

## THE EFFECT OF BREEDING REGION AND YEAR ON MILK TRAITS OF SIMMENTAL BULL DAMS

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**Abstract:** Cows which represent top of the genetic value of the population in regard to their traits are chosen for bull dams. Selection is based on origin, production performance (quantity of milk, milk fat and protein content), milking/dairy traits, reproductive indicators, exterior and linear type scores. This study included 292 cows of Simmental breed selected for bull dams on the territory of Republic of Serbia during one year. Selection of cows for herd of bull dams was done after finalized first and subsequent lactation. In this study, the effect of region and year of calving on milk traits is presented. Applying the method of least squares average value of milk production was obtained - 5.754,49 kg, milk fat content - 3,98% and quantity of milk fat - 230,24 kg. Regions had statistically highly significant effect ( $P < 0,01$ ) on all investigated milk traits. Year of calving showed no statistically significant effect on milk yield, yield of milk fat and content of milk fat ( $P > 0,05$ ).

**Key words:** Simmental breed, bull dams, milk performance, region, year.

### Introduction

Increase of production and improvement of the quality of milk, as well as fertility intensity, are main prerequisites of modern cattle production. In order to produce domestic bulls of Simmental breed it is necessary to select from main herd/population the best cows. These animals represent 1% of top cows in the controlled population primarily in regard to production of milk and milk fat, also body and udder development, and fertility traits. Fertilization of bull dams is done according to adequate system. Each cow is assigned a bull, previously selected as bull sire, whose semen will be used for insemination (*Pantelić et al., 2009*).

*Croatian livestock selection centre (2003)* in their annual report presented data that in Croatia during 2002 419 Simmental bull dams had been selected. Average production of milk in standard lactation was 6238 kg with 4.10% of milk fat and 256 kg milk fat. The highest production of milk of 6477 kg and 4.14% milk fat content, i.e. 268 kg of milk fat was recorded in the third lactation.

In their research pertaining to phenotypic variability of the milk traits of Simmental bull dams, *Pantelić et al. (2005)* reported their production in the first lactation of 4767.89 kg with content and yield of milk fat of 3.77% and 179.07 kg, respectively. Calculated to 4% FCM production of 4593.25 kg was realized.

Studying the production characteristics of Simmental cows presented on exhibitions, *Stjelja et al. (2008)* established average milk production in standard lactation of 5613 kg, production of milk fat of 221.47 kg, and content of milk fat of 3.94 %. Analysis of variance showed that the region, year of exhibition and lactation groups had significant effect ( $P < 0.05$ ) on all investigated milk traits.

According to data of the Selection service of the Republic of Serbia in the Institute for Animal Husbandry, Belgrade-Zemun, average milk performance of bull dams in the first lactation at the level of Central Serbia for 2008 was 5540 kg of milk with 3.97 % milk fat, i.e. 218.8 kg of milk fat. Average maximum milk performance was 6503 kg with 3.99 % i.e. 257.8 kg of milk fat. Average duration of first lactation was 310 days, and maximum lactation was 316 days (*Institute for Animal Husbandry, 2009*).

*Konig et al. (2005)* investigated variance components of productive and reproductive traits. In these researches, year and season of calving showed no significant effect on production of milk ( $P > 0.05$ ).

Highly significant effect of breeding region ( $P < 0.01$ ) on production of milk and milk fat, milk fat content and yield of 4% FCM was confirmed by *Petrović et al. (2006)* in first calving Simmental cows. The Authors believe that results obtained indicate justification for use of linear methods, i.e. correction of systematic conditions of the environment.

*Pantelić (2006)* recorded in his research highly significant effect of the region ( $P < 0.01$ ) on all studied milk traits, except milk fat content where no effect was determined ( $P > 0.05$ ). Year of calving exhibited no statistically significant effect ( $P > 0.05$ ) on milk yield, and yield and content of milk fat.

## Materials and Methods

This research included 292 cows of Simmental breed selected to be bull dams on the territory of Republic of Serbia during one year. Selection of cows in the herd of bull dams was carried out after completion of the first, and based on the following lactations. The paper investigates the impact of breeding areas and year of calving on milk traits.

Investigations included following milk traits in the standard lactation:

- milk production, kg
- content of milk fat, %
- production of milk fat, kg

Correction of the lactation to the standard lactation of 305 days was done using coefficients according to *Nenadović, 1974*. Analysis of the effect of paragenetic factors on studied milk traits was done using the method of least squares, fixed model:

$$Y_{ijlm} = \mu + R_i + G_j + e_{ijlm}$$

Where:

$Y_{ijm}$  = expression of investigated trait in  $m$  cow, which produced in  $i$  region and calved in  $j$  year

$\mu$  = general average

$R_i$  = fixed effect of  $i$  region

$G_j$  = fixed effect  $j$  of the year of calving

$E_{ijlm}$  = random error

For the purpose of more precise determination of the effects of various paragenetic factors, all bull dams included in the research originated from 7 breeding area, i.e. regions. Breeding regions and number of selected bull dams per region are following:

1. Belgrade region – 27
2. Podunavlje region – 88
3. Braničevo region – 50
4. Zaječar region – 24
5. Kolubara region – 55
6. Pomoravlje-Rasina region – 32
7. Zlatibor region – 16

Due to specificity of the terrain, i.e. almost same configuration, and rearing conditions for bull dams, the sixth region united municipalities of Jagodina, Kraljevo and Kruševac.

## Results and Discussion

Based on obtained results presented in Table 1 it can be concluded that average production of milk was 5754.49 kg. The highest production of milk of 6199.11 kg of milk was produced by bull dams on the territory of second region, and the lowest – 5356.65 kg bull dams of the seventh region.

If we compare results obtained in this research with values obtained by other authors, they are somewhat higher in relation to results for bull dams in the first lactation for Central Serbia in 2008 (*Institute for Animal Husbandry, 2009*). Significantly higher values in production of milk are reported by the *Croatian livestock selection centre (2003)* for Simmental bull dams.

**Table 1.** General average ( $\mu$ ), deviations from the general average ( $\hat{c}$ ), mean values of the least squares (lsm) and their errors (S) and significance of the studied effects on milk yield in whole lactation, kg

Effects	N	$\hat{c}$	Sc	lsm	Slsm
<b>General average</b>					
$\mu$	975	5754.49	109.80		
<b>Regions**</b>		$f_{tab}=12,883$		$df_1=6$	$df_2=949$
1	117	207.78	75.30	5962.27	127.14
2	248	444.62	56.33	6199.11	115.02
3	183	-61.82	62.48	5692.67	125.50
4	113	-137.22	78.26	5617.27	121.31
5	179	51.41	63.50	5805.91	124.85
6	72	-106.92	95.36	5647.58	147.83
7	63	-397.84	105.82	5356.65	174.04
<b>Year of calving<sup>ns</sup></b>		$f_{tab}= 1,751$		$df_1=8$	$df_2=949$
1	22	-350.05	170.58	5404.44	210.89
2	31	-164.16	143.65	5590.33	187.08
3	52	-11.48	112.45	5743.01	159.93
4	92	3.59	88.24	5758.08	142.28
5	114	-4.93	80.49	5749.56	131.33
6	165	56.80	70.89	5811.30	123.73
7	198	88.42	67.38	5842.91	120.92
8	224	214.40	65.58	5968.89	119.54
9	77	167.40	103.82	5921.90	151.76
<b>ns – P&gt;0.05</b>		<b>* – P&lt;0.05</b>		<b>** – P&lt;0.01</b>	

Production of milk was under highly significant influence of breeding region ( $P<0.01$ ). Demonstrated differences in milk production per regions can be explained by different effect of climatic factors, nutrition and rearing/housing. In the study of the genetic variability of the lactation persistence of Simmental cows *Durđević et al. (2002)* concluded that the investigation of the effect of known environment factors was justified, because the knowledge of their action can contribute to more objective assessment of random effects. Specifically in this case the effect of the farm was highly significant on yield of milk in lactation of 305 days ( $P<0.01$ ).

Year of calving had no effect on production of milk ( $P>0.05$ ). In analysis of obtained results it can be observed that the production was sufficiently uniform.

Identical results of the effect of the calving year on milk production were obtained by *Konig et al. (2005)*.

**Table 2. General average ( $\mu$ ), deviations from the general average ( $\hat{c}$ ), mean values of the least squares (lsm) and their errors (S) and significance of the studied effects on the milk fat content in whole lactation, %**

Effects	N	$\hat{c}$	Sc	lsm	Slsm
<b>General average</b>					
$\mu$	975	3.987	0.016		
<b>Regions**</b>		$f_{tab}=18,821$		$df_1=6$	$df_2=949$
1	117	0.019	0.011	4.006	0.018
2	248	0.041	0.008	4.029	0.017
3	183	-0.072	0.009	3.916	0.018
4	113	0.037	0.011	4.024	0.018
5	179	0.033	0.009	4.020	0.018
6	72	-0.016	0.014	3.971	0.021
7	63	-0.042	0.015	3.946	0.025
<b>Calving year<sup>ns</sup></b>		$f_{tab}= 2,140$		$df_1=8$	$df_2=949$
1	22	-0.034	0.025	3.953	0.031
2	31	-0.050	0.021	3.938	0.027
3	52	0.016	0.016	4.003	0.023
4	92	0.020	0.013	4.008	0.021
5	114	0.026	0.012	4.013	0.019
6	165	-0.011	0.010	3.977	0.018
7	198	0.017	0.010	4.005	0.018
8	224	0.010	0.009	3.997	0.017
9	77	0.006	0.015	3.993	0.022
<b>ns – P&gt;0.05</b>		<b>* – P&lt;0.05</b>		<b>** – P&lt;0.01</b>	

Milk fat content, contrary to production of milk and milk fat, was under greater influence of genotype than environment factors. Mean values for content of milk fat, as well as different influence of paragenetic factors established by method of least squares are presented in Table 2.

Highly significant effect on milk fat content ( $P<0.01$ ) was established for breeding region. The highest percentage of milk fat – 4.02% was recorded in Podunavlje region, and the lowest – 3.91 % in Braničevo region. Year of calving had no significant effect ( $P>0.05$ ) on percentage of milk fat. Deviations from the general average ranged from–0.050% (2. year) to 0.026% (5. year).

Highly significant of the breeding region ( $P<0,01$ ) on milk fat content was reported by *Petrović et al. (2006)*.

Average production of milk fat in whole lactation was 230.24 kg. According to regions, the highest production of milk fat was recorded in

Podunavlje region – 250.18 kg, and the lowest in Zlatibor region 212.97 kg. Obtained results are slightly higher than those reported by *Stjelja et al. (2008)*.

**Table 3. General average ( $\mu$ ), deviations from the general average ( $\hat{c}$ ), mean values of the least squares (lsm) and their errors (S) and significance of the studied effects on yield of milk fat in whole lactation, kg**

Effects	N	$\hat{c}$	Sc	lsm	Slsm
<b>General average</b>					
$\mu$	975	230.24	4.56		
<b>Regions**</b>		$f_{tab}=15,687$		$df_1=6$	$df_2=949$
1	117	8.88	3.12	239.12	5.28
2	248	19.94	2.34	250.18	4.77
3	183	-7.00	2.59	223.24	5.21
4	113	-2.76	3.25	227.48	5.03
5	179	3.58	2.64	233.83	5.18
6	72	-5.36	3.96	224.88	6.13
7	63	-17.27	4.39	212.97	7.22
<b>Calving year<sup>ns</sup></b>		$f_{tab}=1,883$		$df_1=8$	$df_2=949$
1	22	-15.74	7.08	214.51	8.75
2	31	-9.10	5.96	221.14	7.76
3	52	0.26	4.67	230.51	6.64
4	92	1.33	3.66	231.57	5.90
5	114	1.24	3.34	231.48	5.45
6	165	1.64	2.94	231.88	5.13
7	198	4.55	2.80	234.80	5.02
8	224	8.89	2.72	239.13	4.96
9	77	6.94	4.31	237.18	6.30
<b>ns – P&gt;0.05</b>		<b>* – P&lt;0.05</b>		<b>** – P&lt;0.01</b>	

Analyzing the production of milk per years of calving, it can be concluded that it was rather uniform without any high oscillations. The effect of the calving year was not significant for the production of milk fat ( $P>0.05$ ). *Pantelić (2006)* confirmed in his research highly significant effect of the region ( $P<0.01$ ) on production of milk fat.

The effects of the breeding region can be regarded as principal environment factors influencing the production of milk. Knowledge of the influence of systematic factors of the environment on milk and fertility traits and their inclusion into selection models is of special importance for accuracy of assessment of genetic parameters and breeding value of bulls, as well as cows which are candidates for selection. Effects of the breeding region include numerous factors which complement each other, and the major factor is certainly the nutrition *Pantelić (2004)*.

The effect of year on expression of milk and fertility traits is manifested mainly through production and preparation of food, as well as its use in cattle nutrition throughout the year. Climatic factors are very important from the aspect of preparation of animal food, which reflects on its quality and nutritional value which directly influences production and reproduction performance of cows.

## Conclusion

Cows which represent top of the genetic value of the population in regard to their traits are chosen for bull dams. Selection is based on origin, production performance (quantity of milk, milk fat and protein content), milking/dairy traits, reproductive indicators, exterior and linear type scores.

Production of milk and milk fat of bull dams of Simmental breed is considerably above the average realized by registered cows under milk recording control in Serbia, but below the level of production which bull dams have in Western European countries.

Using the method of least squares average values were obtained: milk production – 5754.49 kg, milk fat content – 3.98% and quantity of milk fat – 230.24 kg.

Regions had statistically highly significant effect ( $P < 0.01$ ) on all studied milk traits.

Year of calving demonstrated no statistically significant effect ( $P > 0.05$ ) on yield of milk and milk fat and content of milk fat.

In future breeding-selection work attempt should be made to select bull dams, as well as breeding bulls, based on breeding value calculated by the main breeding organization – on the basis of milk performance data and exterior (linear scoring).

## Uticaj odgajivačkog područja i godine na osobine mlečnosti bikovskih majki simentalске rase

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## Rezime

Za bikovske majke se odabiraju krave koje prema osobinama predstavljaju vrh genetske vrednosti populacije. Izbor se vrši na osnovu porekla, proizvodnih

osobina (količina mleka, sadržaj mlečne masti i proteina), muznih osobina, reproduktivnih pokazatelja, eksterijera i linearnih ocena tipa.

Ovim istraživanjem je obuhvaćeno 292 krave simentalске rase odabrane za bikovske majke na području Republike Srbije u toku godine. Odabiranje krava u zapt bikovskih majki izvršeno je posle završene prve, odnosno na osnovu sledećih laktacija. U radu je ispitan uticaj odgajivačkog područja i godine telenja na osobine mlečnosti.

Koristeći metod najmanjih kvadrata dobijene su prosečne vrednosti proizvodnje mleka 5.754,49 kg, sadržaja mlečne masti 3,98% i količine mlečne masti 230,24 kg. Regioni su imali statistički visoko značajan uticaj ( $P < 0,01$ ) na sve ispitivane osobine mlečnosti. Na osobine prinosa mleka, mlečne masti i sadržaja mlečne masti, godina telenja nije ispoljila statistički značajan uticaj ( $P > 0,05$ ).

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