Egypt. J. Anim. Prod. 20, No. 2, pp. 163—169 (1980)

Fibre Shedding in Relation to Seasonal Changes in Day Length and Atmospheric Temperature

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SKIN samples were collected from 39 rams representing five breed groups of sheep ; Merino (M), Ossimi (O), and the crosses between them, *viz.*, ¾ Ossimi- ¼ Merino (¾O), ½Ossimi-½ Merino (½ O) and ¼ Ossimi- ¾ Merino (¼ O), maintained at Sakha Experiment Station, Kafr El-Sheikh, Egypt with the objectives of detecting the seasonal changes in normal light rhythm as compared to continuous dim light conditions on wool fibre shedding. Percentage of fibre shedding in normal light were 7.8, 4.5, 7.4 and 2.4 in autumn, winter spring, and summer respectively. Respective figures under continuous dim light conditions were 18.5, 10.9, 11.4 and 10.9. Seasonal changes in temperature did not seem to influence the rate of fibre shedding, while the observed changes in fibre shedding from season to season were found to be attributed to seasonal changes in day-light rhythm. Percentages of fibre shedding in normal day light rhythm were 16.0, 6.4, 4.9, 4.6 and 3.0 in O, ¾ O, ½ O ; ¼ O and M respectively. Respectived figures under dim light conditions, were 16.7, 11.2, 11.2 13.4 and 11.4. The absence of light resulted in increased fibre shedding in all groups studied regardless of season.

Several factors had been reported to effect fibre shedding *i.e.* .the different breeds of sheep differ genetically in type and percentage of sheddings (Burns, 1953 ; Margolena, 1960 . Lyne, 1961 and Priestly, 1964). Seasonal shedding occurs either once or twice a year, being in autumn and spring (Ryder, 1956-b and, 1960 and Slee, 1959). Ryder, (1956-b) and Slee, (1963) concluded that the stimulus of shedding was seasonal and not nutritional. Lyne (1964), reported that fibre shedding was the major feature of the reaction of the follicle population to adverse nutrition. Adrenal steroids were also reported to stimulate the follicles to shed their fibres (Lindner and Ferguson, 1956 and Ryder, 1964). Nagarcenkar (1963) reported that the shedding occurs as a result of changing light rhythm. Slee (1965) found lambs kept under constant dim artificial illumination showed retarde moulting. While Hutchinson (1965), found that shedding was related to photoperiodicity which would be reversed by reversing seasonal lighting. The present study aimed at testing, whether changes in light and or atmospheric temperature are responsible for fibre shedding in fine wool Merino, carpet wool Ossimi, and some crosses between them maintained under constant nutritional level.

Material and Methods

This study was conducted during the 1964-1975 season on 39 rams at Sakha Animal Production Research Station, Ministry of Agriculture, Egypt. The animals comprised 8 rams from the purebred "German mutton Merino" (M), 7 rams from the purebred Ossimi (O) and 8 rams from each of the crosses, $\frac{3}{4}$ Ossimi- $\frac{1}{4}$ Merino ($\frac{3}{4}$ O), ½ Ossim - ½ Merino (½ O) and $\frac{1}{4}$ Ossimi-$\frac{3}{4}$ Merino ($\frac{1}{4}$ 0). The rams were 3-4 years old and were fed a constant ration all over the year consisted of 1.5 kg of concentrates and 2 kg of chopped bean straw, supplemented with vitamins A and D-3 at a dose of 6 g/ram/day. The animals were devided into 2 light treatment groups. The first consisted of four animals from each breed group and was kept under constant dim light conditions all over the year. The second group consisted of three rams from each of the other breed groups was kept inside an open pen and set free to sun light and shade zones under the normal day light rhythm throughout the year The difference in temperature between the two experimental pens was within the range of ½-1 O, and was considered insignificant. Complete description of the animals used and the management practiced were presented by Khalil (1976). Fibre shedding was measured using parallel skin sections of 1 cm² taken from four corners of a 100 cm² area in the mid-right-side region of the animal. The skin samples were taken at the end of each season. The histological technique of Clark (1960) was used after some modifications. The wool follicles were counted in 7 microscopic fields and those appearing without fibres were considered as shed. Shedding percentage was then calculated by taking the ratio of follicles without fibres to the total number of follicles. Statistical analyses were performed as described by Kirk (1968) and Snedecor and Cochran (1973). The meteorological data at the site of the experiment are listed in Table 1.

TABLE 1. Maximum and minimum temperatures and mean day length at Sakha Region.

Season	Temperature°		Mean day length hr
	Maximum	Minimum	
Autumn (Oct.- Nov. 1974)	31.8	17.1	11.9
Winter (Dec.- Mar. 1975)	20.4	8.8	10.6
Spring (Apr.- May. 1975)	25.5	10.0	12.4
Summer (June- Sep. 1975)	31.6	17.9	13.7

Results and Discussion

Breed groups differed greatly in their fibre shedding percentage where 8.5% of the total variance was attributed to differences among the breed groups studied. Individual comparisons (Duncan's test) among the breed group means in fibre shedding indicated that the Ossimi (16%) was the only breed which differed from all the other breed groups studied, while under dim light conditions all differences were not significant in the different breed groups. Highly significant differences were also observed between animals raised under the normal day light rhythm (4.74%) and those raised under constant dim light conditions (12.93%) accounting for 30.6% of the total variance. Season was also a highly significant source of variation accounting for 11.0% of the total variance. In the normal light rhythm group, Duncan's comparisons among means revealed that differences were significant between summer and both autumn and spring. While in the dim light group differences were significant between autumn and each of summer, spring and winter. Highly significant breed × season interaction was also observed which accounted for 6.82% of the total variance. While breed × treatment, treatment × season and breed × treatment × season interactions were not significant.

The observed differences among the breed groups in fibre shedding signify that the genetic constitution of the animal is responsible for the expression of the character. Shedding occurred in all the breed groups studied but the rate of shedding differed from one breed to another, with Merino having the lowest percentage, while the Ossimi had the highest. This result confirms the reports of Slee (1959), Slee and Carter (1962) and Ryder and Slee (1967) who found that the percentage of fibre shedding was strongly influenced genetically and that the extent of fibre shedding differed between breeds. In the dim light group, however, the absence of light might have affected the percentage of fibre shedding at different extents in the different breeds in such a way to ameliorate the significant differences that existed under normal light conditions. Several workers have demonstrated the effect of light on fibre shedding (Burns, 1953 ; Ryder, 1956-b and Slee, 1959 and 1963) who reported that seasonal changes in day length were a major operative factor in fibre shedding. Hutchinson (1965) had also showed that shedding of fibres was affected by the photoperiodicity. Comparing the two means of fibre shedding in the normal light rhythm (4.74%) and in the dim light (12.93%) may indicate that fibre shedding was increased under constant dim light conditions although this increase occurred mainly during autumn at the start of the experiment. The highly significant effect of season on the percentage of fibre shedding in the normal light group when compared with that under constant dim light conditions indicates that the change in the percentage shedding coincided with changes in day light hours rather than changes in temperature. This was in confirmation with the results found by Slee (1959), Nagarcenkar (1963) and Hutchinson (1965) who found that changes in seasonal photoperiodicity was a major factor affecting fibre shedding. It was evident that there are two peaks of fibre shedding, one being in autumn (7.8%) and the other in spring (7.4%) which is in agreement with the results found by Burns (1953), Ryder (1956-b and 1960), Slee (1959) and Hayman and Nay (1961). On the other hand, in the dim light group it was apparent that only one peak of fibre shedding occurred in autumn (18.46%) at the start of the experiment when the normal light rhythm prevailed before the animals were changed to dim light conditions. No significant differences were detected thereafter, which may indicate that the change in light rhythm was the factor of significance in fibre shedding at the beginning of the experiment, with no obvious effect of temperature changes. This confirms the previous results that shedding is stimulated by the change in day-light rhythm which normally occurs between seasons specially exhibited in autumn and spring (Burns, 1953; Ryder, 1956-b and 1960; Slee 1959 and Hayman and Nay 1961).

Comparison of the percentage of fibre shedding in dim and normal light conditions in the different seasons revealed that an increase in the percentage of fibre shedding occurred in the dim light in all four seasons, being highly significant in autumn, winter and summer and non-significant in spring. The differences between the dim light and the normal light treatments were greatest in autumn followed by summer, winter and spring in a descending order. These results indicate that the seasonal rhythm in fibre shedding observed normally in the normal light group was almost diminished in the dim light group, which might be due to the absence of light rhythm rather than the duration of light in itself.

The significant interaction between breed and season in the normal light group suggests that, the Ossimi was affected more by the seasonal changes in the light rhythm while the Merino was little if at all affected. The percentage effect in the crossbreds seems to be proportional to the percentage blood inherent from the parents. This result conforms well with that of Ryder and Slee (1967). It also suggests that seasonal shedding coincided with increased fibre diameter where increased fibre diameter resulted in increased fibre shedding. Burns (1953) and Ryder (1956) had confirmed a genotypeseason interaction affecting the percentage of fibre shedding in Scottish Blackface, Herdwick and Masham sheep. On the other hand, Margolena (1960) and Lyne (1961) found no seasonal trends in fibre shedding in Ramboiullet and Merino sheep. While under complete dim light conditions the absence of light caused four out of five breed groups to have their peaks of fibre shedding in autumn instead of being twice a year under normal light. It also indicates that the higher fibre shedding percentage noticed in autumn at the start of the experiment, was a normal response to the changes in the light rhythm and that most of the breed groups showed an almost equal response. Merino, however, was an exception and showed no evidence of seasonal rhythm in fibre shedding in response to changes in the light rhythm either under normal or dim light conditions. Moreover, Merino showed a greater fibre shedding percentage in all seasons under dim light as compared to normal light rhythm. To our knowledge, however, no reports are available to the response of breeds to constant dim light conditions. The above results may be explained in part by the fact that adrenal steroids are known to stimulate the follicle to shed its fibre (Lindner and Ferguson, 1956; Ryder, 1964 and Thwaites, 1972), and that the follicle undergo resting phase with decreasing day length (Rougeot, 1957 and 1961). It may be postulated however, that follicle inactivity and fibre shedding are caused by greater levels of adrenocorticoids secreted in the absence of light. Turner and Bagnara (1971) reported an increase in adrenocortical hormones in rats in the absence of light.

TABLE 2. Mean fibre shedding percentage in the normal (L) and dim light (D) conditions classified by breed and season.

Season		Breed group					Mean
		O.	¾ O.	½ O.	¼O.	M.	
Autumn	(L)	14.37	8.05	7.73	5.68	4.85	7.81
	(D)	20.98	18.58	19.90	20.98	11.85	18.06
Winter	(L)	9.50	6.53	5.80	3.00	1.85	4.51
	(D)	18.33	9.38	5.90	11.63	9.28	10.90
Spring	(L)	23.55	2.00	7.70	6.65	3.50	7.41
	(D)	19.15	5.43	12.90	9.13	10.33	11.39
Summer	(L)	2.40	2.17	4.48	1.20	1.98	2.63
	(D)	8.36	11.33	8.80	11.73	14.23	10.87
Mean	(L)	16.00	4.95	6.43	4.58	3.04	4.47
	(D)	16.71	11.17	11.88	13.36	11.42	21.93

In conclusion, it is quite safe to assume that fibre shedding is genetically controlled and is also influenced by seasonal changes in day light rhythm. Absence of light seems to increase the incidence of fibre shedding regardless of season or breed. However, seasonal changes in temperature in the absence of light seems to have no detected effect on fibre shedding as evidenced from the unchanged shedding percentage during winter, spring and summer.

References

Burns, M. (1953) Observations on the follicle population of Blackface sheep. *Joural of Agricultural science*, Cambridge, 43, 422.

Clarke, D.H. (1960) A histological technique for the study of the skin follicle population in sheep. Common Wealth Scientific and Industrial Research Organization, Technical Paper No. 3.

Dowling, D.F. and Nay, T. (1960) Cyclic changes in the follicle and hair coat in cattle. *Australian Journal of Agricultural Research*, 11, 1064.

Hayman, R.H. and Nay, T. (1961) Observations on hair growth and shedding in cattle, *Australian Journal of Agriculture Reseasch*, 12, 513.

Hutchinson, J.C.D. (1965) Photoperiodic control of the annual rhythm of wool growth. "*In the Biology of the Skin and Hair Growth*". Lyne, A.G. and Short, B.F. Edit., pp 565-574. Angus and Robertson, Sydney, Australia.

Khalil, M.H. (1976) *M.Sc. Thesis*, Al-Azhar University, Faculty of Agriculture, Cairo, Egypt.

Kirk, R.E. (1968) "*Experimental Design Procedure for the Behavioural Sciences*". Wasworth Publishing Company, Incorporation, U.S.A.

Lindner, H.R. and Ferguson, K.A. (1956) Influence of the adrenal cortex on wool growth and its relation to "break" and "tenderness" of the fleece. *Nature*, London, 177, 188.

Lyne, A.G. (1961) The mostnatal development of wool follicles, shedding and skin thikness in inbred Merino and South Down-Merino crossbred sheep. *Australian Journal of Biological Science*, **14**, 141.

Lyne, A.G. (1964) Effect of adverse nutrition on the skin and wool follicles in Merino sheep. *Australian Journal of Agriculture Research*, 15, 788.

Margolena, L.A. (1960) Season and comparative activity of wool follicle. Anatomical Record, 138, 368.

Nagarcenkar, R. (1963) Shedding of fibres in sheep. *Naturwissenshaften*, 50, 162.

Priestly, G.C. (1964) *Ph.D. Thesis*, University of Leeds.

Rougeot, J. (1957) The effect of seasonal variation in daily length in lighting on the moult of certain fibres of the fleece of Limousin sheep. *Societé Biologique*, Paris, 151, 834.

Rougeot, J. (1961) Comparative effect of annual and semi-annual periodic variation of day length on the follicle cycles of the short kemp fibres of the fleece of limousin ewes. Relationship with reproductive cycles. *Annals of animal Biology, Biochemistry and Biophysics*, 1, 385.

Ryder, M.L. (1956-a) The blood supply to the follicle. Conference of the Wool Research Institute, Australia, p-63-91.

Ryder, M.L. (1956-b) Observations on nutritional and seasoanl changes in the fleece of some Masham Sheep. *Journal of Agricultural Science, Cambridge*, 47, 129.

Ryder, M.L. (1960) A study of the coat of the Moufflon Ovis Musimon with special reference to seasonal changes. *Proceedings of the zoological Society*, London, 135, 304.

Ryder, M.L. (1964) Moulting and replacement. In progress in "*Biological science in relation to dermatology*". Rook and R.R. Chapman Edition 2, 325, Cambridge University Press, London.

Ryder, M.L. and Slee, J. (1967) The effect of cold exposure on wool growth in Scottish Blackface and Merino-cheviot sheep. *Journal of Agricultural Science, Cambridge*, 69, 449.

Slee, J. (1956) Fleece shedding, Staple length and fleece weight in experimental Weltshire Horn-Scottish Blackface crosses. *Journal of Agricultural Science, Cambridge*, 53, 209.

Slee, J. (1963) Birthcoat shedding in Wiltshire Horn lambs. Animal Production. *Journal of the British Society of Animol Production*, 5, 301.

Slee, J. (1965) Seasonal patterns of moulting in Wiltshire Horn sheep. In "*Biology of skin and hair*". A.G. Lyne and B.F. Short Edition, pp.543-563, Angus and Robertson, Sydney.

Slee, J. and Carter, H.B. (1962) Fibre shedding and fibre follicle relationship in the fleece of Wiltshire Horn x Scottish Blackface sheep crosses, *Journal of Agricultural Science, Cambridge*, **58**, 309.

Snedecor, G.W. and Cochran, W.G. (1973) "*Statistical Methods*". 6 th Edition, Iowa, U.S.A.

Thwaites, C.J. (1972) The effect of short term under nutrition and adrenocortical stimulation on wool growth.Animal Production , *Journal of the British Society of Animal Production*, **15**,39.

Turner, C.D. and Bangara, J.T. (1971) "*General Endocrinology*". W.B. Sounders Company, Phyladelphia, Pennsylvania, U.S.A.

Yeats, N.T.M. (1954) Environmental control of coat changes in cattle. *Nature*, London, **174**, 609.

Yeats, N.T.M. (1955) Photoperiodicity in cattle. I- Seasonal changes in coat characters and hair importance in heat regulation. *Australian Journal of Agriculture Research* **6**, 891.

Yeats, N.T.M. (1957) Photoperiodicity in cattle. II-The equatorial light environment and its effect on coat of European cattle, *Australian Journal of Agriculrure Research*, **8**, 733.

تســاقط ألياف الصــوف بالتغيرات الموسمية فى طول فترة الاضاءة ودرجة الحرارة

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اخذت عينات من الجلد من ٣٩ كبش ممثلة لخمســـة مجموعات هى المرينو والأوسيمى والخليط ٣/٤ أوسيمى + ١/٤ مرينو – ١/٢ أوسيمى + ١/٢ مرينو – ١/٤ أوسيمى + ٣/٤ مرينو مرباه بمحطـة بحوث الانتـاج الحيوانى بسخا التابعه لوزارة الزراعة بكفر الشيخ • كان هدف الدراسة هو الوقوف على تأثير التغيرات الموسمية لطول فترة الاضاءة الطبيعية مقارنة بالاضاءة المعتمة صناعيا على تساقط الياف الصوف •

كانت النسبة المئوية للألياف المتساقطة تحت ظروف الاضاءة الطبيعية هى ٧ر٨ ، ٥ر٤ ، ٤ر٧ ، ٤ر٢٪ فى مواسم الخريف – الشتاء – الربيع – الصيف على التوالى • والنتائج المقابلة تجت ظروف الاضاءة المعتمة كانت ٥ر١٨ ، ٩ر١٠ ، ٤ر١١ ، ٩ر١٠ على الترتيب • لم يلاحظ أى تأثير حقيقى للتغيرات الموسمية فى درجة الحرارة على نسبة الألياف المتساقطة بينما أعزى التأثير المشاهد فى هذه الصفة الى التغيرات الموسمية فى طول فترة الاضاءة الطبيعية •

كانت نسبة الألياف المتساقطة تحت ظروف الاضاءة الطبيعية ٠ر١٦ ، ٤ر٦ ، ٩ر٤ ، ٦ر٤ ، ٠ر٣ فى سلالة الأوسيمى ، ٣/٤ أوسيمى ، ١/٢ أوسيمى ، ١/٤ أوسيمى والمرينو على التوالى بينما كانت النتائج المقابلة تحت ظروف الاضاءة المعتمة هى ٧ر١٦ ، ٢ر١١ ، ٢ر١١ ، ٤ر١٣ ، ٤ر١١٪ على الترتيب •

ويبدو أن غياب الاضاءة الطبيعية أدى الى زيادة نسبة الألياف المتساقطة فى كل المجموعات المدروسة بصرف النظر عن تأثير الموسم •