

**RELATION BETWEEN EXTERIOR CONFORMATION AND
PRODUCTION TRAITS IN FIRST CALVERS OF THE BLACK
AND WHITE CATTLE****J. Bouška, F. Urban, M. Štípková****Summary**

The utilization of secondary traits for more precise definition of the selection of farm animals participates increasingly in the selection progress in the population. Efficiency of the selection methods depends not only on their theoretical effectiveness but to a large extent also on the way of their implementation in practice. That is why the linear description and exterior evaluation became integral part of breeding bulls progeny testing in this country. It is logical that production traits are the main criteria for the selection of cows. In spite of it the other traits, to which the exterior conformation belongs, can not be omitted. A high performance of dairy cows is a basis for the efficient herd, and a good exterior conformation augments this trait considerably as it is a basis for a further repetition of high yields in subsequent lactations. It is true especially of the cattle population reconstruction which occurs in this country and when objective selection criteria for economically efficient processes in herds and populations are looked for.

- The results of analyses confirmed a possibility to utilize the results of linear description and exterior evaluation to define selection more precisely, especially at the reconstruction of our cattle population.
- From the view - point of selection, the concentration on size (stature), angularity and udder traits appeared as the most effective.
- The utilization of the resulting characteristics of exterior evaluation which included the results of linear description of individual traits proved to be more advantageous for proper selection.
- From all resulting characteristics, dairy character, body capacity and cow udder conformation proved to be the most important traits for the efficiency of the herd.

Rad je priopćen na "48th Annual Meeting of the European Association for Animal Production", Vienna, 1997.

J. Bouška, F. Urban, M. Štípková, Research Institute of Animal Production, Prague -10, Uhřetěves, 10400, Czech Republic

Introduction

The utilization of secondary traits for more precise definition of the selection of farm animals participates increasingly in the selection progress in the population. Efficiency of the selection methods depends not only on their theoretical effectiveness but to a large extent also on the way of their implementation in practice. That is why the linear description and exterior evaluation became integral part of breeding bulls progeny testing in this country. It is logical that production traits are the main criteria for the selection of cows. In spite of it the other traits, to which the exterior conformation belongs, can not be omitted. A high performance of dairy cows is a basis for the the efficient herd, and a good exterior conformation augments this trait considerably as it is a basis for a further repetition of high yields in subsequent lactations. It is true especially of the cattle population reconstruction which occurs in this country and when objective selection criteria for economically efficient processes in herds and populations are looked for.

Material and methods

The aim of the work was to estimate the basic genetic parameters for individual exterior traits. At the same time, the relation between exterior traits of first calvers and their production qualities was found out. The linear description and exterior evaluation of cows were carried out in accordance with methods issuing out of recommendations of the International working team for the harmonization of exterior evaluation in Black and White cattle. Data of 2835 evaluated first calvers - daughters of 105 young breeding bulls in test were included in the evaluation.

Following model was determined for results processing:

$$y_{ijk} = \mu + A_i + B_j + C_k + \beta(x - \bar{x}) + e_{ijkl}$$

where μ = mean value
 A_i = herd effect and effect of calving season
 B_j = effect of sire's group
 C_k = effect of dam's group
 $\beta(x - \bar{x})$ = regression on age at the first calving
 e_{ijkl} = residual error

Results

The results of estimations of heritability coefficients (h^2) for the traits of exterior linear description are given in Table 1. The highest heritability was estimated for size (stature) ($h^2 = 0.48$) and chest width ($h^2 = 0.33$). Coefficients of heritability for angularity, body depth and rump width were estimated at the level of $h^2 = 0.27$. In the other traits described, the coefficients of heritability fluctuated within the range from 0.07 to 0.16. The lowest heritability was found in claws conformation.

Table 1. - ESTIMATED COEFFICIENTS OF HERITABILITY FOR THE TRAITS OF EXTERIOR LINEAR DESCRIPTION

Indicator	h^2	s_h^2
Angularity	0.27	0.05
Size	0.48	0.08
Chest width	0.33	0.06
Body depth	0.27	0.05
Rump angle	0.17	0.04
Rump width	0.27	0.05
Rear leg set	0.19	0.04
Foot (claw) conformation	0.07	0.03
Fore udder attachment	0.22	0.05
Rear udder attachment	0.15	0.04
Suspensory ligament	0.13	0.04
Udder depth	0.10	0.03
Teat placement	0.20	0.05
Teat lenght	0.16	0.04

Table 2. - ESTIMATED COEFFICIENTS OF HERITABILITY FOR THE CHARACTERISTICS OF EXTERIOR EVALUATION

Indicator	h^2	s_h^2
Dairy character	0.20	0.05
Capacity	0.40	0.07
Rump	0.26	0.05
Extremities (feet plus legs)	0.13	0.04
Udder	0.25	0.05

Among the characteristics of exterior evaluation in first calvers (Table 2), the highest heritability coefficients were estimated for body capacity ($h^2 = 0.40$), rump conformation ($h^2 = 0.26$) and udder conformation ($h^2 = 0.25$).

Table 2A. - ESTIMATED COEFFICIENTS OF HERITABILITY FOR PRODUCTION TRAIT

Production per 305 days of lactation	h^2	s_h^2
Milk kg	0.29	0.06
Fat kg	0.23	0.05
Protein kg	0.30	0.06

For a productive selection of breeding cows for functional type it is necessary to know mutual relations between the exterior indicators and production traits of cows. Estimated genetic correlations r_g between exterior traits and production of first calvers are given in Table 3. The highest positive genetic correlations between milk production in kg and exterior traits were estimated for:

- rear udder attachment $-r_g = 0.52$
- angularity $-r_g = 0.44$
- suspensory ligament $-r_g = 0.44$
- size (stature) $-r_g = 0.33$
- body depth $-r_g = 0.29$

Table 3. - GENETIC CORRELATIONS R_g BETWEEN THE TRAITS OF EXTERIOR LINEAR DESCRIPTION AND YIELDS PER 305 DAYS OF THE 1st LACTATION

Trait	Production in the 1 st lactation					
	Milk (kg)		Fat (kg)		Protein (kg)	
	r_g	s_{rg}	r_g	s_{rg}	r_g	s_{rg}
Angularity	0.44	0.13	0.42	0.14	0.35	0.14
Size (stature)	0.33	0.13	0.36	0.13	0.34	0.12
Chest width	0.22	0.14	0.20	0.15	0.22	0.14
Body depth	0.29	0.14	0.32	0.14	0.26	0.14
Rump angle	0.08	0.17	-0.09	0.17	0.05	0.17
Rump width	-0.12	0.15	-0.05	0.16	-0.07	0.15
Rear leg set	-0.29	0.16	-0.13	0.17	-0.21	0.16
Foot (claw) conformation	0.06	0.22	-0.10	0.23	0.06	0.22
Fore udder attachment	0.17	0.15	0.20	0.16	0.15	0.15
Rear udder attachment	0.52	0.14	0.51	0.15	0.45	0.15
Suspensory ligament	0.44	0.16	0.34	0.17	0.33	0.16
Udder depth	-0.35	0.20	-0.23	0.21	-0.35	0.20
Teat placement	0.06	0.16	0.01	0.17	0.06	0.16
Teat length	0.12	0.17	0.07	0.18	0.11	0.17

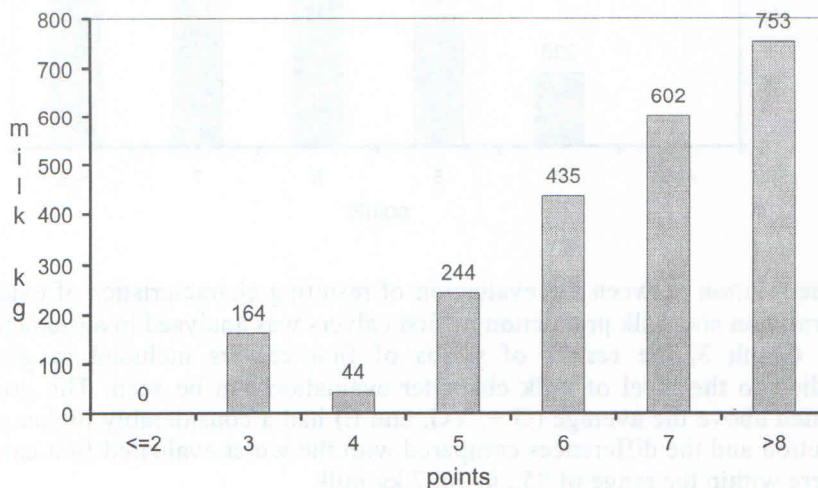
The most important negative correlation was estimated between udder depth and milk and protein production (in kg) ($r_g = -0.35$). Following values of genetic correlations were estimated for resulting characteristics of exterior evaluation (Table 4):

- dairy character - $r_g = 0.44$ for milk production
 $r_g = 0.41$ for protein production
- body capacity - $r_g = 0.19$ for milk production
 $r_g = 0.21$ for protein production
- udder conformation - $r_g = 0.40$ for milk production
 $r_g = 0.38$ for protein production

Table 4. - GENETIC CORRELATIONS R_g BETWEEN THE CHARACTERISTICS OF EVALUATION AND YIELDS PER 305 DAYS OF THE L¹ LACTATION

Characteristic	Production in the 1 st lactation					
	Milk (kg)		Fat (kg)		Protein (kg)	
	r_g	S_{rg}	r_g	S_{rg}	r_g	S_{rg}
Dairy character	0.44	0.13	0.58	0.13	0.41	0.14
Capacity	0.19	0.14	0.29	0.14	0.21	0.13
Rump	-0.07	0.15	0.08	0.16	0.01	0.15
Exteremities (feet and legs)	0.27	0.17	0.25	0.18	0.27	0.17
Udder	0.40	0.13	0.47	0.13	0.38	0.13

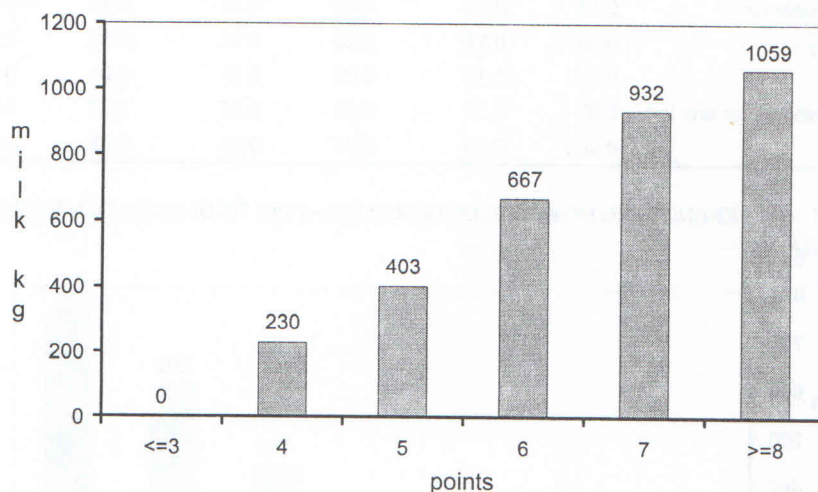
Graph 1. - DIFFERENCIES IN MILK PRODUCTION IN RELATION TO DESCRIPTION RESULTS - ANGULARITY -



A detailed observation of production traits of first calvers' groups classified concordantly in selected exterior traits was a part of relation determination between production and exterior conformation in first calvers. Differences in kg milk production as related to angularity conformation are given in Graph 1. The first calvers' group evaluated with 8 and, more points for this trait showed 753 kg higher production in comparison with the worst evaluated group. Also the other groups of first calvers evaluated on the above-average reached a production higher by 435 and 602 kg milk, respectively.

The similar trend was found in size (stature), body depth and rear attachment of udder. The difference in yields between the groups of first calvers evaluated concordantly for rear udder attachment are given in Graph 2. A difference in milk production of 1069 kg was found between the best and worst evaluated groups for this trait. The growth of production between groups shows an almost linear course and makes approximately 200 kg milk.

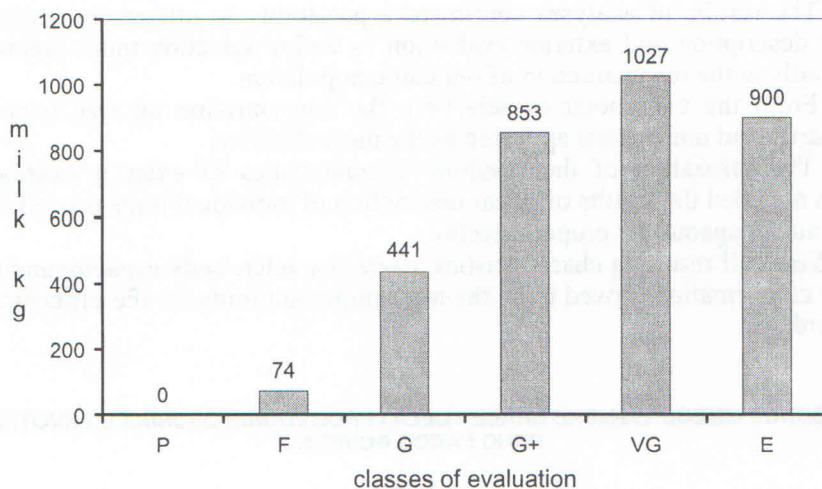
Graph 2. - DIFFERENCIES IN MILK PRODUCTION IN RELATION TO DESCRIPTION RESULTS - REAR UDDER ATTACHMENT -



The relation between the evaluation of resulting characteristics of exterior conformation and milk production of first calvers was analysed in agreement.

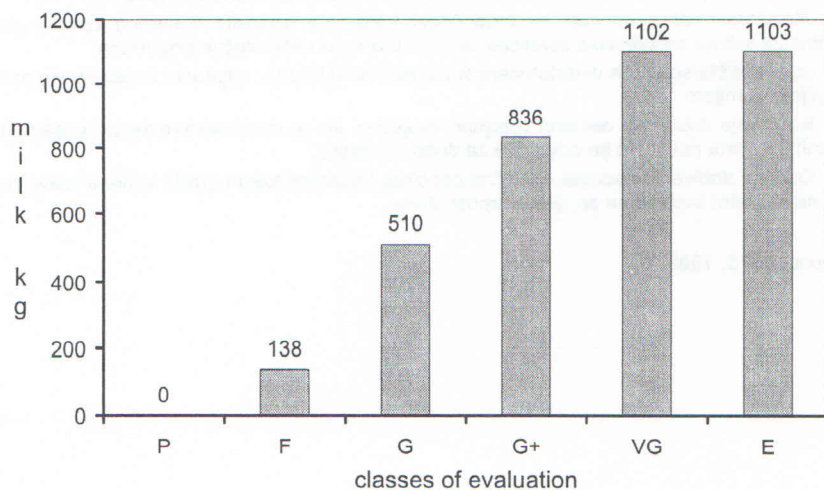
In Graph 3, the results of yields of first calvers included in groups according to the level of milk character evaluation can be seen. The groups evaluated above the average (G +, VG, and E) had a considerably higher milk production and the differences compared with the worst evaluated first calvers (P) were within the range of 853 to 1027 kg milk.

Graph 3. - DIFFERENCIES IN MILK PRODUCTION IN RELATION TO DAIRY CHARACTER EVALUATION



A substantially similar trend was found in groups of first calvers with the same marks for udder conformation (Graph 4). First calvers evaluated with marks VG and E for udder conformation produced on the average approximately 1100 kg milk more than the group of dairy cows evaluated with mark P.

Graph 4. - DIFFERENCIES IN MILK PRODUCTION AS RELATED TO THE EVALUATION OF UDDER CONFORMATION



Conclusion

- The results of analyses confirmed a possibility to utilize the results of linear description and exterior evaluation to define selection more precisely, especially at the reconstruction of our cattle population.
- From the view-point of selection, the concentration on size (stature), angularity and udder traits appeared as the most effective.
- The utilization of the resulting characteristics of exterior evaluation which included the results of linear description of individual traits proved to be more advantageous for proper selection.
- From all resulting characteristics, dairy character, body capacity and cow udder conformation proved to be the most important traits for the efficiency of the herd.

ODNOS IZMEĐU VANJSKE GRAĐE TIJELA I PROIZVODNIH OSOBINA U PRVOTELKI CRNO ŠAROG GOVEDA

Sažetak

Upotreba sekundarnih osobina za točnije određivanje selekcije domaćih životinja sve više sudjeluje u selekcijskom radu u populaciji. Djelotvornost postupaka u selekciji ovisi ne samo o njihovoj teoretskoj uspješnosti već u velikoj mjeri i o načinu primjene u praksi. Zbog toga su linearni opisi i procjene vanjske građe tijela postali sastavni dio progenog testiranja rasplodnih bikova u ovoj zemlji (Češkoj). Logično je da su proizvodne osobine glavni kriteriji za selekciju krava. Usprkos tomu druge osobine, koje uključuju vanjsku građu tijela ne mogu se zaobići. Visoka performanca mliječnih krava osnova je za uspješno stado, a dobra vanjska građa tijela znatno povećava ovu osobinu, jer je to temelj za ponavljanje visokog prinosa u sljedećim laktacijama. To osobito vrijedi za obnovu stočne populacije u ovoj zemlji te kad se traže kriteriji objektivne selekcije za ekonomski djelotvorne procese u stadima i populacijama.

- Rezultati analiza potvrdili su mogućnost korištenja rezultata linearnog opisa i procjene vanjšine za točnije određivanje selekcije, osobito u obnovi naše stočne populacije.

- Sa stajališta selekcije usredotočenost na veličinu (staturu), uglatost i značajke vimena činila se najdjelotvornijom.

- Korištenje dobivenih osobina procjene vanjšine, što je obuhvatilo rezultate linearnog opisa pojedinih osobina pokazalo se povoljnije za dobru selekciju.

- Od svih dobivenih osobina, mliječne osobine, kapacitet tijela i građa vimena krave pokazali su se najvažnijim svojstvima za djelotvornost stada.

Primljeno: 15. 5. 1998.