SUMMARY

The present investigation was conducted for the following aims: (i) to drive equations for predicting the physical properties of cotton yarn from the physical properties of the cotton fibers from which this yarn was spun, in view to help cotton breeder, trader and spinner, (ii) to find out the effect of some processing variables, namely, yarn count, twist multiplier, carding and combining as well as cotton variety and their interactions on the physical properties of the cotton spun yarns, (iii) to compare the new and relatively older varieties with respect to quality and spinning performance, and (iv) to propose the best end uses for raw cotton fibers and cotton spun yarns dealt with in this investigation.

The raw cottons used were the relatively older Giza 75 and new established Giza 83 and Giza 85 long-stapled varieties (LS), as well as the relatively older Giza 70 and Giza 77 and the new introduced Giza 84 extra long-stapled cotton varieties (ELS). Twenty kg bulk sample from each of Giza 83, Giza 84 and Giza 85 new introduced varieties were provided by the Cotton Maintenance Research department, meanwhile 20 kg bulk sample from each of the relatively older Giza 70, Giza 75 and Giza 77 were provided by the Cotton Breeding Research Department, CRI, ARC, Giza. Fiber and yarn tests as well as spinning were conducted at controlled atmospheric conditions of temperature (20°C±2) and relative humidity (65%±2). The results of fiber and yarn physical properties were subjected to statistical analysis techniques for simple correlation coefficients, forward selection statistical procedure for dependent variable according to **SAS (1988).** The results for the effect of the processing variables were analyzed for variance. The comparison between new and old varieties were treated through variation parameters, comparison with the world yarn levels as well as percentage

increase and decrease of the new varieties with respect to the relatively older varieties. The most important results achieved could be summarized as follows:

1. Contribution of fiber to yarn physical properties

1.1. The longer, the more uniform the fiber length distribution, the higher the fineness/maturity of the fibers, the stronger and the more extensible the bundles of the fibers. However, the bundle stiffness and toughness did not show definite trend with either length or fineness/maturity measurements which is difficult to be interpreted physically. Nevertheless, the relationships differ from LS to ELS and to LS+ELS categories.

1.2. The more even the less imperfected, the less variable in strength and extension, the stronger, the more extensible and toughier the carded yarns spun from LS, ELS, LS+ELS varieties and the combed yarns spun from ELS varieties. However, the stiffness behaved differently from LS to ELS to LS+ELS carded to ELS combed yarns.

1.3. Based on the values of r's between various yarn properties, it was seen that the best three physical properties of spun yarn to be predicted from the fiber physical properties were; yarn strength, evenness and nep count/100 meters.

1.4. The best equation for predicting the strength of 40^S and 60^S carded LS yarns from group 1 and group 2 of fiber properties were equations No. 7, 14, 20 and 29, respectively. Meanwhile, the best equations for predicting strength of 60^S and 100^S ELS carded yarns from group 1 and group 2 of fiber properties were equations No. 32, 45, 52 and 62, respectively. The fiber properties required to predict yarn strength differ from one count to another and from one length category to another.

1.5. The evenness of LS 40^S and 60^S carded yarns were best predicted from group 1 and group 2 fiber properties by equation No. 69, 74, 81 and 92, respectively. Meanwhile the evenness of ELS 60^S and 100^S carded yarns were best predicted from group 1 and group 2 of fiber properties by equations No. 99, 106, 112 and 117, respectively. However, the fiber properties needed for predicting yarn evenness differ from one count to another and from LS to ELS in case of any group of fiber properties.

1.6. The nep count/100 meters in LS 40^S and 60^S carded yarns could be safely predicted from group 1 and group 2 of fiber properties by equations No. 125, 131, 139 and 145, respectively. Whereas the nep count of ELS 60^S and 100^S carded yarns were best predicted from group 1 and group 2 of fiber properties by equations No. 151, 157, 167 and 176, respectively. Similarly, the fiber variables included in the prediction equations in case of group 1 and group 2 of fiber properties differ from one count to another and from LS to ELS categories.

2. The effect of variety and processing variables on the physical properties of cotton yarns.

2.1. For LS category, Giza 75 produced the strongest, the more uniform in strength, stiffer and more even and the lowest in thick places, followed by Giza 85 and Giza 83 yarns. The varieties of ELS category take the above descending order as Giza 84, Giza 70 and Giza 77.

2.2. The strength, elongation % and evenness decreased with increasing the fineness of the yarn. Nevertheless, the strength and elongation % variations as well a the number of imperfections increase with increasing the yarn fineness.

2.3. The trend of twist with strength, strength and elongation % variations and imperfections differ from LS to ELS carded or combed yarns, possibly due to the differences in optimum twist from one category to another and from carded to combed yarns.

2.4. The variety x count interaction exerted significant effect on all tensile properties except the strength and elongation of LS and ELS carded yarns and the stiffness of ELS combed yarns. However, the trend differed from one variety to another. On the other hand, the unevenness and imperfections increased with increasing the count of LS and ELS carded and combed yarns.

2.5. The variety x twist multiplier interaction exerted significant effects on strength, strength variation and toughness of LS carded yarns. Giza 85 showed the best response to twist and was toughter and more even than Giza 75 and Giza 83, possibly due to the differences between these varieties in optimum twist multiplier. For ELS carded yarns, the trend differed from one yarn property to another. For ELS combed yarns, the effect was only significant on the strength variation.

2.6. The count x twist multiplier interaction exerted significant effects on strength and elongation variations and evenness of ELS carded yarns and on the imperfections of LS and ELS carded and combed yarns.

2.7. The second order variety x count x twist multiplier interaction exerted significant effects on strength and elongation variations as well as thick places and neps of ELS yarns. However, the effect was only significant on the imperfections and evenness of LS yarns.

3. Comparison between new introduced and older commercial varieties

3.1. It was found that the short fiber content expressed in terms of floating fiber index in both LS and ELS categories was higher and reversly affected the physical properties of the spun yarn. Thus, the breeder should give more care to this property through various selection stages and this improvement in these properties of fiber would led to improvement in yarn spun from them.

3.2. The evenness, strength and nep count of 30^S and 40^S carded LS yarns spun at 3.6 and 4.4 twist multiplier and ELS 40 carded yarns spun at 3.6 and 4.4 twist multiplier lied within the range of the world yarn production. Meanwhile, in combed yarns spun at 3.6 and 4.4 twist multiplier, only strength lied within the range of the world production, whereas both evenness and nep count lied above the 95% of the world production. However, there are many facts which should be taken into account when making such comparison which are (i) the micro spinning technique, at CRI, is dealing and designed particularly for very small size samples of 40 or 60 grams in case of carded yarns or 1 kg in case of combed yarns which differ in precision from commercial spinning mills. However, the technique is valid for the comparison of the results between samples, grades, strains and varieties for the benefit of cotton breeder, seed propagation, trader, exporter and spinner, (ii) the relatively old technology used in the microspinning technique of CRI.

3.3. Giza 75 cotton variety showed superiority in fiber properties over Giza 85 which was better than Giza 83. On the other hand, Giza 84 showed higher FFI of 37.41% higher than Giza 77 and was finer than both Giza 70 and Giza 77 in terms of micronaire reading and linear density and was less in maturity than Giza 70 and lower in standard linear density than

both Giza 70 and Giza 77. Nevertheless, Giza 84 was stronger and more extensible than Giza 77 and lower in stiffness higher in toughness than Giza 70 and Giza 77.

3.4. Similar to the trend of the physical fiber properties, Giza 75 carded yarns showed superiority of yarn physical properties over those of Giza 85 yarns which was better than Giza 83 yarns.

3.5. Giza 84 carded yarns, in most cases were superior in tensile properties, evenness and less inperfected than both Giza 70 and Giza 77 yarns, possibly due to the superiority of most fiber physical properties with the exception of fiber length.

3.6. Giza 84 combed yarns were superior in all yarn physical properties than those of both Giza 70 and Giza 77 combed yarns, which is likely due to the superiority of fiber properties of Giza 84 over those of Giza 70 and Giza 77 varieties.

3.7. In conclusion, the attention of cotton breeder and technologist must be attracted to more emphasis in breeding within the LS category. However, their role within ELS category is highly appreciated .

4. Proposed end uses for raw cottons and cotton spun yarns

Various end uses were proposed for the different raw cottons and spun yarns dealt with in the present investigation based on their physical properties as well as the recent technologies, presently applied.