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Genetic and environmental variability of some productive traits in sheep of Bulgarian Dairy Synthetic Population in the flock of the Agricultural Institute - Stara Zagora

ABSTRACT

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The dissertation consists of 142 pages, 42 tables and 45 figures. The list of references includes 177 literary sources, of which 31 in Cyrillic and 146 in Latin.

The numbering of sections, tables and figures in the Abstract does not correspond to those in the thesis.

The defense of the dissertation will take place on 2022 from …… in the Conference Hall of the Agricultural Institute - Stara Zagora. The materials related to the defense of disseratation are available at the Scientific Secretary of the Agricultural Institute - Stara Zagora.

Scientific Jury:
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The reviews and opinions of the members of the Scientific Jury, as well as the Abstract, are published on the website of the Agricultural Institute – Stara Zagora:
http://www.szinstitute.com/

I. INTRODUCTION

Sheep breeding is a sector with long traditions in our country, favoured by the appropriate natural and climatic conditions. Sheep milk represents 7.1% of the total volume of milk raw material produced in our country. About 65% of sheep milk is produced from farms situated in southern Bulgaria.

Current trends are related to improving the quality of sheep milk and meat, the introduction of new technologies, improved production management, reduced costs and environmentally friendly production methods. In recent years, as well as the forecasts of leading world institutions show, there is a steady trend of increasing the relative share of processed milk in durable products (cheese, cheese, etc.). The dairy industry is paying more and more attention to the cheese-making qualities - the coagulation ability of milk, as this is a key indicator related to the profitability of the dairy and milk processing sectors. In Bulgaria, sheep milk is used to make some of the highest quality cheese, yellow cheese and yoghurt.

The largest relative share of the total sheep population in the country have the dairy sheep, as the animals of Bulgarian Dairy Synthetic Population have the largest share. A characteristic of this breed is its heterogeneity. Over the years, blood from the specialized milk breeds Lacaune, Assaf, Awassi and Chios has been infused in order to increase milk yield and prolificacy. The study of the different genotypes of Bulgarian Dairy Synthetic Population will provide the necessary information about the existing diversity within the breed and the development of a strategy for the transformation into a breed with high milk yield and proliifcacy, competitive with imported ones.

II. AIM AND TASKS

The aim of the present study was to analyze the genetic structure of Bulgarian Dairy Synthetic Population sheep flock raised at the Agricultural Institute - Stara Zagora, its heterogeneity and the relationship with the productive traits: milk yield, prolificacy and live weight, as well as to establish the individual coagulation ability and the qualitative composition of milk in ewes of Bulgarian Dairy Synthetic Population and in breeds involved in selection for the introduction of genetic plasma for increasing milk yield and prolificacy - Awassi, Lacaune, Chios an Pleven Blackhead breeds.

To achieve the aim we set the following tasks::

- Analysis of milk production of ewes of Bulgarian Dairy Synthetic Population in relation to the year and type of birth;
- Determination of the influence of the number of lambs born per ewe on the milk yield of ewes of Bulgarian Dairy Synthetic Population;
- Establishing the influence of suckling period on milk production;
- Analysis of the existing genetic structure of the flock raised at the Agricultural Institute - Stara Zagora in terms of its heterogeneity and relationship with the productive traits: milk yield, prolificacy and live weight;
- Comparative characteristics of the quality composition and coagulation ability of milk of ewes of Bulgarian Dairy Synthetic Population with different genotype;
- Determination of individual coagulation ability of milk and milk quality composition in ewes of Awassi, Lacaune, Chios, Pleven Blackhead breeds and in ewes of Bulgarian Dairy Synthetic Population;

- Determination of the relationship between % fat and % protein content with parameters characterizing the coagulation ability of milk.

III. MATERIAL AND METHODS

1. *Analysis of milk yield of BDSP ewes in relation to the year of birth*

Data from monthly controls of BDSP ewes born in the period 2006-2015 were used to analyze milk production. The study included 4182 milk yield records from the monthly controls of 327 ewes between 2006 and 2015. Daily milk yield data were obtained during the lactation period using the AC method as specified in the ICAR nomenclature, corresponding to 1066 lactations over the productive life of the animals studied. The number of consecutive lactations found was as follows: 1-st – 328; 2-nd – 282; 3-rd – 188; 4-th – 119; 5-th – 75; 6–th – 41; 7–th – 21, над 8-th – 12.

A test day model was used in which each test - day milk record was considered as a separate observation. The following model was used to establish the effect of the year of birth on milk production:

$$Milkday_{ijklmno} = yb_i + age_j + ym_k + parity_l + animal_m + pe_n + e_{ijklmno},$$

where:

$Milkday_{ijklmno}$ – ***o*** milk yield measured on a given control day;

yb_i – fixed effect ***i*** of the year of birth;

Age_j – j^{-tha} age of a given test dat – covariate;

Ym_k – fixed effect of the κ^{a} year of lambing;

$Parity_l$ – fixed effect of l^{-th} lambing;

$Animal_m$ – random effect of the m^{th} animal;

Pe_n –random effect of the n^{th} permanent environmental effect in the flock;

$e_{ijklmno}$ – random effect of unobserved factors .

2. *Analysis of the influence of reproductive ability and maternal qualities on milk productivity for the control day.*

2.1. Milk yield in BDSP ewes depending on the year and type of birth

Data from the monthly controls of BDSP ewes in relation to the year of birth (2006 – 2015) and type of birth of ewes (born as single, twins, triplets) were used. The study included 4182 milk yield records from the monthly controls of 327 ewes between 2006 and 2015. The number of the ewes born as singles was 169, as twins – 125 and as triplets - 33.

The following model was used to establish the influence of the type of birth on milk production:

$$Milkday_{ijklmnop} = yb_i + tbs_j + age_k + ym_l + parity_m + animal_n + pe_o + e_{ijklmnop},$$

where:

Milkday – ***p*** milk yield measured on a given control day;

yb_i – fixed effect ***i*** of year of birth;

tbs_j – fixed effect of the ***j*** type of birth (1– single, 2–twins, 3– triplets);

Age_k – k^{th} age of a given test dat – covariate;

Ym_l – fixed effect of the l^{-th} year of lambing;

$Parity_m$ – fixed effect of m^{-th} lambing;

$Animal_n$– random effect of the ***n^{th}*** animal;

Pe_o –random effect of the ***o^{th}*** permanent environmental effect in the flock;

$e_{ijklmnop}$ – random effect of unobserved factors.

2.2. Determination of the influence of the number of lambs born on the milk production of BDSP ewes.

The study included 4182 milk yield records from the monthly controls of 327 ewes in the period 2006–2015. The daily milk yield data were obtained during the lactation period, corresponding to 1066 lactations for the entire productive life of the studied animals. The number of ewes that gave birth to one lamb was 176, to twins – 144, and those that gave birth to three lambs were 7.

To achieve unbiased solutions, a control day model was used in which each daily milk control was treated as a separate observation.

$$Milkday_{ijklmno} = broilamb_i + age_j + ym_k + parity_l + animal_m + pe_n + e_{ijklmno},$$

where:

$Milkday_{ijklmno}$ – o milk yield measured on a given control day;

$Broilamb_i$ – i number of lambs in the specific lambing campaign;

Age_j – j age of a given test dat – covariate;

Ym_k – fixed effect of the ***κ^{-th}*** year of lambing;

$Parity_l$ – fixed effect of ***l^{-th}*** lambing;

$Animal_m$ – random effect of the ***m^{th}*** animal;

Pe_n –random effect of the ***n^{th}*** permanent environmental effect in the flock;

$e_{ijklmno}$ – random effect of unobserved factors .

2.3. Determination of the effect of suckling period on milk production of BDSP ewes.

Control day milk yield data were obtained from monthly controls conducted during the milking period (42 monthly controls for the period 2006 – 2015). The study included 4182 milk yield records from monthly controls of 327 ewes in the period 2006 – 2015 for 1066 lactations. Ewes were grouped into 5 classes according to the length of the suckling period (30 to 40; 41 to 50; 51 to 60; 61 to 70 and over 70 days suckling period).

The following model was used to establish the effect of suckling period on milk production:

$$Milkday_{ijklmnop} = dsp_i + nl_j + age_k + ym_l + parity_m + animal_n + pe_o + e_{ijklmnop},$$

where:

$Milkday_{ijklmnop}$ –p milk yield measured on a given control day;

Dsp_i– fixed effect of the ***i*** duration of the sucking period;

nl_j – fixed effect of the ***j*** number of lambs in the specific lambing campaign;

Age_k – k age of a given test dat – covariate;

Ym_l – fixed effect of the ***l^{-th}*** year of lambing;

$Parity_m$ – fixed effect of ***m^{-momo}*** lambing;

$Animal_n$– random effect of the ***n^{th}*** animal;

Pe_o –random effect of the ***o^{th}*** permanent environmental effect in the flock;

$e_{ijklmnop}$ – random effect of unobserved factors .

Data were analysed with the software Systat 13, PEST /Groenevel/.

3. *Analysis of the existing genetic structure of the flock raised at the Agricultural Institute - Stara Zagora in terms of its heterogeneity and the relationship with the productive traits - milk yield, prolificacy and live weight*

In order to accomplish the set task, the created database of pedigree data for BDSP ewes from the flock of AI – Stara Zagora was analyzed in terms of their heterogeneity in the period 2006 – 2015. The genetic code of each individual was made up of eight digits, each of which was the genetic code of an ancestor and the sum of which represented the genotype of the animal itself. In the BDSP ewes pedigree database, the breeds involved in the establishment schemes of the study flock, the individuals, the product of internal breeding and the breeds involved in the breeding experiments carried out for the introduction of genetic plasma to increase milk yield and prolificacy were indicated by the following codes:

1– *Bulgarian Dairy Synthetic Population (BDSP);* 2– *Lacaune (L);* 3– *Chios (Ch);* 4– *East Friesian (EF);* 5– *Stara Zagora breed (SZ);* 6– *Pleven Blackhead breed (PB)*

4. *Analysis of the the qualitative composition and the individual coagulation ability of milk in BDSP ewes with different genotype*

An analysis of 288 individual milk samples from 96 ewes (BDSP), taken in three consecutive controls during the period April – June 2016, was performed. In order to fulfill the set task, the created database of pedigree data for the BDSP ewes from the flock of AI-Stara Zagora was analyzed from the point of view of their heterogeneity.

All tests related to the individual milk samples were carried out in the milk laboratory of the Agricultural Institute – Stara Zagora. The qualitative composition of the milk was analysed using an ultrasonic milk analyser–Lactoscan S PFP, and the individual coagulation ability of milk - by Computerized Renneting Metter – Polo Trade, Italy.

5. *Analysis of the qualitative milk composition and individual coagulation ability of milk in different sheep breeds.*

The subject of study were 514 individual milk samples taken once from the following dairy breeds: **Lacaune** – village of Vodenichane, Yambol District – 50 samples; **Awassi** – village of Dimovtsi, Stara Zagora District – 62 samples; **Pleven Blackhead breed** – village of Kolarovo, Stara Zagora District – 190 samples; **Chios breed** – village of Ezerovo, Plovdiv District – 116 samples; **Bulgarian Dairy Synthetic Population** – Agricultural Institute - Stara Zagora – 96 samples.

The traits describing the coagulation ability of milk and those characterizing the qualitative milk composition were studied. Individual milk samples were taken during the morning milking without the addition of preservatives. The samples were stored in refrigerated bags at a temperature of 4°C, and were transported to the laboratory and analyzed within three hours after collection. All the tests related to the individual milk samples were performed in the milk laboratory of the Agricultural Institute - Stara Zagora. The physicochemical parameters of the milk samples were analyzed using an ultrasonic milk analyzer – Lactoscan S PFP.

The analysis of the individual coagulation ability of milk was performed using Computerized Renneting Metter – Polo Trade, Italy.

5.1. Establishing the relationship between % fat and % protein and the parameters characterizing Rennet Coagulation Time /RCT/.

To obtain a better approximation, the content of fat and protein substances were presented in classes for:

- Fat content: first – from 5,00 до 5,99 %; second – от 6,00 до 6,99 %; third – от 7,00 до 7,99 %; fourth – от 8,00 до 8,99 %; fifth – over 9,00 %.
- Protein content: first – from 4,00 до 4,99 %; second – from 5,00 до 5,99 %; third – over 6,00 %.

Data were analysed with the software Systat 13.

IV. RESULTS AND DISCUSSION

1. Analysis of productive traits in BDSP ewes

Milk yield, prolificacy and live weight data at different ages during the entire study period are presented in Table 1. The milk yield at the first lactation was 111,62 l. A positive trend of increasing milk yield was observed at the second (128,77 l) and third lactation (127,10 l). Prolificacy is another essential selection trait for modern sheep breeding. For the entire study period, the average lambing rates at first, second and third lambing were 1,19, 1,29 and 1,40 lambs per ewe, respectively. The live weight at weaning was 18,41 kg. At 9 months of age, 18 months of age and 2,5 years of age, the average values of the trait were 45,53 kg, 53,33 kg and 58,04 kg, respectively.

Table 1. Milk yield, fertility and live weight of BDSP ewes, born in the period 2006-2015.

Traits	$\overline{x}$	**SD**	**CV**	**Significance**
Milk yield, l				
I– lactation /a/	111,62	31,93	28,6	a:b*** a:c*** a:d**
II– lactation /b/	128,77	41,83	32,5	
III– lactation /c/	127,10	34,99	27,5	
IV– lactation /d/	115,59	27,41	23,7	
Prolificacy				
I– lambing /a/	1,19	0,39	32,9	a:b** a:c***
II– lambing /b/	1,29	0,47	36,3	b:c***
III– lambing /c/	1,40	0,50	36,0	
Live weight, kg				
at weaning /a/	18,41	3,62	19,7	a:b*** a:c*** a:d***
at 9 months of age /b/	42,53	5,76	13,5	b:c***
at 18 months of age /c/	53,33	6,10	11,4	c:d***
at 2.5 years of age /d/	58,04	7,02	12,1	

p < 0.05; **p < 0.01; ***p < 0.001

The statistical analysis showed a highly significant difference between the first and second, third and fourth and first and fourth lactation (p<0.001). Regarding the lambing rate, statistically significant differences were found between the first and third lambing and second and third lambing (p<0.001), as well as between the first and second lambing (p<0.01). A high level of statistical significance was estimated between live weights at different ages (p<0.001).

Table 2 presents the results of the variant components and degrees of significance for the influence of various factors on the milk yield of BDSP ewes. The type of birth factor had a medium significant influence ($p<0.05$) on the milk yield, while the year of birth, days of suckling period and litter size had a highly significant effect ($p<0.001$) on the studied trait. In a study conducted by Zvonimir et al. (2016) with sheep of the East Friesian breed, the authors found a significant influence of the number of lambs born on milk yield. Ewes with twin and triplet lambs had significantly ($p<0.05$) higher milk yield (per day and per lactation) compared to ewes with a single lamb.

Table 2. ***F – values and levels of significance for the influence of different traits / type of birth, year of birth, days of suckling period, number of lambs born per ewe / on the milk yield of BDSP ewes.***

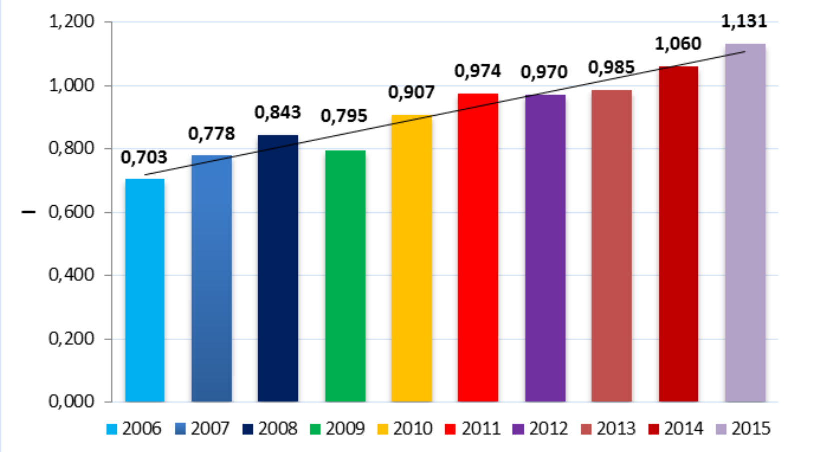
Traits	*F – Values*
Type of birth of ewes	4.085*
Year of birth of ewes	23.025***
Suckling period, days	2.389***
Litter size	22.061***

p< 0.05; **p < 0.01; ***p< 0.001

1. Analysis of daily milk yield of BDSP ewes dependingon the year of birth.

The tendency of development of daily milk yield in Bulgarian Dairy Synthetic Population depending on the year of birth of ewes is shown in **Figure 1**. Daily milk yield increased in relation to the year of birth. In ewes born after 2010, milk yield was higher than 0,900 l per day. The highest milk yield was observed in ewes born in 2015 – 1,131 l per day, and the lowest (0,703 l) – in ewes born in 2006. Similar values for the milk yield were found in ewes born in 2011 and 2012 – 0,974 l and 0,970 l, respectively. According to **Stancheva (2013)** in a study of sheep of Bulgarian Dairy Synthetic Population, born in the period 2004 - 2008, the highest milk yield had ewes born in 2008 (107,01 l), followed by those born in 2007 (96,97 l) and in 2004 (95,62 l). The lowest milk yield had ewes born in 2006 and 2005 (90,62 l and 91,00 l). In a study of Lacaune sheep, **Oravcová (2007)** found that as the year of birth increased, milk yield also increased.

Figure 1. Tendency of the trait milk yield depending on the year of birth

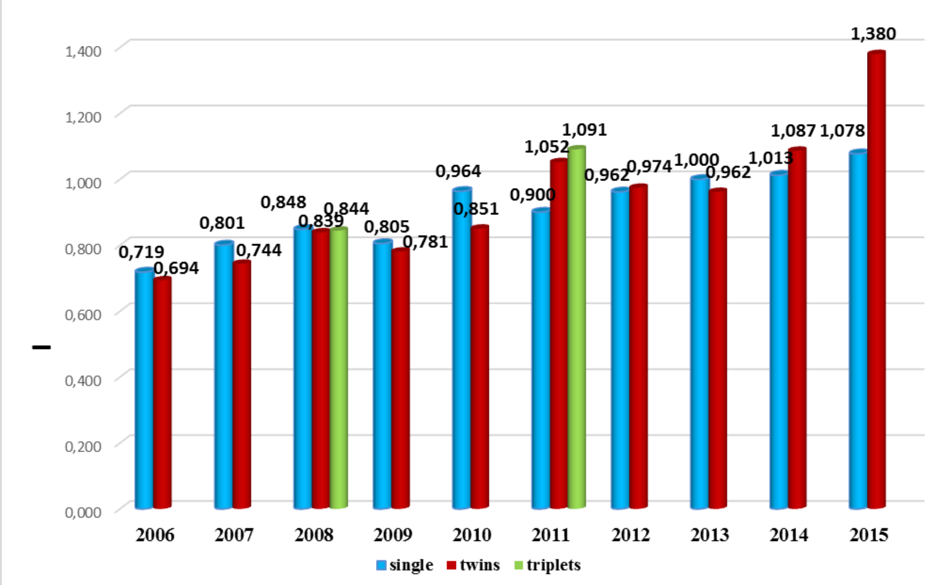


2. Analysis of the influence of reproductive ability and maternal qualities on the milk production for the control day.

2.1. Analysis of the daily milk production of BDSP ewes depending on the type of birtrh.

Figure 2 shows the milk values for the control day in BDSP ewes depending on the birth type. The lowest daily milk yield values were observed in ewes born in 2006 as twins – 0,694 l and as singles – 0,719 l. In ewes born in the following years - 2007, 2008, 2009 and 2010 we found lower milk yield in those born as twins. The highest daily milk yield was found in ewes born as twins in 2015 - 1,380 l. We reported higher milk yield values for animals born as twins in 2012 and 2014. For those born in 2011, we reported higher milk yield for ewes born as twins and triplets than as singles (1,052 l and 1,091 l).

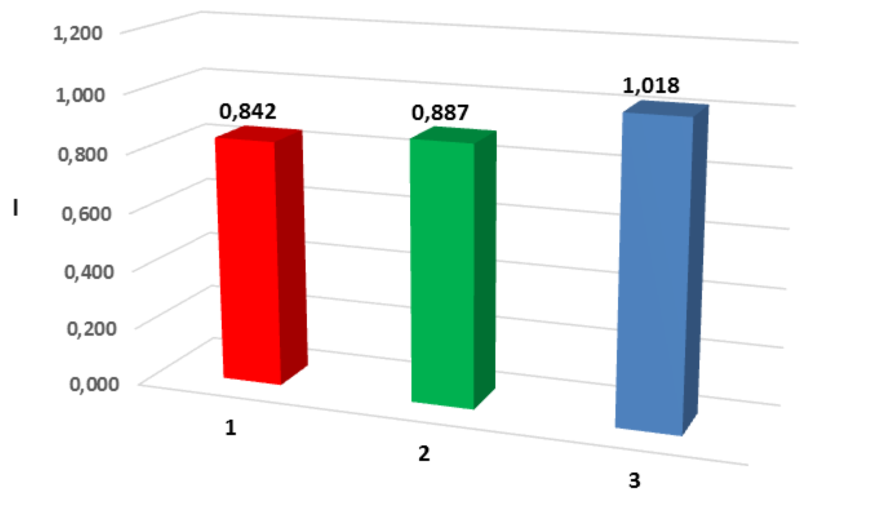
Figure 2. Daily milk yield depending on the type of lamb



3.2. Determination of the influence of the number of lambs born per ewe on the daily milk yield of BDSP ewes.

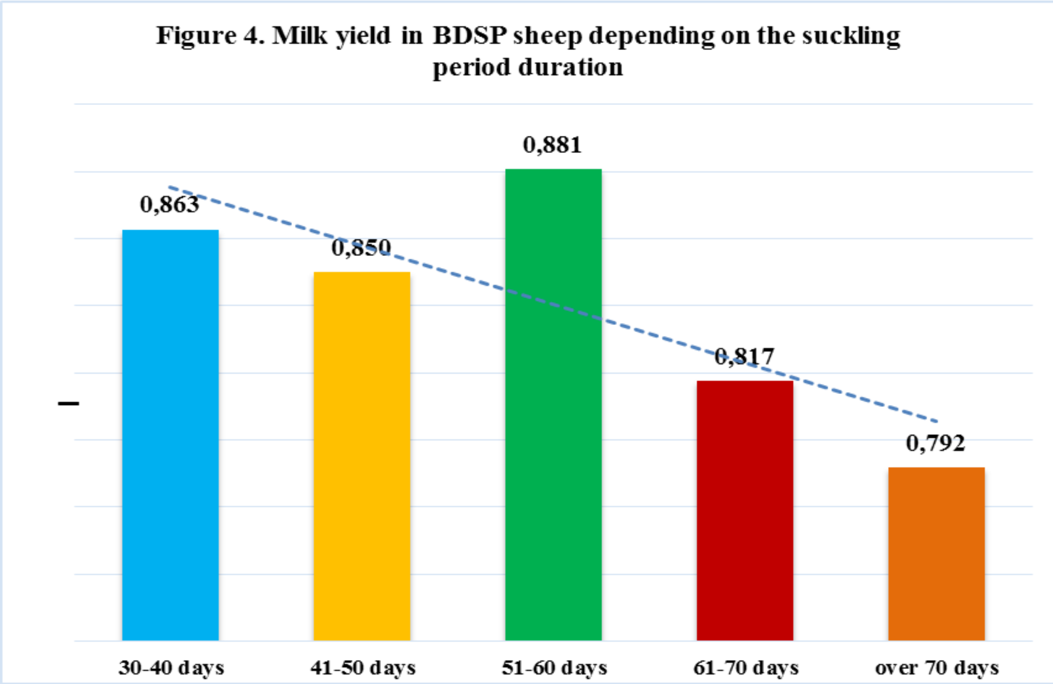
Figure 3 presents the influence of the number of lambs born per ewe on milk yields. According to the results, ewes giving birth to triplets tended to have higher milk yields (1,018 l) than those with singlets – 0,842 l. Ewes that gave birth to twins, had a daily milk yield of 0,887 l. Our results corresponded to those given by **Abd Allah et al. (2011)** in a study conducted with sheep of the Chios and Rahmani breeds in Egypt. The authors reported that the total milk yield was higher in ewes raising twin lambs (78,79 l) than in ewes with a single lamb (62,34 l). A similar trend was noted by **Mohamed (2010)** who found that ewes giving birth to twins had higher milk yield than those raising a single lamb. In a scientific study with sheep of the Lacaune and Chura breeds, **Abecia and Palacios (2018)** found that ewes that gave birth to twin lambs produced more milk than ewes that gave birth to singles. This conclusion was made by **Alkass et al. (2009)** in a study with Awassi sheep and crosses with Assaf, as well as by **Jawasreh et al. (2007)** in a study conducted with the Awassi breed. According to the authors, the increase in milk yield was due to the increased stimulation of the udder.

Figure 3. Milk yield in BDSP sheep depending on the litter size for the period 2006-2015г.



3.3. Establishing the influence of the duration of the suckling period on the daily milk yield of BDSP ewes.

The effect of suckling period duration on milk yield for the entire study period is shown on Figure 4. Similar results were found in ewes with a suckling period of 30 to 40 days and 41-50 days – 0,863 l and 0,850 l, respectively. The highest value of the studied trait was observed for a suckling period of 50 – 60 days – 0,881 l, and the lowest for a suckling period over 70 days – 0,792 l. **Stancheva et al. (2018)** also obtained such results in a study of BDSP ewes (Agricultural Institute – Shumen). The authors found the lowest milk yield in animals with a suckling period of 71 –80 and over 80 days (0,682 and 0,554 l), and the highest for a suckling period up to 20 (0,962 l) and up to 30 days (0,911 l). The established tendency for the milk yield to decrease with increasing the days of the suckling period is logical.



4. Analysis of the existing genetic structure of the flock raised at the Agricultural Institute – Stara Zagora

4.1. Milk production of BDSP ewes depending on the genotype

In our analysis of the existing genetic structure of the flock raised at the Agricultural Institute – Stara Zagora, we established that depending on the percentage of blood of individual breeds in the registered genotypes, 15 groups were formed. The diversity available in them derived from the ways of formation of the genotype and breed position in the genetic code of individuals (Table 3).

Table 4 presents the milk yield of BDSP ewes born in 2006 with a different genotype. The highest milk yield at second – 230 l, third – 162 l and fourth – 185 l lactation was reported in animals with genotype ***11111111 (100% BDSP)*** as the differences were proved to genotype ***11111511 (87,5% BDSP: 12,5% SZ), 11115151 (75% BDSP : 25% SZ), 11151511 (75% BDSP : 25% SZ), 15111511 (75% BDSP : 25% SZ)*** **–** $p<0.05$, third lactation. A significant effect at third lactation was found for genotype ***11153333 (50% Chios: 37,5% BDSP : 12,5%SZ)*** compared to animals with genotype ***15111511 (75% BDSP: 25% SZ), 15141111 (75% BDSP :12,5% SZ :12,5% EF), 15551111 (62,5% BDSP: 37,5% SZ)*** – $p<0.005$**.** Differences with degrees of significance from $p<0.01$ to $p<0.05$ were observed between the different genotypes.

Table 3. Genetic groups of ewes of Bulgarian Dairy Synthetic Population in the flock of AI-Stara Zagora.

Individual code	***% blood from individual breeds in the genotype***	***Total number of individuals***
11111111	*100% BDSP*	23
11111115 ***11111511***	*87,5 % BDSP: 12,5 % SZ*	20
11115151 ***11151115*** ***11151511*** ***11551111*** ***15111115*** ***11111515*** ***15111511***	*75 % BDSP: 25 % SZ*	30
11551115 ***11551511*** ***15551111***	*62,5 % BDSP: 37,5 % SZ*	13
11112222	*50 % BDSP: 50 % Lacaune*	23
11222222	*75 % Lacaune: 25 % BDSP*	6
11221222	*62,5 % Lacaune : 37,5 % BDSP*	5
11111222	*62,5 % BDSP: 37,5 % Lacaune*	5
11111415 ***11141115*** ***15141111***	*75 % BDSP:12,5 % SZ : 12,5 % EF*	20
11153333	*50 % Chios : 37,5 % BDSP: 12,5 % SZ*	8
11113333	*50 % BDSP: 50 % Chios*	6
11552222	*50% Lacaune : 25 % BDSP: 25 % SZ*	11
13222222	*75 % Lacaune : 12,5 % BDSP: 12,5 % Chios*	6
15111564 ***11151564***	*50% BDSP: 25% SZ : 12,5 % EF : 12,5% PB*	6
16111515	*62,5 % BDSP: 25 % SZ : 12,5 % PB*	8

Table 4. Statistical parameters and degree of significance of milk yield in ewes born in 2006 with different genotype

Genotype		min	max	‾x ± Sx	SD	CV	Significance
11111111 /a/	*I– lact.*	90,00	118,00	100,75 ± 6,10	12,20	12,1	a:f* a:h*
	II– lact.	110,00	230,00	152,50 ± 27,73	55,45	36,4	
	III– lact.	135,00	162,00	146,75 ± 5,96	11,93	8,1	a:b* a:d* a:e* a:g*
	IV– lact.	120,00	185,00	143,75 ± 14,34	28,69	20,0	a:b* a:d* a:g*
11111511 /b/	*I– lact..*	90,00	95,00	92,67 ± 1,45	2,52	2,7	b:f** b:g* b:h**
	II– lact.	95,00	120,00	105,00 ± 7,64	13,23	12,6	
	III– lact.	102,00	125,00	110,67 ± 7,22	12,50	11,3	b:f* b:h* b:j*
	IV– lact.	100,00	134,00	116,33 ± 9,84	17,04	14,6	b:h* b:j*
11111115 /c/	*I– lact.*	95,00	125,00	111,67 ± 8,82	15,28	13,7	c:f* c:h*
	II– lact.	110,00	125,00	118,33 ± 4,41	7,64	18,7	
	III– lact.	90,00	130,00	108,33 ± 11,67	20,21	18,7	c:f*
	IV– lact.	100,00	105,00	101,67 ± 1,67	2,89	2,8	c:d* c:g* c:h* c:j**
11115151 /d/	*I– lact.*	95,00	108,00	101,00 ± 3,79	6,56	6,5	d:f** d:h*
	II– lact.	95,00	110,00	103,33 ± 4,41	7,64	7,4	
	III– lact.	90,00	105,00	98,33 ± 4,41	7,64	7,8	d:e* d:f** d:h** d:j*
	IV– lact.	85,00	100,00	91,67 ± 4,41	7,64	8,3	d:h* d:j*
11151511 /e/	*I– lact.*	100,00	130,00	113,33 ± 8,82	15,28	13,5	e:f* e:h*
	II– lact.	90,00	120,00	108,33 ± 9,28	16,07	14,8	
	III– lact.	102,00	115,00	107,33 ±3 ,93	6,81	6,3	e:f** e:h*
	IV– lact.	80,00	105,00	92,67 ± 7,219	12,50	13,5	e:h* e:j*
1115 3333 /f/	*I– lact.*	140,00	145,00	142,333 ± 1,45	2,52	1,8	f:g** f:i** f:j**
	II– lact.	145,00	155,00	150,00 ± 2,89	5,00	3,3	

	III– lact..	140,00	150,00	145,00 ± 2,89	5,00	3,4	f:i*
	IV– lact.	100,00	120,00	106,67 ± 6,67	11,55	10,8	f:h* f:j*
15111511 /g/	*I– lact.*	99,00	102,00	100,33 ± 0,88	1,53	1,5	g:h*
	II– lact.	83,00	100,00	92,67 ± 5,04	8,74	9,4	
	III– lact.	115,000	148,00	129,33 ± 9,77	16,92	13,1	g:j*
	IV– lact.	90,00	100,00	95,00 ± 2,89	5,00	5,3	g:h* g:j*
15111564 /h/	*I– lact.*	130,00	145,00	137,68 ± 4,33	7,51	5,5	h:i* h:j*
	II– lact.	124,00	130,00	126,33 ± 1,86	3,22	2,5	h:i* h:j*
	III– lact.	135,00	142,00	139,00 ± 2,08	3,61	2,6	
	IV– lact.	125,00	145,00	136,67 ± 6,01	10,41	7,6	
15141111 /i/	*I– lact.*	90,00	100,00	94,33 ± 2,96	5,13	5,4	
	II– lact.	96,00	120,00	105,33 ± 7,42	12,86	12,2	
	III– lact.	94,00	125,00	107,00 ± 9,29	16,09	15,0	i:j*
	IV– lact.	80,00	110,00	98,33 ± 9,28	16,07	16,3	i:j*
15551111 /j/	*I– lact.*	90,00	105,00	97,50 ± 3,23	6,46	6,6	
	II– lact.	110,00	125,00	117,50 ± 3,23	6,46	5,5	
	III– lact..	140,00	158,00	148,25 ± 3,84	7,68	5,2	
	IV– lact.	125,00	146,00	137,75 ± 4,48	8,96	6,5	

p< 0.05; **p < 0.01; ***p< 0.001

Data on the milk yield of ewes born in 2007 are presented in **Table 5**. Animals with genotype ***111111511 (87,5% BDSP : 12,5% SZ)*** had similar values at the first lactation – 88 l with genotype ***11151564 (50% BDSP : 25% SZ : 12,5 % EF : 12,5% PB)*** – 89 l. It was obvious that the highest milk yield had ewes of the II and III lactation, with the highest values of the second lactation for the ewes with genotype ***87,5% BDSP, 12,5% SZ*** – 167 l. On the second lactation we established significant differences (p<0.05) in animals with a genetic code ***11111511 (87,5% BDSP: 12,5% SZ)*** to genotypes ***11151115 (75% BDSP : 25% SZ)*** and ***11151564 (50% BDSP : 25% SZ : 12,5% EF : 12,5% PB).***

Table 5. Statistical parameters and level of significance of the milk yield in ewes born in 2007 with different genotype

Genotype		min	max	$\bar{x} \pm Sx$	SD	CV	Significance
11111511 /a/	*I– lact.*	85,00	90,00	88,33 ± 1,67	2,89	3,3	
	II– lact.	155,00	178,00	166,67 ± 6,64	11,50	6,9	a:b* a:c*
	III– lact.	95,00	160,00	126,33 ± 18,80	32,56	25,8	
	IV– lact.	100,00	115,00	108,67 ± 4,49	7,77	7,1	a:b*
11151115 /b/	*I– lact.*	85,00	100,00	93,33 ± 4,41	7,64	8,2	
	II– lact.	100,00	105,00	102,33 ± 1,45	2,52	2,5	b:d*
	III– lact.	90,00	120,00	108,33 ± 9,28	16,07	14,8	b:d*
	IV– lact.	90,00	100,00	95,00 ± 2,89	5,00	5,3	b:d*
11151564 /c/	*I– lact.*	85,00	92,00	88,67 ± 2,03	3,51	4,0	
	II– lact.	94,00	110,00	101,33 ± 4,68	8,08	8,0	c:d*
	III– lact.	110,00	115,00	112,33 ± 1,45	2,52	2,2	c:d*
	IV– lact.	98,00	102,00	100,00 ± 1,16	2,00	2,0	
11153333 /d/	*I– lact.*	95,00	140,00	112,40 ± 7,60	16,99	15,1	
	II– lact..	102,00	170,00	148,60 ± 12,20	27,27	18,4	
	III– lact.	123,00	180,00	146,60 ± 9,72	21,73	14,8	
	IV– lact.	97,00	110,00	102,00 ± 2,43	5,43	5,3	

****p< 0.05; **p < 0.01; ***p< 0.001***

The following Table 6 shows the results obtained for the milk yield of ewes born in 2008. High milk yield was found in ewes with genotype ***50 % Chios: 50% BDSP*** at the II and III lactation – 163 l and 166 l, respectively. Ewes with a genotype ***75% BDSP, 12,5% SZ, 12,5% EF*** – 162 l (III lactation), 156 l (IV lactation) also had milk yield over 150 l. The differences between the breeds were proven with different degrees of significance (p<0.05, p<0.01, p<0.001).

Table 6. Statistical parameters and level of significance of the milk yield in ewes born in 2008 with different genotype

Genotype		min	max	‾x ± Sx	SD	CV	Significance
11111111 /a/	*I– lact.*	100,00	129,00	114,00 ± 7,56	15,12	13,3	
	II– lact.	98,00	104,00	100,50 ± 1,26	2,52	2,5	a:b* a:c* a:d** a:e* a:f** a:g***
	III– lact.	118,00	136,00	127,50 ± 4,43	8,85	6,9	a:c* a:f** a:g**
	IV– lact.	98,00	125,00	108,50 ± 6,20	12,40	11,4	a:b* a:c* a:f**
11111115 /b/	*I– lact.*	85,00	102,00	94,25 ± 4,05	8,10	8,6	b:c* b:d* b:f* b:g**
	II– lact.	114,00	173,00	134,50 ±13,16	26,31	19,6	b:f*
	III– lact.	125,00	182,00	142,50 ± 13,27	26,54	18,6	b:d* b:g*
	IV– lact.	130,00	180,00	148,50 ± 10,91	21,81	14,7	
11141115 /c/	*I– lact.*	100,00	111,00	105,33 ± 3,18	5,51	5,2	c:d** c:e* c:g*
	II– lact.	122,00	130,00	125,67 ± 2,33	4,04	3,2	c:d* c:g*** c:d**
	III– lact.	153,00	168,00	161,67 ± 4,49	7,77	4,8	c:d** c:e* c:f* c:g*
	IV– lact.	149,00	161,00	156,33 ± 3,71	6,43	4,1	c:g***
11151115 /d/	*I– lact.*	108,00	118,00	112,33 ± 2,96	5,13	4,6	d:e* d:g*
	II– lact.	137,00	150,00	142,67 ± 3,84	6,66	4,7	d:e* d:g*
	III– lact.	128,00	148,00	140,33 ± 6,23	10,79	7,7	d:f* d:g*
	IV– lact.	98,00	102,00	100,00 ± 1,16	2,00	2,0	d:e** d:f***
11551115 /e/	*I– lact.*	89,00	100,00	94,67 ± 3,18	5,51	5,8	e:f* e:g**
	II– lact.	118,00	136,00	128,67 ± 5,46	9,45	7,3	e:f* e:g*
	III– lact.	128,00	140,00	132,67 ± 3,71	6,43	4,8	e:f*** e:g*
	IV– lact.	125,00	126,67	126,67 ± 0,88	1,53	1,2	e:f** e:g**
15111115 /f/	*I– lact.*	115,00	136,00	123,75 ± 4,70	9,39	7,6	f:g*
	II– lact.	133,00	150,00	139,50 ± 3,80	7,59	5,4	
	III– lact.	164,00	177,00	168,50 ± 2,96	5,92	3,5	
	IV– lact.	160,00	175,00	169,25 ± 3,33	6,65	3,9	
11113333 /g/	*I– lact.*	124,00	140,00	129,50 ± 2,55	6,25	4,8	
	II– lact.	152,00	171,00	162,50 ± 2,95	7,23	4,5	
	III– lact.	154,00	180,00	165,50 ± 3,71	9,09	5,5	
	IV– lact.	90,00	112,00	100,00 ± 2,88	7,04	7,0	

p< 0.05; **p < 0.01; ***p< 0.001

Table 7 presents the milk yield of ewes born in 2009. The maximum of milk yield occurred during the third lactation, and in ewes with genotype ***11111111*** (***100% BDSP)*** the value was the highest (145 l). Only in ewes with blood content of ***75% BDSP, 25% SZ*** we established the highest milk yield at the second lactation - 117 l. It was noteworthy that with milk yield over 110 l at the IV lactation were the ewes with the following genotypes: ***11111111 (100% BDSP)***–129 l; ***11551115 (62,5% BDSP: 37,5% SZ)***–120 l and ***16111515 (62,5% BDSP : 25% SZ : 12,5% PB)*** – 114 l, with the exception of ewes with genotype ***15111115 (75% BDSP: 25% SZ)*** – 90 l. The highest maximum values of milk yield (152 l) were found in ewes with genotype ***16111515 (62,5% BDSP : 25 % SZ : 12,5 % PB)*** at the III lactation, as well as in animals with genotype ***11111111 (100% BDSP)*** –151 l with proven differences compared to genotype ***15111115 (75% BDSP : 25% SZ)*** – p<0.05.

Table 7. Statistical parameters and level of significance of the milk yield in ewes born in 2009 with different genotype

Genotype		min	max	‾x ± Sx	SD	CV	Significance
11111111 /a/	*I– lact.*	94,00	111,00	103,00 ± 3,13	7,00	6,8	a:c*
	II– lact.	100,00	128,00	115,60 ± 4,58	10,24	8,9	a:d*
	III– lact.	141,00	151,00	145,00 ± 1,76	3,94	2,7	a:c*
	IV– lact.	111,00	138,00	128,80 ± 4,71	10,52	8,2	a:c**
1551115 /b/	*I– lact.*	92,00	98,00	95,00 ± 1,73	3,00	3,2	
	II– lact.	110,00	132,00	121,33 ± 6,36	11,02	9,1	
	III– lact.	122,00	144,00	135,33 ± 6,77	11,72	8,7	b:c*
	IV– lact.	112,00	128,00	120,00 ± 4,62	8,00	6,7	b:c*
15111115 /c/	*I– lact.*	90,00	100,00	96,00 ± 3,06	5,29	5,5	
	II– lact.	114,00	120,00	116,67 ± 1,76	3,06	2,6	
	III– lact.	95,00	115,00	103,33 ± 6,01	10,41	10,1	c:d*
	IV– lact.	98,00	100,00	99,33 ± 0,67	1,16	1,2	
16111515 /d/	*I– lact.*	85,00	105,00	93,25 ± 2,30	6,50	7,0	
	II– lact.	102,00	142,00	125,75 ± 4,49	12,70	10,1	
	III– lact.	114,00	152,00	135,63 ± 5,35	15,13	11,2	
	IV– lact.	98,00	130,00	114,25 ± 5,27	14,91	13,0	

p< 0.05; **p < 0.01; ***p< 0.001

The results for the milk yield of ewes born in 2010 are presented in Table 8. The highest milk yield was found in animals with blood content of ***50% BDSP : 50 % Lacaune*** –145 l and in ewes with genotype ***11111111***–141 l on the 4th lactation. Milk yield increased from the first to the fourth lactation, with the exception of ewes with genotype ***1155222 (50% Lacaune : 37,5% BDSP : 12,5% SZ)***, in which the peak occurred on the third lactation – 107 l. We can say that there were no significant differences in the milk yield of ewes born in 2010.

Table 8. Statistical parameters and level of significance of the milk yield in ewes born in 2010 with different genotype

Genotype		min	max	‾x ± Sx	SD	CV	Significance
11111111 /a/	*I– lact.*	95,00	114,00	105,25 ± 4,23	8,46	8,0	
	II– lact.	105,00	117,00	112,75 ± 2,66	5,32	4,7	a:b* a:d*
	III– lact.	113,00	148,00	125,25 ± 8,02	16,05	12,8	
	IV– lact.	128,00	152,00	140,75 ± 4,92	9,85	7,0	a:b** a:c*
11111515 /b/	*I– lact.*	92,00	95,00	93,33 ± 0,88	1,53	1,6	
	II– lact.	98,00	100,00	99,33 ± 0,67	1,16	1,2	b:d*
	III– lact.	100,00	110,00	104,67 ± 2,91	5,03	4,8	b:d*
	IV– lact.	100,00	118,00	110,00 ± 5,29	9,17	8,3	b:d**
11552222 /c/	*I– lact.*	85,00	130,00	101,33 ± 14,38	24,91	24,6	
	II– lact.	94,00	106,00	100,00 ± 3,46	6,00	6,0	
	III– lact.	100,00	112,00	107,33 ± 3,71	6,43	6,0	
	IV– lact.	98,00	102,00	100,00 ± 1,15	2,00	2,0	c:d***
11112222 /d/	*I– lact.*	100,00	132,00	113,00 ± 7,06	14,12	12,5	
	II– lact.	115,00	150,00	131,25 ± 8,26	16,52	12,6	
	III– lact.	115,00	145,00	130,00 ± 7,36	14,72	11,3	
	IV– lact.	100,00	162,00	145,25 ± 15,10	30,19	20,8	

p< 0.05; **p < 0.01; ***p< 0.001

Table 9 presents the milk yield of ewes born in 2011 with a different genotype. The highest value was reported in ewes with blood ***50% BDSP*** and ***50% Lacaune*** **(*11112222*)**. At the first lactation, ewes with this genotype produced 117 l of milk, and the peak occurred at the second lactation – 170 l ($p<0.001$). There was a slight decrease in milk yield in the III lactation – 151 l ($p<0.01$) and IV lactation – 146 l ($p<0.05$). **Oravcova (2007)** registered a variation in milk yield in the range of 156–189 l in Lacaune sheep. In sheep with genotype ***50% Lacaune, 25% BDSP, 25% SZ*** we found an increase in milk yield with increasing the lactation period, with the highest value reported in ewes of the IV lactation (130 l).

Table 9. Statistical parameters and level of significance of the milk yield in ewes born in 2011 with different genotype

Genotype		min	max	$\bar{x} \pm Sx$	SD	CV	Significance
11112222 /a/	*I– lact.*	100,00	145,00	117,17 ± 6,55	16,04	13,7	
	II– lact.	160,00	185,00	169,50 ± 3,82	9,35	5,5	a:b***
	III– lact.	140,00	164,00	151,17 ± 3,73	9,13	6,0	a:b**
	IV– lact.	140,00	154,00	146,00 ± 2,11	5,18	3,5	a:b*
11552222 /b/	*I– lact.*	90,00	100,00	97,00 ± 2,38	4,76	4,9	
	II– lact.	100,00	105,00	101,75 ± 1,18	2,36	2,3	
	III– lact.	102,00	105,00	104,00 ± 0,71	1,41	1,4	
	IV– lact.	125,00	135,00	129,50 ± 2,10	4,20	3,2	

****p< 0.05; **p < 0.01; ***p< 0.001***

The following Table 10 shows the results obtained for the milk yield of ewes born in 2012. Here we observed only two groups of animals, and higher values were found in ewes with genotype ***50% BDSP: 50% Lacaune***. The highest milk yield was reported in ewes at the second lactation – 201 l. In our opinion, the higher milk productivity was most likely due to the participation of the highly productive Lacaune breed in the animal genotype. In ewes with genotype ***75% BDSP: 12,5% SZ: 12,5% EF*** close values were found on I – 100 l ($p<0.05$) and II lactation – 112 l ($p<0.001$).

Table 10. Statistical parameters and level of significance of the milk yield in ewes born in 2012 with different genotype

Genotype		min	max	$\bar{x} \pm Sx$	SD	CV	Significance
11111415 /a/	*I– lact.*	95,00	105,00	100,25 ± 2,06	4,11	4,1	a:b**
	II– lact.	110,00	115,00	111,75 ± 1,18	2,36	2,1	a:b***
	III– lact.	112,00	135,00	125,50 ± 4,94	9,88	7,9	
	IV– lact.	100,00	129,00	117,50 ± 6,17	12,34	10,5	a:b*
11112222 /b/	*I– lact.*	124,00	130,00	126,75 ± 1,38	2,75	2,2	
	II– lact.	195,00	205,00	200,50 ± 2,10	4,20	2,1	
	III– lact.	120,00	155,00	142,50 ± 7,77	15,55	10,9	
	IV– lact.	125,00	150,00	139,75 ± 5,27	10,53	7,5	

****p< 0.05; **p < 0.01; ***p< 0.001***

The milk yield of lactating ewes born in 2013 is presented in **Table 11**. The highest milk yield was found in animals with genotype ***50% BDSP: 50% Lacaune*** at the I (163l) and III lactation (137 l). Ewes with genetic code ***11111415 (75% BDSP : 12,5% SZ : 12,5% EF)*–**135 l***; 111111511 (87,5% BDSP : 12,5% SZ)* –** 128 l and ***11551511 (62,5% BDSP : 37,5% SZ)*–** 121 l had the highest milk yield on the III lactation. At the IV lactation the milk yield was the highest in ewes with genotype ***11222222 (75% Lacaune : 25% BDSP***) –122 l, the lowest milk yield of this lactation was found in ewes with blood content ***37,5% SZ, 62,5% BDSP*** – 104 l. According to the data from the performed milk controls, the ewes with blood content ***50% BDSP: 50% Lacaune*** had the highest maximum milk yield (166 l) of the first lactation with proven differences compared to genotypes ***11151511*** **(*75% BDSP : 25% SZ*) –** p<0.01, ***11222222 (75% Lacaune : 25% BDSP)*–** p<0.01, ***11551511 (62,5% BDSP : 37,5% SZ)*–** p<0.01.

Table 11. Statistical parameters and level of significance of the milk yield in ewes born in 2013 with different genotype

Genotype		min	max	$\bar{x}$ ± Sx	SD	CV	Significance
11111415 /a/	*I– lact.*	96,00	112,00	102,75 ± 3,64	7,27	7,1	a:c** a:e**
	II– lact.	100,00	110,00	104,00 ± 2,16	4,32	4,2	a:b* a:d* a:e*
	III– lact.	128,00	144,00	134,750± 3,40	6,80	5,0	a:d*
	IV– lact.	108,00	144,00	121,25 ± 8,16	16,32	13,5	
11111511 /b/	*I– lact.*	100,00	126,00	115,75 ± 5,72	11,44	9,9	b:c** b:e*
	II– lact.	112,00	135,00	124,25 ± 5,51	11,03	8,9	b:c*
	III– lact.	125,00	130,00	128,25 ± 1,18	2,36	1,8	
	IV– lact.	102,00	109,00	105,25 ± 1,49	2,99	2,8	b:c**
11112222 /c/	*I– lact.*	160,00	166,00	163,00 ± 1,29	2,58	1,6	c:d** c:e** c:f**
	II– lact.	100,00	130,00	115,25 ± 6,40	12,79	11,1	
	III– lact.	130,00	147,00	137,25 ± 3,90	7,81	5,7	c:e* c:f*
	IV– lact.	115,00	121,00	117,25 ± 1,44	2,87	2,4	c:d*
11151511 /d/	*I– lact.*	100,00	110,00	104,00 ± 3,06	5,29	5,1	
	II– lact.	120,00	130,00	126,00 ± 3,06	5,29	4,2	
	III– lact.	115,00	125,00	120,00 ± 2,89	5,00	4,2	
	IV– lact.	100,00	110,00	105,00 ± 2,89	5,00	4,8	
11222222 /e/	*I– lact.*	128,00	144,00	136,67 ± 2,67	6,53	4,8	
	II– lact.	100,00	132,00	120,17 ± 5,06	12,40	10,3	
	III– lact.	121,00	144,00	131,17 ± 3,28	8,04	6,1	
	IV– lact.	102,00	136,00	121,83 ± 5,23	12,81	10,5	
11551511 /f/	*I– lact.*	97,00	114,00	105,00 ± 4,93	8,544	8,1	
	II– lact.	100,00	115,00	107,67 ± 4,33	7,506	7,0	
	III– lact.	110,00	132,00	121,33 ± 6,36	11,015	9,1	
	IV– lact.	95,00	112,00	104,00 ± 4,93	8,544	8,2	

p< 0.05; **p < 0.01; ***p< 0.001

Table 12 shows the milk yield of ewes born in 2014. Animals with genetic code ***11112222 (50% BDSP : 50% Lacaune)*** produced the highest milk yield at III lactation (172 l) and II lactation (169 l). In them we found different degrees of significance at6 the first lactation compared to animals with genotype ***11551111*** **(*75% BDSP: 25% SZ)*** – p<0.01, ***11552222 (50% Lacaune: 37,5% BDSP :12,5% SZ)* –** p<0.05, ***13222222 (75% Lacaune :12,5% BDSP:12,5% Chios*) –** p<0.001.

Table 12. Statistical parameters and level of significance of the milk yield in ewes born in 2014 with different genotype

Genotype		min	max	$\bar{x} \pm Sx$	SD	CV	Significance
11111111 /a/	*I– lact.*	95,00	112,00	102,33 ± 2,84	6,95	6,8	a:c*** a:e* a:f*
	II– lact.	110,00	135,00	125,17 ± 3,83	9,37	7,5	a:c** a:f*
	III– lact.	110,00	142,00	130,33 ± 4,90	12,01	9,2	
	IV– lact.	100,00	134,00	123,00 ± 5,09	12,46	10,1	a:b* a:c* a:e*
11111415 /b/	*I– lact.*	95,00	112,00	104,00 ± 4,93	8,54	8,2	b:c*
	II– lact.	120,00	130,00	125,33 ± 2,91	5,03	4,0	b:c* b:e*
	III– lact.	125,00	135,00	130,00 ± 2,89	5,00	3,8	
	IV– lact.	98,00	102,00	100,00 ± 1,16	2,00	2,0	b:c* b:f*
11112222 /c/	*I– lact.*	124,00	130,00	127,00 ± 0,93	2,45	1,9	c:d* c:e** c:f**
	II– lact.	155,00	185,00	169,17 ± 4,00	10,57	6,3	c:d* c:e* c:f*
	III– lact.	150,00	184,00	171,83 ± 4,74	12,55	7,3	
	IV– lact.	126,00	151,00	142,83 ± 3,14	8,30	5,8	c:e* c:f*
11551111 /d/	*I– lact.*	102,00	111,00	106,00 ± 2,65	4,58	4,3	
	II– lact.	118,00	128,00	122,67 ± 2,91	5,03	4,1	d:e*
	III– lact.	118,00	140,00	130,00 ± 6,43	11,14	8,6	
	IV– lact.	110,00	138,00	126,00 ± 8,33	14,42	11,4	
11552222 /e/	*I– lact.*	100,000	105,000	102,33 ± 1,45	2,52	2,5	
	II– lact.	142,000	147,000	144,67 ± 1,45	2,52	1,7	
	III– lact.	134,000	145,000	140,33 ± 3,28	5,69	4,1	
	IV– lact.	98,000	102,000	100,00 ± 1,16	2,00	2,0	e:f*
13222222 /f/	*I– lact.*	103,000	116,000	110,33 ± 2,32	5,68	5,1	
	II– lact.	115,000	158,000	145,00 ± 6,27	15,36	10,6	
	III– lact.	132,000	150,000	142,33 ± 2,62	6,41	4,5	
	IV– lact.	110,000	140,000	125,33 ± 4,41	10,80	8,6	

p< 0.05; **p < 0.01; ***p< 0.001

The analysis of the results for the milk yield of ewes born in 2015 with a different genotype showed that it was the highest in the II (151 l), III (151 l) and IV (150 l) lactation in ewes with ***62,5% blood from Lacaune***, and the lowest – in animals with genotype ***111111511*** (***87,5% BDSP : 12,5% SZ)*** of II (112 l) and III (113 l)) lactation (Table 13). The highest maximum milk yield was reported in animals with genotype ***11221222*** (***62,5 % Lacaune : 37,5 % BDSP)*** of the third lactation, as the differences were proven to genotypes ***11111511 (87,5% BDSP : 12,5% SZ)*** – p<0.05 and ***11111222 (62,5% BDSP : 37,5% Lacaune)*** – p<0.05.

Table 13. Statistical parameters and level of significance of the milk yield in ewes born in 2015 with different genotype

Genotype		min	max	$\bar{x} \pm Sx$	SD	CV	Significance
11221222 /a/	*I– lact.*	105,00	125,00	116,40 ± 3,31	7,40	6,4	a:c*
	II– lact.	140,00	160,00	151,20 ± 3,40	7,60	5,0	a:b* a:d*
	III– lact.	135,00	162,00	150,80 ± 4,71	10,52	7,0	a:b* a:d*
	IV– lact.	142,00	160,00	150,80 ± 3,71	8,29	5,5	a:b* a:c* a:d**
11111511 /b/	*I– lact.*	110,00	115,00	112,33 ± 1,45	2,52	2,2	
	II– lact.	110,00	118,00	113,00 ± 2,52	4,36	3,9	
	III– lact.	125,00	134,00	129,00 ± 2,65	4,58	3,6	
	IV– lact.	111,00	120,00	116,00 ± 2,73	4,73	4,1	
11111415 /c/	*I– lact.*	110,00	117,00	114,00 ± 2,08	3,61	3,2	c:d*
	II– lact.	120,00	133,00	125,00 ± 4,04	7,00	5,6	
	III– lact.	130,00	135,00	132,00 ± 1,53	2,65	2,0	
	IV– lact.	108,00	118,00	112,67 ± 2,91	5,03	4,5	
11111222 /d/	*I– lact.*	108,00	125,00	116,40 ± 3,14	7,02	6,0	
	II– lact.	104,00	150,00	133,00 ± 7,76	17,35	13,0	
	III– lact.	126,00	137,00	130,60 ± 1,89	4,22	3,2	
	IV– lact.	120,00	134,00	126,60 ± 2,44	5,46	4,3	

p< 0.05; **p < 0.01; ***p< 0.001

4.2. Prolificacy of BDSP ewes depending on genotype.

Milk yield and prolificacy are the most important productive traits in dairy sheep. Figures 5, 6 and 7 show the prolificacy of ewes of different genotypes in the first, second and third lambing. Depending on the sequence of lambing, it is noticeable that prolificacy was the highest at the second and third lambing, and the lowest –at the first lambing. Similar results were found by **Stancheva (2013)** in a study of BDSP ewes raised at AI –Shumen. **Stancheva (2013)** found the lowest prolificacy on the first lambing (1,25 lambs), and the highest on the third lambing (1,52 lambs).

Better values of the studied indicator at the first lambing showed the ewes with ***75 % BDSP : 1,25 % SZ: 12,5 EF*** (1,6 lambs); ***62,5 % BDSP: 25 % SZ : 12,5 % PB*** (1,6 lambs); ***50 % Chios : 37,5 % BDSP : 12,5 % SZ*** (1,5 lambs)**;** ***62,5 % BDSP : 37,5 % SZ*** (1,5 lambs***)*** and ***75 % BDSP :25% SZ*** (1,5 lambs). In studies with Awassi sheep, **Goodwin et al. (2000)** and **Degen et al. (2003)** reported for 1,28 lambs per ewe. At second lambing we again reported good results in ewes with blood ***62,5 % Lacaune : 37,5 % BDSP*** (1,8 lambs); ***50 % Chios : 37,5 % BDSP: 12,5 % SZ*** (1,8 lambs); ***75 % BDSP: 25% SZ*** (1,7 lambs); ***62,5 % BDSP: 37,5 % SZ*** (1,7 lambs); ***75 % BDSP: 25% SZ*** (1,6 lambs); ***62,5 % BDSP : 37,5 % Lacaune*** (1,6 lambs). Prolificacy at the third lambing was the highest. Here, in addition to the animals from the first and second lambing, high values showed the ewes with blood from the Stara Zagora and Pleven Blackhead breeds (***75 % BDSP : 12,5 % SZ : 12,5% PB; 62,5 % BDSP: 25 % SZ : 12,5 % PB).***

Figure 5. Prolificacy of ewes with different genotype at first lambing, number of lambs born

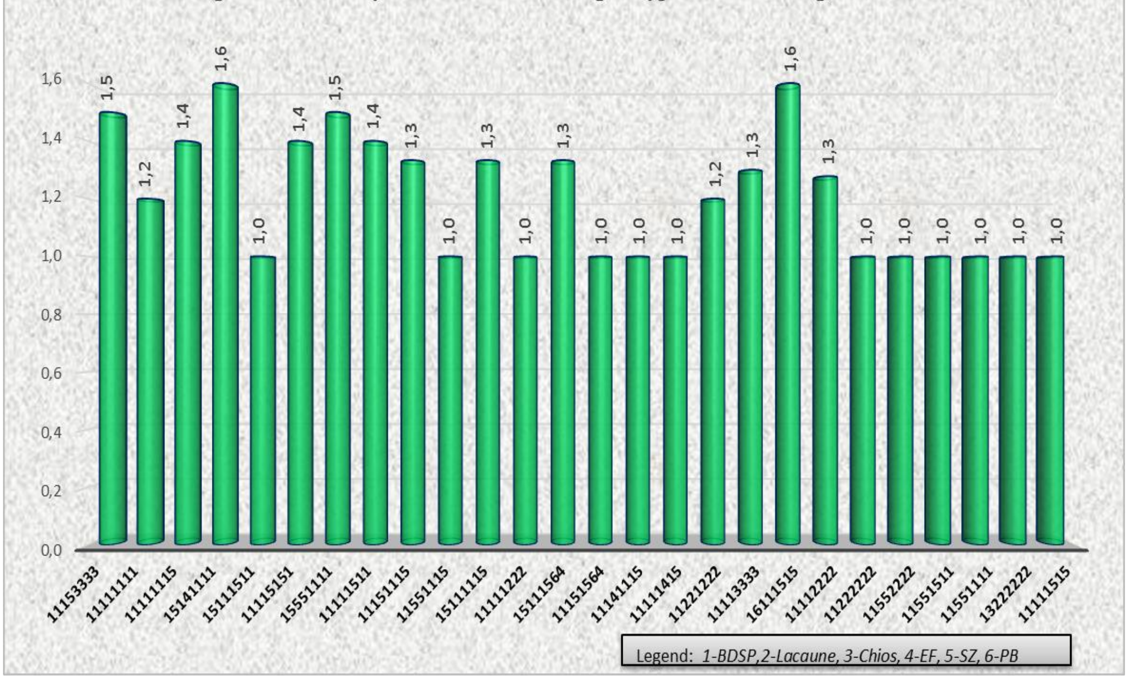


Figure 6. Prolificacy of ewes with different genotype at second lambing, number of lambs born

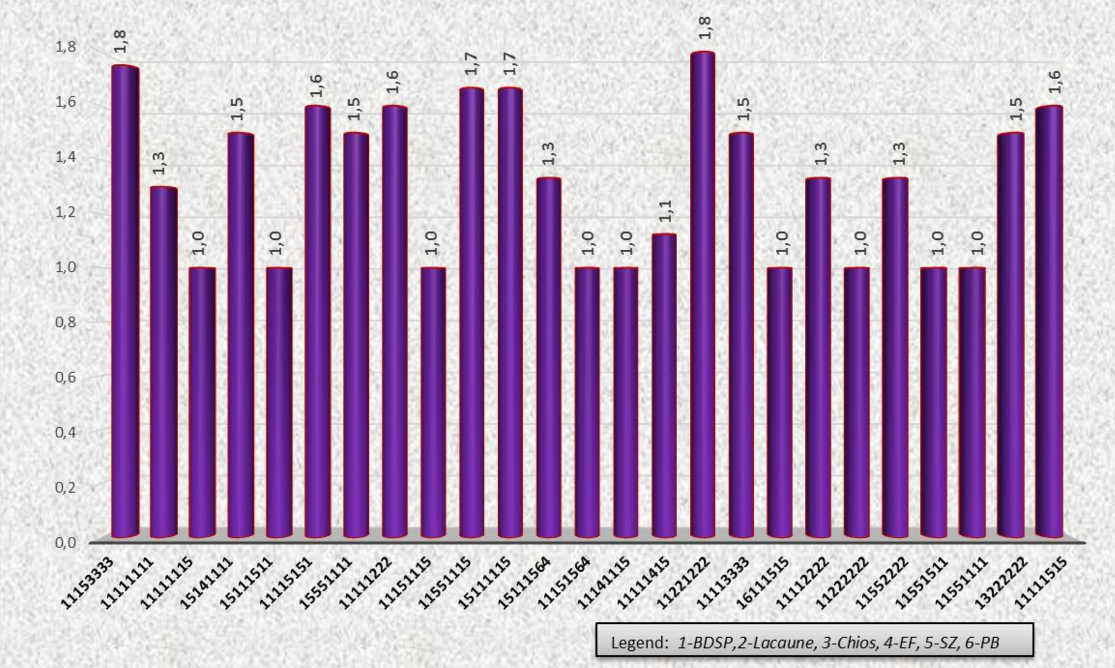
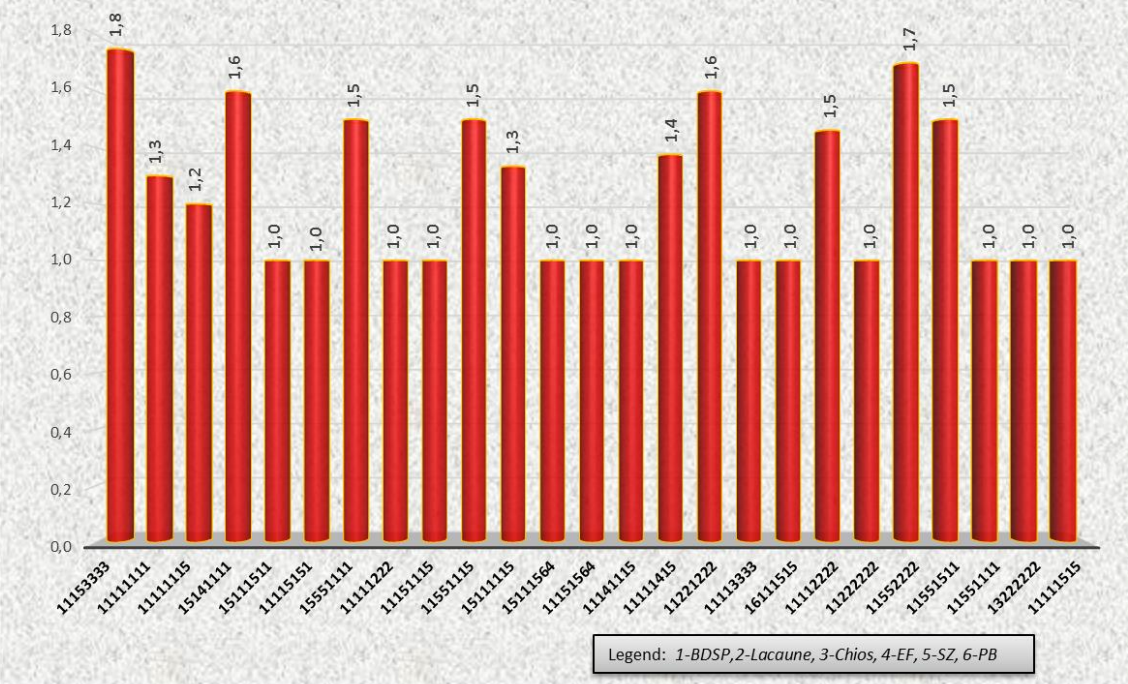


Figure 7. Prolificacy of ewes with different genotype at third lambing, number of lambs born



4.3. Live weight of BDSP ewes depending on genotype

Data on the live weight of ewes born in 2006 with different genotype are shown in Table 14. At weaning the live weight of animals with a genotype ***11153333 (50% Chios : 37,5% BDSP : 12,5 % SZ)*** – 24 kg was the highest with proven differences to genotypes ***15111511 (75% BDSP : 25% SZ) –*** $p<0.05$, ***15111564 (50% BDSP : 25% SZ : 12,5% EF: 12,5% PB) –*** $p<0.01$, ***15141111 (75% BDSP :12,5% SZ : 12,5% EF) –*** $p<0.05$ and ***15551111 (62,5% BDSP : 37,5% SZ) –*** $p<0.05$. The lowest live weight was reported in ewes with genotype ***15111564 (50% BDSP : 25% SZ : 12,5% EF : 12,5% PB)*** – 15 kg.

The highest values at 9 months of age showed the results obtained in ewes with genotype ***11111111 (100% BDSP)*** – 54 kg, which were highly significant ($p<0.001$) compared to animals with genotype ***15551111 (62,5% BDSP : 37,5% SZ).***

The animals with genetic code ***11111111*** (***100% BDSP)*** had the highest live weight at the next age as well – 65 kg. **Djorbineva et al. (2008)** reported a live weight of BDSP animals at 18 months of age in the range of 40–67 kg. At the age of 2,5 years, ewes with blood of ***100% BDSP*** again reached high live weight, together with animals with a blood percentage of ***62,5% BDSP : 37,5% SZ*** – 70 kg. Higher values for the trait live weight (73,18 kg) at the age of 2,5 years were reported by **Stancheva (2013)** for the flock of BDSP of AI –Shumen. Lower values for the live weight at the age of 2,5 years for BDSP animals were found by **Iliev et al. (2018)** – 59,13 kg.

Table 14. Statistical parameters and levels of significance of the trait live weight in ewes born in 2006 with different genotype

Genotype		min	max	x̄ ± Sx	SD	CV	Significance
11111111 /a/	*At weaning*	21,00	24,00	22,50 ± 0,65	1,29	5,7	a:b* a:d* a:g* a:h** a:j*
	At 9 months of age	52,00	55,00	53,50 ± 0,65	1,29	2,4	a:b* a:c* a:d* a:e* a:g** a:h** a:i** a:j***
	At 18 months of age	61,00	70,00	64,50 ± 1,94	3,87	6,0	a:b* a:d* a:e*
	At 2,5 years of age	65,00	74,00	69,50 ± 1,85	3,70	5,3	a:b* a:d* a:e* a:h* a:i*
11111511 /b/	*At weaning*	17,00	18,00	17,33 ± 0,33	0,58	33,3	b:c* b:d* b:e* b:f* b:j*
	At 9 months of age	42,00	45,00	43,33 ±0,88	1,53	3,5	b:c*
	At 18 months of age	53,00	55,00	54,00 ±0,58	1,00	1,9	b:c*
	At 2,5 years of age	50,00	51,00	50,33 ± 0,33	0,58	1,1	b:c** b:d* b:e** b:f** b:i* b:j**
11111115 /c/	*At weaning*	18,00	21,00	19,67 ± 0,88	1,53	7,8	
	At 9 months of age	48,00	51,00	49,67 ± 0,88	1,53	3,1	c:d** c:e*
	At 18 months of age	60,00	65,00	63,00 ± 1,53	2,65	4,2	c:d*
	At 2,5 years of age	63,00	66,00	64,33 ± 0,88	1,53	2,4	c:d* c:e**
11115151 /d/	*At weaning*	18,00	19,00	18,67 ± 0,33	0,58	3,1	
	At 9 months of age	40,00	45,00	42,67 ± 1,45	2,52	5,9	
	At 18 months of age	56,00	59,00	57,67 ± 0,88	1,53	2,6	
	At 2,5 years of age	56,00	60,00	57,67 ± 1,20	2,08	3,6	
11151511 /e/	*At weaning*	18,00	20,00	19,00 ± 0,58	1,00	5,3	
	At 9 months of age	41,00	44,00	42,67 ± 0,88	1,53	3,6	
	At 18 months of age	54,00	56,00	55,00 ± 0,58	1,00	1,8	
	At 2,5 years of age	55,00	59,00	56,33 ± 1,33	2,31	4,1	e:f*
11153333 /f/	*At weaning*	22,00	25,00	23,67 ± 0,88	1,53	6,5	f:g* f:h** f:i* f:j*
	At 9 months of age	46,00	48,00	47,00 ± 0,58	1,00	2,1	f:h**
	At 18 months of age	55,00	58,00	56,67 ± 0,88	1,53	2,7	

	At 2,5 years of age	60,00	64,00	62,33 ± 1,20	2,08	3,3	
15111511 /g/	*At weaning*	17,00	18,00	17,67 ± 0,33	0,58	3,3	g:j*g:h*
	At 9 months of age	45,00	48,00	46,67 ± 0,88	1,53	3,3	g:h** g:i*
	At 18 months of age	51,00	63,00	58,67 ± 3,84	6,66	11,3	g:h*
	At 2,5 years of age	63,00	69,00	66,67 ± 1,86	3,22	4,8	
15111564 /h/	*At weaning*	14,00	16,00	15,00 ± 0,58	1,00	6,7	h:j* h:c*
	At 9 months of age	31,00	34,00	32,33 ± 0,88	1,53	4,7	h:j*
	At 18 months of age	50,00	51,00	50,33 ± 0,33	0,58	1,1	
	At 2,5 years of age	51,00	53,00	52,00 ± 0,58	1,00	1,9	h:j*** h:c**
15141111 /i/	*At weaning*	16,00	19,00	17,67 ± 0,88	1,53	8,6	
	At 9 months of age	41,00	44,00	42,67 ± 0,88	1,53	3,6	i:j*
	At 18 months of age	53,00	59,00	56,67 ± 1,86	3,22	5,7	
	At 2,5 years of age	50,00	51,00	50,333 ± 0,33	0,58	1,1	i:j** i:c**
15551111 /j/	*At weaning*	17,00	20,00	18,50 ± 0,65	1,29	7,0	
	At 9 months of age	39,00	41,00	40,00 ± 0,41	0,82	2,0	
	At 18 months of age	60,00	67,00	62,50 ± 1,66	3,32	5,3	
	At 2,5 years of age	67,00	76,00	70,25 ± 2,02	4,03	5,7	

p< 0.05; **p < 0.01; ***p< 0.001

Table 15 presents the live weight data of the ewes born in 2007 with a different genotype. Live weight at weaning was the highest in ewes with a blood ***25% SZ : 75 % BDSP*** – 27 kg and ***12,5% SZ: 87,5% BDSP*** – 23 kg ($p<0.05$). This was followed by an increase in weight with increasing the age, and at 2,5 years again ewes with blood ***25%SZ : 75% BDSP*** had the highest weight (58 kg). Ewes with genotype ***11111511 (87,5% BDSP : 12,5% SZ)*** – 55 kg ($p<0.05$) were also distinguished with weight over 53 kg at the same age.

Table 15. Statistical parameters and levels of significance of the trait live weight in ewes born in 2007 with different genotype

Genotype		min	max	$\bar{x} \pm Sx$	SD	CV	Significance
11111511 /a/	*At weaning*	20,00	25,00	23,00 ± 1,53	2,65	11,5	a:b*
	At 9 months of age	34,00	41,00	38,00 ± 2,08	3,61	9,5	
	At 18 months of age	51,00	55,00	53,33 ± 1,20	2,08	3,9	a:c*
	At 2,5 years of age	53,00	58,00	55,33 ± 1,45	2,52	4,5	a:d*
11151115 /b/	*At weaning*	26,00	28,00	27,00 ± 0,58	1,00	3,7	
	At 9 months of age	44,00	49,00	46,67 ± 1,45	2,52	5,4	b:c* b:d*
	At 18 months of age	50,00	58,00	53,33 ± 2,40	4,16	7,8	b:d*
	At 2,5 years of age	53,00	65,00	58,00 ± 3,61	6,25	10,8	
11151564 /c/	*At weaning*	18,00	22,00	20,00 ± 1,16	2,00	10,0	
	At 9 months of age	38,00	46,00	41,33 ± 2,40	4,16	10,1	
	At 18 months of age	44,00	50,00	48,00 ± 2,00	3,46	7,2	
	At 2,5 years of age	50,00	54,00	52,00 ± 1,15	2,00	3,8	
11153333 /d/	*At weaning*	19,00	27,00	22,40 ± 1,69	3,78	16,9	
	At 9 months of age	40,00	41,00	40,40 ± 0,25	0,55	1,4	
	At 18 months of age	49,00	55,00	52,80 ± 1,11	2,49	4,7	
	At 2,5 years of age	46,00	50,00	48,40 ± 0,68	1,52	3,1	

p< 0.05; **p < 0.01; ***p< 0.001

The results for live weight at different ages of ewes born in 2008 with different genotype are presented in Table 16. It gives the impression that the highest weight at all ages had the ewes with blood ***75% BDSP : 25% SZ*** – 24 kg (at weaning), 47 kg (at 9 months), 55 kg (at 18 months), 62 kg (at 2.5 years). High live weight at different ages was also reported for animals with genotype ***11151115*** (***75% BDSP: 25% SZ)*** – 22 kg (at weaning), 42 kg (at 9 months), 51 kg (at 18 months), 59 kg (at 2,5 years of age), and the available differences were proved to genotype ***11551115 (62,5% BDSP : 37,5% SZ) –*** $p<0.05$ and ***11113333 (50% BDSP: 50% Chios) –*** $p<0.001$. In ewes with this genotype, we established the highest maximum values of live weight at 18 months of age and 2,5 years of age – 58 kg ($p<0.01$) and 63 kg ($p<0.05$), respectively.

Table 16. Statistical parameters and levels of significance of the trait live weight in ewes born in 2008 with different genotype

Genotype		min	max	‾x ± Sx	SD	CV	Significance
11111111 /a/	*At weaning*	19,00	20,00	19,50 ± 0,29	0,58	3,0	a:b* a:d*
	At 9 months of age	38,00	41,00	39,50 ± 0,65	1,29	3,3	a:d** a:f*
	At 18 months of age	48,00	54,00	51,50 ± 1,323	2,65	5,1	a:c** a:f*
	At 2,5 years of age	53,00	58,00	54,75 ± 1,18	2,36	4,3	a:c* a:f**
11111115 /b/	*At weaning*	19,00	22,00	20,50 ± 0,65	1,29	6,3	
	At 9 months of age	37,00	41,00	38,25 ± 0,95	1,89	4,9	b:c* b:d** b:f*
	At 18 months of age	46,00	54,00	49,25 ± 1,80	3,59	7,3	b:f**
	At 2,5 years of age	47,00	62,00	53,75 ± 3,20	6,40	11,9	b:f*
11141115 /c/	*At weaning*	15,00	27,00	21,000 ± 3,46	6,00	28,6	
	At 9 months of age	40,00	43,00	41,333 ± 0,88	1,53	3,7	c:d** c:f**
	At 18 months of age	46,00	48,00	47,333 ± 0,67	1,56	2,4	c:f* c:g*
	At 2,5 years of age	50,00	51,00	50,667 ± 0,33	0,58	1,1	c:d* c:f*
11151115 /d/	*At weaning*	20,00	23,00	21,667 ± 0,88	1,53	7,1	
	At 9 months of age	40,00	44,00	42,333 ± 1,20	2,08	4,9	d:e** d:f* d:g**
	At 18 months of age	48,00	55,00	50,667 ± 2,19	3,79	7,5	d:f*
	At 2,5 years of age	57,00	60,00	58,667 ± 0,88	1,53	2,6	d:e* d:f*
11551115 /e/	*At weaning*	20,00	21,00	20,333 ± 0,33	0,58	2,8	
	At 9 months of age	37,00	39,00	38,000 ± 0,58	1,00	2,6	e:f*
	At 18 months of age	49,00	52,00	50,667 ± 0,88	1,53	3,0	
	At 2,5 years of age	49,00	51,00	50,000 ± 0,58	1,00	2,0	e:f*
15111115 /f/	*At weaning*	21,00	25,00	23,500 ± 0,87	1,73	7,4	f:g**
	At 9 months of age	44,00	51,00	47,250 ± 1,44	2,87	6,1	
	At 18 months of age	52,00	58,00	55,250 ± 1,25	2,50	4,5	f:g**
	At 2,5 years of age	60,00	63,00	61,750 ± 0,75	1,50	2,4	f:g*
11113333 /g/	*At weaning*	18,00	20,00	19,000 ± 0,26	0,63	3,3	
	At 9 months of age	34,00	39,00	36,833 ± 0,79	1,94	5,3	
	At 18 months of age	46,00	52,00	48,667 ± 0,99	2,42	5,0	
	At 2,5 years of age	50,00	57,00	54,000 ± 1,16	2,83	5,2	

p< 0.05; **p < 0.01; ***p< 0.001

The following Table 17 presents the results for the live weight of ewes born in 2009 with a different genotype. When analyzing the results for weight development, we found that animals with genotype ***11551115*** (***62,5% BDSP : 37,5% SZ***) and ***11111111 (100% BDSP)***, born in 2009, had the highest weights at weaning (17 kg) and at the age of 2,5 years (64 kg; 61 kg). The lowest weight at different ages had ewes with blood content ***75% BDSP : 25% SZ (15111115)***. The values are as follows – 15 kg (at weaning), 39 kg (at 9 months of age), 42 kg (at 18 months of age), 55 kg (at 2,5 years of age). Differences were found between the different genotypes (p<0.05). Significance of the trait was established in animals with genotype ***11111111*** (***100% BDSP)*** compared to genotype ***16111515 (62,5% BDSP : 25% SZ : 12,5% PB)*** at weaning, 9 months of age and 18 months age, as well as in ewes with genotype ***11551115 (62,5% BDSP : 37,5% SZ)*** compared to genotype ***16111515 (62,5% BDSP: 25% SZ : 12,5% PB)*** at 18 months age and at 2.5 years of age.

Table 17. Statistical parameters and levels of significance of the trait live weight in ewes born in 2009 with different genotype

Genotype		min	max	x̄ ± Sx	SD	CV	Significance
11111111 /a/	*At weaning*	16,00	19,00	17,60 ± 0,51	1,14	6,5	a:d*
	At 9 months of age	41,00	44,00	43,20 ± 0,58	1,30	3,0	a:d*
	At 18 months of age	44,00	49,00	46,60 ± 0,93	2,07	4,4	a:b* a:d*
	At 2,5 years of age	53,00	65,00	61,40 ± 2,16	4,83	7,9	
1551115 /b/	*At weaning*	15,00	20,00	17,33 ± 1,45	2,52	14,5	
	At 9 months of age	38,00	42,00	40,00 ± 1,16	2,00	5,0	
	At 18 months of age	42,00	45,00	43,67 ± 0,88	1,53	3,5	b:d*
	At 2,5 years of age	64,00	65,00	64,33 ± 0,33	0,58	0,9	b:d*
15111115 /c/	*At weaning*	15,00	16,00	15,33 ± 0,33	0,58	3,8	
	At 9 months of age	38,00	40,00	39,33 ± 0,67	1,16	2,9	
	At 18 months of age	40,00	43,00	41,67 ± 0,88	1,53	3,7	c:d*
	At 2,5 years of age	52,00	63,00	56,67 ± 3,28	5,69	10,0	
16111515 /d/	*At weaning*	14,00	16,00	15,25 ± 0,25	0,71	4,6	
	At 9 months of age	37,00	43,00	40,38 ± 0,65	1,85	4,6	
	At 18 months of age	47,00	55,00	50,13 ± 0,97	2,75	5,5	
	At 2,5 years of age	54,00	69,00	60,38 ± 1,92	5,42	9,0	

*p< 0.05; **p < 0.01; ***p< 0.001*

The results for the weight development of animals born in 2010 are shown in Table 18. With the highest values at weaning (19 kg), at 9 months of age (50 kg) and at 18 months of age (59 kg) were distinguished the ewes with genotype ***11112222 (50% BDSP: 50% Lacaune)***. At the age of 2.5 years, the animals with genotype ***11111515 (75% BDSP : 25% SZ) –*** 67kg (p<0.05) and ***11111111*** (***100% BDSP)*** – 65 kg had the highest live weight.

Table 18. Statistical parameters and levels of significance of the trait live weight in ewes born in 2010 with different genotype

Genotype		min	max	x̄ ± Sx	SD	CV	Significance
11111111 /a/	*At weaning*	15,00	19,00	16,00 ± 1,00	2,00	12,5	
	At 9 months of age	46,00	53,00	48,50 ± 1,56	3,11	6,4	a:c*
	At 18 months of age	52,00	55,00	54,00 ± 0,71	1,41	2,6	a:c** a:d*
	At 2,5 years of age	62,00	70,00	65,25 ± 1,70	3,40	5,2	
11111515 /b/	*At weaning*	14,00	15,00	14,67 ± 0,33	0,58	3,9	
	At 9 months of age	43,00	46,00	44,67 ± 0,88	1,53	3,4	b:c** b:d*
	At 18 months of age	56,00	59,00	58,00 ± 1,00	1,73	3,0	b:c*
	At 2,5 years of age	66,00	68,00	67,00 ± 0,58	1,00	1,5	b:d*
1552222 /c/	*At weaning*	15,00	16,00	15,33 ± 0,33	0,58	3,8	
	At 9 months of age	40,00	42,00	41,00 ± 0,58	1,00	2,4	c:d*
	At 18 months of age	48,00	52,00	50,00 ± 1,16	2,00	4,0	c:d*
	At 2,5 years of age	60,00	70,00	64,00 ± 3,06	5,29	8,3	
11112222 /d/	*At weaning*	18,00	19,00	18,50 ± 0,29	0,58	3,1	
	At 9 months of age	47,00	52,00	49,75 ± 1,03	2,06	4,1	
	At 18 months of age	58,00	60,00	59,00 ± 0,58	1,16	2,0	
	At 2,5 years of age	60,00	65,00	63,00 ± 1,23	2,45	3,9	

*p< 0.05; **p < 0.01; ***p< 0.001*

Live weight at weaning was the lower in ewes with blood ***11552222 (50% Lacaune : 37,5% BDSP : 12,5%SZ)*** –16 kg, and the highest in animals with blood ***50 % BDSP: 50 % Lacaune*** – 17 kg (**Table 19**). This was followed by an increase with age, and the values of the weight were close. The average live weight of animals at the age of 2,5 years with both genotypes was 61 kg.

Table 19. Statistical parameters and levels of significance of the trait live weight in ewes born in 2011 with different genotype

Genotype		min	max	̅x ± Sx	SD	CV	Significance
11112222 /a/	*At weaning*	15,00	18,00	17,00 ± 0,71	1,41	8,3	NS
	At 9 months of age	46,00	48,00	47,25 ± 0,48	0,96	2,0	
	At 18 months of age	50,00	62,00	57,50 ± 2,63	5,26	9,1	
	At 2,5 years of age	58,00	63,00	61,25 ± 1,11	2,22	3,6	
11552222 /b/	*At weaning*	15,00	18,00	16,25 ± 0,75	1,50	9,2	
	At 9 months of age	47,00	48,00	47,50 ± 0,29	0,58	1,2	
	At 18 months of age	55,00	59,00	56,75 ± 0,85	1,71	3,0	
	At 2,5 years of age	59,00	63,00	60,75 ± 0,85	1,71	2,8	

p< 0.05; **p < 0.01; ***p< 0.001

Table 20 presents the results for the live weight of ewes born in 2012 with a different genotype. At weaning and at 2.5 years of age, higher was the live weight of ewes with blood content ***50% BDSP : 37,5 % SZ : 12,5 % EF*** – 26 kg and 65 kg (p<0.01), respectively. Ewes with blood content of ***50 % BDSP: 50 % Lacaune*** had a higher weight at 9 months and 18 months of age –45 kg and 57 kg, respectively.

Table 20. Statistical parameters and levels of significance of the trait live weight in ewes born in 2012 with different genotype

Genotype		min	max	̅x ± Sx	SD	CV	Significance
11111415 /a/	*At weaning*	21,00	30,00	26,00 ± 2,12	4,24	16,3	
	At 9 months of age	40,00	50,00	44,00 ± 2,27	4,55	10,3	
	At 18 months of age	53,00	56,00	54,50 ± 0,65	1,29	2,4	
	At 2,5 years of age	64,00	66,00	64,75 ± 0,48	0,96	1,5	a:b**
11112222 /b/	*At weaning*	24,00	26,00	24,75 ± 0,48	0,96	3,9	
	At 9 months of age	43,00	48,00	45,25 ± 1,11	2,22	4,9	
	At 18 months of age	51,00	56,00	57,00 ± 2,16	4,32	7,6	
	At 2,5 years of age	59,00	62,00	60,25 ± 0,63	1,26	2,1	

p< 0.05; **p < 0.01; ***p< 0.001

At weaning, the lowest weight for ewes born in 2013 was found for animals with genetic codes ***11111415 (75% BDSP :12,5% SZ : 12,5% EF)*** and ***11111511 (87,5% BDSP : 12,5% SZ)*** –15 kg, and the highest value – for ewes with blood ***50 % BDSP : 50 % Lacaune*** – 18 kg (**Table 21**). At 9 months of age, the studied animals did not show significant differences in live weight. The average live weight at 2.5 years of age was the highest in ewes with genetic code ***11111415 (75% BDSP :12,5% SZ : 12,5% EF) –*** p<0.05 and ***11112222 (50% BDSP : 50% Lacaune) –*** p<0.05 – 65 kg.

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Table 21. Statistical parameters and levels of significance of the trait live weight in ewes born in 2013 with different genotype

Genotype		min	max	x̄ ± Sx	SD	CV	Significance
11111415 /a/	*At weaning*	14,00	17,00	15,25 ± 0,63	1,26	8,3	a:c* a:f*
	At 9 months of age	49,00	50,00	49,75 ± 0,25	0,50	1,0	
	At 18 months of age	54,00	64,00	57,50 ± 2,22	4,44	7,7	a:b* a:c*
	At 2,5 years of age	58,00	70,00	65,25 ± 2,56	5,12	7,9	a:b*
11111511 /b/	*At weaning*	14,00	16,00	14,75 ± 0,48	0,96	6,5	b:c* b:f*
	At 9 months of age	47,00	53,00	50,00 ± 1,23	2,45	4,9	
	At 18 months of age	49,00	54,00	52,00 ± 1,23	2,45	4,7	b:f**
	At 2,5 years of age	55,00	60,00	57,00 ± 1,23	2,45	4,3	b:c** b:e*
11112222 /c/	*At weaning*	17,00	20,00	18,25 ± 0,75	1,50	8,2	
	At 9 months of age	49,00	53,00	50,75 ± 0,85	1,71	3,4	c:f*
	At 18 months of age	50,00	55,00	52,25 ± 1,11	2,22	4,2	c:f*
	At 2,5 years of age	62,00	64,00	64,50 ± 0,87	1,73	2,7	c:e* c:f*
11151511 /d/	*At weaning*	15,00	18,00	16,67 ± 0,88	1,53	9,2	
	At 9 months of age	50,00	53,00	52,00 ± 1,00	1,73	3,3	
	At 18 months of age	49,00	66,00	57,00 ± 4,93	8,54	15,0	
	At 2,5 years of age	55,00	60,00	58,33± 1,67	2,89	4,9	
11222222 /e/	*At weaning*	14,00	20,00	16,67 ± 0,80	1,97	11,8	
	At 9 months of age	49,00	52,00	50,50 ± 1,76	0,72	3,5	
	At 18 months of age	48,00	59,00	53,33 ± 1,59	3,88	7,3	e:f*
	At 2,5 years of age	60,00	64,00	61,67 ± 0,67	1,63	2,6	
11551511 /f/	*At weaning*	15,00	19,00	17,00 ± 1,16	2,00	11,8	
	At 9 months of age	48,00	51,00	49,33 ± 0,88	1,53	3,1	
	At 18 months of age	62,00	64,00	63,00 ± 0,58	1,00	1,6	
	At 2,5 years of age	57,00	59,00	58,00 ± 0,58	1,00	01,7	

p< 0.05; **p < 0.01; ***p< 0.001

Table 22 presents the results of the live weight of ewes born in 2014. The highest values at weaning had the animals with genotypes ***1155222 (50% Lacaune : 37,5% BDSP : 12,5%SZ)*** – 19 kg, ***11112222 (50% BDSP : 50% Lacaune)*** - 18 kg and ***11551111 (75% BDSP: 25% SZ*** – 18 kg. With increasing the age there was an increase in weight, as in animals with blood ***75% BDSP : 25% SZ (11551111)*** and ***50% BDSP: 50% Lacaune (11112222)*** the live weight at the age of 2.5 years was 58 kg. The lowest weight at weaning was found in animals with genotype ***11111111 (100% BDSP)*** with proven differences to ewes with genotype **11111415 (*75% BDSP :12,5% SZ : 12,5% EF)* –** p<0.05, ***11112222 (50% BDSP : 50% Lacaune)* –** p<0.01, ***11551111 (75% BDSP : 25% SZ)* –** p<0.05.

Table 22. Statistial parameters and levels of significance of the trait live weight in ewes born in 2014 with different genotype

Genotype		min	max	$\bar{x} \pm Sx$	SD	CV	Significance
11111111 /a/	*At weaning*	14,00	15,00	14,33 ± 0,21	0,52	3,6	a:b* a:c** a:d*
	At 9 months of age	30,00	35,00	32,33 ± 0,76	1,86	5,8	a:f** a:d*
	At 18 months of age	50,00	56,00	53,00 ± 0,97	2,37	4,5	
	At 2,5 years of age	52,00	59,00	55,17 ± 0,95	2,32	4,2	a:d*
11111415 /b/	*At weaning*	17,00	18,00	17,33 ± 0,33	0,58	33,3	b:c* b:f**
	At 9 months of age	32,00	36,00	34,33 ± 1,20	2,08	6,1	b:c* b:d*
	At 18 months of age	50,00	52,00	50,67 ± 0,67	1,16	2,3	
	At 2,5 years of age	54,00	55,00	54,67 ± 0,33	0,58	1,1	b:d*
11112222 /c/	*At weaning*	16,00	19,00	17,83 ± 0,60	1,47	8,3	c:f*
	At 9 months of age	36,00	47,00	42,17 ± 1,66	4,07	9,7	
	At 18 months of age	50,00	60,00	54,17 ± 2,01	4,92	9,1	
	At 2,5 years of age	55,00	64,00	58,00 ± 1,51	3,69	6,4	
11551111 /d/	*At weaning*	17,00	19,00	18,00 ± 0,58	1,00	5,6	d:f**
	At 9 months of age	40,00	42,00	41,00 ± 0,58	1,00	2,4	
	At 18 months of age	52,00	54,00	53,00 ± 0,58	1,00	1,9	
	At 2,5 years of age	57,00	59,00	58,00 ± 0,58	1,00	1,7	d:e*
11552222 /e/	*At weaning*	15,00	22,00	18,67 ± 2,03	3,51	18,8	e:f*
	At 9 months of age	34,00	38,00	36,00 ± 1,16	2,00	5,6	
	At 18 months of age	52,00	54,00	56,00 ± 1,16	2,00	3,7	
	At 2,5 years of age	53,00	56,00	54,67 ± 0,88	1,53	2,8	
13222222 /f/	*At weaning*	13,00	17,00	14,67 ± 0,62	1,51	10,3	
	At 9 months of age	31,00	39,00	36,00 ± 1,16	2,83	7,9	
	At 18 months of age	50,00	56,00	52,83 ± 1,28	3,13	5,9	
	At 2,5 years of age	52,00	60,00	56,00 ± 1,24	3,03	5,4	

p< 0.05; **p < 0.01; ***p< 0.001

The analysis of the results for the weight development of the animals born in 2015 is presented in **Table 23**. At weaning ewes with blood content ***62,5 % Lacaune: 37,5% BDSP*** had the highest live weight (20 kg). The variation of the trait during different age periods was not high. At 18 months of age we reported for a weight of 57 kg in two genotypes ***11111415*** (***75% BDSP :12,5% SZ: 12,5% EF)*** and ***11221222*** (***37,5% Lacaune : 62,5% BDSP)***. Here we reported for the highest weight at 2.5 years (66 kg) in ewes with a blood content ***75% BDSP :12,5% C3 : 12,5% EF***. The highest maximum value of live weight at 2.5 years of age (69 kg) was found in animals with a blood content ***37,5% Lacaune : 62,5% BDSP***. Here we also reported for the highest value of the standard deviation (6,80) and coefficient of variation (11,5).

Table 23. Statistical parameters and levels of significance of the trait live weight in ewes born in 2015 with different genotype

Genotype		min	max	‾x ± Sx	SD	CV	Significance
11221222 /a/	*At weaning*	18,00	22,00	19,80 ± 0,66	1,48	7,5	
	At 9 months of age	42,00	50,00	44,60 ± 1,40	3,13	7,0	
	At 18 months of age	56,00	58,00	56,60 ± 0,40	0,89	1,6	
	At 2,5 years of age	55,00	66,00	58,80 ± 1,99	4,44	7,5	
11111511 /b/	*At weaning*	16,00	18,00	17,00 ± 0,58	1,00	5,9	
	At 9 months of age	40,00	44,00	42,00 ± 1,16	2,00	4,8	
	At 18 months of age	54,00	56,00	55,00 ± 0,58	1,00	1,8	b:d*
	At 2,5 years of age	56,00	60,00	58,67 ± 1,33	2,31	3,9	b:c**
11111415 /c/	*At weaning*	16,00	18,00	17,00 ± 0,58	1,00	5,9	
	At 9 months of age	42,00	46,00	44,00 ± 1,16	2,00	4,5	
	At 18 months of age	55,00	59,00	57,33 ± 1,20	2,08	3,6	
	At 2,5 years of age	64,00	67,00	65,67 ± 0,88	1,53	2,3	
11111222 /d/	*At weaning*	14,00	18,00	16,00 ± 0,71	1,58	9,9	
	At 9 months of age	39,00	45,00	41,20 ± 1,07	2,39	5,8	
	At 18 months of age	55,00	57,00	56,20 ± 0,37	0,84	1,5	
	At 2,5 years of age	53,00	69,00	59,40 ± 3,04	6,80	11,5	

p< 0.05; **p < 0.01; ***p< 0.001

4. Analysis of the qualitative composition and individual coagulation ability of milk in ewes of BDSP with different genotype.

The milk of the ewes of Bulgarian Dairy Synthetic Population has very good quality characteristics (**Stancheva et al., 2011**). Figure 8 shows the results of the fat content of milk of ewes with different genotypes. The indicator varied in the range from 6,14 to 6,60%. The highest percentage of fatty substances in milk (6,60%) was found in animals with genotype ***11112222*** (***50% BDSP: 50% Lacaune)***. In a study conducted with 53 ewes of BDSP of different ages and sequences of lactation, **Ivanova et al. (2015)** reported for a fat content of milk in the range of 6,39–7,15%.

Figure 8. Fat content in the milk of BDSP sheep with different genotype

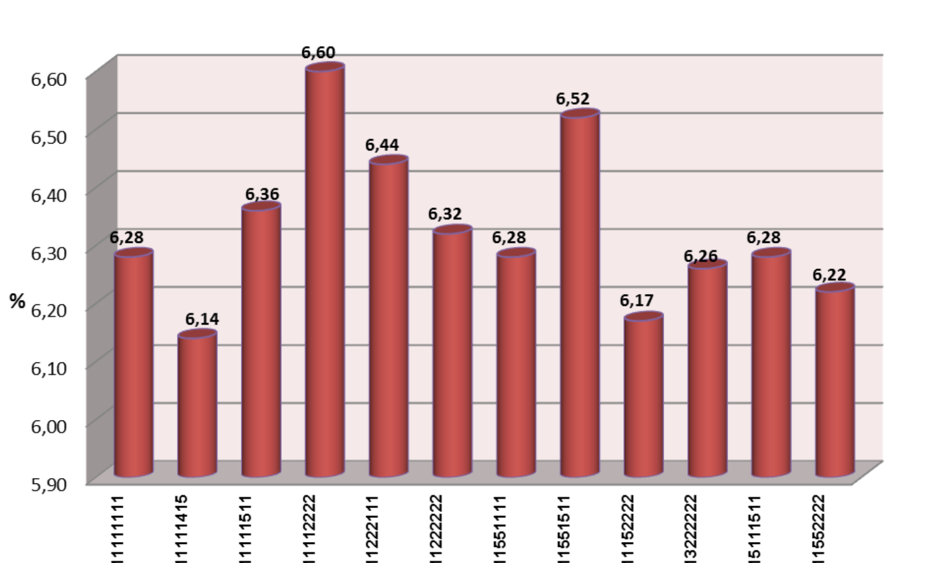


Figure 9 presents the results obtained for the content of protein substances. The variation of the indicator in ndividual ianimals was not very pronounced. The highest levels of protein substances in milk were found in ewes with blood content ***62,5% BDSP : 37,5% SZ*** – 4,85%. **Ivanova et al. (2015)** indicated protein content in milk in the range of 5,66–6,05%, and **Stancheva et al. (2011)** reported for a value of 5,35%. In ewes with ***50% Lacaune, 37,5% BDSP, 12,5% SZ*** and animals with ***50% Lacaune, 25% BDSP, 25% SZ*** we reported the lowest values of the studied indicator: 4,61% and 4,57%, respectively.

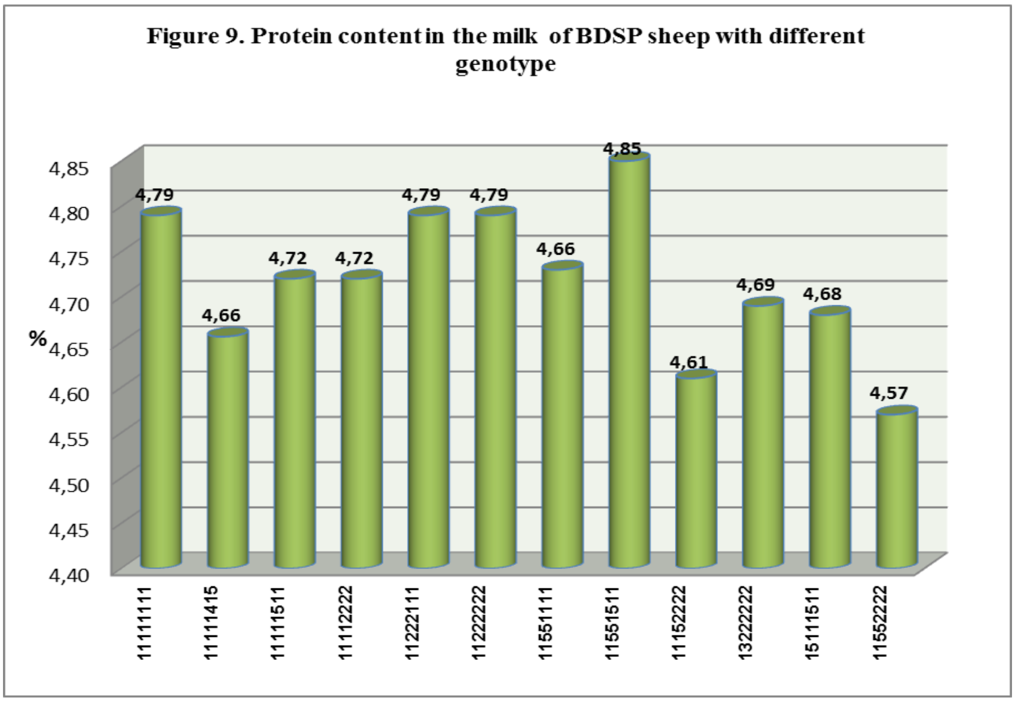


Figure 10 shows the rennet coagulation time of milk (RCT) in BDSP ewes as the obtained values varied in a wide range. The shortest RCT was found in animals with ***87,5% blood from BDSP, 12,5% SZ*** – 13,16 min, in ewes with ***50% BDSP, 50% Lacaune*** – 13,61 min and in animals with ***62,5% BDSP, 37,5% Lacaune*** – 13,66 min.

The longest RCT was found in animals with genotypes ***11222222 (75% Lacaune : 25% BDSP)*** – 17,13 min, ***11552222 (50% Lacaune : 25% BDSP: 25% SZ)*** – 16,62 min and ***13222222*** (***75% Lacaune :12,5% BDSP: 12,5% Chios***) – 16,32 min.

The results for the curd firmness (a30), which characterizes the coagulation ability of milk, are shown in **Figure 11**. Ewes with ***75% blood from BDSP and 25% blood from SZ*** were characterized by the highest hardness of coagulum –45 mm, as well as animals with ***87.5% blood from BDSP and 12.5% blood from SZ***–44 mm. Equal values of the studied trait were reported in ewes with genotype ***11111111 (100% BDSP) –*** 42 mm, ***11152222 (50% Lacaune: 37,5% BDSP : 12,5% SZ –*** 42 mm and ***11222111 (62,5% BDSP: 37,5% Lacaune) –*** 42 mm; ***11552222 (50% Lacaune : 25% BDSP : 25% SZ)*** – 40 mm, ***13222222*** (***75% Lacaune : 12,5% BDSP: 12,5% Chios)*** – 40 mm; ***15111511 (75% BDSP : 25% SZ)*** – 38 mm, ***11222222*** (***75% Lacaune : 25% BDSP) –*** 38 mm. The less firm coagulum was found in ewes with genotype ***11111415 (75% BDSP : 12,5% SZ: 12,5% EF)*** – 37 mm.

Figure 10. Rennet coagulation time in BDSP sheep with different genotype

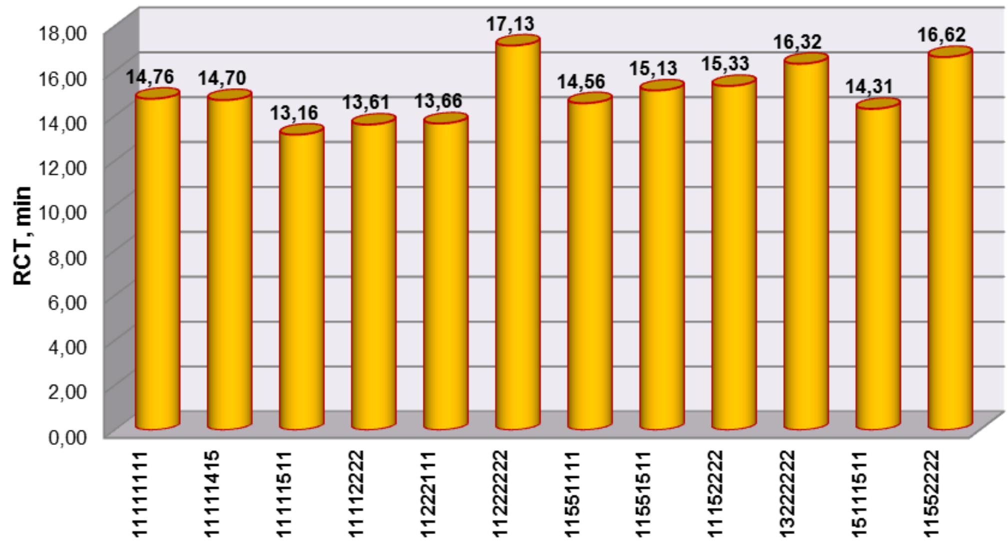
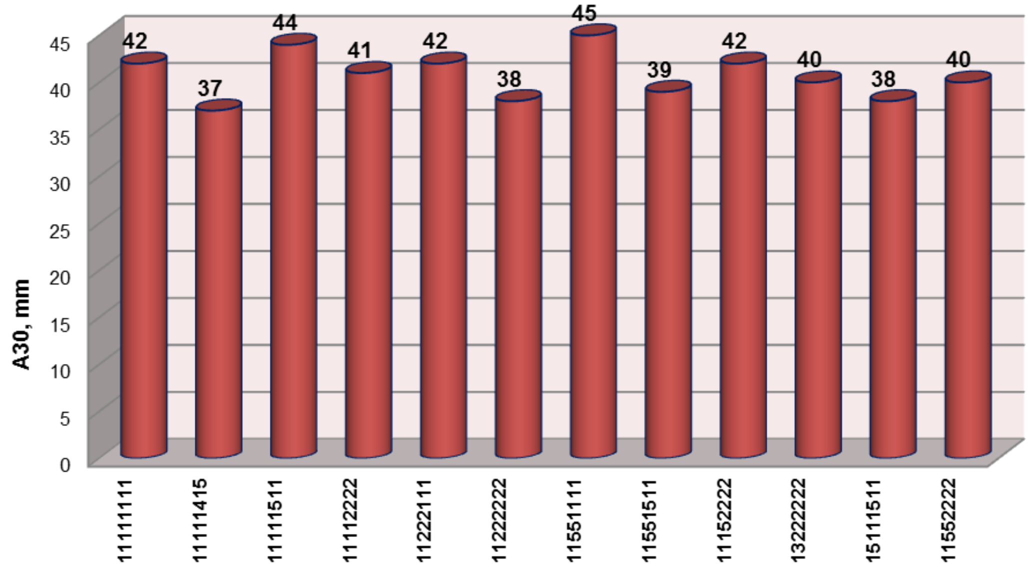


Figure 11. Curd firmness in milk of sheep from BDSP with different genotype



6. Analysis of the qualitative composition and coagulation ability of milk in ewes of different breeds.

Table 24 presents the results obtained by us for the content of fat and protein substances in milk of the ewes of the studied breeds. The highest content of fatty substances in milk was found for the ewes of the Pleven Blackhead breed – 8,50%. In his study of the same breed **Kalaydzhiev (2014)** reported for values of the indicator – 8,13%. **Panayotov et al. (2008)** reported for a fat content in milk ranging from 5,96 to 7,64%. The lowest content of fatty substances in milk was reported for ewes of the Awassi breed – 5,68%. In a study of the Awassi breed in Spain, **Milán et al. (2011)** reported for a higher fat content of 6,52%. Higher values were also published by **Pacinovski et al. (2006)** in a study conducted in the |Republic of North Macedonia – 6,92%, with ewes of the same breed. In Lacaune sheep we found 6,50% fat content in milk. This result was close to the reported by **Oravcová (2007)** – 6,58%. The sheep milk from BDSP contained 6,28% fat, and from the Chios breed – 6,05%. The analysis for significance of the differences between breeds showed that there was a high significant difference between the BDSP ewes and Awassi, BDSP and PB, Awassi and Chios, Awassi and PB, Lacaune and PB, Chios and PB ewes ($p<0.001$).

In the ewes of Lacaune breed we reported the highest value of the content of protein substances in milk – 6,63% with significant differences to the Chios ($p<0.001$) and PB ($p<0.001$) breeds. Compared to our results, **Oravcová (2007)** reported for a lower protein content in milk – 5,63%. In Awassi ewes, we found 4,74% protein content in milk. Close to our results for the Awassi breed reported **Pacinovski et al. (2006)** – 4,87%. For the breeds Chios and Pleven Blackhead similar results were observed in the obtained results – 4,52% and 4,57% respectively. **Panayotov et al. (2008)** found higher values of protein in milk for the Pleven Blackhead breed – 5,70 – 6,19%.

Table 25 presents the parameters characterizing the coagulation ability of milk – rennet coagulation time (RCT, min) and curd firmness (a30, mm) in ewes of BDSP and Awassi, Lacaune, Chios and Pleven Blackhead breeds. The shortest time for coagulation of milk was found in Chios breed – 10,90 min, and the difference was with a high degree of significance compared to the breed PB ($p<0.001$). Close to these values we reported for the Awassi breed – 11,30 min, and for the Lacaune breed–13,60 min.

The lowest values for the trait Coalgulum firmness were reported for the Lacaune breed – 36,94 mm, and the available differences were proved compared to the breeds Chios ($p<0.05$) and PB ($p<0.05$). The milk of Awassi ewes (42,15 mm) was characterized by the firmest coagulum, with proven differences compared to the breeds Lacaune ($p<0.01$), Chios ($p<0.05$) and PB ($p<0.05$). Close values of the trait were reported for BDSP (40,91 mm) and Chios ewes (40.13 mm).

Table 24. ***Statistical parameters of the indicator fatty and protein substances in milk (%)***

breeds	fatty substances, /%/						protein substances, /%/					
	min	max	$\bar{x} \pm Sx$	SD	CV	Significance	min	max	$\bar{x} \pm Sx$	SD	CV	Significance
BDSP */a/*	5,02	8,92	6,28 ± 0,10	0,94	15,0	a:b*** a:c* a:e***	4,28	5,82	4,81 ± 0,03	0,27	5,7	a:c*** a:d*** a:e***
Awassi */b/*	5,00	6,70	5,68 ± 0,06	0,45	8,0	b:c*** b:d*** b:e***	4,39	5,48	4,74 ± 0,03	0,25	5,2	b:c*** b:d** b:e*
Lacaune /c/	5,08	8,49	6,50 ± 0,13	0,90	13,8	c:d* c:e***	5,39	7,81	6,63 ± 0,07	0,51	7,7	c:d*** c:e***
Chios/d/	5,05	7,97	6,05 ± 0,07	0,72	12,0	d:e***	4,01	4,99	4,52 ± 0,03	0,30	6,5	
PB/e/	5,42	11,97	8,50 ± 0,11	1,49	17,5		4,01	5,50	4,57 ± 0,03	0,38	8,3	

****p< 0.05; **p < 0.01; ***p< 0.001***

Table 25. ***Statistical parameters of the indicators Rennet Coagulation Time /RCT, min/ and Curd firmness /a30, mm/***

breeds	RCT /min/						a_{30} /mm/					
	min	max	$\bar{x} \pm Sx$	SD	CV	Significance	min	max	$\bar{x} \pm Sx$	SD	CV	Significance
BDSP */a/*	5,57	30,00	17,83 ± 0,79	7,71	43,2	a:b*** a:c* a:d***	18,00	60,00	40,91 ± 0,90	8,80	21,5	a:c*
Awassi */b/*	5,26	30,00	11,30 ± 0,80	6,32	55,9	b:c* b:e***	26,00	57,00	42,15 ± 0,81	6,34	15,0	b:c** b:d* b:e*
Lacaune /c/	2,38	30,00	13,60 ± 1,44	10,16	74,7	c:d* c:e*	23,00	53,00	36,94 ± 1,03	7,27	19,7	c:d* c:e*
Chios/d/	5,11	30,00	10,90 ± 0,42	4,56	41,8	d:e***	20,00	54,00	40,13 ± 0,58	6,30	15,7	
PB/e/	4,22	30,00	15,19 ± 0,54	7,38	48,6		20,00	56,00	39,54 ± 0,47	6,51	16,5	

****p< 0.05; **p < 0.01; ***p< 0.001***

Figures 12 and **13** show the influence of fatty and protein substances on the RCT in sheep of Lacaune, Awassi, Chios, BDSP and Pleven Blackhead breeds. From the obtained results we can note that the shortest RCT was estimated for the Chios breed – 10,60 min, at a fat content of 5,00 – 5,99% (**Figure 12**). In the Awassi breed, the RCT ranged from 10,86 min (6,00–6,99%) to 11.44 min (5,00 – 5,99%). The shortest RCT in the Lacaune breed –13,75 min, was reported for a fat content of 7,00 – 7,99%, and the longest – for a fat content of 8,00–8,99% (16,23 min).

The shortest RCT for the Awassi (10,46 min) was registered at a protein content of 4,00–4,99% (**Figure 13**). Very close values were reported for ewes of BDSP – 15,46 min and 15,77 min at a protein content in milk of 4,00–4,99 % and 5,00–5,99 %, respectively.

Figure 12. Influence of fat content on rennet coagulation time in different breeds of sheep

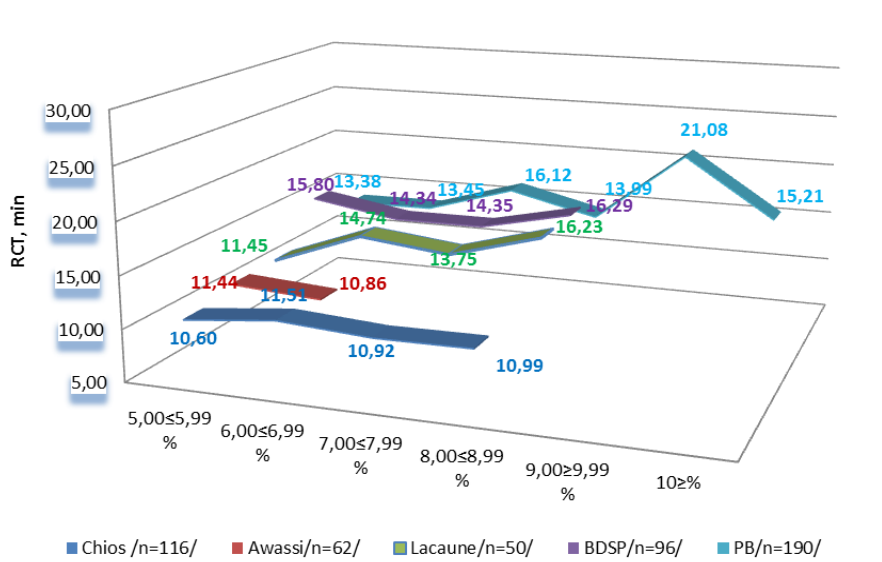
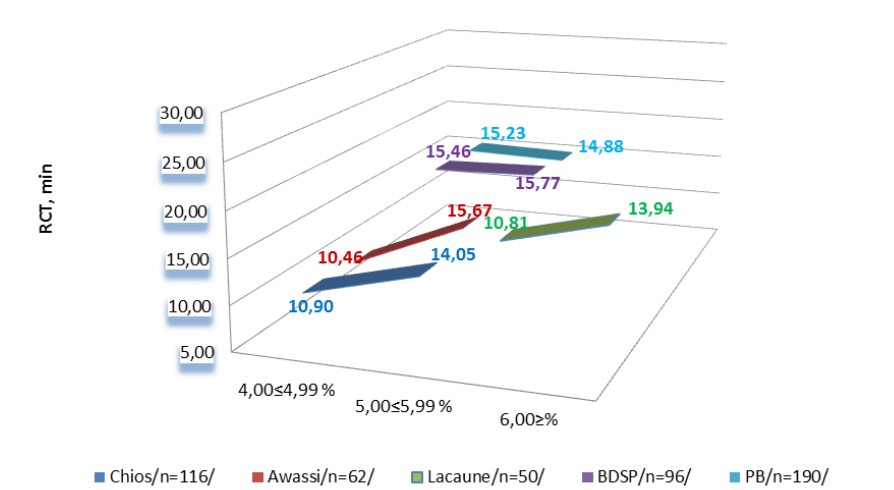


Figure 13. Influence of protein content on rennet coagulation time in different breeds of sheep



The influence of fatty and protein substances on the curd firmness trait was presented in **Figures 14** and **15**. Regarding the influence of fatty substances on the curd firmness trait the highest value – 45.00 mm (8.00–8.99%) was find in Chios sheep (**Figure 14**). Regarding the influence of protein substances on the Coagulum firmness, we found the lowest value of 36,64 mm (over 6,00%) in the Lacaune breed (**Figure 15**). The firmest coagulum value was found fo the Awassi breed –42,50 mm (4,00–4,99%).

Figure 14. Influence of fat content on curd firmness in different breeds of sheep

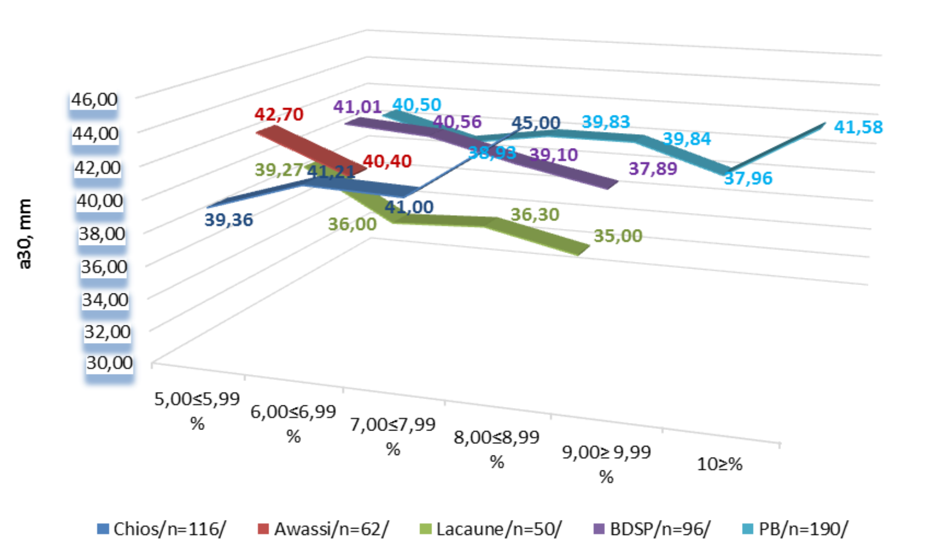
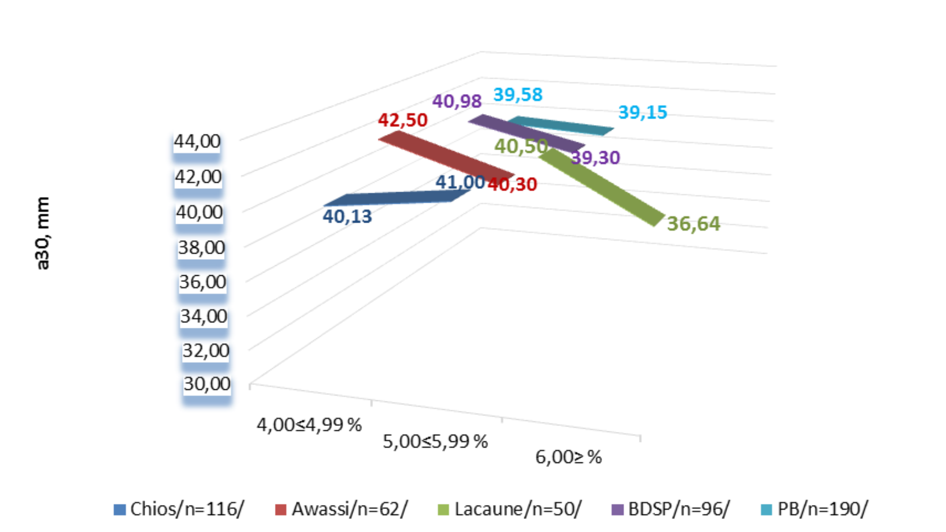


Figure 15. Influence of protein content on curd firmness in different breeds of sheep



The influence of % fat and protein substances on curd firmness time in the studied breeds is presented in **Figures 16** and **17**. The shortest curd firmness time was found for the breeds Lacaune and Chios – 0,28 min (5,00–5,99%; 7,00–7,99%) and 0,29 min (6,00–6,99%). The sheep of BDSP and Pleven Blackhead breed were characterized by the longest curd firmness time – 0,55 min (**Figure 16**).

The milk with protein content (5.00–5.99%) had the shortest curd firmness time –0.29 min in the Lacaune breed (**Figure 17**). The curd firmness time in the Chios breed was within 0,30–0,35 min. A longer curd firmness time we found in sheep of the Pleven Blackhead breed and Bulgarian Dairy Synthetic Population. Their values were over 0,45 min, as the longest curd firmness time was established for BDSP–0.61 min (5,00 to 5,99%).

Figure 16. Influence of fat content on curd firmness time in different breeds of sheep

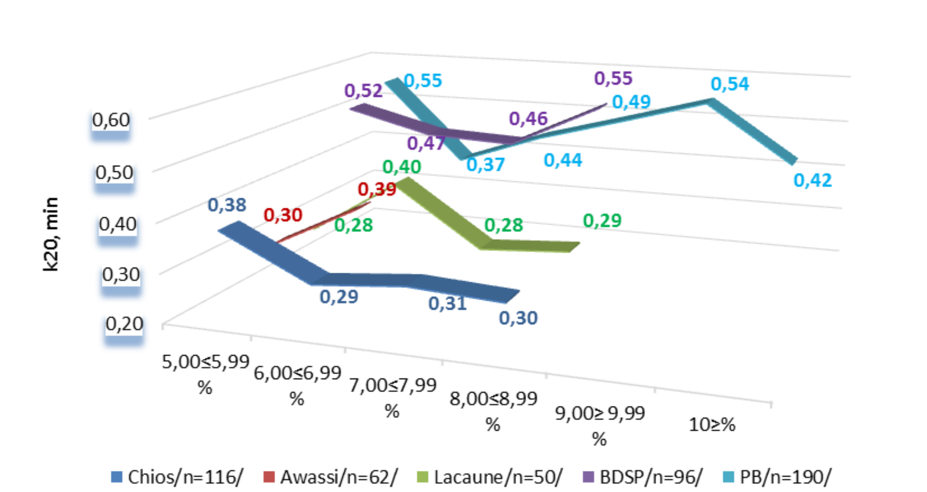
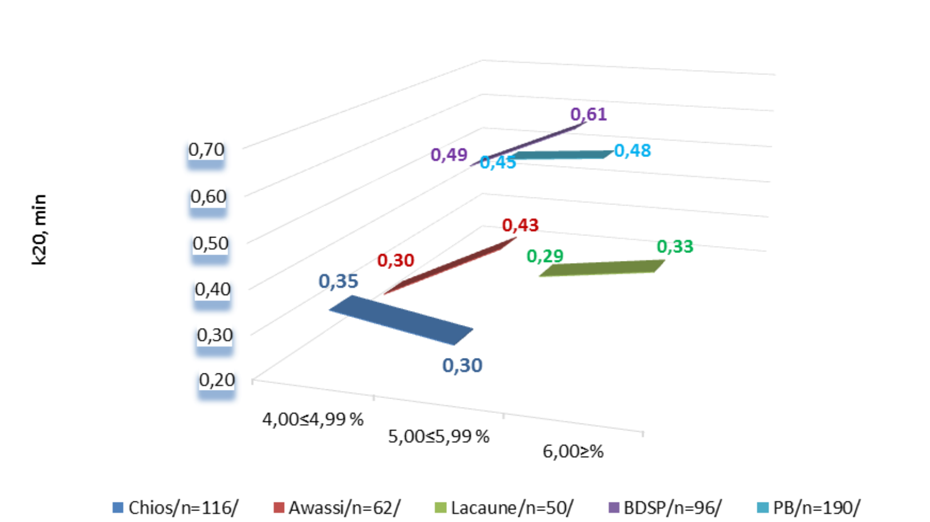


Figure 17. Influence of protein content on curd firmness time in different breeds of sheep



V. CONCLUSIONS AND RECOMMENDATIONS:

Conclusions

1. A positive genetic trend was established for the trait of milk yield, as ewes with blood of Lacaune breed (50%, 62,5% blood) in their genotype had the highest milk yield in the period 2010-2015.

2. The highest prolificacy at the first lambing was reported for ewes with blood ***75 % BDSP : 12,5% SZ: 12,5% EF*** (160%); ***62,5% BDSP : 25% SZ: 12,5% PB*** (160%); at the second lambing - in ewes with blood ***62,5% Lacaune : 37,5% BDSP*** (180%) and ***50% Chios : 37,5% BDSP : 12,5% SZ***(180%); at the third lambing – ***50% Chios: 37,5% BDSP : 12,5% SZ*** (180%).

3.The live weight of ewes at different ages was established, such as:

3.1. At weaning – the highest weight was found in animals with blood ***75% BDSP: 25% C3*** (born in 2007) – 27 kg;

3.2. At the age of 9 months, at the age of 18 months and at the age of 2,5 years, animals with genotype ***11111111 (100% BDSP),*** born in 2006, had the highest live weight;

3.3. By lower live weight were distinguished the animals with blood ***50% BDSP : 25% SZ: 12,5% EF: 12,5% PB*** – 32 kg; with blood content ***75% BDSP: 25% SZ*** –42 kg; with blood content ***50% Chios : 37,5% BDSP: 12,5% SZ*** –48 kg, respectively at 9 months of age, at 18 months of age and at 2,5 years of age.

4. The milk of ewes of BDSP had very good quality characteristics:

4.1. The highest fat content in milk (6,60%) was found in animals with genotype ***11112222 (50% BDSP : 50% Lacaune***), and the lowest (6,14%) in animals with genotype ***11111415 (75% BDSP: 12,5% SZ : 12,5% EF);***

4.2. Animals with ***62,5% blood from BDSP: 37,5% SZ*** produced milk with the highest protein content – 4,85%, and with the lowest (4,57%) –ewes with genotype ***11552222 (50% Lacaune: 25% BDSP: 25% SZ)***;

4.3. The shortest RCT was recorded for the ewes with genotype ***11111511 (87,5% BDSP: 12,5% SZ)*** – 13,19 min; the ewes with genotype ***11551111 (75% BDSP: 25 %SZ)*** had the highest curd firmness (45,29 mm) and the shortest curd firmness time (0,41 min).

5. The milk produced by the ewes of the Pleven Blackhead breed had the highest fat content – 8,50%, and the lowest had the milk of the Awassi ewes –5,68%;

6. The highest protein content in milk was found for the ewes of the Lacaune breed (6,63%), and the lowest – for the ewes of the Chios breed (4,52%);

7. The shortest RCT was registered for the animals of the Chios breed – 10,90 min, and the longest RCT – in the animals of BDSP – 17,83 min;

8. The highest curd firmness was found for the ewes of the Awassi breed (42,15 mm), while the milk of the Lacaune breed had the lowest curd firmness value – (36,94 mm);

<u>Recommendations:</u>

1. To increase the milk yield of BDSP animals, we recommend the use of the highly productive Lacaune breed.
2. To increase the prolificacy of BDSP ewes we recommend infusion of blood from the Lacaune and Chios breeds.

V. CONTRIBUTIONS:

1. The existing genetic structure of the flock raised at the Agricultural Institute – Stara Zagora was analyzed from the point of view of its heterogeneity and the relation to the productive traits of economic importance –prolificacy, live weight and milk yield, as well as the coagulation ability of milk. In this regard, the study of phenotypic and genetic variability according to us is the key to the possibilities for effective and economically usefull genetic progress.
2. The influence of the number of lambs born per ewe and the influence of the duration of lactation period on milk productivity of BDSP ewes was established;
3. The qualitative composition and coagulation ability of milk in BDSP ewes with different genotypes was studied.
4. The individual coagulation ability and the quality composition of milk of the Awassi, Lacaune, Chios, Pleven Blackhead breeds and BDSP were established;
5. The relationship between the content of % fat and % protein substances in milk with the parameters characterizing the coagulation ability of milk was studied.

VI. PUBLICATIONS RELATED TO THE DISSERTATION :

1. **Miteva, D., 2020.** Content of protein substances in milk and parameters of its coagulation ability in dairy sheep. Bulgarian Journal of Animal Husbandry, LVII, 6/2020, 50–58
   https://animalscience-bg.org/page/bg/details.php?article_id=617