

FUTURE PERSPECTIVES IN BREEDING THE INDIGENOUS LOCAL STARA ZAGORA SHEEP AND IMPROVING THE PHENOTYPIC AND GENETIC PARAMETERS OF THE BREED

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Abstract: One of the most phenotypically attractive breeds in Bulgaria is the local Stara Zagora sheep. It is a local - indigenous breed specialized in dairy direction. In recent years, this valuable genetic resource is on the verge of being lost as the breed is threatened with extinction. The aim of the study is to monitor the genetic and phenotypic parameters of the main reproductive and productive traits in local Stara Zagora sheep. The research includes a total of 9495 ewes of the local Stara Zagora breed reared in 15 farms, produced during the period from 2011 to 2020 including. The studied traits were: fertility - biological of the first, second and third lambing, milk yield for a 120-day period of first, second and third standard lactation and live weight of different age categories. The statistical model that we used was based on the model of animal /Animal model/, using the software product PEST and VCE (Groeneveld), SYSTST 13 and SPSS for Descriptive statistics. The average phenotypic values of the traits: are respectively - fertility of 1st - 113%, 2nd - 125% and 3rd - 129% lambing; live weight of weaning - 29.79 kg, at 18 months - 63.87 kg, and at 2.5 years 72.92 kg; milk yield of the 1st - 98.37 l; 2nd - 104.60 l and 3rd - 108.80 l. lactation. Heritability (h^2) in the main selection traits milk yield of the first, second and third lactation is characterized by moderate values - 0.191; 0.225 and 0.184, respectively, and we report from low to moderate values of h^2 on the fertility in all three studied groups - fertility in the 1st - 0.183; 2nd - 0.149 and 3rd lambing 0.137. Milk yield is in high positive correlation and with a high statistical significance at different stages of lactation, between the 1st and 2nd - 0.849, between the 2nd and 3rd - 0.628 and between the 1st and 3rd - 0.447.

Key words: milk yield, fertility, heritability, correlation, genetic

Introduction

Worldwide, there are many indigenous breeds of farm animals and in particular endangered small ruminants. All these initial forms are the "genetic basis" of modern high-yielding widespread sheep breeds. They represent a valuable genetic resource, not only for the countries where their origin is, but also globally (*Belabdi et al., 2019*). Such is the local Stara Zagora sheep breed. The need to preserve these breeds of sheep is the motivation for this study. The monitoring will be useful for further breeding efforts with the breed.

The sheep reared and bred in Bulgaria before 1939 are mostly local and indigenous and bear their name from the region of their distribution. Such is one of the most attractive in phenotypic aspect breeds, namely the local Stara Zagora sheep. It is considered to be an intermediate form derived from the cross between Tsigai and Tsakel, but closer to Tsigai phenotypic and genetically. The most typical representatives of the breed are in the Stara Zagora region, where the origin of its name comes from. The area of distribution is not only in the low part of Stara Zagora, but also in Sliven, Haskovo and Yambol regions, as well as in the Thracian lowlands of southern Bulgaria. There are separate herds in other parts of the country. For many years it has been one of the most valuable in our country dairy breeds (*Kalaydzhiev et al., 2012*).



Figure 1. Local Stara Zagora sheep area of distribution, "Livestock breeds in the Republic of Bulgaria" 2011



Figure 2. Ram from local Stara Zagora sheep breed, from the archives of "ABSSBB" National Sheep Breeding Fair - Arbanasi 2021

The local Stara Zagora sheep in the recent past was one of the most common local milk breeds in Bulgaria, this fact provoked us to carry out this study, giving rise to the idea to study the basic phenotypic and genotypic indicators of some reproductive and productive traits of the sheep in the population. Phenotypically the breed is characterized by large and elongated body shapes, the typical features of dairy sheep. The head is relatively elongated, narrow and tender, not covered with wool. The breed is characterized by a curved profile of the nasal

line. The ears are long, wide and drooping, often wavy at the end. Basically, sheep are hornless, although 50-60 years ago it was considered normal to have horns as well. The legs are long, strong and thin. The tail is long and reaches below the hocks of the animals. The color of the fleece is white and the wool is uniform. In the descriptions of the first authors who studied the breed, animals with a black fleece color were also found. Their phenotypic traits are belonging to realm of cultivation - different economic years. Especially recently, the most preferred are the so-called "sandlot type" - with a pronounced long body, very long ears and tail, curved sometimes even very deformed profile of the head.

Milk production is of strategic importance for Bulgaria. The most numerous part of the sheep population in our country is dairy, that fact determines their headed place in the structure of the national gene pool (*Stancheva et al., 2013*).

The local Stara Zagora sheep is one of the breeds included in the schemes for complex reproductive crossbreeding and creation of the Bulgarian Dairy Synthetic Population (BDSP) (*Stancheva et al., 2014*).

One of the most important features of the existing local forms of domestic animals in the past is their adaptation to a given ecological zone or microdistrict of the country (*Bowles, 2015; Belabdi et al., 2019*). Created and bred for centuries in these areas, individual animal populations have gradually adapted to its characteristics - climate, terrain, soil and food and often bore the name of the region.

Stara Zagora sheep are much more sensitive, especially to the changing conditions of feeding and care (*Djorbineva, 1984*). These qualities do not make them attractive in today's market economy, despite their relatively good productivity. Many breeders have significantly reduced the number of ewes, and many have even given up, due to a number of difficulties, both financial and objective - related to the characteristics of both the market and the breed. This has led to a large reduction in the population.

Despite the developed program for the establishment of dairy sheep breeding in the country in the 80s the number of ewes of this breed did not increase significantly. After 1989 the number of controlled sheep decreased dramatically, as most of the animals were slaughtered, and others were distributed to private owners (*Djorbineva et al., 1995*). Thus, in this period, extremely valuable genetic material modeled and maintained over the decades is irretrievably lost.

The core of the Stara Zagora sheep breeding population has been reduced in recent years. There are very few farmers raising more than 50-60 sheep of the breed. Small farms with flocks of 20-30 purebred sheep predominate, which are extremely insufficient to conduct adequate selection (*Djorbineva et al., 2011*). Due to market situation, more breeders are turning to nurture of imported highly productive breeds in search of bigger profit.

Preservation of the typical phenotype of the population is also a serious problem, due to the fact that in recent years some farmers raising Stara Zagora sheep, cross them with introduced breeds for milk, and some with meat-breeds. Preservation of the breed in its authentic appearance requires purebred breeding (Kalaydzhiev *et al.*, 2012).

Effective part of the population which is controlled and work out in the direction of preserving the authentic appearance of the breed and at the same time its selection improvement varies over the years. In the last ten years the number of purebred Stara Zagora sheep included in the selection program of ABSSBB NGOs varies from 600 to 1150 ewes.

The aim of the study is to monitor the genetic and phenotypic parameters of the main reproductive and productive traits in local Stara Zagora sheep.

Materials and Methods

The study included private farms from Bulgaria - Stara Zagora, Haskovo and Sofia districts, flocks are owned by members of the NGO "Association for Breeding of Stara Zagora sheep breed in Bulgaria" (ABSSBB), based in Stara Zagora.

The study covers a total of 9495 ewes of the local Stara Zagora breed reared in 15 farms, produced during the period from 2011 to 2020 including - 10 year period. The sheep are being raised by a traditional technology typical for the low lands of our country - semi-intensively, not only on pasture but additionally fed.

All fifteen farms participating in the study are members of the NGO "Association for Breeding the Stara Zagora Sheep Breed in Bulgaria". The studied traits were: fertility - biological of the first, second and third lambing, milk yield for a 120-day period of first, second and third standard lactation and live weight of different age categories.

The control of milk yield was performed during the milking period, and over the years four controls were performed. The milk yield data refer only to the milk obtained from the ewes after complete weaning of the lambs. The quantity of milk is presented in volume units (ml). The individual milk yield of each ewe for the control day was calculated by multiplying the amount of milk obtained by the morning individual control by a herd ratio representing the ratio: morning + evening milk / morning milk. The milk yield for a 120-day milking period was calculated as the sum of the milk yields from the individual control periods of each sheep. Live weight was measured individually at weaning, at 18 months and 2.5 years.

The examined traits are controlled and registered according to a standard method and instructions, provided in the Instruction for control of the productive qualities and grading of the sheep in Bulgarian legislation (*MAFF 2003-2013*).

The necessary primary information for the study was obtained from the herd books and primary documentation kept in the “Association for breeding local Stara Zagora sheep breed in Bulgaria”.

The phenotypic and genotypic parameters of the productive and reproductive indicators of the local Stara Zagora sheep were studied taking into account the influence of genetic and non-genetic factors on the studied traits.

The analysis of genetic and environmental variances is based on the hypothesis that genetic variation is influenced by the effects: herd-year-season, year of birth, parity, litter size, permanent environmental effect and other effects reported in the error.

The general statistical working model is based on the model of animal /Animal model/:

$$Y_{ijklm} = \text{HYM } i + \text{Lam } j + \text{SL } k + \text{Lact } l + \text{LW } m + e_{ijklmno}$$

where:

Y_{ijklm} - observation of the respective trait;

HYM i - fixed effect of i th herd-year season;

Lam j - fixed effect of the size of j th lambing;

SL k - fixed effect of k th consecutive lambing;

Lact l - effect of the l th consecutive lactation;

LW m - effect of the m th live weight level of the animal – on weaning, 18 months and 2,5 years of age;

$E_{ijklmno}$ - random effect of unobserved factors;

Used software products to perform the statistical analysis of phenotypical values of the productive and reproductive traits in local Stara Zagora sheep, mean phenotypic values of fertility traits in 1st, 2nd and 3rd lambing and mean phenotypic values of traits live weight at weaning, at 18 months and 2.5 years, mean phenotypic values of the trait milk yield for 120 days at the 1st, 2nd and 3rd lactation were SYSTST 13 and SPSS.

Software products PEST was used to perform statistical analysis for calculation heritability and VCE (Groeneveld) for calculation the genetic correlations between the main productive and reproductive traits of local Stara Zagora sheep.

The method applied by us is similar to these used by *Kalydzhiev (2021)*.

Results and Discussion

Over time and under the influence of market changes, objective changes occur in the exterior of the animals in order to meet the specific needs of the market and to ensure the normal profitability of producers. In this way, the genome of the population is directly modeled and phenotypic changes occur. It is necessary to be traced in purebred breeding, which is carried out in the particular breed, whether it would bring qualitative and quantitative changes in the main traits, through selection based on phenotype. This would be possible only with a higher genetic diversity of the examined traits in the local Stara Zagora sheep. The studied population is one of the smallest in the country. The number of animals under control from 2010 to the present varies from 600 to 1,150 ewes.

The main statistical parameters of the traits: biological fertility; live weight and milk yield in different stages of development and producing of the animal, are presented on Table 1.

In recent years, the direction of selection in the population is aimed at increasing fertility, due to the fact that the realized lambs for slaughter and breeding represent over 45% of revenues from ewes, this determines the trait as a priority (*Slavova et al., 2017*). The average values of this trait obtained by us for the studied period are the following: fertility of 1st – 113%, 2nd – 125% and 3rd – 129% lambing.

Table 1. Phenotypic values of the main statistical parameters of the productive and reproductive traits in local Stara Zagora sheep

Trait	Main statistical parameters	STZ n= 9495	Trait	Main statistical parameters	STZ n= 9495	Trait	Main statistical parameters	STZ n= 9495
Fertility at 1 st lambing	Min. value	1	Live weight at weaning	Min. value	27	Milk yield at 1 st lactation	Min. value	78
	Max. value	2		Max. value	32		Max. value	116.5
	Mean value	1.13		Mean value	29.79		Mean value	98.37
	SD	0.427		SD	0.686		SD	3.346
	CV	34		CV	3		CV	4
Fertility at 2 nd lambing	Min. value	1	Live weight at 18 months	Min. value	60	Milk yield at 2 nd lactation	Min. value	83
	Max. value	3		Max. value	65		Max. value	124.7
	Mean value	1.25		Mean value	63.87		Mean value	104.60
	SD	0.519		SD	1.005		SD	3.780
	CV	34		CV	2		CV	4
Fertility at 3 rd lambing	Min. value	1	Live weight at 2.5 years	Min. value	68	Milk yield at 3 rd lactation	Min. value	85
	Max. value	3		Max. value	76		Max. value	129.6
	Mean value	1.29		Mean value	72.92		Mean value	108.80
	SD	0.498		SD	1.264		SD	4.425
	CV	35		CV	2		CV	3

STZ – local Stara Zagora sheep; SD - Standard Deviation; CV - Coefficient of variation

Compared to highly productive milk sheep breeds, the results are relatively low *Kalydzhiev (2021)*, but for local - indigenous breed are significant. According to *Djorbineva et al. (2011)* the average fertility of the Strao Zagora sheep in 1980. was 112% in 1989. - 108% and in 1999. - 96%. The reported standard deviation for the trait is low, but the coefficient of variation is high, with values of 34 for the 1st and 2nd lambing and 35 for the 3rd.

As mentioned above, increasing the profitability of a sheep breeding is also associated with increasing the number of animals realized for slaughter, which automatically makes live weight one of the important signs. The local Stara Zagora sheep is one of the largest sheep breeds in our country, the values for the trait exceed the average for sheep in Bulgaria. The obtained results prove it, as the average live weight of weaning is 29.79 kg, at 18 months - 63.87 kg, and at 2.5 years is 72.92 kg. Over the last 15 years, an increase of 8% has been reported for this sign.

The main selection trait for the Stara Zagora breed is milk yield. It provides about 50% of the income in the farms rearing the breed. The reported milk yield in our study is moderate, with a standard deviation in the range of 3 to 5, and the coefficient of variation with values from 3 to 4, which determines a not so variable sign with more constant values. The average values for milk yield per lactations are: 1st – 98.37 l; 2nd – 104.60 l and 3rd – 108.80 l. According to *Djorbineva et al. (2011)* the average milk yield of the Stara Zogora sheep in 1980 was 74.6 l, in 1989 - 89.0 l and in 1999. - 76.7 l. Conducting purposeful breeding activity on the trait of the last 40 years has led to its significant increase. For the studied period there are reported low minimum and relatively high maximum values of the trait in individual farms, this is a fact resulting from the diversification in the level of selection activity in individual farms. Some farmers still have difficulties in achieving better milk production, as breeding conditions are more primitive and the genetic potential of animals is lower.

Table 2 presents heritability of the selection traits: live weight; fertility and milk yield during different stages of development and production in the local Stara Zagora sheep breed.

Table 2. Heritability (h^2) of the main selection traits of local Stara Zagora sheep

Trait	h^2	Trait	h^2	Trait	h^2
Fertility at 1 st lambing	0.183 ± 0.021	Live weight at weaning	0.078 ± 0.021	Milk yield at 1 st lactation	0.191 ± 0.067
Fertility at 2 nd lambing	0.149 ± 0.025	Live weight at 18 months	0.022 ± 0.004	Milk yield at 2 nd lactation	0.225 ± 0.044
Fertility at 3 rd lambing	0.137 ± 0.074	Live weight at 2.5 years	0.033 ± 0.004	Milk yield at 3 rd lactation	0.184 ± 0.039

Biological fertility in the 1st, 2nd and 3rd lambing are the main reproductive traits included in our study. We report moderate values of h^2 at: fertility in the 1st - 0.183; 2nd - 0.149 and 3rd lambing 0.137 respectively. The values of heritability established by us are a reliable basis for conducting a purposeful breeding activity in the direction of increasing fertility. They also correspond to those established by (Kalaydzhiev, 2014).

Coefficient of heritability of the traits characterizing the intensity of growth: live weight at weaning, live weight at 18 months and live weight at 2.5 years obtained by us are identify with low values in the three groups - Table 2.

The lowest values of the indicator were reported at a live weight of 18 months - 0.022 h^2 . The heritability values were also low in the other two periods of development of the animals included in the study: live weight at 2.5 years - 0.33 and live weight at weaning - 0.078, the last was slightly higher than the other two periods.

Milk yield is the productive trait wit main importance for the local Stara Zagora sheep breed. The results obtained by us show moderately high levels of hertabils in the milk yield of the 1st, 2nd and 3rd lactation - 0.191; 0.225 and 0.184 respectively. Published by Kalaydzhiev *et al.* (2012), correspond to those received from us. The genetic diversity established by us for the trait of milk yield in the local Stara Zagora sheep is a favorable fact that would contribute to positive results in conducting targeted selection on the trait.

Table 3 presents results describing the genetic correlations between traits: live weight; biological fertility and milk yield during different stages of development and production in the local Stara Zagora sheep.

The correlations regarding the fertility trait are high and positive. It is highest between the 2nd and 3rd lambing 0.814 and has a degree of statistical significance, and the lowest between the 1st and 3rd lambing 0.471. Conducting selection for higher fertility of the 1st lambing would lead to a high positive result in the following, ie. can rely on selection carried out at an earlier stage of animal development, which will indirectly lead to a positive change in this trait in late stages of development.

Correlations within respect to the same trait in terms of age, ie. the recurrence of the trait in different phases of the development of the organism is evincible of the degree of its age variability. Earlier assessment of the potential of the animals is of great importance for selection and allows optimization of the control on productive traits and earlier indirect selection.

Correlation between biological fertility and live weight at different development stages of individuals characterizes with positive values. Between the fertility of the 3rd lambing and live weight of 2.5 years of age we established a medium negative correlation (- 0.428). Due to the obtained results we can conclude that in future breeding activity on the traits biological fertility and live weight

should be conducted purposeful selection according to the selection limits for the indigenous breed.

Table 3. Genetic correlations between the main productive and reproductive traits in local Stara Zagora sheep

Trait	Fertility at 1 st lambing	Fertility at 2 nd lambing	Fertility at 3 rd lambing	Live weight at weaning	Live weight at 18months	Live weight at 2.5 years	Milk yield at 1 st lactation	Milk yield at 2 nd lactation	Milk yield at 3 rd lactation
Fertility at 1 st lambing		0.631*	0.471	0.173*	0.188**	0.122	0.454**	0.268	-0.113
Fertility at 2 nd lambing			0.814*	0.134	0.076*	0.351**	0.084	-0.128**	-0.187
Fertility at 3 rd lambing				0.205	0.312**	-0.428	-0.725	0.144	-0.639**
Live weight at weaning					0.193*	-0.055	-0.041	-0.336	-0.077
Live weight at 18 months						-0.449	-0.791***	-0.294	-0.194
Live weight at 2.5 years							-0.213	-0.172**	0.318
Milk yield at 1 st lactation								0.849***	0.447**
Milk yield at 2 nd lactation									0.628**
Milk yield at 3 rd lactation									

statistical significance *: $p < 0.05$ **: $p < 0.01$ ***: $p < 0.001$

The dependence between the signs determining live weight at different stages of development of animals are from low to moderate negative, with the exclusion of the relationship between live weight at weaning and live weight at 18 months 0.193. This is exponential that it is suitably to carry out live weight selection independently and at least up to 18 months of age.

The trait milk production is in a high positive correlation and with a high degree of statistical significance at different stages of lactation. Between the 1st and 3rd lactation we found the lowest value 0.447, between the 2nd and 3rd 0.628 and between the 1st and 2nd lactation we report the highest value 0.849. The conducted

results gives us a reason to believe that targeted selection for the trait of milk yield of the 1st lactation would lead to a positive effect on the levels of the trait in the later stages of production. This aftermaths are also an strong argument for proposition optimization of milk control in different stages (up to lactation II), given their complexity.

It is important to note that the trait milk production is negatively correlated, in dissimilar extent, with most of the sights included in the study. An exclusion is the fertility of the 1st lambing, as the dependence between it and the milk production of the 1st and 2nd lactation is 0.454 and 0.268, respectively, but the correlation of the trait with the third lactation is negative (-0.113). We also establish a positive correlation between the milk yield of the 3rd lactation and the live weight at 2.5 year 0.318. This sign is straight related to both fertility and milk yield of ewes. According to our founding's, animals with a higher level of milk yield of third - lactation have a higher live weight at 2.5 years. Low positive dependence is observed between the signs of milk yield of the 1st lactation and fertility of the 2nd lambing 0.084, as well as in the milk yield of the 2nd lactation and fertility of the 3rd lambing 0.144. It should be mentioned that the results show very high negative correlations with a high degree of statistical significance in milk yield of 3rd lactation and fertility at 3rd lambing (-0.639), as well as in milk yield at 1st lactation and live weight of 18 months of age (-0.791).

The established results and the made analyzes are the reason to consider that for the future selection activity with the local Stara Zagora breed it is necessary to continue purebred breeding in order to keep the breed in its current phenotype, and it would be appropriate in view of the results independent selection on some of the main productive and reproductive traits - live weight, milk yield and fertility, according to the accepted selection limits for the breed. Recommendations that can be made are: the live weight of female animals be monitored until at least 18 months of age; fertility on the 1st and 2nd lambing; and milk yield on the 1st and 2nd lactation.

Monitoring the population and tracking its development during the years in which the selection was conducted by ABSSBB, leads to a clearer idea of what is happening inside it. The analyzes will lead to a more adequate direction and goal that must be pursued by breeders of the breed. Above all, it should be aimed at preserving the existing population of the local Stara Zagora sheep breed. This determines the task of preserving the genetic variability present in the breed in all morphological, qualitative and quantitative traits.

Conclusions

The average phenotypic values of the traits: of the local Stara Zagora sheep, respectively - fertility of 1st – 113%, 2nd – 125% and 3rd – 129% lambing; live weight of weaning 29.79 kg, 18 months - 63.87 kg, and 2.5 years 72.92 kg; milk yield of the 1st – 98.37 l; 2nd – 104.60 l and 3rd – 108.80 l lactation, as the established coefficient of variation and the standard deviations are moderate and prove that the direction of breeding during the development of the breed over time is aimed at establishing the above-mentioned traits as the main selection ones.

Heritability (h^2) in the selection traits milk yield at first, second and third lactation is characterized by moderate values - 0.191; 0.225 and 0.184, respectively, and we report from low to middle range values of h^2 for the three studied groups - fertility in the first - 0.183; second - 0.149 and third lambing 0.137. Moderate levels of genetic diversity in the studied traits of the local Stara Zagora sheep are reason to believe that breeding activities on phenotype would lead to positive results in increasing milk production and fertility.

The low rate of h^2 for the signs characterizing the growth intensity show vicinity and low variability in the studied part of the population. Live weight at weaning - 0.078, live weight at 18 months - 0.022 and live weight at 2.5 years - 0.33. The possibility of effective selection based on phenotype on the trait minimized by low levels of genetic diversity.

The positive correlations between the two traits fertility and growth intensity in all their phases of development are a reliable basis for leading a mass selection (by phenotype) and indirect selection on them.

Milk yield is in high positive and with a high degree of statistical significance at different stages of lactation, between the 1st and 3rd - 0.447, 2nd and 3rd - 0.628 and between the 1st and 2nd - 0.849. The established results gives us a reason to believe that targeted selection for improving milk yield of the 1st lactation would lead to a positive effect on the levels of the trait in the later stages of production.

Positive correlations were also found between fertility of the 1st lambing and milk yield of the 1st and 2nd lactation - 0.454 and 0.268 respectively. Which is also a basis for conducting indirect selection on the traits.

Perspektive uzgajanja autohtone lokalne starozagorske ovce i poboljšanje fenotipskih i genetskih parametara rase

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Rezime

Jedna od fenotipski najatraktivnijih rasa u Bugarskoj je lokalna starozagorska ovca. To je lokalna autohtona rasa specijalizovana za proizvodnju mleka. Poslednjih godina, ovaj vredni genetski resurs je na ivici ugroženosti jer rasi preti izumiranje. Cilj rada je praćenje genetskih i fenotipskih parametara glavnih reproduktivnih i produktivnih osobina lokalnih starozagorskih ovaca. Istraživanjem je obuhvaćeno ukupno 9495 ovaca domaće starozagorske rase gajenih na 15 farmi, proizvedenih u periodu od 2011. do 2020. godine. Ispitivane osobine su: plodnost - biološka prvog, drugog i trećeg jagnjenja, mlečnost za 120-dnevni period prve, druge i treće standardne laktacije i masa živih grla različitih starosnih kategorija. Statistički model koji smo koristili baziran je na Animal modelu, koristeći softverski proizvod PEST i VCE (Groeneveld), SYSTST 13 i SPSS za deskriptivnu statistiku. Prosečne fenotipske vrednosti osobina su: - plodnost 1. jagnjenje – 113%, 2. jagnjenje – 125% i 3. jagnjenje – 129%; masa grla na odbijanju - 29,79 kg, sa 18 meseci - 63,87 kg, a sa 2,5 godine 72,92 kg; mlečnost 1. laktacija – 98,37 l; 2. Laktacija – 104,60 l i 3. Laktacija – 108,80 l. laktacija. Heritabilnost (h^2) u glavnim selekcijskim osobinama - mlečnost u prvoj, drugoj i trećoj laktaciji, karakterišu umerene vrednosti - 0,191; 0,225 i 0,184, sa niskim do umerenim vrednostima h^2 za plodnost u sve tri ispitivane grupe - plodnost u 1. Jagnjenju - 0,183; 2. Jagnjenju - 0,149 i 3. Jagnjenju - 0,137. Mlečnost je u visokoj pozitivnoj korelaciji i sa visokom statističkom značajnošću u različitim fazama laktacije, između 1. i 2. - 0,849, između 2. i 3. - 0,628 i između 1. i 3. - 0,447.

Ključne reči: prinos mleka, plodnost, heritabilitet, korelacija, genetika

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