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THE IMPACT OF IMPORT OF BREEDING SIMMENTAL COWS ON IMPROVEMENT OF PRODUCTION PERFORMANCE IN DOMESTIC POPULATION

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Invited paper

Abstract: The aim of this study was to obtain relevant data pertaining to the basic indicators of milk and fertility Simmental cows, in the production conditions on individual farms, using appropriate modern methodologies, and to determine the effect of import of breeding cows on implementation of the breeding programs and improvement of production performance in domestic population on the territory of Šumadija district. Imported animals have realized in all three lactations higher milk production (449.08 kg, 568.52 kg and 488.73 kg), milk fat (19.87 kg, 22.66 kg and 18.52 kg) and 4% fat corrected milk (477.64 kg, 567.26 kg and 473.36 kg), in the first, second and third lactations, respectively. Domestic cows had lower milk fat content in the first lactation by 0.05%, but higher in the second and third by 0.01%. Domestic cows first calved earlier by 79.13 days, the second time by 89.51, and the third time by 88.62 days, and all differences were statistically highly relevant. They also showed statistically significant differences ($p < 0.01$) in the duration of service period where domestic cows had shorter service periods by 10.19 (II lactation) to 15.94 days (III lactation). Based on the results obtained in this study it can be concluded that the imports of high-quality heifers of Simmental breed from Germany significantly influenced the improvement of milk and fertility performance of domestic cow population in the Šumadija district.

Key words: milk performance, fertility, Simmental breed.

Introduction

In regard to the breed structure of cattle in Serbia, it is estimated that the Simmental breed makes up about 80%, a group of Black and White Holstein-Friesian cattle, about 10%, while the indigenous breeds and crossbreeds make up about 10% of the total number of cattle. Simmental breed is primarily present in Central Serbia with 115.000 breeding animals, while the number in Vojvodina is much smaller - about 6.000 registered animals. A similar situation is in the region of Sumadija, where over 90% of cows belong to Simmental breed. The main reason for the above mentioned share of Simmental cattle lies primarily in very good acclimatization abilities, and the ability to adapt to different rearing conditions.

In the last two decades there has been a decline in the number of heads of Simmental breed in Serbia, but also the increase the number of registered cows, and the trend is still present. In order to increase the number and quality of breeding animals, to improve the genetic composition and increase milk production in the Sumadija district, 150 heifers of Simmental breed were imported from Germany.

Perković et al. (2003) have examined the influence of Montbeliard bulls to improve milk production traits and meat production in domestic spotted cattle. Daughters of Montbeliard bulls, compared with daughters of bulls domestic spotted breed, had by 299 kg more milk and 0.54% less fat.

Comparative examination of results achieved in 2 groups of daughters F1 generation, *Kučević et al. (2005)* have concluded that primiparous animals tested in Germany achieved a significantly greater yield of milk, milk fat and fat content (1.057 kg, 41 kg, 0.22%, respectively).

Results of comparative tests of first calving heifers of domestic Simmental and Austrian provenience in the same growing conditions (*Medić et al. 2006*) showed that in imported heads realized higher production of milk by significant 1.171 kg and 0.49% fat.

Examining the production potential of Simmental heifers calved in the period 2007-2010, on individual sector in Serbia, *Nikšić et al. (2011)* have established their average milk yield of 4.348 kg of milk with 3.93% milk fat and a yield of 171.1 kg milk fat.

Analyzing the phenotypic variability of Simmental bull dams *Pantelić et al. (2013)* have determined milk production of 5754.49kg, with 3.98% and 230.24 kg milk fat or 5755.47kg 4% FCM.

Problems with fertility have become one of the most expensive factors in dairy cattle. Selection on maternal fertility is becoming increasingly important, and requires its greater involvement in the overall breeding value. If there are serious

problems in reproduction, in addition to direct consequences on the milk production and milk fat, difficulties arise in the normal implementation of the renewal of the herd, which is reflected in the economy of production (*Pantelić et al. 2009*).

Material and methods

During the last ten years, a significant number of pregnant heifers, mainly from Germany and Austria have been imported to Serbia. Majority of imported heifers are Simmental breed followed by the Holstein Friesian breed, while other breeds were imported in much smaller numbers.

Investigation of differences in milk production of domestic and imported cattle and contribution of import of as pregnant heifers as well as frozen bull semen, to the improvement of breed structure and milk production was tested on a total of 303 cows in first three lactations. Heifers and cows were reared on numerous individual farms, but we can say generally in very similar conditions of keeping and feeding. Cows were kept in stalls with tied system, on long and medium places for lying down with straw bedding. Nutrition was based on hay and alfalfa haylage, rarely grass, corn silage and principally mixture of concentrate. Milking was done with machines, mostly into cans, and milk was stored in lacto-freezes until delivery. Control of productivity was done according to the principles of AT4 productivity control by breeding organizations. The following milk production traits in the first three standard lactation were studied:

- Milk yield, kg;
- Milk fat content, %;
- Milk fat yield, kg
- Yield of 4% fat corrected milk, kg.

In addition to milk production traits, for each cow age at calving and the service period in each lactation were determined.

Average values and variability of all studied traits was determined using standard statistical methods, and the significance of the impact of order of lactation, heifers origin and provenience of their bull-sires by applying the *t* and *F* test.

Results and Discussion

Milk production in Serbia is still carried out on relatively small farms, often with less than 10 cows, but it is not negligible, nor in terms of the total quantity of milk produced, nor in terms of the number of people engaged in it. In

conditions of social transition, milk production, even for farmers with smaller number of cows, is an important source of livelihood. By importing pregnant heifers farmers want primarily to increase the strength of their herds, and improve production and genetic potential on their farms, because the Serbian market for quality heifers is still underdeveloped.

Table 1. Average values and variability of investigated milk production traits of domestic cattle (n=245)

Indicator	\bar{x}	SD	CV	Min.	Max.
<i>First lactation</i>					
Milk yield, kg	4385.97	366.30	8.35	3166	5831
Content of milk fat, %	3.91	0.08	2.00	3.37	4.18
Yield of milk fat, kg	171.65	14.93	8.70	116.83	233.24
Yield of 4%FCM, kg	4329.10	367.88	8.50	3019	5831
<i>Second lactation</i>					
Milk yield, kg	4970.89	378.80	7.62	3836	6021
Content of milk fat, %	3.93	0.06	1.65	3.71	4.13
Yield of milk fat, kg	195.51	15.14	7.74	148.07	237.08
Yield of 4%FCM, kg	4921.03	376.55	7.65	3755	5931
<i>Third lactation</i>					
Milk yield, kg	5351.98	398.45	7.44	4129	6690
Content of milk fat, %	3.95	0.07	1.83	3.35	4.14
Yield of milk fat, kg	211.35	16.06	7.60	165.16	267.60
Yield of 4%FCM, kg	5311.12	397.43	7.48	4129	6690

Cows from domestic rearing/breeding, as primiparous, achieved in standard lactation yield of 4385.97 kg of milk with 3.91% fat, and milk fat yield was 171.65 kg, and the yield of 4% fat corrected milk 4329.10 kg. The values of investigated indicator of milk performance, respectively, in the second standard lactation were: 4970.89 kg; 3.93%; 195.51 and 4921.03 kg. In the third lactation cows achieved the highest yield of milk (5351,98kg), milk fat (211.35 kg) and 4% fat corrected milk, as well as the highest milk fat content (3.95%).

Lower production results for the first calving Simmental cows reared in our conditions, were recorded in the research of *Đurđević et al. (1994)*, *Miščević et al.(1995)* and *Petrović M. (2000)*, and approximately the same *Perišić (1998)*, and *Gutić et al. (2002)*.

Results of milk production in the first three standard lactations of imported heifers are shown in Table 2.

Table 2. Average values and variability of investigated milk production traits of imported cattle (n=58)

Indicator	\bar{x}	SD	CV	Min.	Max.
<i>First lactation</i>					
Milk yield, kg	4835.05	497.68	10.29	3780	5844
Content of milk fat, %	3.96	0.04	1.06	3.89	4.07
Yield of milk fat, kg	191.51	19.83	10.35	151.20	233.60
Yield of 4%FCM, kg	4806.74	495.90	10.32	3780	5828
<i>Second lactation</i>					
Milk yield, kg	5539.41	527.16	9.52	4416	7430
Content of milk fat, %	3.94	0.07	1.78	3.72	4.10
Yield of milk fat, kg	218.17	21.91	10.04	177.08	294.97
Yield of 4%FCM, kg	5488.29	537.68	9.80	4423	7397
<i>Third lactation</i>					
Milk yield, kg	5840.71	604.50	10.35	4454	8480
Content of milk fat, %	3.94	0.08	1.96	3.67	4.20
Yield of milk fat, kg	229.88	23.76	10.34	176.82	336.66
Yield of 4%FCM, kg	5784.47	595.72	10.30	4434	8442

Imported animals, in all three lactations realized higher yield of milk (449.08 kg in the first, 568.52 kg in the second and 488.73 in the third lactation), milk fat (19.87 kg, 22.66 kg and 18.52 kg, respectively) and 4% fat corrected milk (477.64 kg, 567.26 kg and 473.36 kg, respectively). When it comes to milk fat from domestic cows, they had lower milk fat content in the first lactation by 0.05%, but higher in the second and third by 0.01%. Differences (Tab. 3) in yield of milk and milk fat, 4% fat corrected milk in favour of imported cattle were highly significant ($p < 0.01$), as well as differences in the content of fat in the first lactation, while the differences in the content of fat in the second and third lactation were statistically insignificant ($p > 0.05$).

Lower values of milk yield for imported animals from Germany are reported by *Perišić (1998)*. *Romčević et al. (1990)* found a highly significant difference in milk production, milk fat and milk fat in cows progeny of the same bulls in German population in relation to the production performance of the population in Serbia.

Table 3. Differences in studied milk performance traits between domestic and imported cattle

Indicator	I lact.		II lact.		III lact.	
	difference	t _{exp}	difference	t _{exp}	difference	t _{exp}
Milk yield, kg	-449.08	-7.795**	-568.52	-9.472**	-488.73	-7.524**
Content of milk fat, %	-0.05	-4.502**	0.01	-0.409 ^{ns}	0.01	1.174 ^{ns}
Yield of milk fat, kg	-19.87	-8.519**	-22.66	-9.326**	-18.52	-7.136**
Yield of 4%FCM, kg	-477.64	-8.274**	-567.26	-9.431**	-473.36	-7.336**

* - p<0.05; ** - p<0.01; ^{ns} - p>0.05

Average values and variability of fertility traits in domestic and imported cattle are shown in Tables 4 and 5.

Table 4. Average values and variability of studied fertility traits in domestic cattle (n=245)

Indicator	\bar{X}	SD	CV	Min.	Max.
<i>First lactation</i>					
Age at calving, days	765.03	78.68	10.28	652	1129
Duration of service period, days	98.18	50.29	51.22	27	320
<i>Second lactation</i>					
Age at calving, days	1154.73	100.36	8.69	979	1518
Duration of service period, days	93.48	49.49	52.94	30	341
<i>Third lactation</i>					
Age at calving, days	1535.34	113.71	7.41	1283	1930
Duration of service period, days	88.07	33.29	37.79	39	202

Table 5. Average values and variability of studied fertility traits in imported cattle (n=58)

Indicator	\bar{X}	SD	CV	Min.	Max.
<i>First lactation</i>					
Age at calving, days	844.16	102.16	12.10	684	1311
Duration of service period, days	111.47	59.53	53.40	40	277
<i>Second lactation</i>					
Age at calving, days	1244.24	118.50	9.52	1023	1701
Duration of service period, days	103.67	59.37	57.26	38	317
<i>Third lactation</i>					
Age at calving, days	1623.97	153.44	9.45	1194	2062
Duration of service period, days	104.02	36.02	34.63	41	244

Domestic cows first calved earlier by 79.13 days, the second time by 89.51 and third time by 88.62 days, and all differences were statistically highly relevant ($p < 0.01$). In Table 6, statistically significant differences ($p < 0.01$) in the duration of service period can be seen and that the cows from domestic breeding/rearing had a shorter service period by 10.19 (II lactation) and 15.94 days (III lactation). *Croatian Livestock Selection Centre (2003)* in its annual report cites certain reproduction indicators for Simmental cattle population. The average age of registered cows in first lactation was 28 months, in second lactation 39 and the third 53 months. Average duration of service period was 120 days.

By analysing production and reproductive performance of Simmental bull dams in our country, *Pantelić et al. (2005)* have found the average age at first conception of 517.61 days, as well as the service period of 108.98 days.

Table 6. Differences in studied fertility traits between domestic and imported cows

Indicator	I lact.		II lact.		III lact.	
	difference	t _{exp}	difference	t _{exp}	difference	t _{exp}
Age at calving, days	-79.13	-6.479**	-89.51	-5.892**	-88.62	-4.965**
Duration of service period, days	-13.28	-1.744*	-10.19	-1.355 ^{ns}	-15.94	-3.228**

* - $P < 0.05$; ** - $P < 0.01$; ^{ns} - $P > 0.05$

The results indicate that even though there were statistically significant differences in age at calving and duration of service period between domestic and imported cows in first lactation, these differences did not significantly increase in the second and third lactation. This can mean that the imported heifers were fertilized later, or that they needed some time to adapt and prepare for insemination for the second calving.

Conclusion

Based on the results concerning the effect of import of breeding cattle of Simmental breed on improvement of production traits of domestic cattle population on the territory of Šumadija district, the following can be concluded:

Imported animals, in all three lactations realized higher yield of milk (449.08 kg in the first, 568.52 kg in the second and 488.73 in the third lactation), milk fat (19.87 kg, 22.66 kg and 18.52 kg, respectively) and 4% fat corrected milk (477.64 kg, 567.26 kg and 473.36 kg, respectively). When it comes to milk fat

from domestic cows, they had lower milk fat content in the first lactation by 0.05%, but higher in the second and third by 0.01%.

Differences in yield of milk and milk fat, 4% fat corrected milk in favour of imported cattle were highly significant ($p < 0.01$), as well as differences in the content of fat in the first lactation, while the differences in the content of fat in the second and third lactation were statistically insignificant ($p > 0.05$).

All studied cows on average calved the first time at the age of 780.17 days, the second time on 1171.86, and third 1552.31 days, the average service time decreased with the subsequent lactations from 100.73 days to 95.43 days and 91.13 days.

Domestic cows first calved earlier by 79.13 days, the second time by 89.51 and third time by 88.62 days, and all differences were statistically highly relevant ($p < 0.01$). Statistically significant differences ($p < 0.01$) were established in the duration of service period and it can be concluded that the cows from domestic breeding/rearing had a shorter service period by 10.19 (II lactation) and 15.94 days (III lactation).

From the results obtained in the study it can be concluded that the imports of high-quality heifers of Simmental breed from Germany significantly influenced the improvement of milk and fertility traits in cow population in the Šumadija district.

Efekat uvoza priplodnih krava simentalске rase na poboljšanje proizvodnih osobina domaće populacije

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Rezime

Na osnovu rezultatata ispitivanja efekta uvoza prilpodnih grla simentalске rase na poboljšanje proizvodnih osobina domaće populacije krava na teritoriji Šumadijskog okruga, mogu se izvesti sledeći zaključci:

Grļa iz uvoza su u sve tri laktacije ostvarile veću proizvodnju mleka (449,08 kg u I, 568,52 kg u II i 488,73 u III), mlečne masti (19,87 kg; 22,66 kg i 18,52 kg) i 4% mast korigovanog mleka (477,64 kg; 567,26 kg i 473,36 kg). Krave iz domaćeg odgoja imale su niži sadržaj mlečne masti u prvoj laktaciji za 0,05%, ali i viši u drugoj i trećoj za po 0,01%.

Razlike u ostvarenim prinosima mleka, mlečne masti i 4% mast korigovanog mleka u korist uvoznih krava bile su visoko signifikantne ($p < 0,01$), kao i razlika u sadržaju mlečne masti u prvoj laktaciji, dok su razlike u sadržaju mlečne masti u drugoj i trećoj laktaciji bile statistički neznačajne ($p > 0,05$).

Sve ispitane krave su se u proseku prvi put telile u uzrastu od 780,17 dana, drugi put 1171,86 dana, i treći put 1552,31 dana, prosečan servis period je opadao sa porastom laktacije po redu od 100,73 dana, preko 95,43 dana do 91,13 dana.

Krave iz domaćeg odgoja su se prvi put telile ranije za 79,13 dana, drugi put za 89,51 dan i treći put za 88,62 dana, i sve razlike su bile statistički visoko značajne. Takođe su ustanovljene statistički značajne razlike ($p < 0,01$) i u trajanju servis perioda gde su krave iz domaćeg odgoja imale kraće servis periode od 10,19 (II laktacija) do 15,94 dana (III laktacija).

Na osnovu iznetog u zaključku može se konstatovati da je uvoz kvalitetnih priplodnih junica simentalске rase iz Nemačke značajno uticao na poboljšanje osobina mlečnosti i plodnosti populacije krava u Šumadijskom okrugu.

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