with those obtained by. **Awan *et al* (2011), Hamoda *et al* (2013), Hamoda and Emara (2014), Başal, *et al* (2014), Kumar *et al* (2017), Ghoprial *et al* (2018) and Deshish (2021b).**

**Table 3**. Yield and fiber properties of Egyptian cotton as affected by planting patterns in 2019 and 2020 seasons

| Characters | 2019 season | | | | L.S.D at 5% |
|---|---|---|---|---|---|
| | $P_1$ | $P_2$ | $P_3$ | $P_4$ | |
| **Seed cotton yield fed$^{-1}$ (kentar)** | 9.70 | 10.15 | 9.68 | 10.16 | 0.22 |
| **Micronaire reading** | 5.08 | 5.06 | 5.09 | 5.13 | NS |
| **Fiber strength (g/tex)** | 9.34 | 9.31 | 9.30 | 9.36 | NS |
| **2.5 % span length (mm)** | 30. 93 | 31.29 | 31.24 | 31.56 | NS |
| **Length uniformity ratio (%)** | 83.44 | 83.75 | 83.20 | 83.29 | NS |
| **Lint index (g)** | 6.08 | 6.42 | 6.27 | 6.71 | 0.16 |
| | **2020 season** | | | | |
| **Seed cotton yield fed-1 (kentar)** | 7.10 | 7.56 | 7.18 | 7.94 | 0.28 |
| **Micronaire reading** | 5.02 | 4.99 | 5.01 | 5.08 | NS |
| **Fiber strength (g/tex)** | 9.41 | 9.44 | 9.43 | 9.48 | NS |
| **2.5 % span length (mm)** | 31.77 | 31.54 | 31.59 | 31.99 | NS |
| **Length uniformity ratio (%)** | 83.88 | 84.25 | 83.90 | 84.01 | NS |
| **Lint index (g)** | 6.65 | 7.03 | 6.78 | 7.29 | 0.09 |

**$P_1$=** 65 cm ridges width +25 cm hills space **$P_2$=** 65 cm ridges width + 30 cm hill space NS=No significance
**$P_3$=** 130 cm bed width + 25 cm hill space planted in two sides **$P_4$=** 130 cm bed width + 30 cm hill space planted in two sides

***-Effect of NK fertilizer levels:***

The results obtained in **Table 4** reveal that NK fertilizer levels had a significant effect on seed cotton yield fed$^{-1}$ and lint index in both seasons, fiber strength and 2.5 % span length in the first season only. $NK_3$ treatment gave the highest values of seed cotton yield fed$^{-1}$ (10.21 and 7.71 kentar), fiber strength (9.49 and 9.46 g/tex), 2.5 % span length (31.83 and 31.92 mm) and lint index (6.56 and 7.18 g) in the first and second seasons, respectively. These results may be due to the well-known roles of N in building up the plant tissues and stimulating their growth. It is well established that the cotton plant, owing to its indeterminate growth habit, responds favorably to increasing NK levels, and its growth is linearly correlated with N supply. Similar results were obtained by **Ghoprial *et al* (2018), Zakzok *et al* (2018), Emara *et al* (2020), Deshish (2021a) and Deshish (2021b).**

***- Interactions Effect:***

The interactions effects between the experiment factors were not significant on the all studies traits in both seasons except seed cotton yield fed$^{-1}$ was affected by the interaction between planting date and planting patterns in the first season (Table 5). Sown in 20th March under $P_2$ treatment gave the highest value of seed cotton yield fed$^{-1}$ (12.19 kentar) in the first season. On the other hand, the lowest value of seed cotton yield fed$^{-1}$ (7.80 kentar) were obtained by sown in 20th April under $P_1$ treatment in the first season**.**

**Table 4.** Yield and fiber properties of Egyptian cotton as affected by NK fertilizer levels in 2019 and 2020 seasons

| Characters | 2019 season | | | LSD at 5% | 2020 season | | | LSD at 5% |
|---|---|---|---|---|---|---|---|---|
| | $NK_1$ | $NK_2$ | $NK_3$ | | $NK_1$ | $NK_2$ | $NK_3$ | |
| **Seed cotton yield fed$^{-1}$ (kentar)** | 9.58 | 9.97 | 10.21 | 0.30 | 7.12 | 7.49 | 7.71 | 0.30 |
| **Micronaire reading** | 5.04 | 5.07 | 5.16 | NS | 5.03 | 5.02 | 5.01 | NS |
| **Fiber strength (g/tex)** | 9.24 | 9.29 | 9.49 | 0.09 | 9.44 | 9.41 | 9.46 | NS |
| **2.5 % span length (mm)** | 30.97 | 30.96 | 31. 83 | 0.23 | 31.58 | 31.67 | 31.92 | NS |
| **Length uniformity ratio (%)** | 83.25 | 83.46 | 83.55 | NS | 83.74 | 84.09 | 84.20 | NS |
| **Lint index (g)** | 6.17 | 6.38 | 6.56 | 0.15 | 6.63 | 7.01 | 7.18 | 0.17 |

**$NK_1$**=45 kg N + 24 kg $K_2O$ fed$^{-1}$ **$NK_2$**=60 kg N + 36 kg $K_2O$ fed$^{-1}$ **$NK_3$**=75 kg N + 48 kg $K_2O$ fed$^{-1}$ **NS**=No significance

**Table 5.** Effect of the interaction between of planting date and patterns on seed cotton yield fed$^{-1}$ (kentar) in 2019 and 2020 seasons

| Planting date | 2019 season | | | | 2020 season | | | |
|---|---|---|---|---|---|---|---|---|
| | Seed cotton yield fed$^{-1}$ (kentar) | | | | | | | |
| | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $P_1$ | $P_2$ | $P_3$ | $P_4$ |
| **20$^{th}$ March** | 11.60 | 12.19 | 11.48 | 11.69 | 7.84 | 8.22 | 7.83 | 8.60 |
| **20$^{th}$ April** | 7.80 | 8.10 | 7.88 | 8.63 | 6.35 | 6.89 | 6.52 | 7.27 |
| **L.S.D at 5%** | 0.31 | | | | NS | | | |

**$P_1$**= 65 cm ridges width +25 cm hills space **$P_2$**= 65 cm ridges width + 30 cm hill space **NS**=No significance

**$P_3$**= 130 cm bed width + 25 cm hill space planted in two sides **$P_4$**= 130 cm bed width + 30 cm hill space planted in two sides

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# تأثير نظم الزراعة ومستويات التسميد النيتروجيني والبوتاسي تحت ميعادي زراعه علي المحصول وصفات التيلة للقطن المصري في مصر الوسطي

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أجريت هذه الدراسة بمنطقه ملوي – محافظة المنيا خلال موسمي الزراعة 2019 و2020 لدراسة تأثير أربعة نظم الزراعة وثلاث معدلات من التسميد النيتروجيني والبوتاسي تحت ميعادي زراعه علي المحصول وبعض صفات التيله لهجين مبشر(سي بي 58x جيزة 90) من القطن المصري في مصر الوسطي . حيث كان التصميم المستخدم قطاعات كامله العشوائية في أربعة مكررات بتوزيع القطع المنشقة مرتين حيث وضع ميعادي الزراعة في القطع الرئيسية ووضعت نظم الزراعة في القطع الشقية الأولي بينما وضعت معدلات التسميد في القطع الشقية الثانية.

**ويمكن تلخيص أهم النتائج فيما يلي:**

زاد معنويا محصول القطن زهر ف$^{-1}$ ودليل التيلة عند الزراعة فى 20 مارس في كلا موسمي الزراعة. وأيضا زاد معنويا الطول عند 2.5 و النسبة المئوية للإنتظام في الموسم الاول فقط. بينما زادت صفة النعومة زيادة معنوية عند الزراعة فى 20 إبريل في الموسم الاول فقط.

كان لنظم الزراعة تأثير معنوي لكل من محصول القطن زهر ف$^{-1}$ ودليل التيلة في كلا موسمي الزراعة. حيث كانت هناك زيادة معنوية لمعاملة الزراعة علي مصاطب **P4** لكل من صفتي القطن زهر ف$^{-1}$ ودليل التيلة مقارنة بمعاملات نظم الزراعة الأخري في كلا موسمي الزراعة.

تأثر معنويا صفتي محصول القطن زهر ف$^{-1}$ ودليل التيلة بمعدلات الأسمدة النيتروجينية والبوتاسيه في كلا موسمي الزراعة و صفتي المتانة و الطول عند 2.5 في الموسم الاول فقط . حيث أعطت معاملة إضافة 75 كجم ن + 48 كجم بو$_2$ أ فدان$^{-1}$ أعلي المتوسطات لكل الصفات المدروسة مقارنة بمعاملات معدلات التسميد النيتروجيني والبوتاسي الأخري.

تأثر معنويا محصول القطن زهر ف$^{-1}$ بالتفاعل بين مواعيد الزراعة ونظم الزراعة في الموسم الأول. حيث أعطت معاملة الزراعة في ميعاد 20 مارس مع الزراعة على خطوط أعلى متوسط وبزياده معنوية عن باقي المعاملات الأخري.

توصي هذه الدراسة بالزراعة في ميعاد 20 مارس والزراعة علي مصاطب مع التسميد بمعدل 75كجم نيتروجين+48كجم بوتاسيوم ف$^{-1}$.