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THE RELATIONSHIP BETWEEN THE BODY CONFORMATION TO LONGEVITY IN THE SLOVAK SPOTTED COWS[1]

P. Strapák, P. Juhás, V. Čanji[2]

Abstract: The aim of paper was to investigate the relation of the body traits to the length of productive life in the Slovak Spotted cattle in Slovakia. Analysis of the level of the longevity was done in group of 118 646 milking cows of the Slovak Spotted breed. The average length of productive life was 1451 days (3.88 years). The linear model of estimation of the influence of type traits to length of productive life was calculated from 3 298 records of cows. The high statistic significance was found for body frame (F-test = 81.48 +++), feet and legs (F-test = 4.18 +++) and udder (F-test = 6.38 +++). Results confirm importance of longevity valuation in selection programs, together other traits.

Introduction

The important role in the dairy breeding improving play not only production and reproduction traits but the time during which the cows provide the adequate profit, which is matching the longevity *(Řehout, 1991)*. The economic value of the dairy is in most size given by its milk yield and longevity. With increasing longevity is increasing lifetime yield and total income *(Strandberg, 1992)*.

In the literature sources is the longevity is evaluated by wide scale of pointers. Most common are number of calving, number of lactations, lifetime, productive life time, average age of herd etc.

The various methods of longevity evaluation shows *Vollema (1998)* too, which observe and compare miscellaneous ways of longevity evaluation in particular breeding countries: lifetime – period between birth and culling, production lifetime – period between first calving and culling, total milk production – lifetime milk yield, number of days of lactation, number of lactations.

The length of productive life in animals is in sound meanings expressed as raw production time, so period from first calving to culling of cow from herd. Intro production life we discriminate the "real production lifetime", (independent on production). In case of correction to milk yield in cow, we gain so-called "functional production lifetime, by which is declared the cow's ability to delay imperative culling because of illness or sterility.

Short and Lawrol (1992) present the direct selection to longevity is impractical because of low heritability jointed with relatively long generational interval. The low efficiency of direct selection to longevity mentioned *Van Doormaal, Burniside and Schaeffer (1986)* too. Therefore the new ways of breeding and optimal traits of longevity in cattle are still researched.

One of possibilities of longevity estimation is applications of correlated traits, which shows the ability from young age and which are related to its survival. There is conformation traits involved in it: body, legs and udder composite *(Dědková a Kučera, 2002).*

The next possibility is using the high phenotype and genetic correlations between milk yield at first lactation and longevity traits. Several authors suggest the phenotype correlation from 0.2 to 0.4 and genetic correlation from 0.2 to 0.6 *(Dejong, Van Vleck, 1999, Vollema, 1998)*.

Egger-Danner (2005) found out that production lifetime decrease in cows of particular breeds in Austria, except The Tyrol Grey breed. The Spotted breed reach the level 3.56 year of age in 2004 year, the Holstein breed reach the 3.21 year of age and Pinzgau reach 3.53 year of age. The author suggest the more strict selection at farms as reason for this tendency, because the genetic trends are production lifetime are relatively fixed.

Páchová and Ďedková (2003) have rated effect of internal and external factors to longevity at sample 1546 cows of the Holstein breed. He culling was the most affected by number and state of lactation. The highest risk of culling was recorded at first lactation and decrease with increasing number of lactation. The next important trait was milk yield; the higher milk yield means lower risk of culling. The sire and kin effect

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2 doc. Ing.Peter Strapák, PhD., Slovak Agricultural University in Nitra, Department of Animal Husbanry, Nitra, Slovak Republic

was considerable, but the suitable number of daughters with scored longevity is necessary. Other factors have not sensible effect to longevity.

The considerable effect of farm confirms Suchánek and Beber (1992), Suchánek a Strnadela (1987). The considerable differences between herds are mentioned by Pšenica and Kadlečík (1991) and Kostrej (1990).

Hansen et al. (1999) have recorded effect of the body size to production lifetime in the Holstein breed. The group of dairy cattle with smaller body reached higher production lifetime then group of the dairy cattle with larger body at regarded levels 72 moths and 84 months of age.

Zednikova et al. (2002) observed relationship between longevity and exterior in the Czech Spotted Cattle. The lowest age at disposal reached dams with values from 1 to 4 points in traits as body and udder conformation and with increasing point levels was increasing age at culling too. The length of teats and body capacity has opposite tendency.

Putz (1995) analyzed longevity relation to exterior traits in the Spotted Cattle in Bavaria and found out the cows with defects in legs conformation–heel joint, expression of heel joint, fetlock and claws reach worse results not only in milk yield, but production lifetime too. Boettcher et al. (1997) mentioned next genetic correlation among effective longevity and current recorded traits of legs, claws balance r=0.85, high of claw r=0.44, rear legs r=0.67, legs angle r=0.41, bone quality r=0.45.

Liu, Jairath and Dekker (2003) analyzed 896529 records about first lactations and first classification of type in the Holstein cows borne from 1977 to 1991 year. The high genetic correlation found out between functional longevity and total score r = 0.59, body frame r = 0.20, rump r = 0.19, legs r = 0.23, fore udder quarter r = 0.56, rear udder quarter r = 0.49, udder r = 0.57 and milk type r = 0.06.

Cassandro et al. 1999) found out positive genetic correlations between functional longevity and udder depth r_g = 0.43, rear sight of teats r_g = 0.21, fore udder attachment r_g = 0.15. Negative correlation were found out between exterior traits for teats length r_g = -0.42, rear legs set r_g = -0.29 and body stature r_g = -0.13. Aumann (1999) underlined that the additional traits which affect production lifetime are body conformation traits recorded during type classification, mainly legs and udder conformation.

Boldman et al. (1992) present the highest positive correlation to udder traits (udder attachment r=0.47, udder depth r=0.38) among recorded traits. Similar results mention Burke and Funk (1993), which suggest udder conformation as most important feature affected longevity, especially fore udder attachment and udder depth. Therewithal found out the cows with sound rear legs set and cows with steep foot angle reach longer production lifetime under all housing conditions. The same conclusions suggest Dekker, Jairath and Distl (2002) and Boettcher et al. (1997). Hamann and Distl (2002) mentioned that legs conformation has considerable relationship to functional longevity (r ranged from 0.62 to 0.69).

Strapák (2000) presents correlations of particular udder traits and effective production lifetime from r=0.1 (udder smartness, evaluated by nonlinear method) to r=0.19 (suspensory ligament and teats conformation).The positive correlations remain after correction to milk yield in traits suspensory ligament, teats placement and teats conformation.

Vukašinovič, Moll a Künzi (1994) have calculated in the Brown Swiss breed the highest genetic correlations between longevity and udder and teats evaluation (r from 0.38 to 0.66), low to medium values for rear legs set (r=0.35), claw (r=0.25), fetlock (r=0.21), body length (r=0.39) and body depth (r=0.42).

Materials and methods

The aim of paper was to verify methodics of procedure of length of productive life evaluation in the Slovak Spotted cattle population. In addition, paper was focused to testing of effects affected length of productive life and analysis relations between conformation traits and length of productive life.

The starting point for analysis of length of productive life duration was records of 118646 cows discarded from database of State breeding institute of Slovak Republic and Slovak Spotted Cattle Herd Book from 1997 to 2003 year.

The length of productive life is period from the first calving to culling from the herd. We have calculated duration of the length of productive life in days for each dairy cow in the database of culled cows and the average of the length of productive life of whole the group.

From the literature sources and own hypothesis we have picked up effects, which can considerable affect the length of productive life – farm, breeding group (S_0, S_1, S_2), sire, year of culling and age at first calving.

The effect impact to production lifetime we have calculated by simple linear model

$Y_{ijklm} = \mu + Po_i + Pl_j + O_k + Rv_l + Vo_m + e_{ijklm}$

Y_{ijklm} – length of productive life
μ - mean
Po_i – effect of i – farm
Pl_j – effect of j –breeding group
O_k – effect of k – Sire
Rv_l - effect of l- year of culling
Vo_m – effect of m – age at first calving
e_{ijklm} – residual error

Since 1.10.1997 the "System 97"– Integrated European system for type classification in the Simmental cattle is used for type classification in Slovakia.

The relations between conformation traits and length of productive life we have evaluated in group of 3298 cows, for which we obtain official records of type classification. The precise estimation of interaction between effects was done by linear models. We have testing impact of main and partial traits and groups of traits of conformation to length of productive life.

Results and discussion

The length of productive life describe net production period in days, so time period from first calving to culling from herd.

The level of reached real length of productive life in population of 118646 cows of the Slovak Spotted cattle. The average length of productive life was 1451 days (3.88 years), what under condition of suitable reproduction, represent average usage at level 3.4 – 3.6 lactations in dairy cows. The considerable lower levels (for 376 days of production lifetime and 3.1 of average number of lactations) of production lifetime found out *Řehout (1991*) in population of the Czech Spotted cattle.

The precise estimation of impact of particular traits to length of productive life was done by simple linear model. The analysis shows the all factors considerable affect the production lifetime. The degree of affect was various (see Tab.1.). The most important effect was the year of culling (F=9539.6) and the breeding group (F=1403.9). Importance of the year of culling (year of birth too) may be caused by general increasing intensification of milk production and milk efficiency, increasing intensity of turnout of the herd, decreasing care for dairy cow, but increasing load to organism of cow connected to increasing milk yield too.

The production lifetime is considerable affected by the farm and the farm management (F=6.81) and the Sire, father of cow, which confirm justness of the selection to longevity otherwise exploitation the breeding values of the production lifetime in the selection indexes in the cattle.

Recognized results of the effects testing should be appropriate used for the breeding values estimation or for the genetic evaluation of traits of longevity in Slovakia.

The results of *Páchová and Dědková (2003*) which found out considerable effect of the Sire and the age at first calving confirm calculated effects of researched factors. They regard also next factors affected length of productive life – number of lactation, state of lactation, service period duration, family, milk yield at first lactation and year of birth. The importance of farm effect confirm *Suchánek and Beber (1992), Suchánek and Strnadel (1987)*. The considerable differences between herds are mentioned by *Pšenica and Kadlečík (1991) and Kostrej (1990)* too.

Relation between length of productive life and conformation traits

One form point of view indirect selection is application of the correlated traits, which shows the ability from young age and which is related to its survival in the herd. From group of main and partial traits are regarded mainly the body conformation traits, the legs and the udder conformation.

Table 1. The testing of factors effect to length of productive life

Effect	F - Value	Significance P
Farm	56.81	0.0001
Breeding group	1 403.98	0.0001
Sire	52.86	0.0001
Year of culling	9 593.60	0.0001
Age at first calving	4.08	0.0001

Table 2. The effect of main and partial traits of type classification to length of productive life in cows

Partial traits	F – test	Significance P
Body frame	81.48	0.0001
Croup height	4.92	0.0001
Rump width	40.35	0.0001
Rump length	3.62	0.0001
Body depth	6.95	0.0001
Body lenght	4.59	0.0001
Chest circumference	1.28	0.0601
Legs	4.18	0.0001
Rear legs set	5.73	0.0001
Heel joint expression	0.47	0.8979
Fetlock	8.95	0.0001
Foot	0.98	0.4460
Udder	6.38	0.0001
Fore udder	4.96	0.0001
Rear udder	32.72	0.0001
Rear udder attachment	11.84	0.0001
Suspensory ligament	4.19	0.0001
Udder depth	55.68	0.0001
Teats lenght	8.45	0.0001
Teats thickness	2.57	0.0121
Teats set	2.55	0.0064

The analysis in the investigated group (3298 cows) shows considerable effect of main trait the body frame (F=81.48) to production lifetime (see Tab. 2.). Several authors mentioned that higher production lifetime in cows of the Simmental breed reach cows with the average or smaller body size. Such results are confirmed mainly in Germany and Austria, which are different from population of the Slovak Spotted cattle population. Apart from above mentioned we have evaluated cows culled from 1997 to 2003 year and during this period the body size increased for 3–5 cm in the Slovak Spotted cattle population, which can considerable affect results of valuation.

Considerable effect to the production lifetime was recorded in the legs conformation (F=4.18) and the udder (F=6.38).

For detailed review we have testing the level of effect in the particular traits of the type classification to the production lifetime (see Tab.2.).

From the measures characterizing relation to the body size as well as depth, width and length of body the most importance was recorded for the rump width (F=40.35), the body depth (F=6.95) and the croup height and the body length at similar level. Abovementioned suggest that wider, more depth, and longer cows with adequate high body reach higher production lifetime. In accordance with our results *Liu Jairath and Dekker (2003) and Cassandro et al. (1999)* suggest the positive relation of body size or high of body to the

longevity too. On the other hand, unalterable negative relations between the body size and the production lifetime found out Hansen et al. (1999).

The analysis of relation of partial traits of legs to length of productive life (see Tab. 2.) shows the most important effect of fetlock conformation (F=8.95), rear legs set (F = 5.73) and total point score of legs (F=4.18). We can state that the cows with sound conformation of the rear legs and the fetlock reach higher production lifetime. Results of our paper confirms conclusions of more national and foreign authors which found out unalterable positive relation between the legs conformation and the longevity regardless of the breed (*Novotný, 1994, Van Doormaal (1986, Short and Lawlor, 1992, Boettcher et al., 1999, Hamann and Distl, 2002, Strapák, 2000 etc*.).

The analysis of partial traits of the udder shows the most important effect to length of productive life has the udder depth (F=55.68), rear udder conformation (F=32.72) and rear udder height (F=11.84). The suspensory ligament manifestation relatively considerable affect production lifetime too. Similar findings present Vinson and *Honnete, (1980), Burke and Funk, (1993), Boettcher et al., (1997), Short and Lawlor, (1992), Boldman et al., (1992), de Jong et al. (1999), especially for simmentalized breeds in Europe Aumann, (1999), Strapák, (2000), Zedníková et al. (2002) etc.*

Rom evaluated traits we calculate the most important and considerable effect to longevity for the teats length (F=8.45). Positive effect of the teats conformation to the production lifetime confirms *Vukašinovič, Moll and Kunzi (1994), Rogerd et al. (1998)* and others too. Our results shows the dairy cows with less shallow, well attached udder, wide and long rear udder and mean teats length reach higher production lifetime in herds.

ODNOS IZMEĐU KONFORMACIJE TELA I DUGOVEČNOSTI KOD KRAVA SLOVAČKE ŠARENE RASE

P. Strapák, P. Juhás, V. Čanji

Rezime

Cilj ovog rada je bio ispitivanje odnosa između telesnih osobina I dužine trajanja proizvodnog života kod slovačkog šarenog govečeta u Slovačkoj. Analiza nivoa dugovečnosti je urađena na grupi od 118 646 mlečnih krava ove rase. Prosečna dužina produktivnog života je bila 1451 dana (3.88 godina). Linearni model ocene uticaja tipa osobina na trajanje produktivnog života krava je izračunat na bazi podataka za 3 298 krava. Visoka statistička sigkifikantnost je utvrđena za okvir/ram tela (F-test = 81.48 +++), noge (F-test = 4.18 +++) I vime (F-test = 6.38 +++). Resultati potvrđuju značajnost ocene dugovečnosti u programima selekcije, zajedno sa drugim osobinama.

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