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FACTORS AFFECTING CYCLIC CHANGES IN HAIR COAT IN TWO DUTCH CATTLE BREEDS

By

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SUMMARY

Coat characters of two Dutch cattle breeds in different months of the year were examined.

A slight difference in hair characters was observed between heifers and older cows.

Seasonal fluctuations of some characters is very definite. In autumn and winter the coat is heavy and long ; while the hair diameter is thinner than in the other seasons and the percentage of medullation is lowest. In summer samples, all fibres were found to be medullated. The percentage of medulla were 64.1, 83.3, 100.0 and 71.7 in winter, spring, summer and autumn respectively for F.H., and 65.8, 86.0, 100.0 and 77.5 in winter, spring, summer and autumn, respectively for M.R.Y.

Correlations between various coat characters as : weight of hair with : hair diameter, hair length and presence of medulla, were -0.17, +0.72 and—0.20 for F.H., and —0.23, +0.70 and —0.28 for M.R.Y., respectively. Hair diameter with : hair length and presence of medulla, were —0.36 and +0.55 for F.H. and —0.59 and +0.86 for M.R.Y., respectively. Correlation between hair length and presence of medulla was —0.46 and +0.58 for F.H. and M.R.Y., respectively.

The variation between the two breeds were found to be highly significant in all characters, except for weight of hair. Pigmented hairs are thinner, shorter and less medullated than white hairs in the same animal.

INTRODUCTION

It is necessary to study the effect of some specific environmental factors on the body and it is in the first place necessary for the cattle breeder, particularly in subtropical and tropical regions to determine the effect of radiation, temper- ature and day light on the hair of cattle.

The production of cattle living in hot countries, is to a certain extent governed by their ability to disperse the excess of heat in their bodies and by their adaptability to the high temperatures prevailing there. The coat of cattle is one of the important factors affecting the rate of heat dispersal of the body.

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Bisonnette and Wilson (1939) were the first to prove experimentally the dependence of the hair growth cycle on the photoperiod.

This was later on shown by Yeates (1955) to be true also for Shorthorn cattle, and by Stegenga (1960) for the first time in the Netherlands on the hair growth of the Dutch Red and White breed.

MATERIAL AND METHOD

The cattle used in this investigation were 33 Friesian cows und 28 M.R.Y. cows from the herd of the "Laboratorium voor Veeteelt" and "Laboratorium voor Dierfysiologie", Wageningen in the Netherlands. 50 hairs from each sample were examined.

The hair characters studied were :

1. Weight of hair per unit area. The area chosen here was 14×14 cm.

2. Hair measurements, including :

   (a) Hair diameter.

   (b) Hair length. (40 longest hairs)

   (c) Presence or absence of medulla.

Hair samples were taken within 1-3 days after calving, during the period 1960-1962. The first sample was taken in January 1960. The relationship of the cow's age and season of calving on coat characters at calving were observed and the variations between the two breeds were also noted. The cows were divided into two groups according to their ages after calving (2-2.5 and over 2 5 years old).

The four seasons used in this study were :

Winter	: January	February	March.
Spring	: April	May	June.
Summer	: July	August	September.
Autumn	: October	November	December.

The procedure, the treatment and the examination of the samples were carried out as it was described by Kassab (1964).

The differences between hair characters of various colours in each sample were observed.

The percentage of partially and completely medullated hairs to non-medullated ones, was calculated from 50 hairs in each sample. The correlation between coat characters just after calving was estimated.

RESULTS AND DISCUSSION

Age of the cow :

A slight difference between heifers and older cows was observed (table 1). These variations were found not to be significant, (table 2 and 3), except for hair length in the F.H. breed, in which case the differences were statistically significant in favour of the group 2-2.5 years old. This might be due to the fact that for 7 out of the 11 cows in group 2-2.5, sampling was performed in winter. Practical experience indicates that younger animals have heavier weights of hair than older ones.

Season of calving :

Different characters of the hair coat were studied (table 4), and although in some seasons particularly the summer, the number of cows calving was very small, a certain seasonal fluctuation of some characters is very definite, and also statistically significant (table 2 and 3). In autumn and winter the coat is heavy and long; while the hair diameter is thinner than in the other seasons and the percentage of medullation is lowest. In summer-samples all fibres were found to be medullated.

Monthly records (tables 5 and 6) show that in December and January the coat is at its maximum for weight and length of hair. In this period the hair diameter is smallest. These findings are in agreement with the results found by Dowling (1959 and 1960), Berman and Volcani (1961) and Hayman and Nay (1961).

Correlation coefficients :

Correlation coefficients between various coat characters are given in table (7). Large positive correlations between weight of hair per unit area and hair length and also between hair diameter and presence of medulla can be observed, while the other correlatins studied were negative. These results confirm those obtained by Dowling (1959 and 1960) and are in general agreement with the correlations reported by Schleger and Turner (1960).

Breed differences :

In table 8 it is shown that F.H. animals have lighter coats with thinner, shorter hair fibres and less medullation than M.R.Y. animals. The variations between the two breeds were found to be highly significant, except for hair weight. These differences might be due to genetic differences between breeds and to differences in metabolic conditions of skin. However, the division of both breeds at calving all over the year was not the same. This might have some influence on this character. This result was in agreement with the findings of Duerden. (1927), Csukas (1940), Dowling (1956), Schleger and Turner (1960) and Hayman and Nay (1961) working on different breeds of sheep and cattle.

TABLE 1.—**Relation between age and hair characters of cows at calving**

Age of cows in years	F.H.					M.R.Y.				
	No.	Weight 14×14 cm	Diameter (μ)	Length (mm)	Presence of medulla	No.	Weight 14×14 cm	Diameter (u)	Length (mm)	Presence of medulla
		(gr.)			%		(gr.)			%
2-2.5	11	2.92	58.7	24.9	65.1	9	3.21	64.4	29.0	83.6
2.5 and over	22	2.28	60.9	19.5	74.5	19	3.02	66.6	27.0	85.0
Difference	33	0.64	2.2	5.4	9.4	28	0.19	2.1	2.0	1.4

TABLE 2.—**Analysis of variance for hair weights, diameters, lengths and presence of medulla (F.H, cows at calving).**

Source of variation	Weight		Diameter		Length		Presence of medulla	
	d.f.	M,S.	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.
Total	32		32		32		32	
Age of the cow	1	2.96	1	36.50	1	218.54*	1	655.51
Season within age	6	7.94**	6	192.37**	6	117.44*	6	614.20
Within season	25	1.64	25	10.23	25	40.03	25	272.60

* Significant ($P < 0.05$)

** Highly significant ($P < 0.01$)

TABLE 3.

Source of variation	Weight		Diameter		Length		Presence of medulla	
	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.
Total	27		27		27		27	
Age of the cow	1	0.22	1	25.38	1	23.90	1	13.68
Season within age	6	3.88	6	313.82**	6	126.48*	6	640.21**
Within season	20	2.11	20	14.88	20	35.88	20	37.99

* Significant ($P<0.05$) ** Highly significant ($P<0.01$)

TABLE 4.—**Seasonal variation in cows, coat characters at calving.**

Breed	F.H.					M.R.Y.				
	No.	Weight (gr.)	Diameter (μ)	Length (mm)	Presence of medulla	No.	Weight (gr.)	Diameter (μ)	Length (mm)	Presence of medulla
Season :										
Winter	18	2.46	56.4	23.7	64.1	8	3.84	56.6	34.1	65.8
Spring	6	0.66	64.5	12.1	83.3	8	1.82	67.2	23.4	86.0
Summer	2	2.70	77.8	20.7	100.0	7	3.34	78.1	22.9	100.0
Autumn	7	4.09	61.0	23.0	71.7	5	3.54	61.8	30.4	77.5

TABLE 5.—Average weight, diameter, length of hair cuttings from a sqaare area (14×14 cm), each sample 50 hairs, (F.H. cows at calving)

Month of calving	Weight		Diameter	Length
	No.	Mean (gr.)	Mean (μ)	Mean (mm)
January	5	3.53	57.6	27.5
February	4	2.44	55.9	29.6
March	9	1.88	56.0	19.0
April	4	0.85	64.2	13.4
May	1	0.08	64.1	7.2
June	1	0.50	66.3	12.1
July				
August				
September	2	2.70	77.8	0.8
October	5	3.77	63.62	20.9
November	1	3.32	59.3	24.6
December	1	6.51	49.9	32.3

TABLE 6.—Average weight, diameter, length of hair cuttings from a square area (14×14 cm) each sample 50 hairs (M. R. Y. cows at calving)

Month of calving	Weight		Diameter	Length
	No.	Mean (gr.)	Mean (μ)	Mean (mm)
Junuary	5	4.70	56.4	35.1
February				
March	3	2.41	56.9	33.0
April	4	2.10	67.4	26.9
May	4	1.54	67.0	19.8
June				
July				
August	3	2.32	78.6	19.3
September	4	4.11	77.7	25.7
October	3	1.89	65.6	30.2
November	2	4.00	56.0	30.8
December				

TABLE 7.—**Correlation between hair characters of the cows at calving per unit of area** (14×14 cm.)

Characters Correlated	F.H.		M.R.Y.	
	No.	Correlation	No.	Correlation
Weight and diameter of hair . . .	33	-0.168	28	-0.234
Weight and length of hair	33	0.719**	28	0.703**
Weight and presence of medulla .	33	-0.201	28	-0.284
Diameter and length of hair . . .	33	-0.356*	28	-0.594**
Diameter and presence of medulla.	33	0.552**	28	0.895**
Length and presence of medulla .	33	-0.458**	28	-0.575**

*Significant ($P<0.05$)
** Highly significant($P<0.05$)

TABLE 8.—**Differences between the two breeds. (F.H. and M.R.Y.) in hair characters of the cows at calving,**

Breed	No.	Weight of Hair	Diameter (μ)	Length [mm)	Presence of Medulla
		(gr.)			%
F. H.	33	2.49	60.2	21.3	71.4
M.R.Y.	28	3.08	65.9	27.6	84.6
Differences		0.59	5.7**	6.3**	13.2**

** Highly significant.

Coloured hair :

It was observed that hair fibres from the white area of the coat are longer, thicker and more medullated than those from red and black areas within animal and breed. Also red hairs in M.R.Y. breed are characterized by a longer, thicker and higher percentage of medullation than black hairs in F.H. breed, irrespective of season (tables 9 and 10). This result confirm the findings of Csukas (1949) who reported that, unpigmented fibres were found to be longer, thicker with more developed medulla than the pigmented fibres from the same individual or other animals of the same breed, of British, German and Hungarian breeds in Hungaria.

This investigation revealed the existence of an annual cycle, as mentioned before, in weight of hair, hair fibre diameter, hair length and medullation. The differences in coat characteristics observed in this work, in winter and spring and in summer and autumn are mainly due to a seasonal replacement of fibres. The summer coat is characterized by club hairs, which cannot grow continuously until the time of shedding, while the winter coat has long hairs with smaller diameters in comparison with the shorter and thicker hairs of summer. Therefore, winter coat must be a new coat and not an elongation of the summer coat. It is worth mention here that the summer fibres are much more medullated than the longer and thinner winter fibres.

TABLE 9.—**Seasonal variation in cows, coat characters according to colours.** (33 F. H. cows)

Season	Black Hair				White Hair			
	No.	Dia. (u)	Len. (mm)	Medulla. %	No.	Dia. (μ)	Len. (mm)	Medulla. %
Winter . . .	275	53.00	24.11	59.33	25	64.16	24.48	84.00
Spring . . .	525	61.92	10.79	78.90	325	64.50	14.58	87.14
Total . .	800	57.46	17.45	69.11	350	64.33	1953	85.57

TABLE 10.—Seasonal variation in cows, coat characters according to colours (28 M.R.Y. cows)

Season	Red Hair				White Hair			
	No.	Dia. (μ)	Len. (mm)	Medulla. %	No.	Dia. (μ)	Len. (mm)	Medulla. %
Winter . . .	280	53.61	25.22	60.08	120	62.06	25.58	81.25
Spring . . .	270	65.54	19.14	81.19	280	67.19	21.01	94.60
Total . .	550	59.57	22.18	70.63	300	64.62	23.29	87.87

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العوامل المؤثرة فى التغييرات الدورية فى الغطاء الشعرى لنوعين من أنواع الماشية الهولندية

الملخص

شمل البحث دراسة نوعين من الماشية الهولندية هما الفريزيان (الأبيض والأسود) وماشية الموزيل والآيسل الحمراء وكانت معايير القياس هى وزن الشعر الناتج من مساحة معينة من الجلد وهى ١٤×١٤ سم٢ وقياس طول الشعر ثم قطر الشعر ووجود النخاع (Medulla) وقد تبين من البحث أن هناك فروقا طفيفة فى صفات الشعر بين العجلات والأبقار كبيرة السن كما تبين وجود تباين فى هذه الصفات مرجعه اختلاف فصول السنة ففى الخريف والشتاء كان الغطاء الشعرى كثيفا والشعر طويلا ورفيع السمك أما فى الصيف فقد كانت العينات كلها أسمك والنخاع غليظا ونسبتها ١ر٤٦٪ ، ٣ر٨٣٪ ، ١٠٠٪ ، ٧ر٧١٪ فى كل من الشتاء والربيع والصيف والخريف على التوالى فى الفريزيان ، ٨ر٦٥٪ ، ـر٨٦٪ ، ـر١٠٠٪ ، ٥ر٧٧٪ فى الشتاء والربيع والصيف والخريف على التوالى فى ماشية الموزيل والآيسل الحمراء .

هذا وقد تبين أيضا أن هناك تلازما بين وزن الشعر من ناحية وكل من قطر الشعر وطول الشعر ووجود النسيج الوسطى كما يلى على التوالى :

ـ١٧ر ، +٧٢ر ، ـ٢٠ر فى الفريزيان و ـ٢٣ر ، ٧٠ر ، ـ٢٨ر للماشية الحمراء . كما تبين أيضا وجود تلازم بين قطر الشعر من ناحية وطول الشعر ووجود النسيج الوسطى قيمته ـ٣٦ر ، +٥٥ر فى الفريزيان و ـ٥٩ر ، +٨٦ر فى الماشية الحمراء كما كان هناك تلازم بين طول الشعر والنسيج الوسطى قيمته ـ٤٦ر فى الفريزيان +٥٨ر فى الماشية الحمراء .

كما ظهر أن هناك فروقا واضحة بين نوعى الماشية وصفات الغطاء الشعرى كلها فيما عدا وزن الشعر . وقد ظهر أن الشعر الملون فى كل الأحوال كان أقل قطرا وأقصر طولا وأقل سمكا فى النخاع عن الشعر الأبيض فى نفس الحيوان .