

## **PRODUCTION PERFORMANCES AND HERD BOOK OF SIMMENTAL AND HOLSTEIN FRIESIAN CATTLE IN CENTRAL SERBIA**

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**Abstract:** Central Serbia has a long tradition of cattle farming and, as a hilly-mountainous area it favors rearing of dual purpose Simmental breed, and to a lesser extent, Holstein-Friesian dairy breed. The first Herd Book of Serbia was founded in 1935. The high quality breeding animals registered are under the control of production performance properties. According to expert report of the Institute for Animal Husbandry and the results of the implementation of the breeding program in 2018 in the territory of Central Serbia, there were a total of 153.979 quality breeding animals of Simmental and 16509 quality breeding animals of Holstein-Friesian breed in the main herd. Both breeds are of national interest and are included in the breeding-selection program for dairy cattle that are implemented through the cooperation of breeders and breeding organizations in the field. In Central Serbia, there are 157 registered breeding organizations involved in breeding and livestock recording activities. In this paper, data of the Head breeding organization in cattle farming, the Institute for Animal Husbandry, as well as reports issued by the same entity each year were used. A tabular analysis and a five-year trend are presented according to: the number of recorded animals, primiparous females in linear evaluation, the realized yield of milk, milk fat and protein, as well as the trend of the number of bull dams in the population. Based on the analysis of the results of work on cattle breeding and selection, it can be concluded that some progress has been made in milk production of both breeds. It is important to emphasize that there is a significant effect of mentioned factors on the productivity of entire cattle population in Central Serbia. Systematic work on the breeding and selection of cattle is an important work that should be carried out in high quality, continuously and appropriately in order to achieve maximum effects in cattle production.

**Key words:** cattle, Herd Book, Central Serbia

## Introduction

Livestock production is the leading branch of agriculture in the Republic of Serbia with its two most important sectors - milk and meat production. Central Serbia has a long tradition of cattle farming.

According to FAO reports from 2013, the world milk production has grown by more than 50%, over the past three decades, the main producers being the United States, India and China. According to the same FAO data (2013), in Serbia, in relation to the realized net value of agricultural production, dairy production takes the first place. Often, the existing genetic potential of cows is not fully exploited, so attention should be paid to correcting the effects of paragenetic factors of production and farm management (diet, housing and care, feeding systems, welfare, etc.). Selection for high milk production that is also reflected on reproductive performance traits, involves changes in the genotype, metabolism and hormonal status of cows (Zolt, 2016).

Popović (2014), based on the 2012 Agriculture Census, states that there are a total of 908.102 bovine animals in Serbia. The state, by providing some funding to breeders, aims to improve livestock production.

The objective of implementation of the current breeding program (2015-2019) is to increase milk yield while maintaining satisfactory reproductive and fitness traits.

Perišić (2008) states that Serbia had a total of about 1.1 million cattle at that time, with Simmental animals accounting for about 70%.

The establishment of the Central Livestock Union in 1892 and the Agricultural Cooperatives in 1894 contributed to first recording/registration of cows in the form of main records of the breeding animals of the highest quality in Serbia, at that time mainly herds of imported populations of the Simmental breed. The first Herd Book of Serbia was founded in 1935.

## Material and Methods

The paper presents the production performances of cattle in Central Serbia, as well as the main goals of the Breeding Program. The data available to the Head Breeding/Selection Organization on the territory of Central Serbia, the Institute for Animal Husbandry, as well as the reports issued by the Institute each year were used. The report on the results of the implementation of the Main Breeding Program from the past 2018 defines the basic selection measures, procedures and methods of selection, their implementation and controls the implementation of

these measures for each breed (GOP, 2015-2019). There is a pyramidal system of stakeholders: from the primary ones performing direct measurements and sampling on animals, through the subsequent ones distributed according to administrative districts of the country, to the head organization providing the results and data analysis and producing the final report to the competent Ministry. Currently, there are 157 registered basic breeding organizations in the territory of Central Serbia that are engaged in activities of animal records and selection of cattle according to the instructions and in cooperation with the head organization and the Herd book.

The methodology for controlling numbers, productivity and other results is in accordance with the provisions of the Law on Livestock production of the Republic of Serbia (*Livestock Law, 2009, 2012, 2016*) and the rules of the International Committee for Agricultural Data Calculation (ICAR, 2014), and these are detailed in the GOP. The Herd Book contains data on the total number of animals of known origin, followed by the data on newly recorded and previously recorded/registered cattle, and information on registered bulls whose semen is used for the fertilization of cows. The control of productivity of the home population of cows implies the results on the achieved production of milk, milk fat and milk proteins, as well as on the linear evaluation of primiparous heifers. The data obtained are analyzed by the statistical program StatSoft.Inc (2010), while the breeding values are determined by the Blup-Animal Model (SPSS 20).

## Results and Discussion

In the bovine breed structure of cattle in the Republic of Serbia it is estimated that the Simmental breed makes up about 75%, the group of Black and White Holstein-Friesian cattle about 15%, while fattening and indigenous breeds and crosses make up about 10% of the total number of cattle (HBOCP, 2019). Animals that have been linearly evaluated according to the Instruction for linear type and fitness evaluation of cattle (*Pantelić 2010*, presented at the Seminar of Breeding Organizations of Serbia), with regularly calving, and of known origin for at least two generations of ancestors (*Law on Livestock , 2009, 2012, 2016*) are selected for main herd. In 2013, the share of registered cattle (cattle under control) in the Simmental bovine population was 34% or 86% of the total number of registered cattle of all breeds (HBOCP, 2014).

According to the Herd Book data presented in Ttable 1, for the past five years and the area of Central Serbia, without Vojvodina, there is a trend of increase in the number of heads of both cattle breeds. In her paper, *Ostojić-Andrić (2015)*

reports similar results of a positive trend in cattle selection over a longer period of observation (2005-2014).

**Table 1. Number of registered animals under control of both breeds during five year period (2014-2018)**

Breed	Number of heads under control				
	2014	2015	2016	2017	2018
Simmental	107860	120861	133926	147957	153979
Holstein-Friesian	16767	17138	17141	17192	16509

The natural resources of the Republic of Serbia are defined by a significantly higher share of Simmental animals (about 80%), especially in the hilly and mountainous regions, i.e. Central Serbia. On the other hand, the Holstein-Friesian breed is mainly reared in the lower regions of Serbia - Vojvodina, while in Central Serbia it represents 10% of the total number of cattle. Although the Holstein-Friesian breed has a relatively lower share in the overall national breed structure, its productive performance as a specialized dairy breed is considered to be an important contributor to the dairy sector in Serbia (*Ostojić-Andrić et al., 2017*).

Linear evaluation of type and body development is very important information on the total breeding value of an animal, on the basis of which breeding heads are selected and classified into classes, and also entered in the Herd Book and obtain the "HB number". Determination of the average value of exterior traits, especially immeasurable properties, is useful information when defining a breeding goal and formulating an effective plan and program (*Lazić et al., 2015*). A linear evaluation of the body conformation enables identification of the traits of dairy animals, which are preliminary indicators of milk yield and longevity. In addition, it indicates the reproductive capacity of the animal, which is of great importance from the point of view of economic efficiency of milk production (*Pantelić et al., 2006*). For the Simmental population, the breeding objective defines the height of the withers of adult animal of over 140 cm and body weight over 650 kg. In addition, the preferable fitness traits, functional traits and animal temperament are also important part of the breeding objectives, followed by favorable calving ease, disease resistance and an average production life of five lactations. *Kebede and Kolmosi (2015)* also conclude that a linear evaluation of the animal is necessary to predict the contribution of cattle performance in programs to improve commercial milk production.

The data in Table 2 shows the results of linearly assessed primiparous heifers of two breeds which after the first calving and linear assessment are included in the main herd, and the trend of change in the number of heads is also shown.

**Table 2. Number of primiparous heifers in linear evaluation over a five-year period (2014-2018)**

Breed	Number of primiparous heifers in linear evaluation				
	2014	2015	2016	2017	2018
Simmental	16473	22311	19367	25903	24977
Holstein-Friesian	3401	3808	3796	3889	4060

According to the FAO public data (2019) presented in Table 3, total milk production in Serbia is 1550704 tonnes in total and has increased slightly compared to the previous five year period.

**Table 3. Total milk production and number of dairy heads (FAO stat data 2019)**

Year	Dairy heads	Milk produced (t)
2013	446924	1494412
2014	456477	1536808
2015	431761	1546216
2016	426224	1548697
2017	429595	1550704

Table 4 shows the milk production performance of dairy cows in the past period 2014-2018. Milk production during the reporting period is characterized by a minimal positive trend, where the milk yield of the main population of the Simmental and Holstein-Friesian breeds in Central Serbia is at a nearly constant level with a slight variation interval.

Data on average milk yield of Holstein-Friesian cows for e.g. 2016 is lower than in Croatia (7.633 kg) and Slovenia (7.535 kg) (CAA, 2016; ICAR, 2016a). In Austria, the average milk yield of Holstein cows in 2016 was 8.809 kg with 4.07% milk fat and 3.30% milk protein (ICAR, 2016b). According to WHFF (2016), HF

populations in Israel and the US with yields in excess of 11.000 kg have the highest milk production in the world, with the highest yields in Europe in Denmark, Germany and the Czech Republic (9-10,000 kg). In Serbia, milk production of this breed is at an average level of about 7.000 kg (Table 4).

Based on the results achieved and the assessed possibilities, the breeding objective for the period 2015-2019 foresees an increase in milk yield in the domestic Simmental breed population to an average production of 6.000 kg of milk with a minimum of 4.10% milk fat and a minimum of 3.60% milk protein, and for the Holstein-Friesian breed, the same program anticipates an increase for average production to 8.000 kg of milk with a minimum of 4.00% milk fat and a minimum of 3.50% milk protein (*GOP, 2015-2019*).

**Table 4. Production of milk, milk fat and protein of both breeds over a five-year period (2014-2018)**

Year	Breed	Number of completed lactations	Milk yield (kg)	Milk fat yield (kg)	Milk fat content (%)	Milk protein yield (kg)	Protein content (%)
2014	HF	10978	7310	264	3.62	236	3.22
2015		11893	7251	258	3.55	229	3.16
2016		11111	7060	253	3.59	221	3.13
2017		11907	6895	252	3.66	219	3.18
2018		11096	6891	254	3.68	221	3.21
2014	SIM	52789	4741	188	3,94	154	3,22
2015		67619	4773	190	3,97	153	3,21
2016		76864	4713	187	3,97	151	3,21
2017		84213	4810	190	3,97	153	3,19
2018		89135	4829	190	3,98	153	3,20

European Union (EU) standards stipulate milk quality and total bacterial count of 100,000 bacteria/ml and somatic cell counts of 400,000/ml, while the current average in Serbia for the total bacterial count in milk is 900,000/ml and somatic cell counts equal to 400,000/ml.

For the purposes of production of domestic bulls of both breeds, the best cows are selected as bull dams, which are at least two standard deviations above

the average of the controlled population in milk production, but also according to body development and origin (*Pantelić et al., 2009*). For optimal selection results, it is necessary that these animals make up about 1% of the population, but in Central Serbia this proportion is significantly lower (*Pantelić et al., 2011; Pantelić et al., 2005*).

The number of bull dams is shown in Table 5, accounting for less than 1% of the cow population in both breeds.

**Table 5. Number of bull dams of both breeds in the five-year period (2014-2018)**

Year	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Breed	SIM					HF				
Number of heads	413	410	365	426	410	168	135	102	129	203

## Conclusion

The main problem in the current situation in cattle farming in Serbia is the number of heads per farm. Small holdings dominate with less than 3 heads accounting for 50%, while the share of holdings with 20 or more heads is only 3.2% (HBOCP, 2014).

Lately, the colonization of cities has led to the villages being abandoned, accompanied by the unfavorable economic situation in the country. Mountainous regions are less populated and people are moving to lower regions of the country (*Petrović, 2015*).

The number of dairy cows in Central Serbia under control is increasing slightly, despite the decline in the total number of cattle in the country.

According to the European Union (EU) standards set for milk quality, in Central Serbia, there is a trend of decrease in the total bacterial count to less than 100,000 bacteria/ml and less somatic cells than 400,000 bacteria/ml milk.

Based on the achieved results in the cattle selection and breeding, over the past five year period, it can be concluded that some progress has been made in milk production in both breeds. However, given the breeding objective set for the controlled population of cows of both breeds in Central Serbia, breeding objectives (6000kg for SIM and 8000kg for HF) are unlikely to be reached by the end of 2019.

The number of bull dams should be maintained at the level of up to 1% of the highest quality animals on the total population.

Significant efforts have been made in the area of selection to improve the genetic potential of animals, but for optimal results it is also necessary to improve the conditions of feeding, housing and health care, which is difficult under the current socio-economic conditions.

Bearing in mind that milk production is very important as a strategic sector of agriculture in the Republic of Serbia, it is necessary to continue the proper implementation of the set and forthcoming breeding programs for both breeds. An important innovation in breeding programs is the inclusion of major non-productive traits (health, fertility, life expectancy, etc.).

Considering the existing problems in cattle breeding, it is important to consistently implement measures to improve the genetic potential of cattle breeds (Simmental and Holstein-Friesian) in line with the measures foreseen by the agricultural development strategy.

## **Proizvodni rezultati i matična evidencija goveda simentalске i holštajn rase u Centralnoj Srbiji**

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### **Rezime**

Centralna Srbija ima dugu tradiciju govedarske proizvodnje i kao brdovito područje pogoduje gajenju kombinovane simentalске, a u manjoj meri i mlečne holštajn-frizijske rase. Prvi *Herd Book* Srbije osnovan je 1935. godine. Kvalitetna priplodna grla registrovana u glavnoj matičnoj evidenciji i knjizi nalaze se pod kontrolom proizvodnih svojstava. Prema stručnom izveštaju Instituta za stočarstvo i rezultatima sprovođenja odgajivačkog programa u 2018. godini na teritoriji Centralne Srbije, ukupno je bilo 153979 kvalitetnih priplodnih grla simentalске i 16509 kvalitetnih priplodnih grla holštajn-frizijske rase u matičnom zapatu. Obe rase koje su od nacionalnog interesa uključene su u odgajivačko-selekcijske programe goveda za proizvodnju mleka koji se sprovode kroz saradnju odgajivača i odgajivačkih organizacija na terenu. U Centralnoj Srbiji postoji 157 registrovanih osnovnih odgajivačkih organizacija koje se bave poslovima matične evidencije i selekcije goveda. U ovom radu korišćeni su podaci glavne odgajivačke organizacije u govedarstvu, Institut za stočarstvo, kao i izveštaji koje isti subjekat izdaje svake godine. Prikazana je tabelarna analiza i petogodišnji trend grla prema:



brojnosti umatičenih grla, linearno ocenjenih prvotelki, ostvarenom prinosu mleka, mlečne masti i proteina, kao i trend broja bikovskih majki u populaciji. Na osnovu analize ostvarenih rezultata rada na selekciji goveda, može se zaključiti da je postignut određeni napredak u proizvodnji mleka obe rase. Važno je naglasiti da se pomenuti efekti reflektuju na produktivnost čitave populacije goveda u Centralnoj Srbiji.

Sistematski rad na odgajivanju i selekciji goveda je značajan posao koji treba da se sprovodi kvalitetno, kontinuirano i u odgovarajućem obimu, kako bi se postigli maksimalni efekti u govedarskoj proizvodnji.

**Ključne reči:** goveda, glavna matična evidencija, Centralna Srbija

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