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SEASONAL VARIATION OF WOOL PRODUCTIVITY FROM VARIOUS BODY POSITIONS IN BARKI SHEEP

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SUMMARY

Twenty-nine coarse wool Barki ewes were used to study the changes in wool productivity throughout the year. wool samples were taken at three months intervals to represent wool growth in summer, autumn, winter and spring. Six body positions were sampled at each occassion; three dorsals and three laterals. Wool production in the present data was studied in terms of greasy wool per unit area, GWA, clean wool per unit area, CWA, staple length, STL, and yield, YLD, as well as greasy fleece weight, GFW.

It appeared that Barki sheep produce wool at a relatively high rate for only short period of time from July to October. The highest estimate of YLD was found in January clip. Results also indicated highly significant position effect in all traits studied; dorsal positions produce more GwA and CWA as well as longer wool and better YLD. The present data showed the importance of the genetic variation in improving the studied traits and suggested that more emphasis has to be paid to the between-position variation when obtaining estimates of these traits. Possible factors affecting wool growth were also discussed.

The most representative sample to the fleece average appeared to be the withers for GWA and STL while the britch sample is good for GWA and mid-side sample is

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favourable for YLD. while GWA was found to be closely related to CWA it is also the most indicative trait for GFW.

Keywords: Barki sheep, wool production, staple length, yield, body positions and seasonality

INTRODUCTION

Barki is one of the important local breeds of sheep dominating the north-western desert of Egypt. Most of the wool used by carpet manufacturers in Egypt comes from this breed which has coarse and white fleeces. Barki sheep are not yet sufficiently improved for wool production.

It is observed that wool dose not grow at a constant rate and the cleanness of such wool varies considerably throughout the year. Accordingly. the effect of various seasons on wool production came to the interest together with the productivity of various body positions in the same fleece. Providing knowledge on the timing of decreasing production seems important before giving considerations to controlling factors.

Previous workers have indicated many factors affecting wool growth such as genetic, nutrition, temperature, photoperiodicity... etc. The study of the between- and within- sheep variation in wool production under the total environmental pattern of semi-arid conditions of Egypt seems essential.

Measuring various wool traits of the whole fleece is costly and time consuming tasks particulary with limited equipment and when large number of animals are involved. It is usually practical to depend on a small sample which is as representative as possible of entire fleece. In an effort to find out the most accurate sampling position from which to predict the different characteristics of the whole fleece, the present study was undertaken.

MATERIALS AND METHODS

Twenty-nine Barki ewes were randomly obtained from the sheep flock located at Mariout research station, 35 km west of Alexandria. The flock was raised where the rainfall averaged 80-110 mm/year. Relative humidity (%), maximum and minimum temperatures ($^{\circ}C$) were 77.4, 34.2 and 23.3 in July, 65.1, 24.8 and 17.7 in October, 62.7, 17.6 and 9.2 in January and 74.5, 20.7 and 13.0 in April. Sheep were gazed on irrigated pastures and supplements by feed co-op mix. Ewes mated in July to start lambing around December each year. The experimental ewes were about 2 years old, all singles and looked healthy throughout the experiment. They were running with their flockmates under the prevailing conditions with no special treatments.

Wool was sampled at three months intervals in July (summer), October (autumn), January (winter) and April (spring). Thus wool collected in one occassion represent the preceding growth period. For example, summer clip in July representing the wool grown in spring. At each sampling time, wool samples were taken from six body positions; three dorsals (withers, Wth, back, Bk, and rump, Rp) as well as three laterals (shoulder, Sh, mid-side, Ms, and britch, Br). From the standing position, wool was cut from the sheep as close as possible to the skin surface using scissors forming a square of approximately 10 cm x 10 cm on each of the six positions. The entire wool samples were taken from these squares at the four sampling occassions previously mentioned. At each sampling time, the dimensions of these squares were recorded to calculate the area shorn. Graesy wool sample obtained from each position was weighed and kept in a plastic bag for further analysis. Greasy wool per unit skin area, GWA, was calculated for each position and season by dividing the weight of greasy wool obtained by the skin area shorn. Wool was then scoured and the clean scoured yield, YLD, was calculated as:

$$\frac{\text{Weight of clean scoured and dry wool} \times 100}{\text{weight of greasy wool}}$$

Clean wool per unit skin area, CWA, was calculated by dividing the weight of clean scoured wool by the skin area shorn for each position and season.

Staple length, STL, was the average of five staples taken randomly from each greasy sample of each position. Measurements were made between the base and the tip of the staple against a ruler to the nearest 0.5 cm. Care was taken not to apply any longitudinal tension to the staple. At the end of the experiment the whole fleece was shorn and the greasy fleece weight, GFW, was recorded for each animal.

Statistical procedures:

The analysis of variance was performed to partition the variability to its sources. The model included season, position, animal and the interaction of season x position. These sources of variation considered to be fixed except the random animal effect.

Correlation coefficients were calculated for each trait between estimates of each of the six body positions and the average of these positions, the fleece average. These correlations were also obtained between traits for each season. where no significant differences between correlations were found, they were pooled over seasons using Fisher's Z transformation (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

The present data indicated the highly significant position effect in all traits studied (Table 1).

Table 2. Analysis of variance estimates and F values for the different traits

Source of variation	d.f	CWA		GWA		YLD		STL	
		MSQ	F	MSQ	F	MSQ	F	MSQ	F
Total	695								
Season(S)	3	0.0190**	95.0	0.0727**	90.88	2272.089**	42.08	232.996**	201.21
Animal	28	0.0015**	7.5	0.0064**	8.00	813.853**	15.07	9.937**	8.58
Position(P)	5	0.0146**	73.0	0.0306**	38.25	1036.603**	19.20	15.684**	13.54
SxP	15	0.0005**	2.5	0.0022**	2.75	795.466**	14.73	1.865**	1.61
Residual	644	0.0002		0.0008		53.996		1.158	

** P < 0.01

Overall seasons, there is a general trend that back position produced more GWA and CWA. Withers gave the best clean scoured yield, YLD whereas staple length, STL, were usually longer from rump position (Table 2). Very definite dorso-lateral gradient existed in all traits studied; dorsal positions being obviously higher. GWA and CWA on the dorsal positions were 58.0% and 60.0% respectively heavier than the corresponding values of the lateral positions as pooled estimates over seasons.

Dorsal positions also had longer staples (5.09 cm vs. 4.62 cm) and better YLD (54.81% Vs.50.61%0 compared with those of lateral positions. No distinct antero-posterior gradient was observed in all traits studied except for STL; posterior positions tended to have longer wool. Many workers in various breeds have indicated gradient over the body positions in the amount of wool produced per unit area (Henderon, 1953; Chapman and Young, 1957; El-Gabbas, 1986) in YLD (Thornberry and Atkins, 1984 El-Gabbas, 1986) and in STL (Badreldin et al., 1952; Guirgis et al., 1979; El-Gabbas, 1986).

Table 1. Means of GWA (g/cm^2), CWA (g/cm^2), YLD (%) and STL (cm) ± their standard errors from different positions in various seasons

		July	October	January	April	pooled
Sh	GWA	0.06±0.0	0.11±0.0	0.07±0.0	0.05±0.0	0.07±0.0
	CWA	0.02±0.0	0.04±0.0	0.04±0.0	0.03±0.0	0.03±0.0
	YLD	40.12±0.5	40.15±1.5	57.33±1.5	55.61±1.5	48.30±0.7
	STL	2.67±0.2	5.74±0.2	4.97±0.2	4.138±0.2	4.38±0.1
Ms	GWA	0.06±0.0	0.10±0.0	0.06±0.0	0.05±0.0	0.07±0.0
	CWA	0.03±0.0	0.05±0.0	0.03±0.0	0.03±0.0	0.03±0.0
	YLD	45.41±1.0	48.14±1.5	57.47±1.5	51.02±1.5	50.51±0.7
	STL	3.10±0.2	5.95±0.2	4.78±0.2	3.78±0.2	4.40±0.1
Br	GWA	0.07±0.0	0.12±0.0	0.08±0.0	0.06±0.0	0.08±0.0
	CWA	0.03±0.0	0.05±0.0	0.04±0.0	0.04±0.0	0.04±0.0
	YLD	49.34±1.5	47.05±0.5	57.44±1.5	58.21±1.5	53.01±0.7
	STL	3.74±0.2	6.55±0.2	5.35±0.2	4.66±0.2	5.07±0.1
Wth	GWA	0.07±0.0	0.13±0.0	0.08±0.0	0.10±0.0	0.10±0.0
	CWA	0.04±0.0	0.08±0.0	0.05±0.0	0.05±0.0	0.05±0.0
	YLD	56.03±1.5	61.74±1.5	60.15±1.5	49.31±1.5	56.81±0.7
	STL	4.21±0.2	6.52±0.2	5.07±0.2	4.28±0.2	5.02±0.1
Bk	GWA	0.08±0.0	0.13±0.0	0.10±0.0	0.11±0.0	0.11±0.0
	CWA	0.04±0.0	0.08±0.0	0.06±0.0	0.05±0.0	0.06±0.0
	YLD	54.93±1.5	58.61±1.5	57.36±1.5	47.35±1.5	54.56±0.7
	STL	3.67±0.2	6.69±0.2	5.14±0.2	4.53±0.2	5.01±0.1
Rp	GWA	0.09±0.0	0.12±0.0	0.09±0.0	0.10±0.0	0.10±0.0
	CWA	0.05±0.0	0.07±0.0	0.05±0.0	0.05±0.0	0.05±0.0
	YLD	51.23±1.5	53.38±1.5	57.61±1.5	50.01±1.5	53.05±0.7
	STL	4.22±0.2	6.40±0.2	5.60±0.2	4.72±0.2	5.24±0.1
Pooled	GWA	0.07±0.0	0.12±0.0	0.08±0.0	0.08±0.0	
	CWA	0.04±0.0	0.06±0.0	0.05±0.0	0.04±0.0	
	YLD	49.51±0.6	51.51±0.6	57.89±0.6	51.92±0.6	
	STL	3.60±0.1	6.31±0.1	5.15±0.1	4.35±0.1	

Henderson (1953) attributed the gradient in the amount of wool grown on various body positions to differences in blood supply to those positions. Ryder (1955) failed to find evidence that the patterns of the blood vessels in the sheep skin could account for that gradient. Cockrem and Wickham (1960) had hypothiezed that measurements of skin temperature could act as an indirect method for estimating blood supply to various body positions. Accordingly, They had partly attributed the gradient of wool growth over the body to differences in blood supply to different body positions of New Zealand Romney March. On the other hand, Cockrem (1962) proposed that an inherent factor associated with either the skin or its follicle population might also be involved in determination of the amount of wool grown on a particular position.

The present data indicated highly significant animal effect in all traits studied (Table 1). On one hand, this might reflect the importance of genetic variations for improving these traits. On the other, the among-position variations, as expressed by F ratios, were found to be much greater than that of among-animals in all traits. This might indicate that greater attention has to be paid to among-position variation compared with individual variation for obtaining estimated of these traits.

Season X position interaction indicated significant effect in all traits studied except for STL (Table 1). The same trend was observed in all traits in which dorsal positions had higher values in all seasons. However, lower YLD was obtained from the dorsal positions in April clip (Table 2).

Tables (1 and 2) indicated that season had highly significant effect on all traits studied. October clip had heavier greasy and clean wool production as well as longer wool compared with other seasons. The most favourite conditions for wool growth seems to predominate during July to October in this flock. The highest estimate of YLD was obtained from January sample. Between-season variation in YLD might reflect the fluctuations of non-wool contaminants such as grease, suint or else from one season to another.

It is worthnoting that the north-western desert of Egypt is often subjected to sand-carrying-winds from March to June which might resulted in the lowest YLD obtained in July clip.

A pronounced seasonal cycle of wool growth was reported by many investigators in various breeds. wool growth was greater in summer in English breeds (Ryder and Stephenson, 1986) while was found to be higher in winter in Ossimi (Badreldin et al., 1952). Controlling the annual rhythm of wool growth has puzzled wool scientists for many year as many factors has been reported to be involved. The amplitude of wool growth cycle seems to vary considerably amongst breeds which reflect the importance of genetic factors. These breed differences were found to be consistent and were not modified by various seasons despite the marked seasonal variations observed in fibre length and diameter (El-Sherbiny and Markotic, 1974). Genetic differences might also be in the metabolic responses to variation in nutritional and other environmental factors (Doney, 1966).

The decrease of wool production occurred at a certain season was thought to be due to lower feeding at that time. However, sheep kept on a constant diet throughout the year indicated annual rhythm of wool growth with a lessening of wool production in winter (Ryder, 1956; Wodzicka, 1960). Moreover, Doney (1964) improved nutrition during winter and observed no increase in wool production although it had a marked effect on live weight maintenance. On the other hand, seasonal variation in availability or quality of feed could be responsible for the magnitude of the differences between summer and winter wool production (Doney and Sumith, 1961). Seasonal variation in nutrition as well as the effect of pregnancy and lactation may also magnify the seasonal rhythm of wool growth. There is evidence that improved nutrition during lactation resulted in an increase in wool production (Doney, 1964). It is also believed that roundworms in the digestive tract may be included in the seasonal variation of wool growth at times.

The effect of climatic environment seems to shift the phase of the seasonal wool rhythm rather than causing an additive effect (Bennett et al. 1962). The photoperiodic rhythm may be one factor and the temperature may be another (Wodzicka, 1960; Morris, 1961; Nagarcenkr and Bhattacharya, 1964).

The depression of wool production in certain periods has been explained by some environmental factors acting through the endocrine system and in particulary thyroid and adrenal glands. Administration of thyroxin increased the weight of wool grown per unit time per unit area according to Ferguson et al., (1965). They also confirmed that adrenal steroids suppress follicular activity and suggested that their increased output at times of physical and emotional stress is responsible for break or tenderness of the fleece.

While annual cycle of wool growth appeared to be affected by various environmental factors, the skin follicle itself is able to exert some measures of control on wool growth. Considerable variation in the proportion of inactive secondary wool follicles has been observed by Ryder (1978) in two successive winters; the greater proportion of inactivity being in the coldest one. Skin grafting experiment (Ryder and Priestley, 1977) have shown that follicle can over-ride systemic controlling factors and grow wool when surrounding follicles remain inactive.

The present data indicated heavier wool production as well as longest wool during July-October period compared with other seasons. During these 3 months, 33.5% of the fleece and 32.6% of the whole staple length are produced. It appeared that Barki sheep produced wool at a higher rate for only short period of time from July to October which would suggest that wool production during this is the most important determinant of the Barki fleece weight.

Improving wool production in breed would resulted from the ability to sustain the higher level of wool growth attained for longer period.

The depression of wool production in the present study appeared to be controlled, apart from the genetic materials, by a combination of seasonal systemic factors as well as local factors within the follicle itself. As yet no practical way has been found to influence development of wool follicle population and therefore the wool producing potential of the sheep . However, the level of nutrition of the lamb's mother during late pregnancy and early lactation can influence the number of fibres producing follicles.

The depression of wool growth most of the year in Barki sheep not only affect the quantity of the wool produced but also the quality of such wool is likely to be deteriorated. A greater thinning of the wool fibres is probable with higher incidence of cotting together with a tendency of such wool to be more tender (Sumner and Wickham, 1969). These effects on quantity and quality of the wool would be reflected on the monetory value as well as the utility of such wool.

Many correlation coefficients have been calculated in the present study, the most significant of which are discussed hereafter. The present data showed the most representative sample to the fleece average, as indicated by the highest correlation coefficients between each of the six body positions and the average of these positions, the fleece average for a given trait. It appeared that withers is the best sampling position for GWA (r= 0.79) and STL (r= 0.76) while the britch sample is good for CWA (r= 0.82) and mid-side position is favourable for YLD (r= 0.85).

The present study revealed highly significant correlation of 0.52 between CWA and STL. On the other hand, GWA indicated highly significant correlations with GFW (r= 0.62), it appeared that GWA is the most indicative criteria for GFW especially when estimated from the back position (r= 0.53). Apparently, GWA and CWA are closely related (r= 0.86), hence predicting the fleece average of CWA is possible by using estimates of GWA from either withers or rump sample (r= 0.71). Similar trends were found in Drysdale sheep of New Zealand (El-Gabbas, 1986).

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الاختلافات الموسمية لانتاجية الصوف من مواقع الجسم المختلفة فى الاغنام البرقى

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تم استخدام ٢٩ نعجة برقى لدراسة التغيرات التى تحدث فى انتاجية الصوف على مدى العام – وقد اخذت عينات الصوف كل ثلاثة اشهر لتمثل نمو الصوف فى المواسم المختلفة فى الصيف – الخريف – الشتاء – الربيع وفى كل هذه الفترات اخذت عينات الصوف من ستة اماكن على جسم الحيوان، ثلاثة على الظهر، ثلاثة على البطن – وقد تم التعبير عن انتاجية الصوف فى هذه الدراسة بكمية الصوف الخام والمغسول فى وحدة المساحة بالاضافة لطول الخصلة ونسبة تصافى الصوف ووزن الجزة الخام.

وقد اوضحت الدراسة ان انتاج الصوف فى الاغنام البرقى يكون بمعدل عالى لمدة قصيرة من يوليو الى اكتوبر بالاضافة لكون الصوف المأخوذ فى يناير عاليا فى نسبة التصافى – وقد اتضح ان هناك تأثير عالى المعنوية لمواقع الجسم المختلفة على الصفات المدروسة حيث تميزت منطقة الظهر بزيادة انتاج الصوف الخام والمغسول فى وحدة المساحة بالاضافة لانتاجها لصوف اطول ذو نسبة تصافى اعلى. وقد اتضحت كذلك اهمية الاختلافات الوراثية فى تحسين هذه الصفات وقد اقترح اهمية ان تؤخذ الاختلافات بين مواقع الجسم المختلفة فى الاعتبار عند تقدير هذه الصفات – وقد تم مناقشة العوامل المختلفة التى يؤثر فى انتاج الصوف .

وقد اتضح كذلك من هذه الدراسة ان مقدمة الظهر تعتبر اكثر تمثيلا للجزة الكاملة عند تقدير كمية الصوف الخام المنتجة فى وحدة المساحة وكذلك لطول الخصلة كما ان منطقة الفخذ تعتبر اكثرتمثيلا للجزة عند تقدير انتاج الصوف المغسول فى وحدة المساحة بينما كانت منطقة منتصف الجانب جيدة عند تقدير نسبة التصافى . وقد اتضح كذلك وجود علاقة قوية بين انتاج الصوف الخام فى وحدة المساحة بين انتاج الصوف المغسول فى وحدة المساحة من جهة وبينه وبين وزن الجزة الخام من جهة اخرى.