USING EFFICIENCY OF MENSURATION INSTRUMENTS FOR EVALUATION THE TECHNOLOGICAL VALUE OF EGYPTIAN COTTON

By

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SUMMARY

This investigation was conducted at the laboratories of Cotton Grade Section, cotton Res. Inst., Agric. Res. Centre, Giza, A.R.E, during 2016 and 2017 seasons, to compare between the results of yarn quality properties (lea product, single yarn strength and unevenness, c.V %) for long Egypt. Cotton varieties i.e. Giza 86, Giza 90 and Giza 95, that they were spun on 40's and 60's yarn count under ring spinning system at spinning unite of industrial Menia El-Kameh School, El-Sharkia Governorate, as well as Extra long staple Egypt cotton varieties i.e Giza 88 and Giza 92 that were spun on 60's and 80's yarn count, twist factor was 3.6 for the two studied category. All these treatments were considered as a first party that their fiber properties were determined, through the four studied cotton grades (F.G., G., FGF and G.F) by using Cotton Classification System (CCS. V_5).

Which designed to measure all fiber properties that determined the quality and the spin ability of both, cotton and manmade fibers used in production of spun yarns. Simple correction analysis according to *Steel and Torrie (1976)* were employed to study the relationship between fiber physical and mechanical properties. Spinning treatments (40's, 60's, 80's) yarn counts, the four grades and the tested varieties were arranged in completely randomized design with three repetitions to show their effects as well as the interactions between them on lea product ($\mathbf{Y_1}$) (that was measured by using Good Brand lea Tests, according to ASTM, D- 1598-93Roo), Single yarn strength ($\mathbf{Y_2}$) (that was estimated by the Statimat ME

Automatic Tensile tester (according to ASTM D2256-91) with a testing speed of 5000mm/min with a test length of 50 cm was used for the testing of tensile properties Average of 120tests for breaking load and the yarn c.V% ($\mathbf{Y_3}$) (that was determined by using Uster tester III, according to ASTM, D-2256-67). The obtained data were subjected to statistical analysis according to the producer outlined by *Snedecor and Cochran (1980).* Least significant difference **5** % test ($LSD_{5\%}$) was used for comparing the different means.

For complete the previous comparison, the mathematical equations or the statistical perdition models represented the second party , that were suggested to cut back the spinning time and make sure of the efficiency of spinning machines for producing high quality of yarn by using four models as follow:-

1- **Fiber Quality index (FQI):-** That is attributed to the simplicity of the use. It realis on some fiber properties i.e UHM, UI, STRF, FEL, SFC and Mic value (*El-Messiery and AbdEl-Latif, 2013*).

2- **Spinning Consistency index (SCI):-** It relies on regression model for HVI fiber properties i.e FSTR, UHML, UI, Mic value, Rd % and +b. *(Anonym, 1999).*

3- **Premium Discount Index (PDI):-** It based on the regression equation relating fiber properties with yarn strength. Some of fiber properties i.e. F.STR, F.EL%, UHML, UI, SFC and Mic value are considered as inputs for calculation it’s equation. (*Majumdar et al, 2005*)

4- **Multiplicative Analytic Hierarchy Process (MI_{AHP}):-** This determination counts on predicting yarn quality with actual one by correlation and multi regression (*Saaty 1994 and Alam and Ghosh, 2013*). It relies on some fiber properties i.e. F.STR, F.EL%, UHML, UI Mic value and SFC that were raised to the power of 0.27, 0.39, 0.291, 0.145, 0.11 and 0.143, respectively.

Regarding to the results of spinning traditional method for the long, Extra long cotton varieties and four grades under study. Giza 86 var. as long category pronounced it's supertiority for the main fiber properties, i.e. UHM, F.S, Mic.value and Rd %.

While Giza 90 and Giza 95 showed their competition for the recent properties during 2016 and 2017 seasons through FG and G grade. Meanwhile, Giza 88 as Extra long var. ranked first due to UHM, F.S and Mic. value, whereas Giza 92 var. values were on equal footing with the previous variety owing to UI%, MR%, FE % and Tr_a, during the two successful seasons and the two grades under study.

With respect to, the three studied yarn quality properties that were affected significantly by the studied grades, the two yarn counts (40's and 60's) and the interactions between them (First and Second order interactions) for the long staple varieties under examined, the results confirmed that spinning Giza 86 cotton var. at F.G grade on 40's or 60's yarn count resulted in the highest means of lea product and single yarn strength. The lowest percentage of c.V% attributed to the same

sircumstances i.e. the studied variety, grade and spinning variable, in both experimental seasons.

In proportion to the Extra-long staple varieties under study, the findings confirmed that the highest averages of L.p and SYS were obtained from Giza 88 cotton var. at F.G grade on 60's yarn count that resulted in the lowest percentage of c.V% during the two experimental seasons.

Regarding to the second party or prediction models equation where their results depend on:-

1- Correlation matrix, that explained the relation between the studied four models equations and the tested yarn quality properties for each long or Extra-long staple variety. At the different yarn count (40's, 60's, or 80's) correlation power differend according to the used model, the studied cotton variety and the experimental seasons, for example PDI Model equation had a strong correlation with lea product and Single yarn strength that belong to Giza 86 var., in 2016 season. While MI_{AHP} model confirmed it's strongest correlation, during 2017 season. As for Giza 88 var. (Extra-long staple) PDI and MI_{AHP} models equations had a strong correlation with Lp and SYS at 60's or 80's, during 2016 season, whereas MI_{AHP} model equation had a strong correlation with Lp at 60's or 80's Y.c. due to Giza 92 var., during 2017 season. Yarn unevenness (c.V %) findings confirmed that negative highly significant correlation had been found between all the studied mathematical models and that yarn properity, in both seasons.

2- Multiple liner regression analysis:-

This liner regression analysis had been detected between the yarn quality properties under study (at 40's and 60's yarn count) as (depended variable) and the studied long Egyptian cotton fiber properties as (explanatory variables). The results ensured that the supposed multiple regression models were significantly contributed the most variability of Lp, SYS and c.V %. Statistically, rational findings were gained using three multiple regression models for each yarn property, each cotton variety under study and for each yarn count, where more than 80% of L.p, SYS and c.V %, R^2 % were attributed to the fiber properties under the two yarn counts. The results corroborated that the contribution of the most fiber properties toward yarn quality properties were significant with some exception for models & yarn property (MY) due to the studied varieties, in both seasons.

As for the Extra-long staple varieties (Giza 88 and Giza 92) , the results followed the same manner, where at 60's yarn count all (MY) equations that contained some of fiber properties are significantly contribution, their R^2 % ranged between 0.960 up to 0.996%, while at 80's yarn count, R^2 % ranged between 0.981 up to 0.997 % in the first season. In 2017 season, the findings ensured the above mentioned data, with some changes for R^2 % , it ranged between 0.887 up to 0.995 % at 60's yarn count, meanwhile at 80's yarn count, R^2 % ranged between 0.911 up to 0.990 %.

3- Stepwise liner regression analysis:-

Notwithstanding the differences between the studied varieties (genotype or catogrey), yarn count used (40's, 60's and 80's) and the experimental seasons, but all M_1, M_2, M_3 equation for each studied yarn quality property, and variety characterized by significantly contribution toward L.p and SYS. For example, in 2016 season, at 40's yarn count R^2 % of lea product was 0.987 % for Giza 90 var. as long staple var., it's F value was 137.1 where the contributor fiber properties were Short F. content (X_3), F. strength (X_6) and F. Elongation % (X_7).

In 2017 season, at 80's yarn count R^2 % of SYS was 0.986 % for Giza 92 var. as (Extra-long staple). It's F value being 172.4 where the two positively contributor fiber properties were Mic. value (X_4) and F. strength (X_6), while Short F. content was negatively contribution fiber properties.

4- Determination of the technological values for each grade and each cotton variety under study:-

Through 2016 and 2017 seasons, the determination of technological values for each grade and studied variety had been detected by using these mathematical models (FQI, SCI, PDI and MI_{AHP}). Generally, technological values were increased with enhancing grade level from GF up to F.G. as estimating by using the four models for each studied variety. These results may be ought to the low grades contained high amount of short fiber, motes, fragments and characterized by darkness color therefore, it expressed about the low technological value. Whereas the

high grade characterized by high fiber strength, F. elongation %, Maturity %, Micronire value, UHML and low content of Short fiber. All these fiber properties reflected positively on technological value of grade and it's price.

Regarding to the ranking technological values of the studied varieties, MI_{AHP} is one of the mathematical model that directed it's attention toward that case. With the application of MI_{AHP} rules and their relations with fiber properties means for each variety, the results confirmed that Giza 88 located the first order, it was followed by Giza 92, Giza 86, Giza 90 and Giza 95.