Evaluation of Relationship between Traits of Milk Production and Reproduction Traits in Dairy Cows of the Slovak spotted breed

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Abstract
The aim this work was to evaluate relationships between traits of milk production and reproduction traits in breeding herds of Slovak spotted breed in the period 1992-2010 the results for 10 514 Slovak cows. The basic statistic analysis were analysed using the SAS version 9.1. In the first lactation of dairy cows produced 4 685.18 kg of milk, 193.82 kg of fat and 156.51 kg of proteins. Correlation between evaluated traits of milk production and age at first calving were lower negative and statistically high significant (P<0.0001), scilicet between kgs of milk age at first calving = - 0.06731and correlation between milk in kg with calving interval 1 (r= - 0.06945) and with calving interval 2 (r= - 0.04554) were statistically high significant (P<0.0001). The analyses by the effect on age of first calving was the highest effect of HYS R^2= 0.4478 and on calving interval was the highest effect of HYS R^2= 0.1526.

Key words: Slovak spotted breed, dairy cows, traits of milk production, reproduction traits, correlation

1. Introduction

Increasing demands for higher efficiency are the basic condition for the improvement of economic effectiveness of cattle breeding. An assumption to achieve this aim is a healthy animal, able to repeatedly achieve a high level and quality of production, while also achieving good reproduction results [1].
Milk production and reproduction are major factors affecting on efficiency and profitability of dairy industry. In most countries breeding programs were mainly oriented toward yield traits. Selection for higher yields of dairy cattle has led to a decline in fertility due to unfavorable genetic correlations between yield and fertility [2-4].
Riecka, Candrák [5] shows in their study relationship between production and reproduction performance in the Holstein cattle population in Slovak republic on 1st lactation during period 2003-2009. Cow with higher milk production had significantly prolonged calving interval. The results suggest that including breeding values for production instead of phenotypic value for milk production in fertility evaluation is more sustainable for a better and more accurately illustration of relationship between traits.
The analysis of productive and reproductive traits in a population of dairy cows of Slovak spotted breed introduces Bujko et al. [6-8] and Kadlecik et al. [9]. Gabor et al. [10, 11] shows in their results

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evaluation of diversity in a population of Slovak spotted breed.
The aim of this study was to evaluate relationships between production and reproduction traits in breeding herds of Slovak spotted breed.

2. Materials and methods

The material for evaluation traits in selected breeding herds of Slovak spotted breed between 1992 and 2010 were received from of Breeding Service of Slovak republic for period [12].
We observed subsequent production for 10 514 Slovak cows: milk in kg (M), fat in kg (F) and proteins in kg (P) and reproduction traits: age at first calving (AFC), age at second calving (ASC), age at third calving (ATC) and calving interval (CI). We divided cows by breed-type to subsequent groups: S_0 - cows with genetic proportion of pure Slovak spotted blood into 87.5 %, S_1 - cows with genetic proportion of pure Slovak spotted blood from 75 % to 87.4 %, S_2 - cows with genetic proportion of pure Slovak spotted blood from 50 % to 74.9 %.
To determine the effect of traits of milk production milk in kg (M), fat in kg (F) and proteins in kg (P) on reproduction traits (age at first calving -AFC and, calving interval -CI) into 3 groups: ***1*** lower than $\bar{x}$ - 1s - (M1, T1, B1), ***2*** from $\bar{x}$ - 1s to $\bar{x}$ +1s - (M2, T2, B2), ***3*** higher than $\bar{x}$ +1s - (M3, T3, B3).

For data processing the results a multifactor analysis of variance were used and GLM procedure statistical program SAS were applied.
For the computation a linear model with fixed effects was used:

$$y_{ijklm} = \mu + HYS_i + b_j + c_k + d_l + d_m + e_{ijklmn}$$

where: μ = mean value, HYS_i = effect of herd, years and season of calving, b_j = father, c_k = breeding type, d_l = number of lactation, d_m = cod of effect of M in kg, e_{ijklmn} = residual error
The basic statistic analysis of traits of milk production and reproduction were analysed using the Statistical Analysis System (SAS) version 9.1 Enterprise Guide 3.0 [13].

3. Results and discussion

The basic traits for milk production at evaluated breeding herds of dairy cows Slovak spotted breed are presented in Table 1. In the first lactation the dairy cows produced 4 685.18 kg of milk, 193.82 kg of fat and 156.51 kg of proteins. An increase of milk production traits in the second lactation was as follows: 8.3 % for milk, 6.9 % for fat and 9.3 % for proteins. A slight increase of the traits was achieved in the third lactation with a range from 1.18 % to 2.1 % comparison with previous period.

Table 1. Statistical characteristic traits of milk production in breeding herds of Slovak spotted breed

Traits		Statistical parameter			
		n[1]	$\bar{x}$ [2]	SD[3]	CV[4]
1st lactation	milk (kg)	10 514	4 685.18	1 593.36	34.01
	fat (kg)		193.82	72.31	37.31
	proteins (kg)		156.51	53.85	34.36
2nd lactation	milk (kg)	8 172	5 076.44	1 852.72	36.50
	fat (kg)		207.27	81.03	39.09
	proteins (kg)		171.13	63.39	37.04
3rd lactation	milk (kg)	6 052	5 181.61	1 900.10	36.67
	fat (kg)		211.40	82.98	39.25
	proteins (kg)		173.15	64.49	37.25

[1]number of observation, [2]average, [3]standard deviation, [4]coefficient of variation

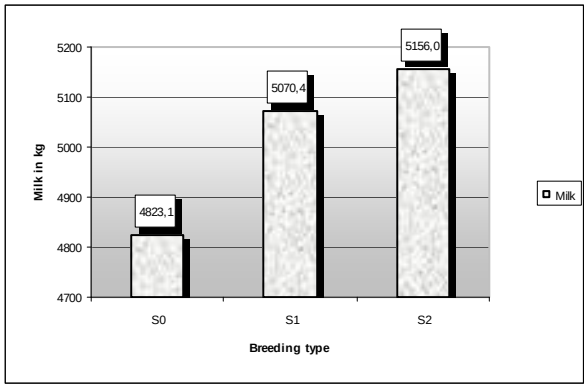

Figure 1 Milk production by breeding type

Figure 1 shows the differences for milk production in kg between breeding type dairy cows in selected herds of Slovak Spotted breed.

The results of reproduction traits in breeding herds of dairy cows of Slovak spotted breed are presented in Table 2. Mean age at first calving (AFC) in data set was 947.66 (31.1 months), age at second calving (ASC) was 1 356.89 days (44.49 months) and age at third calving (ATC) was 1 755.40 days (57.55 months). These results are higher with results by study Ulutaş and Sezer [17] and similar with results in all population of the Slovak spotted breed by results of dairy herd milk recording in Slovak Republic [12].

Table 2. Statistical characterization of mean age at first, second and third calving and calving interval

Traits		Statistical parameter			
		n[1]	$\bar{x}$ [2]	**SD**[3]	**CV**[4]
age	at 1st calving	10 514	947.66	195.66	20.65
	at 2nd calving	8 172	1 356.89	222.48	16.40
	at 3rd calving	6 052	1 755.40	246.26	14.03
calving interval	1	7 909	411.66	82.41	20.02
	2	5 883	404.70	78.89	19.49

[1]number of observation, [2]average, [3]standard deviation, [4]coefficient of variation

The average length between first and second calving was 411.66 days and between second and third calving was 404.7 days, respectively (Table 3). These results are corresponding with results by Bujko et al. [8], S.E. [12] and Ulutaş and Sezer [14].

Table 3. Statistical characteristic of mean age at first calving and calving interval by mean of milk production

Traits	Cod[1]	Statistical parameter			
		n[2]	$\bar{x}$ [3]	**SD**[4]	**CV**[5]
age at first calving	M1	1 945	955.53	202.46	21.19
	M2	7 372	950.20	201.20	21.17
	M3	1 197	919.23	139.48	15.17
calving interval	M1	1 874	400.58	77.75	19.41
	M2	9 131	407.41	80.19	19.68
	M3	2 802	419.09	86.80	20.71

[1]cod of milk production, [2]number of observation, [3]average, [4]standard deviation, [5]coefficient of variation

The results of relation between kgs of milk by groups (M_1, M_2, M_3) were higher value length calving interval in M_3 (419.09 days) and the lower was in M_1 (400.58 days). These results are similar with conclusions by Bujko et al. [6-8].

In Figure 2 we can observe increasing trends of calving interval by average of milk production in kg. By reported Melendez, Pinedo [15] when increase milk production together with extending calving interval.

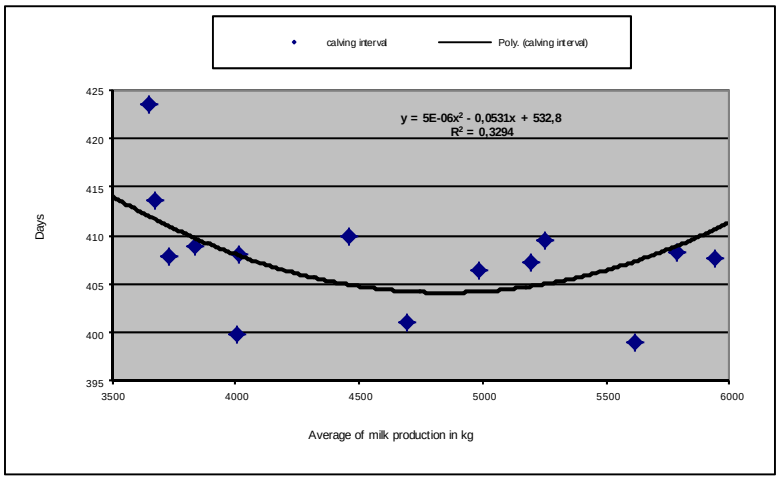

Figure 2 Calving interval lengths by average of milk production

Table 4. Relation between traits of milk production and reproduction traits (age at first, second and third calving and calving interval 1, 2).

Traits		Milk in kg	Fat in kg	Fat in %	Proteins in kg	Proteins in %
age	at 1st calving	-0.06731	-0.09328	-0.08221	-0.06839	-0.01186
		<.0001	<.0001	<.0001	<.0001	0.2241
	at 2nd calving	-0.07640	-0.09241	-0.06986	-0.08422	-0.04688
		<.0001	<.0001	<.0001	<.0001	<.0001
	at 3rd calving	-0.04554	-0.06218	-0.05475	-0.04858	-0.00628
		0.0005	<.0001	<.0001	0.0002	0.6302
calving interval	1	-0.06945	-0.08422	-0.06398	-0.07676	-0.04552
		<.0001	<.0001	<.0001	<.0001	<.0001
	2	-0.04554	-0.06218	-0.05475	-0.04858	-0.00628
		0.0005	<.0001	<.0001	0.0002	0.6302

Correlation between evaluated traits of milk production and age at first calving were lower negative and statistically high significant, scilicet between kgs of milk, kgs of fat, kgs of proteins and age at first calving r= -0.06731, r= -0.09328, r= -0.06839. These results are similar with conclusions by Riecka, Candrák [5] and König et al. [16]. By reported Andersen-Ranberg et al. [18] shows to negative genetic correlation between female fertility and milk production the selection for increased milk yield resulted in genetic decline in female fertility.

Correlation between milk, fat, protein in kg with calving interval 1 (r= -0.06945, r= -0.08422, r= -0.07676) and with calving interval 2, (r= -0.04554, r= -0.06218, r= -0.04858) were statistically high significant (Table 4). This correlation was positive and very lower. These results are similar with conclusions Royal et al. [2], Pryce et al. [3], Riecka et al. [17] and Andersen-Ranberg et al [18].

Table 5. Factors affecting on age of first calving

Sources of variability	DF[1]	Mean Square	F Value	Pr > F	R-Square [2]
					Age of first calving
Herd-years-season	1 097	164321.5	6.96	<.0001	0.447882
Sire	494	284459.5	10.88	<.0001	0.349148
Breeding type	2	1759624.2	46.36	<.0001	0.008744
Cod of milk production	2	567498.192	14.86	<.0001	0.002820

[1]grades of freedom, [2] coefficient of determination (R^2)

In Table 5, Table 6 showed the linear model to represent coefficients of determination on age of first calving and calving interval with all fixed effects. The analyses by the effect on age of first calving was the highest effect of herd-years-season R^2 = 0.447882 than effect of sire R^2 =

0.349148. By analyses by the effect on calving interval was the highest effect of herd-years-season R^2 = 0.152619 than effect of sire R^2 = 0.067281. These effects were significant (p<.0001). These results are similar with results by Riecka, Candrák [5], Bujko et al. [7, 8] and Riecka et al. [10].

Table 6. Factors affecting on calving interval

Sources of variability	DF[1]	Mean Square	F Value	Pr > F	R-Square [2]
					Calving interval
Herd-years-season	1 130	12367.39	2.02	<.0001	0.152619
Sire	496	12421.07	1.94	<.0001	0.067281
Breeding type	2	32751.88	4.94	0.0072	0.000715
Number of lactation	2	253695.99	38.46	<.0001	0.005541
Cod of milk production	2	220331.78	33.38	<.0001	0.004812

[1]grades of freedom, [2] coefficient of determination (R^2)

4. Conclusions

The results confirm the correlation between evaluated traits of milk production and age at first calving were lower negative and statistically high significant (P<0.0001), scilicet between kgs of milk age at first calving r= - 0.06731and correlation between milk in kg with calving interval 1 (r= - 0.06945) and with calving interval 2 (r= - 0.04554) were statistically high significant (P<0.0001).

Acknowledgements

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