EFFECT OF LOCATIONS AND GROWING SEASONS ON PERFORMANCE AND STABILITY OF SOME EGYPTIAN COTTON GENOTYPES FOR AGRONOMIC, FIBER AND SPINNING QUALITY TRAITS

By

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B. Sc. Co-operative Agric. Sci., High Inst. Agric.Co-operation, 1999

M. Sc. Agric. Sc. (Agronomy), Cairo University, 2009

A thesis submitted in partial fulfillment

of

The requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Agricultural Sciences

(Crop Breeding)

Department of Agronomy

Faculty of Agriculture

Ain Shams University

2016

Approval Sheet

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ABSTRACT

Eman Rashwan El-Sayed Abd El- Rahman: Effect of Locations and Growing Seasons on Performance and Stability of some Egyptian Cotton Genotypes for Agronomic, Fiber and Spinning Quality Traits. Unpublished Ph. D. Thesis, Department of Agronomy, Faculty of Agriculture, Ain Shams University, 2016.

The present research was conducted to evaluate performance and stability of six cotton genotypes included two long staple (variety Giza86 and promising strain 10229 × Giza86) and four extra-long staple (Giza88, G92, promising strains; Giza77× Pima S6 and G84(G70×51b)×P62. These materials were evaluated for seed cotton and lint yields (k/f) as well as yield components - fiber and yarn traits: fiber length (mm), fiber strength(g/tex), fiber maturityratio (%), fiber brightness and yellowness as well as single yarn strength (cN/tex),yarn elongation and yarn evenness with two spinning systems (ring and compact). Experiments were planted in four locations of the middle and north Delta during the years of 2011 and 2012. Analysis of variance showed highly significant differences for each of year (Y), location (L) and genotype (G) for all traits suggesting the presence of wide range of differences among genotypes and locations. The first order as well as the second order (Y × L × G) interactions were significant for all studied traits except (Y× G) with seed cotton and lint yields.

The overall mean performance for varieties and lines across the eight environments (4 locations x 2 years) demonstrated that Gharbia location was superior to other locations in seed cotton and lint yields and Kafr El-Sheikh came in second rank followed by Damietta, while Dakahlia produced the lowest value. Damietta location was superior to other locations in fiber strength, fiber maturity, yarn strength and yarn elongation of both spinning system (ring and compact), while Dakahlia location surpassed the other locations in fiber length. Kafr el-Sheikh location ranked second in the superiority of fiber and yarn traits in all governorates.

The long staple promising strain 10229 × Giza86 surpassed variety Giza86 in seed cotton and lint yields, fiber strength, degree of maturity and yarn strength of both ring and compact spinning. The extra- long staple G84 (G70×51b) × P62 recorded the highest seed cotton and lint yieldsfollowed by variety Giza 92. Variety Giza 92 surpassed all other genotypes in fiber maturity, fiber strength and yarn strength of ring and compact spinning, while variety Giza 88 showed superiority in fiber length followed by strain Giza 77 × Pima S6.

The compact spinning system was superior to the traditional ring spinning in single yarn strength and improved yarn evenness for all genotypes under various environments. The results of phenotypic stability revealed that the promising extra - long staple strain G84 (G70×51b) ×P62 had the highest seed and lint cotton yields, regression coefficient equals to one and the deviation from the regression line did not significantly deviate from zero, so it is characterized by high yield, good stability and convenience for all environments. The strain 10229 × Giza86 (long staple category) had the highest seed and lint yield and adaptability to different environments. Therefore, these two promising stains are recommended to be developed as new elite cultivars.

Key words: Cotton yield, Fiber, Yarn, Environment, Phenotypic stability, Adaptability

ACKNOWLEDGEMENT

First of all, ultimate thank are due to **ALLAH**, who without his aid this work can not be done.

I wish to express my deep gratitude and sincere appreciation to **Dr.Afaf Mohamed Tolba,** Professor of Agronomy, Faculty of Agriculture, Ain Shams University, for her supervision, valuable guidance, diligentdiscussion and constructive-criticism throughout the course of this studyand during writing the manuscript.

Many thanks to **Dr. Abd El-Maksoud Mahrous El-Marakby,** Professor Emeritus ofAgronomy, Faculty of Agriculture, Ain ShamsUniversity, for his supervision, advice and great efforts throughout thisstudy and preparing the manuscript.

I am deeply grateful to **Dr. Suzan Houssini Sanad, head** of Spinning Research Department, Cotton Research Institute. Agric. Res. Center, for here supervision, guidance and valuable help during field experiments. Deepest thanks are also extended to the staff and fellow colleagues of Cotton Res. Inst. for their kind help, cooperation and facilities provided throughout this work.

Also I would like to extend my sincere thanks to all staff members of Agronomy Department, Faculty of Agriculture, Ain Shams University, for their encouragement and valuable help during the course of this work.

I am particularly grateful to my husband and my family for their help and continuous encouragement and support during my study and entire life.

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INTRODUCTION

Cotton crop (*Gossypium* spp.) is the most important plant-based natural fibers; it has the potential to provide the world increasing demand for these types of fibers. Egyptian cotton "*Gossypium barbadense* L" is a unique germplasm characterized by high lint quality, and gained tenths of years of world-wide reputation in this concern. For Egyptian people, cotton was a major contributor of gross domestic production (GDP) for many decades. In the last decade, however, Egyptian cotton has been suffering from many domestic and world market difficulties. The cultivated area decreased dramatically compared with the decades of 1970's and 1980's that directly bewildered the projected cotton area and production.

On the other hand, decisions on cotton variety selection are typically based on experience with the potential varieties and production sites. Cotton Research Institute (CRI) introduces new cotton germplasm almost every year. It is important for cotton researcher to note the genotypic and phenotypic differences in varieties in their growing region in order to obtain maximum yield potential and good fiber quality. Moreover, using environmentally stable and high yielding genotypes is important for sustaining Egyptian cotton production. Since there is no single genotype adapted to all cotton locations, a potential way to eliminate the effects of genotype x environmental interaction is by selecting genotypes that are stable and limit interactions with the environment. Previous reports collectively indicated that a successful breeding program should focus efforts on genotype performance (average yield compared to standards), adaptation (the environment that the genotype best perform in), and stability (the consistent of the genotype performance compared to others). Many various techniques have devised to evaluate genotype stability over a range of environments in many crops. **Eberhart and Russell (1966)** found that measuring phenotypic stability could be accomplished by comparing a single variety yield with

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the average yield of all varieties over multiple environments. Each variety included in the experiments can be subjected to regression and parameters b_i and S^2d would provide estimates of stability.

According to the model, a stable genotype is considered to have the highest yield over a broad range of environments, a regression coefficient value of one and deviation mean square of zero.

The genotype x environment interaction was found to be significant for seed cotton and lint yield in many researches. On the other hand, A high yielding genotype will be of low economic value if it is suffering from instability of fiber properties along season or/and growing conditions. Therefore, evaluating the G x E interaction for cotton plants have to take into consideration three major group-components that must be simultaneously stable. These three major components are lint yield, lint quality, and yarn quality.

The current study aimed to evaluate the genotypes performance and estimate the phenotypic stability in order to identify the best performance and environmentally stable cotton genotype for lint yield, fiber and yarn quality under the Delta Nile cotton zone.

REVIEW OF LITERATURE

The review of literature connected with this study will be presented under the following main topics:

A- Effect of locations and growing seasons on cotton genotypes.
B- Effect of genotype x environment interaction.
C- Stability measurements.
D- Effect of spinning systems on yarn properties.

A-Effect of locations and growing seasons on cotton genotypes:

Abo El-Zahab *et al.* (1992) mentioned that the effect of locations were highly significant and significant for boll weight and seed index, respectively, however cotton yield and lint percentage showed insignificance influence by locations.

Gutierrez and El-Zik (1992) observed significant differences among cultivars, locations and years for seed cotton yield, lint cotton yield and lint percentage.

Badr *et al.* (1998) found that location and year mean squares were highly significant for boll weight, seed index, lint percentage, seed cotton yield, lint cotton yield, 2.5%, 50% span length, micronaire reading and yarn strength.

Five Egyptian cotton varieties namely Giza 85, Giza 86, Giza 89, Giza 87 and Giza 88 were planted at five locations i.e., Kafr El-Sheikh, El-Behairah (Damanhur), El-Gharbia (Tanta), El-Dakahlia (Meat Ghamr) and El-Sharkia in the two seasons (1995 and 1996) were evaluated by **Badr (1999)**. The combined analyses of variance showed highly significant mean square for location and year effects on seed cotton yield/plot, lint cotton yield/plot, boll weight, lint percentage, seed index, 2.5% and 50% span length, micronaire reading and yarn strength.

REVIEW OF LITERTURE

Abdel-Hafez *et al.* (2000) found that the mean square for location was significant for seed index, lint percentage, micronaire reading and fiber strength (g/tex), while that for boll weight, seed cotton yield, lint cotton yield and 2.5% span length was not significant. mean square for years were significant for boll weight, seed index, seed and lint cotton yields, fiber strength (g/tex), while lint percentage, micronaire reading and 2.5% span length were insignificant.

Badr and Abd El-Aziz (2000) stated that year effects were significant for seed index, lint percentage, boll weight, seed cotton yield and lint cotton yield.

Badr *et al.* (2001) found that mean square for years was significant for earliness %, boll weight, lint percentage, lint cotton yield, while no. of first fruiting nodes, seed cotton yield were insignificant.

Badr (2003a) evaluated performance of new extra-long cotton promising strain Giza 84 ×(Giza 74 ×Giza 68) with four commercial varieties (Giza 45, Giza 70 , Giza 87 and Giza 88) at three locations in North Delta at Kafr El-Sheikh, El-Beheira (Kafr El-Dawar) and Damietta (Kafr Saad) for seed cotton yield, boll weight, seed index, lint percentage, 2.5% span length, 50% span length, length uniformity ratio, micronaire reading and pressley index in the two growing seasons. Results showed that the average values of studied cotton characters were affected by different locations and growing seasons. The mean square for years was significant for earliness percentage and position of first fruiting node. The first season gave the highest significant values for boll weight, seed index, lint percentage and micronaire reading, while the second season gave the highest significant value for seed cotton yield, 2.5 and 50% span length, length and uniformity ratio and pressley index.

Badr (2003b) studied performance of three Egyptian varieties of cotton namely Giza 85, Giza 86 and Giza 89 and one hybrid (Giza 89 × Giza 86) planted at six locations i.e., Kafr El-Sheikh, El-Beheira, Damietta, El-Gharbia, El-Menofia and El-Sharkia in the two seasons