

POTENTIALS OF SERBIAN LIVESTOCK PRODUCTION - OUTLOOK AND FUTURE

**M.M. Petrović¹, S. Aleksić¹, M. P.Petrović¹, M. Petrović², V. Pantelić¹,
Ž. Novaković¹, D. Ružić-Muslić¹**

¹Institute for Animal Husbandry, Belgrade – Zemun, 11080 Zemun, Serbia

²Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080 Zemun, Serbia

Corresponding author: Milan M.Petrović, e – mail: milpet99@gmail.com

Review paper

Abstract: The paper describes the state of the livestock production in the Republic of Serbia including preliminary results from the 2012 census: according to preliminary data, 908.990 heads of cattle, 3.403.288 pigs, 1.729.278 sheep and 235.576 goats are reared in Serbia. Structural and institutional measures, and measures of credit support should be the main instruments for achieving the goals of progress in animal husbandry. Activities in the breeding-selection work should be carried out in accordance with the recommendations of international organizations (ICAR, INTERBULL, EAAP). One of the most important outcome of these activities should result in a level of over 80% of the total population of cattle, pigs, sheep and other species of domestic farm animals in Serbia included in the control of production performance (presently between 25 and 30%). Genetic improvement of cattle, sheep and pigs (milk, meat) is very complex. More efficient use of reproductive technologies (AI - artificial insemination and embryo transfer ET, etc.), also of methods for evaluation of breeding value of farm animals through new methods of evaluation of breeding value of cows and breeding bulls will contribute to faster genetic improvement of production traits of these species of domestic animals. New knowledge in mapping and gene transfer, marker assisted selection, *in vitro* embryo development, embryo cloning, sexing, etc., are improving rapidly, with new technologies being developed permanently. Breeding/improvement of cattle, sheep and pigs in through breeding – selection work should facilitate further improvement of fertility traits, growth rate, feed efficiency, carcass quality (higher percentage of muscle tissue in the body), the quality of milk and meat, resistance to disease and stress, etc..

Key words: cattle, sheep, pigs, breeding, genetics, ET, MOET

Introduction

In early 2013, preliminary results were obtained in the agricultural census in the Republic of Serbia, carried out in 2012. According to the conducted census, there are 631.122 farms in Serbia as follows: 2.567 holdings of legal entities and entrepreneurs and 628.555 family farms/agricultural holdings. Total area of utilized agricultural area is 3.355.859 ha. The total number of cattle 908.990, 3.403.288 pigs, sheep and goats 1.729.278 and 235.576 heads, respectively. Based on these data and the data for 2011. (sbs, 2012) differences can be observed. The differences were greatest in the number of sheep, according to the 2012 census, there is nearly 300.000 more heads of sheep. Family households make up 99.6% of total households.

Changes in the global livestock production are very dynamic. In developed countries it is stagnant while demand for animal food products has increased in developing countries causing the increase of livestock production. Rising demand in developing countries is a great opportunity for livestock production. Increased demand in these countries is caused by population growth, urbanization and higher incomes of the population of these countries (*Delgado, 2005*). In the future, production will be limited by natural resources, particularly land and water. Improvements in breeding, nutrition and health of domestic animals will contribute to an increase of the genetic potential in production and improved efficiency of livestock production.

The share of livestock production in total agricultural production and the number of livestock units per hectare of agricultural land, indicate the degree of a country's agricultural development (*Petrović 2005., Petrović et al., 2011.*). Serbian agriculture farming is indispensable. It involves significant natural and human resources. Therefore, the intensification of livestock production and increase of participation in agricultural production are the basic requirements and the need to overcome the present backwardness, provide food to satisfy the demand of the population, stop the imports and make thorough preparations in the provision of quality meat produced for domestic and export purposes (*Aleksić et al., 2007*). The Republic of Serbia has significant natural resources (agricultural land, air, water, etc.) and very significant capacity and resources (agricultural population, livestock population, manufacturing and processing facilities and techniques, developed educational scientific activities, etc.). The current level of livestock production in Serbia does not provide cost-effectiveness, therefore it is necessary to work more efficiently and to change the same organization to enhance capacity building in qualitative and quantitative terms. Livestock production in the future should be able to respond to conditions similar to those in developed countries. The Serbian agriculture is dominated by small farms with an average area between 3 and 4 ha. Process of increasing the efficiency of livestock production may also contribute to the linking of stage of production and processing in a single production cycle,

which requires forming of the association of producers. In the structure of agricultural production in Serbia, about 65% derives from the plant production, and less than 35% is livestock production (EU - 70% livestock production and 30% of crop production). Serbia has about 0.60 ha of agricultural land and 0.50 ha of arable land per capita, which is above the average in Europe

Production of milk and meat, number of cattle

Cattle breeding absorbs most of the plant products as those of high quality, but also less valuable by-products, turning them into high value products, thus enabling the use of those areas that could not be used without the cattle. This type of farm animal gives the highest production of milk and meat, the basic high protein foodstuff used in human consumption and as raw material in food industries. About 60% of animal protein in human food is provided, in developed countries, through the use of bovine products, ie. milk, meat and meat products. Two breeds of cattle make the basis of the cattle industry in Serbia: Simmental cattle or domestic spotted in Simmental type, which is most common in rural areas on family farms. This widespread breed of combined traits corresponds to the nutritional resources, as well as the current economic situation of producers and the market situation of milk and meat. The weakness in the future, most likely will be lack of specialized breeds in areas where adequate production potential exists for animal feed (fattening/meat breeds - the mountainous region of Serbia). Black and Red Holstein-Friesian breed (dairy type cattle), is mainly present in the organized manufacturing farm production which supplies raw milk to the dairy industry. Numbers of cattle in recent decades, and especially in the last decade has been showing the trend of drastic decrease. This should not be too much alarming in regard to milk production, because the implementation and use of new biotechnological methods, techniques and technologies of breeding (genetic improvement) and increasing milk yield per cow, as well as with the organization of commodity farmers, in the existing cattle population, the production per cow and total production will intensify. However, the drastic decline in the number of females has negative effect on meat production (fewer cows – less calves or less fattening cattle intended for meat production).

Table 1. Numbers of cattle by Category (000 heads)

Year	1985	1990	1995	2000	2005	2010	2011
Cattle TOTAL	1.483	1.246	1.106	1.087	1.057	938	937
Cows	847	759	622	602	578	498	459
Fattening cattle	168	118	223	187	216	185	184

Source: Statistical Office of the Republic of Serbia

Milk production was not accompanied by pronounced downward trend in the number of cattle. The reason is the continued increase in production per cow. Current production is about 1.400 million liters of milk from which a portion of the food consumed by household members and producers sell at green markets, and most of the milk produced is delivered to dairy industry. People in Serbia have very low per capita milk consumption (about 200 liters). Residents of EU countries have far higher per capita consumption of 950 in Denmark and 280 liters in Bulgaria

Table 2. Production of milk in Serbia

Year	Bovine milk (million litres)	Sheep milk (million litres)
1990.	1.805	20
2000.	1.585	19
2005.	1.602	16
2010.	1.462	9
2011.	1.434	11

Source: Statistical Office of the Republic of Serbia

The total average annual production of beef for the past twenty years in Serbia was about 110,000t, with a tendency of decline, especially in recent years, and the latest data show that it is about 80,000 tons. Exports of cattle for slaughter and beef dropped drastically to meet less than 20% of its quota to the EU (8700 tonnes). Production of this type of meat in the Republic of Serbia has varied from 156,000 in year 1985 to 81,000 t in 2011. This quantity is sufficient meat for the domestic market, as the average consumption per capita is about 12 kg. Lower production of beef compared to Serbia have some Scandinavian countries, Portugal, Bulgaria, Greece, etc..

Table 3. Production of meat in Serbia (in 000 tons)

Year	Beef	Mutton	Pork	Total produced
1985.	156			
1990.	139	23	282	444
2000.	104	19	283	406
2010.	92	23	269	384
2011.	81	24	271	376

Source: Statistical Office of the Republic of Serbia

Cattle breed structure

Changes in the breed structure in cattle population raised in Serbia over the past decade has been intense. More intensive breeds have suppressed the extensive breeds and breeds with poor production, so that they had numerically reduced. Now Simmental and Domestic Spotted in Simmental type make up to about 75% of total population, the group of Black-and-White and Red-and-White Holstein-Friesian cattle around 20%, while the primitive races and crosses make up about 5% of the total number of cattle in the Republic of Serbia. According to estimates, of the total 450.000 cows, there are around 330.000 heifers and cows of Simmental breed in Serbia, Black and White and Red around 90.000 and around 30.000 of others.

Production of milk and meat, number of sheep

Sheep production is mainly in the possession of small family farms and in herds of 10-15 animals, from 70-100 heads, and fewer farms have 200-500 heads (*Petrović et al., 2011*).

Table 4. Number of sheep (000 head)

Year	1990	2000	2005	2010	2011
Sheep TOTAL	2.127	1.611	1.556	1.475	1.460

Source: Statistical Office of the Republic of Serbia

The average production of sheep milk (Table 2) steadily declined from 20 million liters in 1990 up to 11 million liters in 2011. The total average annual production of sheep and lamb meat for the last 20 years is constant and amounts to about 22.000 t (Table 3). This data shows a very low level of consumption of meat in Serbia of about 3 kg per capita per year.

Sheep breed structure

In terms of breed structure various strains of Pramenka make up about half of the total number of sheep, various types of crosses - about 25%, Tsigai breed about 5% and about 20% imported pure breeds used as improvement breeds. On the territory of the Republic of Serbia, the following sheep strains are reared: Sjenica, Svrlijig, Pirot, etc., Tsigai breed sheep, various more or less well-established crosses of different strains of Pramenka sheep and Merino breed. Of improvement sheep breeds in Serbia Merinolandshaf sheep flocks are reared (Wurtemberg breed) as a general improver breed of domestic pramenka strains, Ile de France, Bergamo and

Suffolk, as domestic sheep breed improvers to increase the yield and quality of meat.

Production of pig meat, number of pigs

Number of pigs changed from year to year. In the twenty-year period, the largest number of pigs was reared in 1990 - 4.301 million (Table 5) and the lowest in 2011 - 3.489 million pigs. These data show that for 20 years the number of animals was reduced by one million.

Table 5. Number of pigs (000 head)

Year	1990	1995	2000	2005	2010	2011
Pigs TOTAL	4.301	4.170	4.066	3.870	3.631	3.489
Sows and breeding gilts	708	-	-	-	623	616

Source: Statistical Office of the Republic of Serbia

The main product is high-quality pork. Besides a number of important characteristics of pigs, one of them, which is different from other domestic animals is a considerable amount of meat that can be produced per sow per year (more than 2000 kg of live weight of fatteners or over 1600 kg of carcass sides or more than 800 kg of meat). The importance pig breeding in the world, in Europe and in our country is the fact that of the total production of meat, pork accounts for 40 - 50%. Table 3 shows that the annual production of pork in the twenty-year period (1990-2011) in average was 282. 000 (1990) to 271.000 tons (2011).

Pig breed structure

On farms in Serbia, meat pig breeds and crossbreds are reared. In our swine herds, Landrace breeds (Swedish, Dutch, German, Belgian, Danish), Large White/Yorkshire, Duroc and Pietrain are reared. The most numerous are the breeds Swedish Landrace and Large White/Yorkshire. The share of meat breeds used as the terminal breeds in crossing (Belgian Landrace, German Landrace, Pietrain, Hampshire, Duroc) is low (less than 1% per individual breed). In addition to pure breeds, crosses are produced which make up more than 60% of the total number of sows (Petrović, 2006).

HOW TO IMPROVE THE LIVESTOCK PRODUCTION IN SERBIA

Improvement of livestock production should be set as a number of basic directions and clear goals. The following should be implemented: (change the structure of producers, property and institutions, market development and market

mechanisms, rural development and environmental protection) in order to achieve the basic goals that will result in:

- The formation of a sustainable and efficient livestock production that can compete in other markets, contributing to the growth of national income.
- Provision of food of animal origin that meets the needs of consumers in terms of quality and safety.
- Provide support for sustainable rural development.
- Preserve the environment from the effects of livestock production.
- Preparation of livestock production for Serbia's EU integration.
- Preparing policy and domestic support for trade in livestock and WTO rules (*Petrović, 2005*).

Economic policy

For faster and more economically efficient livestock production (milk, meat, etc.), as well as faster and more efficient organizations and associations of farmers, basically it is necessary to set up and solve the problems that have affected negatively, and still are, destabilizing the overall livestock production, motivation of farmers, the purchasing power of consumers and the regular supply of the market. Increasing the competitiveness of Serbian livestock production can be achieved by creating the conditions for the market environment through investment, both in knowledge and in equipment. Therefore, structural and institutional measures, and measures of credit support should be the main instruments for achieving this goal. Market measures, in an indirect way, may also contribute to achieving this goal (export subsidies, direct support prices, direct payments per hectare / per head of cattle and subsidizing inputs indirectly, by reducing the cost of agricultural products). Structural measures (investment support program through grant a certain percentage should support investment in equipment and machinery to improve production (milking equipment and storage of animal products, facilities, and equipment for raising cattle, sheep and pigs). Lending support through short-term, and especially long-term loans should result in the realization of this goal, as they allow investment in livestock, equipment and new technology.

Selection activities in livestock production

In the future, the activities of the breeding-selection work should be carried out in accordance with the recommendations of international organizations dealing with origin and production traits in farm animals (ICAR, INTERBULL, EAAP and other). In accordance with the EU regulations, a series of steps should be made to

produce formation of: a single database for all types of farm animals, and the system model for monitoring of production data, modeling of the evaluation of breeding values - unique breeding programs, support the organization of associations of breeders of farm animals with the creation of quality requirements/preconditions for organized work through the activities of associations through alliances at the national level and according the species of farm animals, to improve work of performance and progeny centers for testing and production of bull semen, boar semen, etc.

One of the most important results of this activity should result in a level of over 80% of the total population of cattle, pigs, sheep and other species of domestic animals in Serbia included in the control of production performance and traits (now between 25 and 30%).

Genetic improvement of cattle

The main reasons for the increase in domestic production of milk and meat are: the current production is insufficient to meet domestic demand, including potential exports. In Serbia, the number of cattle and cows must be increased (at least 600.000 head of cattle), the breeding-selection work in cattle production must be modernized. Genetic improvement of cattle (milk, meat) is very complex. Firstly, by increasing herd size per farm, conditions for greater genetic progress for more efficient production must be provided. More efficient use of reproductive technologies (AI - artificial insemination and embryo transfer – ET, etc.), and the use of statistical methods for estimating breeding values of farm animals through new methods of evaluation of breeding values of bulls and cows, new traits, which are subject to selection and greater intensity and effect of selection (*Simm et al., 2004*) will contribute to faster genetic improvement of milk production of cows. Linear methods are the basis for determining the breeding value of candidates for selection. The best linear unbiased indicators BLUP with a single and multiple random genetic effects can be divided into individual model, AM, a sire model, reduced animal model - RAM, and for more variables, models with the same and different descriptive matrices, with and without missing data and models with different data on relatives. The latest multi variable model -(test day model, which among other things uses curve and persistency of lactation.

Determining the variances and covariances of the basic population is done using a REML model (restricted maximum likelihood). In addition to milk traits that fall into the primary, the selection should be extended to other secondary traits. To body development characteristics and type, which for a long time have been included in the selection, health, traits of fertility and longevity, etc., are added (*Vollema, 1998*). The incidence of mastitis is a real problem in intensive and high yielding milk production, and among other things it can be reduced through

selection (somatic cells), inspite of the low heritability (0.05 to 0.10). For this purpose, the number of daughters per bull in progeny testing is increased. According to *Vollema (1998)*, heritability of longevity is low (0.10) with the provision that it increases later in life, but it is considered reasonable to pay attention to in the selection, particularly since the correlations between certain properties of body development and longevity are positive. New knowledge in mapping and gene transfer, selection markers through in vitro embryo development, embryo cloning, sexing, etc., very rapidly increasing, with an effort to develop new technologies (*Bulfield, 1998*).

Status and cattle breeding objectives in Serbia. Due to the reduction in the number of cattle and the production of milk and meat per animal and in total, essential programs and resources for reconstruction and development of cattle breeding are necessary. Instead of traditional small producers with two or three cows, which are rapidly extinguished, as many modern commodity farmers as possible should be developed (*Petrović and Lazarević, 2003*). Milk production should be developed in intensive conditions and meat production in a variety of conditions, from extensive to intensive. The breeding programs for improvement of Black and White and Simmental cattle need to be updated and successfully realized with the use of the massive introduction of modern biotechnology in reproduction (AI, ET, MOET). Our cattle populations should be kept open in terms of the breeding but to develop own bull test and selection work and connect with the participation and cooperation with international organizations and programs. In addition to our selection within populations, a controlled introduction of quality genetic material and crossing should be performed in order to achieve faster genetic improvement (*Petrović et al., 2006*). The breeding objectives are: Simmental breed, the average milk production in standard lactation over 6.000 kg with 4.10% milk fat and 3.60% protein; Holstein Friesian breed in standard lactation over 8.000 kg with 4.00% fat and 3,50% protein (*Pantelić et al., 2010*). A possible way to improve fattening and slaughter traits in domestic Simmental breed is the systematic crossbreeding with beef cattle breeds, using the effect of diversity breeds, heterosis effect (*Simm, 1998*) - crosses obtained from crossing domestic cattle of lower production capacity and bulls of beef breeds, French (Charolais, Limousine, Blonde d'Aquitaine), Italian (Chianina, Piemontese), English (Aberdeen Angus, Galloway, Hereford). The breeding objectives of this work and the use of heterosis effect is the creation of such genotypes that will allow final body weight of F1 crosses - young cattle from over 550 kg, average daily gain in the fattening of over 1500 g, warm carcass yield of over 60%, the content of the muscles in the body of over 65% (*Petrović et al., 2007; Petrović et al., 2011*).

Status and sheep breeding objectives in Serbia. Development of sheep production requires a large number of activities: increasing the number of sheep; forming of nucleus herd for certain breeds of sheep, as a way of creating of main population; implementation of flock selection and protection of native sheep breeds in terms of conservation of genetic resources, biodiversity and national biological heritage. In this respect, we should establish a breed standard (selected heads of sheep); increase the use of poorly utilized meadows and pastures. These resources, along with measures of improvement, can provide a good basis for the cheaper production of milk and meat. The main limitations in regard to restoration of these resources is the current process of depopulation in mountainous areas.

Breeding sheep to improve meat yield. In order to achieve a certain genetic progress in sheep breeding in Serbia, it is necessary to implement a programmed selection of breeds that are reared. Bearing in mind that the variability of quantitative traits within a population is expressed and that a number of individuals (+ variants) achieve above-average production results, breeders in countries with developed sheep production approached the formation of the nucleus (selective core), which is the backbone of future development and our sheep production.

In order to increase the production of meat, in addition to breeding and selection in pure breed, breeding/crossing methods are implemented in order to utilize the heterosis and create new, more productive breeds of sheep. This implies the following: the crossing of domestic Pramenka sheep with Merinolandschaf rams, breeding crosses that are the optimum combination of these two breeds with each other, crossing two-breed crosses with the third, the terminal breed of fattening type (Ile de France) to improve the fattening traits of lambs, crossing of Tsigai breed with rams of beef breeds (Suffolk, Ile de France and others.) - create a new breed of sheep for meat production (*Petrović et al., 2009.*)

Breeding to increase meat production should enable getting lambs with higher daily gain (over 300 g), higher final body weight at 90 days of age (over 28 kg), as well as greater carcass yields, (more than 58%). In the future period, the work on the problem of sheep reproduction should be intensified, and thus production of lambs for export and domestic markets. Lambing system should be organized so as to provide multiple pregnancy or postpartum period in ewes and productive life and more lambs per birth. The problem of transition to polycyclicality and fertilization of sheep throughout the year would be solved in two ways: genetically, using the crossing of breeds that manifested estrus outside the normal season (Dorzet Horn, Ile De France and Romanovski) using the method of stimulation, ie. induction and synchronization of estrus. In this way, the conditions for the application of intensive lambing system - two lambs in a year or three lambing in two years, would be created. Lambing system, the system of crossing, selection and line breeding, then shortening of the post-partum interval and the

increased lambing and number of lambs at birth, early weaning of lambs, the use of artificial insemination methods, automatic feeding machine, rearing of lambs using successful milk replacer and fattening of lambs from 30 - 45 kg from 90 to 120 days, will form the basis of modern technology in Serbian sheep breeding.

Status and pig breeding objectives in Serbia. The consequences of the future Serbia's entry into the WTO will be an international competition, the prices of pigs and pork products will likely fall more than the price of inputs. The answer to such a state will be a need to reduce production costs (primarily feed for fattening and piglets), which can be achieved by technological improvements, lower variable and fixed costs. In this regard, intensive family farms will have the advantage, but with the assumption that the above technological improvements are fulfilled, but also of economic and agricultural policies. Production standards are related to the fertility of sows and increase the efficiency of feed conversion. This will certainly be influenced by improved production properties and increase in the number of pigs under selection and expansion of artificial insemination of sows. Countries with developed pig breeding produce per sow 22-24 fatteners per year with and tendency of increase and reduction of losses. Researchers predict the production of 30 fattening pigs per sow per year. At 28 days of lactation, gestation period of 114 days and the duration of the period between weaning and 10 days of fertilization, it is possible to achieve a 2.4 farrowing per sow and year. Sows of poorer reproductive performance reduce the average number of parities per sow per year and therefore this parameter is not just a simple sum of the reproduction cycle. In the assumption that the average 10 piglets born alive per litter, losses during lactation 10%, during the breeding and fattening of 5% and 3%, it is possible to produce 19.9 fattening pigs per sow per year in our swine herds (*Petrović et al., 2012*).

Breeding pigs to improve meat yield through breeding-selection work should facilitate further improvement of fertility traits, growth rate, feed efficiency, carcass quality (higher percentage of muscle tissue in the body), and meat quality of pigs resistant to disease and stress. Constant, systematic and planned breeding-selection is necessary to increase the genetic potential of existing meat breeds and crossbreeds of pigs, to create a line of pure breeds in the application of divergent selection, in order to later have the expression of greater heterosis effect in their crossing. The aim of selection should be the increased muscle tissue in the most valuable parts of the carcass: leg, shoulder and loin. The breeding program in our country provides for crossing of Landrace (Swedish, Dutch) and Large White to produce the gilts of F₁ generation. They are then crossed with boars of the third race (terminal sire breeds: Hampshire, Duroc, Pietrain, German and Belgian Landrace) or boars of F₁ generation (*Petrović et al., 2006*).

It is necessary to choose the best farms in order to establish elite, breeding (reproduction) and production (commercial) herds in the pyramid organization of

production of breeding pigs and fatteners. This is necessary because it is not clearly defined which farms can produce quality breeding sows and boars, what the ratio should be with regard to the number of heads and the path of movement of pigs from the top to the bottom of the pyramid, in order to achieve greater genetic progress. The selection differential must be maximized and short generation interval. In these herds only breeding in pure breed is applied. Reproduction (breeding) herds of pigs are used to reproduce the pure breed because the elite herds can not produce a sufficient number of breeding animals. They purchase tested and positive evaluated animals from elite herds. Genetic improvement of traits at the top of the pyramid is extended to a larger number of animals. In addition to increasing the number of purebred sows, in these herds crossing and production of gilts F₁ generation is applied. In these herd, the production traits of pigs are tested and selection implemented. The criteria are somewhat lower than in the elite herds. Breeding animals from these herds are used for the production of fattening pigs in farms and production by private producers. Production (Commercial) herds produce only fattening pigs. They acquire male and female reproductive breeding animals from the herd. Gilts of F₁ generation can be purchased from reproductive herds, boars can be purchased from the elite herds or boar seed can be purchased of crosses or purebred animals from AI centers. Progeny of the three breed (three line) and / or four breed (four line) crosses are intended only for fattening. Why is the high fertility that is expected from the maternal line important? It is important because the sale must pay the costs of pig production piglets, keeping sows and boars, gilts and the production of pigs. Increasing the number of fattening pigs per sow per year enables to reduce the number of sows on the farm.

Boars from AI centres can be used for breeding in pure breed, producing crossbred sows in reproductive herds and produce commercial hybrids. In this way it is possible to achieve economic gains. Nucleus herds are selling quality breeding animals, the Center for AI greater amount of semen and commercial herds provide quality of animals for fattening and therefore should allocate funds from each of the slaughtered finishing pigs for breeding-selection work. Profit is the reduction of production costs associated with production of fattening pigs, high quality meat products and quality breeding animals are produced for the market.

NUTRITION. Nutrition is the most important paragenetic factor, and it should follow the genetic potential of the animal. In the next period, because of the price of final products of animal origin, special attention should be focused on this area (feed accounts for 50-60% of the cost of products), which ultimately should lead to significant rationalization in Serbian livestock production, i.e. production of milk and meat. Transfer of technological developments in this field in the world and our excellent experience should be placed in the supporting function of improved and new genotypes of domestic animals so that genetic potential of animals could be

manifested. Development and economic efficiency of meat production largely depend on the current and potential opportunities for the development and exploitation of cheap sources of roughage. Further development and improvement in the ruminant diet should largely be directed to the hilly area and utilization of important pasture areas (over one million ha), since they can thus be most effectively utilized. In conditions of preserved natural environment, cattle and sheep will in the best possible way transform a rough forages low in nutritional value into highly digestible proteins with high biological value, which are important in the human diet (beef and lamb, etc.). Technological solutions in the field of nutrition of fattening cattle and sheep will depend on many factors, primarily the specific areas (plains, hills and mountains). Requirements of domestic animals in terms of carbohydrates, protein, minerals and vitamins are known. In the future, the results of modern biotechnological methods in the field of nutrition and physiology should be used, so that they contribute to the development of livestock production and to contribute to the profession in general through better understanding of the processes in the field of nutrition and especially high genetic potential of animals and how they relate to reproductive performance (*Butler, 2000, Dumas et al., 2008*). Efficiency of livestock production fuels permanent research in the field of nutrition. Limitations and instability in production for farmers will represent the increase in feed conversion efficiency per kg of gain, which is one of the basic parameters of profitability.

In other words, milk producers will have to find cheaper and more competitive opportunities in nutrition, to reduce production costs, (example: a higher proportion of feed from meadows and pastures and increase the use of corn silage and some by-products of the food industry).

Conclusion

The paper describes the current condition in livestock production of the Republic of Serbia including preliminary results from the 2012 census. The total numbers of various farm animal species are following: cattle 908.990, pigs 3.403.288, sheep 1.729.278 and goats 235.576. Structural and institutional measures, and measures of credit support should be the main instruments for achieving the goals of progress in animal husbandry. Activities in breeding-selection work should be carried out in accordance with the recommendations of international organizations (ICAR, INTERBULL, EAAP). One of the most important results of this study should result in a higher level of over 80% of the total population of cattle, pigs, sheep and other species of farm animals in Serbia included in the control of production performance (now between 25 and 30%). Genetic improvement of cattle, sheep and pigs (milk, meat) is very complex. More

efficient use of reproductive technologies (AI - artificial insemination and embryo transfer ET, etc.), and use of methods for estimating breeding values of domestic animals through new methods of evaluation of breeding value of cows and breeding bulls will contribute to faster genetic improvement of production traits of these species of farm animals. New knowledge in mapping and gene transfer, marker assisted selection, *in vitro* embryo development, embryo cloning, sexing, etc., are improving rapidly, with new technologies being developed permanently. Breeding/improvement of cattle, sheep and pigs through breeding – selection work should facilitate further improvement of fertility traits, growth rate, feed efficiency, carcass quality (higher percentage of muscle tissue in the body), the quality of milk and meat, resistance to disease and stress, etc.

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Mogućnosti stočarstva Srbije – perspektiva i budućnost

M.M. Petrović, S. Aleksić, M. P. Petrović, M. Petrović, V.Pantelić., Ž. Novaković, D. Ružić-Muslić

Rezime

Početakom 2013. godine dobijeni su preliminarni rezultati popisa poljoprivrede u Republici Srbiji, obavljenog 2012. godine. Ukupan broj goveda je 908.990, svinja 3.403.288, ovaca 1.729.278 i koza 235.576 grla.. Povećanje konkurentnosti stočarstva Srbije se može ostvariti kreiranjem uslova za tržišno okruženje i putem investicija, kako u znanje, tako i u opremu. Zbog toga strukturne i institucionalne mere, kao i mere kreditne podrške treba da budu glavni instrumenti za ostvarenje ovog cilja. Aktivnosti u odgajivačko-seleksijskom radu treba da se sprovedu u skladu sa preporukama međunarodnih organizacija (ICAR, INTERBULL, EAAP i druga). Jedan od najvažnijih rezultata ovog rada treba da prouzrokuje nivo od preko 80% ukupne populacije goveda, svinja, ovaca i ostalih vrsta domaćih životinja u Srbiji bude obuhvaćeno kontrolom proizvodnih svojstava (sada između 25 i 30%).

Status i ciljevi oplemenjivanja goveda u Srbiji. Genetsko unapređenje goveda (mleko,meso) je vrlo kompleksno. Efikasnije korišćenje reproduktivnih

tehnologija (VO-veštačko osemenjavanje i ET-embriotransfer i dr.) i korišćenje metoda za procenu odgajivačke vrednosti domaćih životinja preko novih metoda ocene priplodnih vrednosti bikova i krava će doprineti bržem genetskom unapređenju mlečnosti krava. Nova saznanja u mapiranju i transferu gena, selekciji preko markera, in vitro razvoju embriona, seksiranju i kloniranju embriona i dr. Odgajivački ciljevi-simentalska rasa, prosečna proizvodnja mleka u standardnoj laktaciji preko 6 000 kg; Holštajn frizijska rasa u standardnoj laktaciji preko 8 000 kg. Melezi iz ukrštanja domaćih krava nižih proizvodnih sposobnosti i bikova tovnih rasa, francuskih, italijanskih, engleskih. Odgajivački ciljevi ovakvog oplemenjivačkog rada i korišćenje heterozis efekta je stvaranje takvih genotipova koji će omogućiti završnu telesnu masu meleza F1, junadi od preko 550 kg, prosečni dnevni prirast u tovu preko 1500 g, randman toplih polutki preko 60%, sadržaj mišića u trupu od preko 65%.

Status i ciljevi oplemenjivanja ovaca u Srbiji. Oplemenjivanje u cilju povećanja proizvodnje mesa treba da omogući dobijanje jagnjadi sa većim dnevnim prirastom (preko 300 g), veće završne mase tela sa 90 dana uzrasta (preko 28 kg), kao i većeg randmana trupa, više od 58%). Problem prelaska na policikličnost i oplodnju ovaca u toku cele godine obavio bi se na dva načina: genetički, korišćenjem ukrštanja rasa koje manifestuju estrus izvan normalne sezone (dorzet horn, il de france i romanovska) primenom metoda stimulacije, tj. indukcijom i sinhronizacijom estrusa. Tako bi se stvorili uslovi za primenu intenzivnog sistema jagnjenja dva jagnjenja u jednoj godini odnosno tri jagnjenja u dve godine. Sistem jagnjenja, sistem ukrštanja, selekcija i linijsko odgajivanje, zatim skraćenje post partum intervala i povećanje indeksa jagnjenja, kao i broja jagnjadi pri rođenju, rano zalučenje jagnjadi, korišćenje metode veštačkog osemenjavanja, automatskih mašina za dojenje, odgajivanje jagnjadi uspešnom zamenom za mleko i tov jagnjedi od 30 - 45 kg sa 90 do 120 dana.

Status i ciljevi oplemenjivanja svinja u Srbiji. Oplemenjivanje svinja u cilju unapređenja mesnatosti preko odgajivačko-selekciojskog rada treba da omogući dalje poboljšanje osobina plodnosti, brzine porasta, iskorišćavanja hrane, kvaliteta trupa (veći procenat mišićnog tkiva u trupu), kvaliteta mesa i otpornosti svinja na bolesti i stres. Odgajivačko-selekcijom radom neophodno je: povećati genetski potencijal postojećih mesnatih rasa i meleza svinja, raditi na stvaranju linija unutar čistih rasa primenom divergentne selekcije, kako bi se kasnije njihovim ukrštanjem ispoljivo veći heterozis efekat. Cilj selekcije treba da bude povećanje mišićnog tkiva u najvrednijim delovima trupa: but, plećka i kare. Odgajivački program u našoj zemlji predviđa ukrštanje landrasa (švedski, holandski,) i velikog jorkšira radi proizvodnje nazimica F1 generacije. One se posle toga ukrštaju sa nerastovima treće rase (terminalna rasa nerastova: hempšir, durok, pietren, nemački i belgijski landras) ili nerastovima F1 generacije.

References

- ALEKSIC S, PETROVIC., M.M., SRETENOVIC LJ., PANTELIC V., TOMASEVIC D (2007): Cattle production - current situation and future direction in Republic of Serbia. *Biotechnology in Animal Husbandry*, Book 1, 23, 5-6, 1-11.
- BULFIELD G. (1998): Will animal breeding become biotechnology. *Proceedings of the 6th World congress on genetics applied to livestock production*, vol. 23, p. 19.
- BUTLER, W. R. (2000): Nutritional interactions with reproductive performance in dairy cattle. *Anim. Reprod. Sci.* 60–61, 449–457.
- DELGADO C. (2005): Rising demand for meat and milk in developing countries: implications for grasslands-based livestock production. In *Grassland: a global resource* (ed. McGilloway D. A.), p. 29–39. The Netherlands: Wageningen Academic Publishers.
- DUMAS , A., DIJKSTRA J., FRANCE J. (2008): Mathematical modelling in animal nutrition: a centenary review. *J. Agric. Sci.* 146, 123–142.).
- PANTELIĆ, V., SAMOLOVAC, Lj., ALEKSIĆ, S., TRIVUNOVIĆ, S., PETROVIĆ, M.M., OSTOJIĆ-ANDRIĆ, D., NOVAKOVIĆ, Ž (2010): Heritability of type traits in first calving Black and White cows, *Archiv fur Tierzucht*, Vol 53 (2010), 5, 545-554.
- PETROVIĆ M.M., BOGDANOVIĆ V., PETROVIĆ P.M., RUŽIĆ-MUSLIĆ D., OSTOJIĆ D. (2002): Mogućnosti unapređenja stočarstva brdsko-planinskog područja Srbije, *Biotechnology in Animal Husbandry*, 18 (5-6), p. 1-8.
- PETROVIĆ M. M, LAZAREVIĆ LJ. (2003): The Present Situation in the Livestock Production in the Republic of Serbia .7 International Symposium, *Modern Trends in Livestock Production*, *Biotechnology in Animal Husbandry*, 19 (5-6), p.13-23.
- PETROVIĆ, M. M. (2005): Livestock production in Serbia on way to European Union. *Biotechnology in Animal Husbandry*, 21, (5– 6), p.1 – 8.
- PETROVIĆ, M.M., SRETENOVIC, LJ., PANTELIC, V., ALEKSIĆ, S., MIŠČEVIĆ, B., BOGDANOVIĆ, V., OSTOJIĆ-ANDRIĆ, D., PETROVIĆ, M. (2006): Results of the Application of the Tehnology of Genetic Improvement of Simmental Cattle Population in Serbia. *Biotechnology in Animal Husbandry*, 22(1-2), p.1 – 8.
- PETROVIĆ M.M., ALEKSIĆ, S., SRETENOVIC Lj, MARINKOV G, STOJANOVIĆ LJ., TOMAŠEVIĆ D (2007): "The Effect of Genotype on Quality of Beef". *Animal Science*, British International journal of fundamental and applied research vol 1. 3. International conference, Quality and safety in meat for consumer: from stable to table, Caunas , Lithuania, 06-07 June, p.102-104.
- PETROVIĆ M. M., PETROVIĆ M. P., M. PETROVIĆ, S. ALEKSIĆ, D. D. OSTOJIĆ-ANDRIĆ, V. PANTELIC, Ž. NOVAKOVIĆ (2011): How to increase

production of beef, lamb and pork in Serbia for domestic market and export. 3 rd International Congress-New Perspectives and Challenges of Sustainable Livestock Production, Belgrade, October 5-7. *Biotechnology in Animal Husbandry*, 27, 293-303..

PETROVIĆ M., PUŠIĆ M., RADOJKOVIĆ D., MIJATOVIĆ M., RADOVIĆ Č., ŽIVKOVIĆ B . (2006): Phenotypic and genetic variability of quality traits of carcass sides and meat. *Biotechnology in Animal Husbandry*, 22 (5-6):1-10.

PETROVIĆ M., RADOJKOVIĆ D., RADOVIĆ Č. (2012): Rezultati preduzimanih mera selekcije u svinjarstvu Srbije. Deseto savetovanje sa međunarodnim učešćem "Zdravstvena zaštita, selekcija i reprodukcija svinja", Srebrno jezero, 31. maj- 02. jun, 2012. *Zbornika radova*, 7-13.

PETROVIĆ M.P., RUŽIĆ - MUSLIĆ, D., MAKSIMOVIĆ, N. (2009): Procena genetskog potencijala ovaca u različitim proizvodnim sistemima. *Biotechnology in Animal Husbandry*, vol. 25, 5-6-1, p. 421-429.

SIMM G., BÜNGER L., VILLANUEVA B., Hill W. G. (2004): Limits to yield of farm species: genetic improvement of livestock. In *Yields of farmed species: constraints and opportunities in the 21st century*. Nottingham, UK: Nottingham University Press., pp. 123–141.

SIMM, G. (1998): Genetic improvement of cattle and sheep. p. 1-433.

VOLLEMA A.R. (1998): Longevity of dairy cows: A review of genetic variances and covariances with conformation. *Animal breeding abstracts* 66 (9), p. 781.

***Statistical Office of Serbia, Belgrade: Census of Agriculture 2012 in the Republic of Serbia – First results

***Statistički godišnjak Republike Srbije (STAT.GOD.SRB.2012.): Republički zavod za statistiku, Beograd, 1985 - 2012.