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THE IMPORTANCE OF COAT COLOUR AND COAT TYPE AS INDICATORS OF PRODUCTIVE ADAPTABILITY OF BEEF CATTLE IN A SUBTROPICAL ENVIRONMENT

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The effect of coat colour and coat type on the productive adaptability of beef cattle in the subtropics was studied on 3097 Afrikander (Z x Z), Afrikander x European dual - purpose breed (Z x D) and Afrikander x British beef breed (Z x M) and their offspring sired by bulls of European dual-purpose (D) and British beef breeds (M).

Coat colour of cows did not affect either their own body weight or the weaning weight of their offspring. There were highly significant ($P < 0.001$) differences in coat type between breeding groups of cows and between genetic groups of offspring. The highly significant effect of coat type on cow body weight was similar in all three dam breeding groups. Weaning weights of calves were affected by coat type of their dams only when disregarding the effect of the dams weight. Weight gain in young cattle within a given age period was more closely correl - ated with coat type at the end of this period, indicating that coat type was not so much the cause of differences in weight gain, but rather the result of such differences. Thus, coat colour and coat type seem to be unsuitable criteria for selection of beef cattle for improving productive adaptability in a subtropical environment.

Key words: cattle, adaptation, breed comparison, coat characteristics

In environments with high ambient temperatures and intense solar radiation, characteristics like coat pigmentation and coat type may play a vital role in productive adaptability, especially of crossbred cattle having *Bos taurus* genes.

Evidence of the relationship between coat colour and absorption of solar radiation was given by early studies of Riemerschmid and Elder(1945) and Bonsma (1949), showing that absorption rate increases from white-yellow through red to black coat colours. Schleger (1962) came to a similar con - clusion when comparing light-red and dark-red pigmentations in beef cattle exhibiting different heat absorption capacities. These differences were equivalent to about 30% of endogenous heat production. However, there is little information about direct effects of heat absorption on the animals' productive capacity.

Bonsma (1949), Turner and Schleger (1960), Yeates (1965) and Schleger (1967) stressed the importance of coat type for heat absorption and heat loss and, thus, for the adaptability of animals. Cattle with a woolly coat type have been shown to be less adaptable to hot climates.

Since knowledge of breed-specific adaptation characters may be of the utmost importance for proper selection of cattle for specific environments, coat colour and coat type were taken as additional parameters to explain variation in performance within an investigation of the significance of crossbreeding for beef production in the subtropics.

Materials and Methods

Performance data from 3097 beef cows and their offspring were collec - ted over a period of $3_{1/2}$ years on beef cattle ranches in areas with limit-

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ed disease pressure in South Africa.

All cattle were involved in a crossbreeding programme using European dual-purpose breeds (D) and British beef breeds (M), together with the Afrikander and Afrikander x Brahman population (Z). The cows were divided into 3 breed groups: Z x Z; Z x D and Z x M, while the breed structure of the progeny is shown in Table 1. Suckler cows and calves were weighed at

Table 1:

Breed structure of progeny

Mating combination		Breed structure (%)			
Dam	Sire	Z	D	M	n
Z	Z	100	-	-	487
Z	D	50	50	-	945
Z	M	50	-	50	60
ZD	Z	75	25	-	742
ZD	D	25	75	-	98
ZD	M	25	25	50	73
ZM	Z	75	-	25	577
ZM	D	25	50	25	67
ZM	M	25	-	75	48

Z = Afrikander, Afrikander x Brahman
D = Fleckvieh, Braunvieh, South Devon, Pinzgauer, Friesian
M = Hereford, Shorthorn, Sussex

weaning (7 months) and young stock at 12, 15 and 18 months of age. Scoring of coat characteristics took place at each weighing. Coat colour was divided into 8 different colour groups, according to the absorption rates reported by Riemerschmid and Elder (1945). The groups ranged from grey (score 2), yellow-fawn (4), light-red (6), red (8), dark-red (10), brown (12), dark-brown (14) to black (16).

For scoring coat type the description given by Turner and Schleger (1960) was adopted. The groups ranged from extremely short (score 2), very short (4), fairly short (6), fairly long (8), long (10), woolly (12) to very woolly (14). Young stock were additionally appraised for body size and body condition at each weighing.

Body size was appraised according to the animal's height at withers and groups of small-framed (1), medium-framed (2) and large-framed (3) animals were then established. Body condition was appraised according to the scores of very thin (1), thin (2), fleshy (3), very fleshy (4), fat (5), very fat (6).

Calves born during the main calving season in summer (wet season) were weaned in winter (dry season); calves born during the short calving season in winter were weaned in summer.

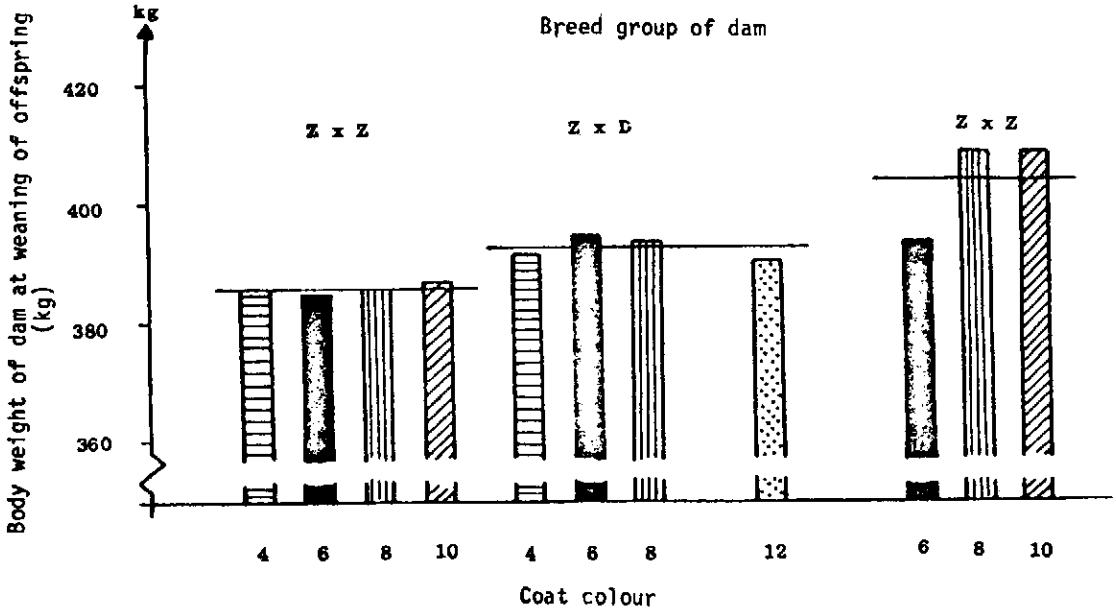
The method used for analyzing these data was the Least-squares analysis as described by Harvey (1968), analysis being made with genetic groups, after adjusting calf weights for age. Influence of coat colour on performance was analysed within genetic groups of suckler cows according to the occurrence of pigmentation pattern.

Results and Disucssion

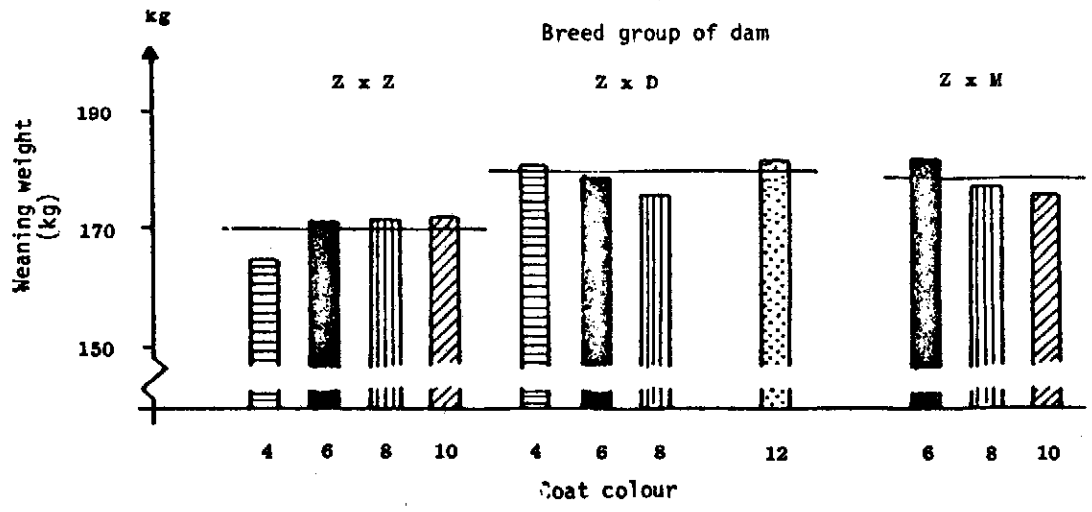
Effect of coat colour: Coat colour of dams had no significant effect ($P > 0.05$) on body weight of cows or on weaning weights of calves, although Z x M cows did tend to have higher weights in the darker coloured pigmentation classes (red to dark-brown), Figure 1.

Figure 1:

a) Effect of coat colour on body weight of dam at weaning of offspring



b) Effect of coat colour of dam on weaning weight of offspring



Hence, with these results, the theoretically expected importance of coat colour for productive adaptability cannot be confirmed under real sub tropical environmental conditions.

Schleger (1962) also reported inconclusive results. Despite the

existing differences in heat absorption between animals, relationships be - tween colour coat and rectal temperature did not exist, but animals with a dark-red hair coat showed better growth performance.

In dairy cows, on the contrary, Schleger (1967) found increasing milk yields with decreasing intensity of red pigmentation of hair caot. However, reasons for these contradictory phenomena are not known.

In environments with intense solar radiation, pigmentation of hair coat per se is likely to be much more important for avoiding skin diseases such as erythemas and skin cancer, than in reducing the intensity of solar radiation.

Type of hair coat. Seasonality: Type of hair coat of dams and calves at weaning was appraised in dry season (winter) and wet season (summer). Coat type and weights of dams and calves also showed coat type as being shorter and body weight greater in the wet season.

Distinct seasonal differences ($P < 0.001$) in coat type do exist in all genetic groups. Similar differences between winter and summer coats were described also by Berman and Volcani (1961) who attributed their reults to changes in thyroid gland activity, due to light and thermal stimuli. Futher, it must be supposed that there is a certain interaction between the animal's nutritive status and the type of coat, since less favourable hair coats (high scores) are linked with lower body weights. This statement is in agreement with the results of Schleger and Turner (1965) and Schleger and Bean (1973) who reported better coat types in better-nourished animals.

Breeding group of suckler cows: Main values of coat type adjusted for systematic effects (environment, season, calving season) are: 6.37 ± 2.06, 7.64 ± 2.02 and 8.16 ± 2.09 for Z x Z, Z x D and Z x M cow breeding groups repectively. Differences of mean values between the three genetic groups are significant at the $P < 0.001$ level. This result is to be expected since zebu cattle tend to have better coats than *Bos taurus* cattle.

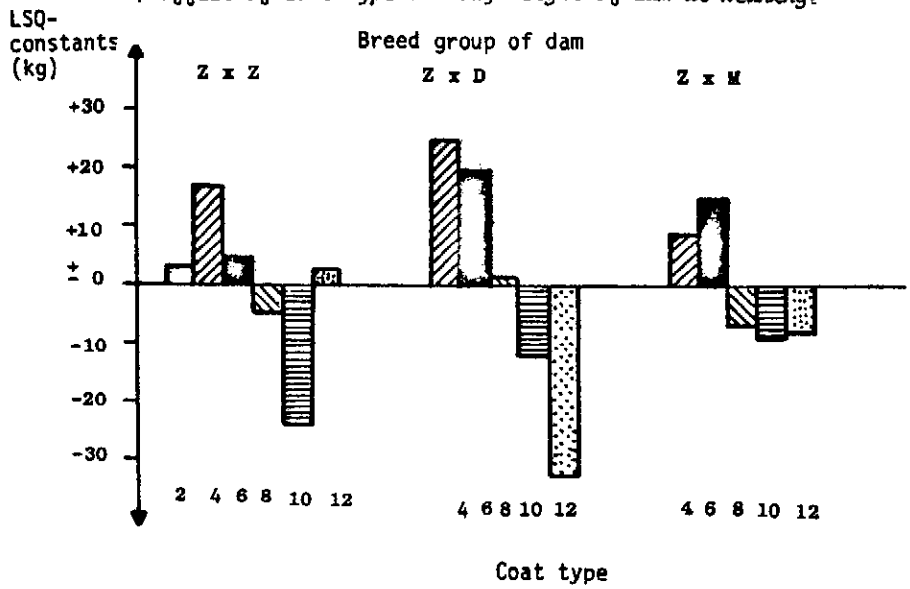
Suckler cow performance: The importance of coat type on performance of cattle during the reproductive phase was studied through measurement of their body weight and the weaning weight of their calves. LSQ estimates calculated for the various coat types after adjusting for systematic environmental effects are shown in Figure 2. The highly significant effect ($P < 0.001$) of coat type on cow weight is presented in Figure 2a. Cows with a long and woolly coat had lower weights than those with short coats. This becomes particularly evident in the Z x D group, while Z x Z and Z x M cows also manifest a highly significant but less marked effect of coat type on weight.

However, since coat type, as a source of variance, accounts for 3.09, 3.68 and 2.41% in the total variance of body weights of Z x Z, Z x D and Z x M cows respectively, this effect seems to be of minor importance in the breeding groups studied.

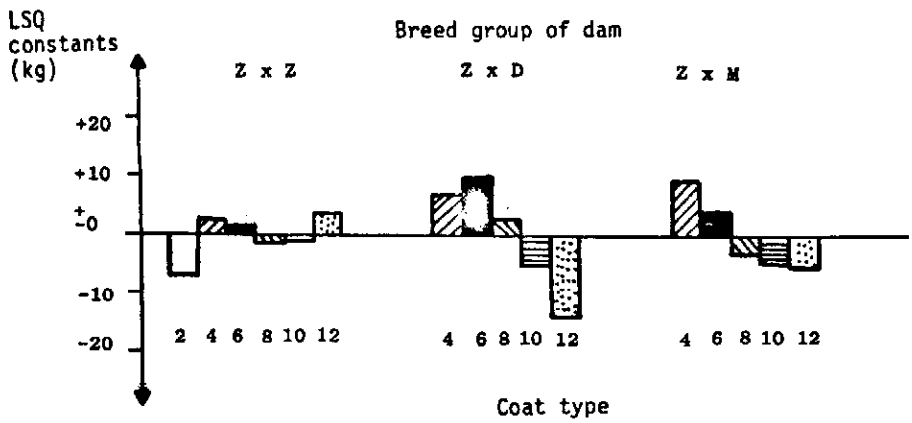
There are also significant effects of coat type of cows on rearing performance (210 day weaning weights) of their calves as shown in Figure 2b. These effects are of major economic importance. In the breeding group of Z x Z cows weaning weight tends to decrease as coat type improves, while while weaning weight increases with improved coat type in Z x D and Z x M cows ($P < 0.001$ and $P < 0.01$ respectively). However, only 0.5% (Z x Z), 4.2% (Z x D) and 1.3% (Z x M) of the total variance in weaning weights are due to coat type of cows. This shows that the direct effect of coat type of dam on

Figure 2:

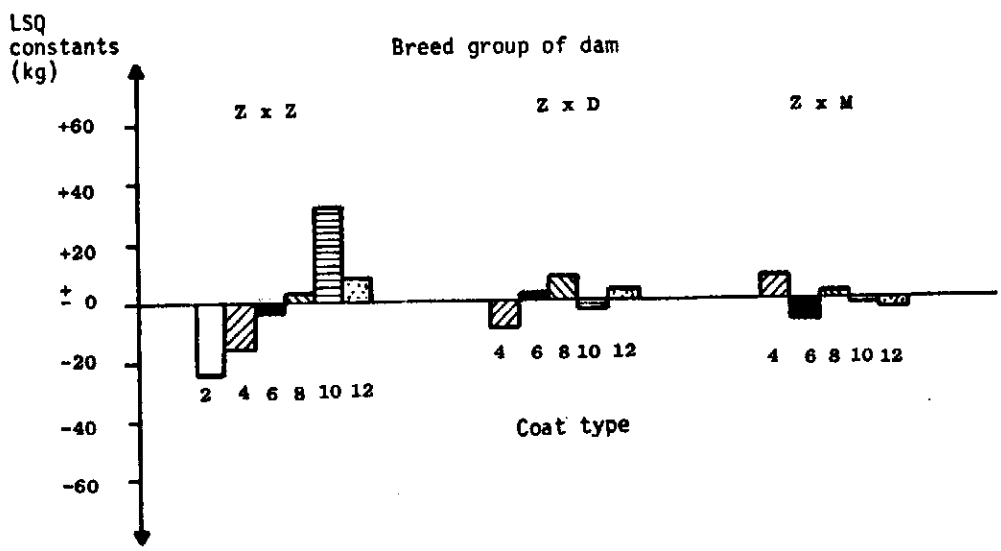
a) Effect of coat type on body weight of dam at weaning



b) Effect of coat type of dam on 210 day weaning weight of offspring



c) Effect of coat type of dams on 210 day weaning weight per unit cow weight



the performance of their calves is less marked than the effect on their own body weight. When considering weaning weight produced per unit of cow weight (Figure 2c) the significant effect of coat type in the Z x D and Z x M cows is eliminated while in the Z x Z cows there is again an unexpected effect of "improved" coat type decreasing performance.

From the above it follows that weaning weights of calves are not so much effected by coat type but rather by body weight of the dams.

Weight gain in young stock: To assess the effect of coat type on growth rate in young stock of different genetic type, their body weight and coat type were recorded at 12, 15 and 18 months of age.

The relationship between type of coat assessed at the various ages and weight gain between weighings were calculated after adjusting for systematic environmental effects and are presented in Table 2.for each genetic group of young stock. All correlations are remarkably low,especially those of older animals. However, in some genetic groups there are significant

Table 2:
Correlation between coat type and weight gain

Breed group		100Z	75Z 25D	50Z 50D	>50D	75Z 25B	≥50B
Number of animals		132	314	386	47	266	74
Between	Coat type at:						
7-12 month	7 months	-.00	$-.12^{+}$	.00	-.10	$-.12^{+}$	-.10
	12 months	-.09	$-.24^{+++}$	-.04	-.27	$-.28^{+++}$	$-.26^{+}$
12-15 months	12 months	.07	-.08°	.01	-.12	.02	$+.33^{++}$
	15 months	.03	-.00°	.01	.06	-.11	.06
15-18 months	15 months	.01	.04°	$.11^{+}$	.13	-.01	.14
	18 months	-.08	-.o2°	.04	.09	.03	.04

correlations between weight gain and coat type during the period after weaning with correlations being closer with coat type at the end of the period rather than coat type at the beginning of the respective growth period.This indicates that coat type reflected the conditions for growth during the preceding period rather than influencing growth rate during the subsequent period. Furthermore, the correlation coefficients reported show that there was no genetic effect on the relation bewteen coat type and weight development although the proportion of *Bos taurus* genes in crossbreds varied from 25% to 75%.

The non-significant ($P > 0.05$) effect of coat type on weight gain in 18 month old animals (adjusted for systematic environment effects)confirmed the results with younger animals (Table 3). On the other hand weight gain was significantly related to body size and condition.

Figure 3 illustrates the highly significant ($P < 0.001$) differences in both coat type and body weight in 18 month old cattle of different genetic types. Although an increase in *Bos taurus* genes is associated with a breed

Table 3:

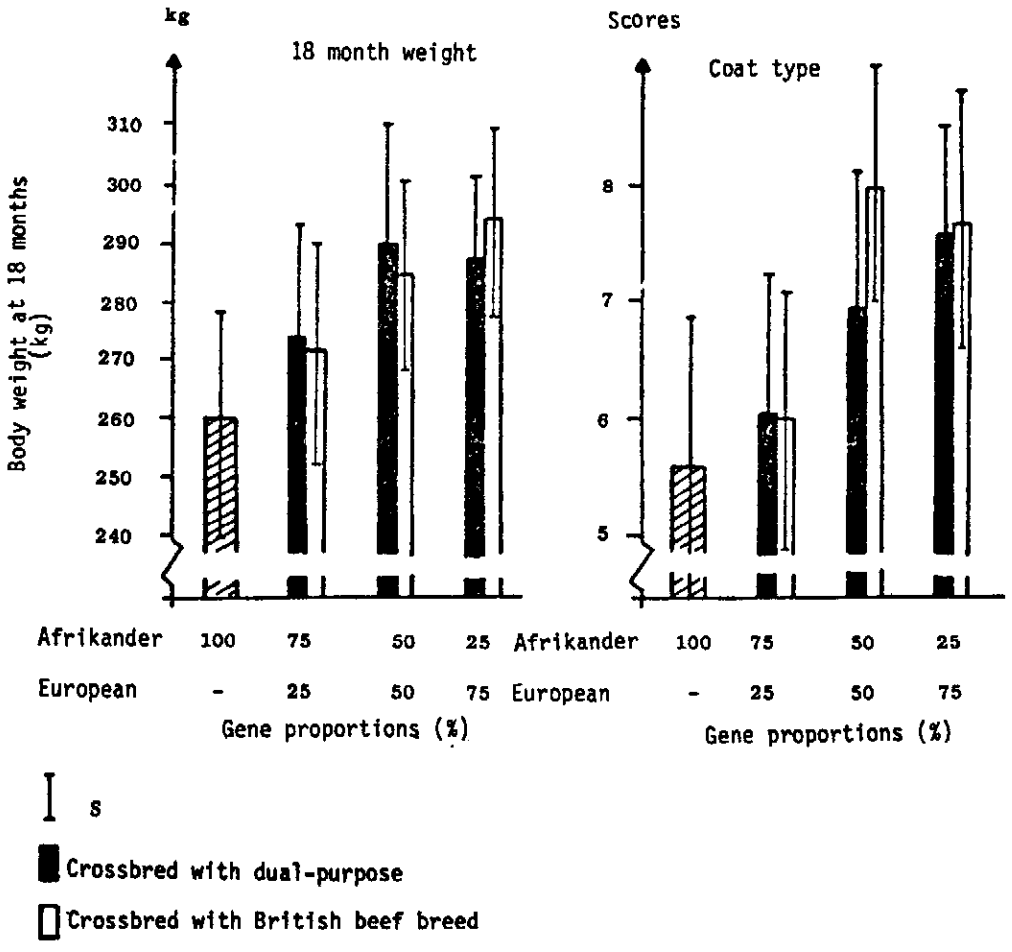
Dependence of 18 month weight (y) on body weight (x_1), condition (x_2) and coat type (x_3)

Breed group	N	18 month weight		
		Body size (X_1)	Condition (X_2)	Coat type (X_3)
100 Z	146	$+.57^{+++}$	$+.35^{+++}$	$-.05^{\circ}$
75 Z 25 D	209	$+.52^{+++}$	$+.45^{+++}$	$-.05^{\circ}$
50 Z 50 D	223	$+.63^{+++}$	$+.20^{+++}$	$-.06^{\circ}$
>50 D >50 M	69	$+.54^{+++}$	$+.58^{+++}$	$+.03^{\circ}$
75 Z 25 M	131	$+.25^{++}$	$+.50^{+++}$	$+.16^{\circ}$

After correcting for systematic effects:

° = P > 0.05; + = P < 0.05; ++ = P < 0.01; +++ = P < 0.001

Figure 3:
Genetic effects on body weight and coat type in young stock



specific change in coat type it must be stated that both actual growth and genetically determined growth capacities increased simultaneously.

Even those genetic groups with higher *Bos taurus* gene proportions did not show that unfavourable coat types had a negative effect on growth rate. This result is in contradiction to the findings of Turner and Schleger (1960), Turner (1964) and Hayman (1965) who found a lower weight gain in *Bos taurus* cattle with an unfavourable coat type. Bianca (1961) and Turner (1962, 1964) deemed coat type to be an indication of the animal's physiological status, especially of its endocrine functions and the efficency of its energy metabolism. The results presented indicated a tendency towards such a relationship only between coat type and performance of suckler cows, while in young stock there was no evidence of pathways related to coat type.

Conclusions

The following conclusions can be drawn:

1. Intensity of coat colour was not significantly correlated either with body weight of suckler cows or with their rearing performance and is not, therefore, a reliable indicator of productive adaptability.

2. Coat type was significantly affected by season; being negatively affected during the dry season (winter) irrespective of the animals' genetic structure. There was an inverse proportional relationship between coat type and body weight, indicating an interaction between the animals' nutritional status and coat type.

3. The various genetic groups of suckler cows showed highly significant ($P < 0.001$) differences in coat type. According to breed-specific coat characteristics most favourable coat types are found in Z x Z and most unfavourable in Z x M cows.

4. Coat type of cows was more closely correlated with their own body weight than with the rearing performance (in terms of the 210 day weights) of their calves. There were no significant correlations between the calf weight produced per unit cow weight and the coat type of dam. Thus, rearing performance is not so much determined by type of coat but rather by body weight of cows.

5. To appraise the relationship between coat type and post-weaning growth performance of young stock, several criteria were measured at 12, 15 and 18 months of age. It appeared that all genetic groups showed only low correlations between weight gain within age period and coat type at the beginning and end of each period. However, there were somewhat closer correlations between weight gain and coat type at the end of the period. This indicates that coat type was not so much the cause of weight performance but rather its result.

6. Increasing the proportion of *Bos taurus* genes in young stock resulted in a breed-specific change of coat type, but had no negative effect on growth performance. However, in situations of heavier hide infestation a rough coat might well be of a disadvantage.

7. While coat characteristics seem to be of limited value in selection of beef cattle to improve thermal adaptation, coat type can play a role in a-

voiding ecto parasitic infestations. The selection criteria to improve performance, however, will not be the coat type per se but rather the animals productive adaptability expressed as weight gain per reproductive unit.

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