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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.

Caractéristiques industrielles de la laine fabriquée à partir de moutons nourris à base de cultures forragères halophytes

Résumé. *Le présent essai a duré 14 semaines et a utilisé 24 agneaux de race Barki (18,8 kg de poids corporel moyen et 6 mois d'âge) pour étudier l'effet de alimenter les animaux avec des plantes tolérantes au sel sur les caractéristiques industrielles de la laine brut et des fils de laine. Les animaux ont été nourris avec un mélange de plantes tolérantes au sel (47% de Kochia et 53% de millet perle) sous forme de foin (G2) ou ensilage avec 5% de mélasse (G3), tandis que le groupe de contrôle (G1) se nourrissait de foin de bersim. Le groupe G3 groupe avait des différences significatives dans le diamètre des fibres, la force de base, l'allongement de base et des fibres médullées par rapport avec le groupe de foin. Le facteur picotement était jugée de 49,2 (G1), 37,2 (G2) et 46,6 (G3) avec des différences significatives (P<0,05) entre les deux (G1) et (G3) par rapport à (G2). La force de base était plus élevée (P<0,05) dans le G1 (35.9N / ktex) et le G3 (35.7N / ktex) par rapport à G2 (29.1N / ktex). La résistance du fil a augmenté significativement (P <0,05) dans le G3 (7,2 kg) par rapport au groupe G2 (5,8 kg). L'irregularité des fils, représentée par le nombre de places minces et épaisses ainsi que le nombre de noeuds, a été significativement différent (P<0,05) dans G2 et G3 par rapport à G1. Il a été conclu que le groupe alimenté avec l'ensilage eu de meilleures caractéristiques de laine que le group alimenté avec foin, alors que ces deux traitements ont montré des caractéristiques de qualité plus faibles par rapport au groupe de contrôle. Les corrélations entre les les caractéristiques des fils et de la laine brute ont été également discutées.*

Mots-clés*: Laine – Fil – Plantes tolérantes á la salinité – Force – Diamètre de la fibre.*

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 ofwool 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 wereraised 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 cm^2 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.

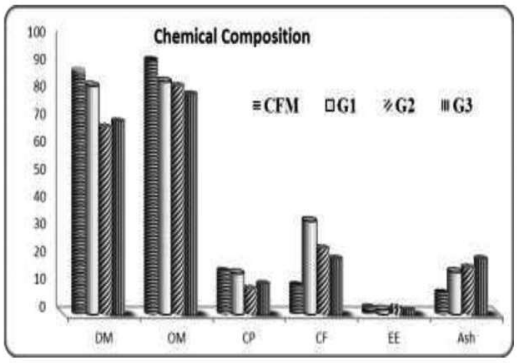

Fig. 1. Chemical composition of rations used for the same experimental groups as measured by (Youssef, *et al.,* 2009). DM: Dry matter, OM: Organic matter, CP: Crude protein, CF: Crude fiber, EE: Ether extract, G1: Control group,G2: Hay group, G3: Haylage group.

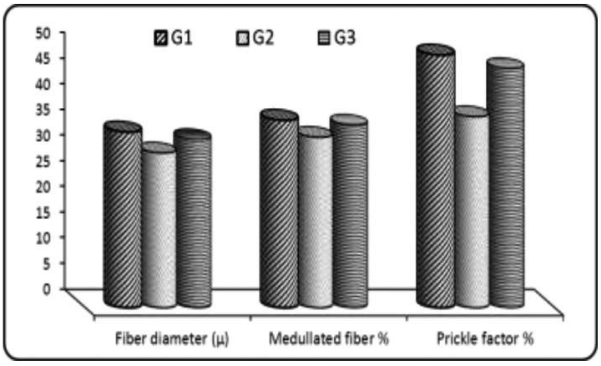

Fig. 2. Fiber diameter and both percentage of modulated fiber and prickle factors among treated groups.G1: Control group, G2: Hay group, G3: Haylage group.

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 filer percentage (r = 0.83) and significant negative correlation with kemp percentage (r = -0.74).

Table 1. Least squares means of wool characteristics among experimental groups

Items	G1	G2	G3	±SE
Fiber diameter (µm)	34.1[a]	30.0[b]	32.4[c]	0.096
Staple Strength (N/Ktex)	35.9[a]	29.1[b]	35.7[a]	1.190
Staple elongation (%)	47.2[a]	45.3[b]	45.4[a]	0.153
Kemp (%)	3.7[a]	3.8[a]	3.8[a]	0.058
Medullated fibers (%)	36.6[a]	32.1[b]	35.4[c]	0.082
Fine fibers (%)	63.2[a]	67.9[b]	64.2[c]	0.115

G1: Control group, G2: Hay group, G3: Haylage group.Values with different superscripts within the same row are significantly different ($p<0.05$).

Table 2. Least squares means of wool yarn characteristics among experimental groups

Items	G1	G2	G3	±SE
Tex	285.3[a]	294.4[a]	288.1[a]	0.84
Friction	1011.2[a]	877.3[b]	938.3[c]	0.709
Thin-places	364.5[a]	455.8[b]	434.4[c]	1.297
Thick-places	131.0[a]	204.1[b]	193.1[c]	1.219
Neps	55.2[a]	78.0[b]	69.2[c]	0.613
Strength	7.8[a]	5.8[b]	7.2[c]	0.079
Elongation	12.6[a]	9.2[b]	10.3[c]	0.205

G1: Control group, G2: Hay group, G3: Haylage group.Values with different superscripts within the same row are significantly different ($p<0.05$).

Table 3. Simple correlation among yarn and staple characteristics

	Yarn characteristics						Staple characteristics				
	Thin	Thick	YN	YS	YEl%	FD	SS	EL%	K%	MF%	FF%
Yarn characteristics											
YFr	0.94**	0.91**	0.98**	-0.97**	-0.95**	-0.99**	-0.78*	-0.83**	0.64 NS	-0.98**	0.96**
Thin	0.99**	0.98**	-0.84**	-0.97**	-0.91**	-0.60NS	-0.95**	0.65 NS	-0.84**	0.81**	
Thick	0.96**	-0.79*	-0.95**	-0.88**	-0.55 NS	-0.97**	0.64 NS	-0.79*	0.76*		
YN	-0.91**	-0.97**	-0.96**	-0.69 *	-0.89**	0.63 NS	-0.91**	0.89**			
YS	0.88**	0.99**	0.81**	0.72*	-0.54 NS	0.99**	-0.98**				
YEl%	0.93**	0.60 NS	0.92**	-0.51 NS	0.88**	-0.85**					
Staple characterist											
FD	0.78*	0.82**	-0.59 NS	0.99**	-0.97**						
SS	0.44	-0.74*	0.83**	-0.86**							
EL%	-0.58 NS	0.73*	-0.67*								
K	-0.57 NS	-0.58NS									
MF%	-0.99**										

Yarn characteristics:-YFr = Yarn Friction, Thin= Yarn thin places, Thick = Yarn thick places, YN = Yarn neps, YS = Yarn strength and YEl = 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 demonstratedbetter wool characteristics than hay one while both treatments with salt tolerant plants had poorer wool characteristics than the berseem clover control group.

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