

## AGE INFLUENCE AT THE FIRST INSEMINATION AND THE SERVICE PERIOD ON LONGEVITY AND LIFE-LONG PRODUCTION OF MILK IN SIMMENTAL COWS\*

Zvonko Spasić<sup>1</sup>, Nikola Stolić<sup>2</sup>, Božidar Milošević<sup>1</sup>, Zoran Ilić<sup>1</sup>, Ljiljana Anđušić<sup>1</sup>

<sup>1</sup>Faculty of Agriculture, University of Priština

<sup>2</sup>Agricultural College Prokuplje, Republic of Serbia

spasic.zvonko@gmail.com

Genetic improvement of quantitative traits in domestic animals is not possible without being familiar with necessary population-genetic parameters. Higher values of heritability indicate possibility of more effective selection work and traits improvement, while lower values show that we cannot improve these traits (i.e. reproductive traits) to such an extent within the population. Therefore, in this paper we set up an assignment to estimate values of heritability and phenotypic correlations among reproductive traits in the population of Simmental cows in the area of Kosmet. Investigations have been performed at the farm Dubrava in Istok, on the basis of data regarding milk production and the duration of cows' exploitation in the production process. On the basis of our assignments in this paper the average data values of the investigated reproductive traits have been presented. The aim of this paper is, along with determination of needed parameters, to explore the possibility for application of the obtained results in the selection work in order to improve the mentioned traits.

**Key words:** heritability; phenotypic correlations; Simmental breed; service-period

## ВЛИЈАНИЕ НА ВОЗРАСТА ПРИ ПРВАТА ИНСЕМИНАЦИЈА И НА СЕРВИСНИОТ ПЕРИОД ВРЗ ДОЛГОВЕЧНОСТА И ДОЖИВОТНАТА ПРОДУКЦИЈА НА МЛЕКО КАЈ СИМЕНТАЛСКИТЕ КРАВИ

Генетското унапредување на квантитативните својства кај домашните животни е невозможно без познавање на потребните популацио-генетски параметри. Повисоките вредности на херитабилитетот укажуваат на можноста за поефикасна селекција и подобрување на својствата, додека пониските вредности покажуваат дека овие својства (репродуктивни) не можеме да ги подобриме до таков степен во рамките на популацијата. Поради тоа во овој труд вршиме процена на вредностите на херитабилитетот и фенотипските корелации помеѓу репродуктивните својства во популација на сименталските крави на подрачјето на Косово. Испитувањата беа изведени на фармата Дубрава во Исток врз база на податоците кои се однесуваат на продукцијата на млеко и на времетраењето на експлоатацијата на кравите во производствениот процес. Во овој труд се претставени просечните вредности на испитуваните репродуктивни својства. Целта на овој труд е, со одредувањето на потребните параметри, да се истражи можноста за апликација на добиените резултати во селекциската работа за подобрување на споменатите својства.

**Клучни зборови:** херитабилитет; фенотипски корелации; сименталска раса; сервисен период

### INTRODUCTION

Genetic improvement of quantitative traits is not possible without being familiar with necessary

population genetics parameters. It is known that heredity coefficient or heritability ( $h^2$ ) is one of the most important parameters, whose value depends upon the degree of variability of certain trait in the

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investigated population. As a result of previous investigations in regard to heritability of productive and reproductive traits approximate average values and degree of variation have been determined. Higher values of heritability indicate possibilities for a more effective selection work and traits improvement in domestic animals, while lower values show that such traits (i.e. reproductive) cannot be improved in a higher degree. Concerning the heritability of longevity and lifelong milk and milk fat production, determined by other authors at different breeds of cattle, it could be concluded that these traits show high variability and the average values of heritability are low (Đurđević, 2001, Jovanka Panić, 2005; Spasić et al., 2009). Since our literature contains no enough information about dairy cows selection on productive, reproductive and lifelong production traits, we established a goal for this research to estimate heritability and phenotypic correlation of these traits in a herd of Simmental cows in the area of Kosmet. In addition, the aim of this research, besides the determination of necessary parameters, is to explore the possibility for application of obtained results in the selection process aimed at improving the investigated traits.

#### MATERIAL AND METHODS

The research has been conducted at dairy cows farm "Dubrava" located in Istok, on the basis of data regarding the milk production and duration of exploitation of cows in the production. Altogether, 210 cows of the Simmental breed were included in the research. Utilization manner during the production cycle until the culling of cows was similar for all animals. The nutrition, housing and breeding were approximately similar and specific for the farm. All cows were under control with proper documentation of origin, milk production and reproduction. On the basis of farm records for each cow we determined the age at the first conception, duration of the first service period, the age at culling, the exploitation index, the number of lactation, lifelong milk yield, the lifelong yield of 4% fat corrected milk and the production of milk per milking day.

With regard to the established goal to determine the heritability coefficients of the investigated traits, for its estimation we used the method of parent offspring regression (Latinović, 1996). By the method of covariance coefficients and

standard errors of phenotypic correlation between reproduction traits and the traits of longevity and lifelong production have been determined, while significance of correlation coefficients has been tested by *t*-test for significance levels of 5, 1 and 0,1%, according to Latinović (1996).

#### RESULTS AND DISCUSSION

On the basis of the established research objective in this work, the results about average values of investigated domestic spotted cows have been given.

Table 1

*Average values and variability of reproduction, longevity and lifelong milk production traits in the Simmental cows*

Traits	$\bar{X} \pm S_x$	SD	CV	min-max.	
Age at the first insemination (days)	684.5	16.7	190.8	27.8	361–1.056
Duration of service periods (days)	267.1	16.3	177.8	66.6	44–666
Age at culling (days)	2.402.1	65.7	751.5	31.3	1.098–4.388
Utilization index (%)	57.3	1.25	14.3	24.9	19.5–82.1
Number of lactations	2.69	0.12	1.36	50.6	1–7
Lifelong milk production	10.331.5	544	3.623	35.1	2.772–27.098
Lifelong production of 4% FCM (kg)	9.719.4	513	3.587	36.9	2.728–25.344
Milk production per milking day (kg)	10.0	0.16	1.87	18.6	4.2–16.5

These data show that the average age of cows at the first conception was 22.8 months, which is 85.9 days longer than the age of the same breed investigated by Ranić (2008).

On the basis of the variation interval it can be noted that certain animals were mated about 2.89 years of age, which is unacceptable in the intensive production. An identical problem appears considering the following reproductive trait, the

first service period, which in the investigated population lasted three and more times longer than those regarded optimal. According to Bijma et al. (1998), the first service period in different populations of the Simmental breed goes from 101.4 to 133 days. The next sequence of the table shows the results regarding longevity and lifelong milk production. It is obvious that these traits are very variable depending upon individuals, which confirm that high values of variability go above 50%. The average age at culling was 6.58 years that is in accordance with results determined by cited authors. However, how much unsatisfactory duration of cows exploitation is, can be seen from the index of utilization, which shows that the period until the first calving participates with more than 52% in regard to the total utilization period in the investigated population. The maximal number of lactation achieved was seven, while the average per animal was just 2.69, which is significantly lower in comparison with results presented by Ostrec et al. (1998).

In Table 2, coefficients of heritability estimated by the regression of daughters on their mothers for all investigated traits are presented.

Table 2

*Coefficients ( $h^2$ ) and standard errors of heritability ( $S.E.h^2$ ) of reproduction, longevity and lifelong milk production traits in the Simmental cows*

Traits	$h^2$	S.E. $h^2$
Age at the first insemination (days)	0.016	0.267
Duration of service periods (days)	0.126	0.112
Age at culling (days)	0.074	0.163
Utilization index (%)	0.077	0.082
Number of lactations	0.177	0.066
Lifelong milk production	0.116	0.105
Lifelong production of 4% FCM (kg)	0.117	0.104
Milk production per milking day (kg)	0.106	0.065

As it was expected on the basis of theoretic postulates and by comparison with the data obtained by Spasić et al. (2009), and with data given by the cited authors too, all estimated coefficients, as for reproduction traits, so for the traits of longevity and lifelong milk production, are quite low and go from 0.016 for the average age at the first

conception to 0.177 for the average number of lactation during the productive life in the investigated cows.

By observing the data given in Table 3, it can be concluded that, except phenotypic correlation between the age at the first conception and the age at culling that is positive (and non significant), all other traits under investigation were negatively correlated. Also, the strength of phenotypic correlations was very weak, except the relation of utilization index and the age at the first conception, which was weak and highly significant (0.01%). Therefore, a linear regression analysis was performed, which derived the following formula:

$$y = 73.3 - 0.023x,$$

wherefore it clearly indicates that with every day of prolonging the first conception, the utilization index goes down for 0.023 percent.

Table 3

*Coefficients ( $h^2$ ) and standard errors of heritability ( $S.E.h^2$ ) of reproduction, longevity and lifelong milk production traits in the Simmental cows*

Traits	Age at the first insemination (days)		Duration of service periods (days)	
	$r$	$S_r$	$r$	$S_r$
Age at culling (days)	0.209 <sup>NS</sup>	0.119	-0.166 <sup>NS</sup>	0.133
Utilization index (%)	-0.358 <sup>***</sup>	0.113	-0.158 <sup>NS</sup>	0.133
Number of lactations	-0.170 <sup>NS</sup>	0.120	-0.454 <sup>***</sup>	0.120
Lifelong milk production	-0.119 <sup>NS</sup>	0.120	-0.275 <sup>*</sup>	0.130
Lifelong production of 4% FCM (kg)	-0.122 <sup>NS</sup>	0.120	-0.270 <sup>*</sup>	0.130
Milk production per milking day (kg)	-0.149 <sup>*</sup>	0.119	-0.192 <sup>*</sup>	0.132

All investigated longevity and lifelong production traits were negatively correlated with the service period duration and very weak, except the average number of lactation that is also negative and weak along with high significance. The linear regression formula

$$y = 3.59 - 0.00275x$$

shows that with every day of the service period prolongation the average number of achieved lactation goes down for 0.003.

All above determined, draw attention on the additional need for taking into account the selection work traits with low heritability coefficients, as well as their often negative phenotypic correlation, which additionally can slow down the selection progress in the population where selection measures are taking place.

### CONCLUSIONS

On the basis of the results obtained from investigation of variability and correlation of some reproductive traits of longevity and lifelong milk production in the population of the Simmental cows, the following conclusions can be drawn:

– The average age at the first calving is extremely adverse and prolonged for six months in regard to optimal for this breed;

– The average duration of the service period in the investigated population lasted three and more times longer than those regarded optimal;

– As estimated heritability coefficients for all investigated traits are very low, it can be concluded that these traits cannot be improved by direct selection, but this must be performed in the indirect way;

– Regarding the obtained negative phenotypic correlation between the productive and longevity traits, an additional attention in the selection work is needed on traits with low heritability coefficients, as well as on their often negative phenotypic correlation, which additionally can slow down the selection progress in the population where selection measures are taking place.

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