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Industrial characteristics of wool produced from sheep fed on salt tolerant fodder crops

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Abstract. The present trial was conducted over 14 weeks and used twenty four males Barki lambs (18.8 Kg average body weight and 6 months of age) to investigate the effect of feeding salt tolerant plants on the industrial characteristics of raw and yarns of wool. Animals were fed on different salt tolerant plant mixture (47% Kochia and 53% Pearl millet grass) as hay (G2) or haylage with 5% molasses (G3), or Berseem hay as a control diet (G1). Haylage group had significant differences in fiber diameter, staple strength, staple elongation and medullated fibers compared with the hay group. The prickle factor found to be 49.2 (G1), 37.2 (G2) and 46.6 (G3) with significant differences (P<0.05) between both (G1) and (G3) compared with (G2). Staple strength found to be higher (P<0.05) in G1 (35.9 N/ktex) and G3 (35.7 N/ktex) compared with G2 (29.1 N/ktex). Yarn strength increased significantly (P<0.05) in the haylage group (7.2 kg) compared with the hay group (5.8 kg). Yarn irregularity represented by the number of thin and thick places as well as number of nodes, was significantly different (P<0.05) in both G2 and G3 compared with G1. It was concluded that haylage group had better wool characteristics than the hay group, while both treatments had lower wool characteristics compared to the control group. Correlations among both yarn and raw wool characteristics were also discussed.

Keywords. Wool – Yarn – Salt tolerant plants – Strength – Fiber diameter.

I – Introduction

Rhoades and Loveday (1990) illustrated that about 20% of the worlds cultivated lands as well as half of the irrigated lands are affected by salinity. Kochia indica and Pennisetum mericanum as a salt tolerant plants showed great palatability as animal fodders, and used it in hay or silages form.
be more efficiently rather than in fresh state because of these processing tended to improve their nutritive values (Youssef et al., 2009). Thus, the present study was carried out to investigate the effect of feeding Kochia indica and Pennisetum mericanum on the characteristics of wool of Barki lambs (both as a raw material and industrial characteristics of wool yarns).

II – Materials and methods

The present trial lasted for 14 weeks and involved twenty four males of Barki lambs divided randomly into three groups of 8 lambs. The lambs were 6 months old and had a mean live weight of 18.8 Kg. Animals were raised in South Sinai Research Station which belongs to Desert Research Center, Egypt. The same amount of concentrate feed mixture (CFM) was given to all animals to cover 100% of their maintenance requirement. Large quantity of chopped air-dried of Kochia (Kochia indica) and Pearl millet grass (Pennisetum americanum) mixed together at a ratio of 47:53%, respectively. The total amount of mixture was divided into two equal parts: the first part was kept as hay to be fed for the second group (G2), while the other part was mixed with 5% molasses to make haylage for the third group (G3). The Berseem hay (Trifolium lexandrinum, 4th cut) was fed to the first group (G1) as a control group. Wool growth of 10 cm² patch from left mid-side position was taken from each animal. Five hundred fibers from each sample were used to calculate the average fiber diameter as well as medullated fiber percentage using optical fiber diameter image analyzer (LEICAQ 500 MC). Three greasy staples of each sample were used to measure staple strength, point of break and elongation, using Agritest Staple Breaker. Sub samples “not less than 300 fibers” were classified into kemp, medullated and fine fiber categories. Samples of yarns coming from each category after woolen process were tested as follows:- Yarn count (Tex), Yarn strength and elongation, Yarn evenness and hairiness, Yarn friction. Data were statistically analyzed using one way analysis of variance using General Linear model (GLM) of SAS(2000) and differences between means were tested using Duncan’s multiple range test (Duncan, 1955).

III – Results and discussion

Figure (1) showed that G3 (Haylage group) had higher crude protein compared with G2 (Hay group). That could be related to the effect of Haylage process which slightly increased the crude protein (CP) and cellulose values as a result of biological treatment as reported by Youssef, et al. (2009). Sahoo and Soren, (2011) reported that wool production affected by both level and type of protein compared with energy level. Helal (2004) indicated that feeding protected protein tended to increase wool growth. Result findings in Figs 1) and 2 could explain the increase in fiber diameter in G1 (control group) followed by G3 then G2 according to the same pattern of CP expressed in Fig. 1. Prickle factor as a sensation arises from the coarse fiber which doesn’t bend readily and be able to provide sufficient distortion of the skin to excite some receptors compared with fine fibers (Lamb, 1997). The percentage of fibers greater than 30 micrometers is a useful predictor of prickle response (Naylor, 1992). Harsher wool grade found to be associated with maximum prickle factor (Al-Betar, 2007), in the present study fiber diameter found to be associated with both percentage of medullated fibers and prickle factor. Control group had the highest fiber diameter with significant difference (P<0.05) compared with G2 while G3 had lower value of fiber diameter but insignificantly compared with G1 (Figure 2 and Table1). Staple strength found to be higher (P<0.05) in G1 and G3 compared with G2 and this result is very important because staple strength is a good indicator for yarn strength (Ross et al. 1986) and essential in all manufacture processing to reduce the waste as carding losses or combing noilage (Rogan, 1988). Staple strength is affected by many factors such as fiber diameter (Mooy et al. 1988), Variation in fiber diameter along the staple (Hansford and Kennedy, 1990), Coefficient of variation (De Groot, 1995), presence of kemp fibers (Groff 1983), Sulfur in the diet and sulfur amino acids (Helal, 2004). Table (1) illustrate that fiber diameter was associated with staple strength.
Yarn strength could be affected by other factors like yarn twisting and fibers evenness (Lamb, 1997a) as well as irregularity in the yarn (Lamb 1997). Thick places in yarns of G2 reached 1.6 times compared with G1 which considered as a very important indicator for irregularity of yarns.

Haylage group had lower values of thin places (434.4), thick places (193.1) and nodes (69.2) compared with G2 (455.8, 204.1 and 78, respectively). Increase in fiber diameter coefficient of variation leads to increases number of thin places (De Groot 1992). In the present study friction found to be higher in G1 followed by G3 and the lowest group was G2. It could be concluded that yarn friction increased with increasing fiber diameter (Tables 1 and 2). Table 3 illustrates that fiber diameter had a significantly positive correlation with staple strength (r = 0.78), staple elongation (r = 0.82) and modulated fiber (r = 0.99). Staple strength had a highly significant positive correlation with Medullated fiber percentage (r = 0.83) and significant negative correlation with kemp percentage (r = -0.74).
### Table 3. Simple correlation among yarn and staple characteristics

<table>
<thead>
<tr>
<th>Yarn characteristics</th>
<th>Thin</th>
<th>Thick</th>
<th>YN</th>
<th>YS</th>
<th>YEI%</th>
<th>FD</th>
<th>SS</th>
<th>EL%</th>
<th>K%</th>
<th>MF%</th>
<th>FF%</th>
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</thead>
<tbody>
<tr>
<td>YFr</td>
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<td>0.91**</td>
<td>0.98**</td>
<td>-0.97**</td>
<td>-0.95**</td>
<td>-0.99**</td>
<td>-0.78*</td>
<td>-0.83**</td>
<td>0.64 NS</td>
<td>-0.98**</td>
<td>0.96**</td>
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<tr>
<td>Thin</td>
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<td>0.98**</td>
<td>-0.84**</td>
<td>-0.97**</td>
<td>-0.91**</td>
<td>-0.60 NS</td>
<td>-0.95**</td>
<td>0.65 NS</td>
<td>-0.84**</td>
<td>0.81**</td>
<td></td>
</tr>
<tr>
<td>Thick</td>
<td>0.96**</td>
<td>-0.79*</td>
<td>-0.95**</td>
<td>-0.88**</td>
<td>-0.55 NS</td>
<td>-0.97**</td>
<td>0.64 NS</td>
<td>-0.79*</td>
<td>0.76*</td>
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<td></td>
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<tr>
<td>YN</td>
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<td>-0.96**</td>
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<td>-0.89**</td>
<td>0.63 NS</td>
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<tr>
<td>YS</td>
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<td>0.81**</td>
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<td>-0.54 NS</td>
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<tr>
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<td>0.60 NS</td>
<td>0.92**</td>
<td>-0.51 NS</td>
<td>0.88**</td>
<td>-0.85**</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Staple characteristics</th>
<th>FD</th>
<th>SS</th>
<th>EL%</th>
<th>K%</th>
<th>MF%</th>
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</thead>
<tbody>
<tr>
<td>0.78*</td>
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<td>-0.57 NS</td>
<td>-0.58 NS</td>
<td></td>
<td></td>
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<tr>
<td>-0.99**</td>
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</table>

Yarn characteristics: YFr = Yarn Friction, Thin = Yarn thin places, Thick = Yarn thick places, YN = Yarn neps, YS = Yarn strength and YEI = Yarn elongation. Staple characteristics: FD = Fiber diameter, SS = Staple strength, EL = Elongation, K Kemp, MF% = Medullated fiber percentage and NMF% = Fine fiber percentage.
IV – Conclusion

The haylage group demonstrated better wool characteristics than hay one while both treatments with salt tolerant plants had poorer wool characteristics than the berseem clover control group.

Acknowledgments

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References


