

INFLUENCE OF CERTAIN FACTORS ON THE ANNUAL MILK PRODUCTION OF THE CROSSBREEDS BETWEEN AWASSI AND DOMESTIC POPULATION OF SHEEP

UTJECAJ NEKIH FAKTORA NA GODIŠNJU PROIZVODNJU MLIJEKA KRIŽANACA AWASSI OVCE I DOMAĆE POPULACIJE OVACA

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SUMMARY

A study on few production traits (total milk production, commercial milk, lactation period), in a total of 89 crossbreeds between Awassi and domestic population of sheep in Macedonia was carried out in a during two year period (2004, 2005).

The sheep were in the first and second lactation and a total of 1145 individual lactation tests were carried out on them, during two years.

All the data were analyzed by multi trait fixed model. The separate trait influence was studied by the F-test, and the differences between LS – estimates of each effect were determined by the T-test. The analyses were made by the set of programs SPSS.

Several factors (year and lactation), had a highly significant influence ($P < 0,001$) on all the traits from the yearly production of milk. Other factors like the month of lambing showed a highly significant influence ($P < 0,01$) on certain traits (lactation, amount of commercial milk and length of lactation), while this factor did not have any influence on the other traits (suckling period). The fertility did not have any influence ($P > 0,05$).

Key words: Awasi crossbreeds, production traits, factor influence (year, lactation, month of lambing, fertility)

INTRODUCTION

In the process of promotion of production traits in domestic population of sheep in Macedonia, several breeds are used: Virtemberg, Awassi, Chios, Sardinian, East Friesian. Everything is done with one aim, to get sheep with higher genetic basis for certain products through method of crossbreeding, which in further breeding will be permanently selected in production.

The crossbreeding method in sheep breeding has a significant advantage in the other countries of the Mediterranean region too, where a lot of farmers, sheep breeders, insist on increasing milk production in the domestic local sheep breeds through import of highly productive dairy breeds (Ugarte et al., 2001)

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The influence of several factors on the annual milk production traits by crossbreeding F_1 generation of Awassi and domestic population of sheep in Macedonia is shown in this paper.

MATERIAL AND METHODS

The crossbreeds F_1 between Awasi and domestic population of sheep, located on the farm, in the village Kozle, Skopje region, represent the material for research. The research on the crossbreeds lasted 2 years (2004 and 2005). The research comprised a total of 89 sheep in 2004 and 88 sheep in 2005 or in the two years a total of 177 crossbreeds were tested. (Table 1).

The tested sheep during 2004 were in the first lactation, while those in 2005, were in the second.

The age structure of the tested sheep per year is shown in Table 2.

The tested sheep were in the first and the second lactation, or more precisely, a total of 575 lactation controls in the first lactation period and 570 in the second lactation period or total of 1145 individual lactation tests were carried out on these sheep. (Table 3).

The raising system applied in the farm was combined (barn and pasture) and involved use of the available vegetation in most of the year (7-8 months). The rest of the year, the sheep were fed meadow hay (November-February) and concentrate (November-April).

The milking period started after the weaning of lambs (2-2.5 months after lambing) and depending on individual milk production lasted until August-October.

Table 1. Number of tested sheep per year

Tablica 1. Broj kontroliranih ovaca po godinama

Population - Populacija	Year - Godina		Total - Ukupno
	2004	2005	
Crossbreeds F_1 generation Generacija križanaca F_1	89	88	177

Table 2. The age structure of the tested sheep per year

Tablica 2. Dobna struktura testiranih ovaca po godini

Year - Godina	Lactation in order - Laktacija po redu		Total - Ukupno
	I	II	
2004	89	/	89
2005	/	88	88
Total	89	88	177

Table 3. Individual sheep lactation tests

Tablica 3. Pojedinačna kontrola laktacija ovaca

Period (year) - Razdoblje (godina)	Lactation in order - Laktacija po redu		Total lactation tests Ukupno kontrole laktacija
	I	II	
2004 - 2005	575	570	1145

The individual lactation of the sheep was observed according to standard A_4 method (ICRPMA, 1990), that involved measuring daily milk production in intervals of 28 to 34 days. Milk testing started 10 days after lambing and lasted up to the moment of drying which occurred by the middle of October.

The number of milk tests was on average 8, and in every milk test a collective individual milk sample of 50 ml was taken (at least 25 from every milking) for analysis of the milk fat.

Based on these lactation measurements, the following was examined:

- Total production of milk per one lactation in liters (l);
- Total production of commercial milk per one lactation in liters (l);
- Amount of milk consumed by the lambs in liters (l);
- Length of suckling period in all sheep;
- Lactation length.

Mean values on all of these traits were determined based on 1145 individual lactation tests (Table 3).

Regarding the statistical analysis, the traits of the annual milk production (lactation milk, suckling and commercial milk, suckling period, lactation length) were analyzed by the following multi trait fixed model:

$$Y = \mu + Y_j + L_k + MBI + F_m + e_{jklm}$$

where:

Y – is individual observation of every trait in the annual testing (lactation milk, suckling and commercial milk, suckling period, lactation length);

μ – is basic, collective average for the researched traits;

Y_j – effect of j year with ($j = 2004, 2005$);

L_k – effect of k lactation with ($k = 1, 2$)

MBI – effect of l month of lambing with ($l = \text{January, February}$)

F_m – effect of m number in newborn lambs with ($m = 1, 2$)

e_{jklm} – residual influence

The separate trait influence was studied by the F-test, and the differences between LS – estimates of each effect were determined by the T-test.

The analyses were made by the set of programs SPSS.

RESULTS AND DISCUSSION

According to the data the year and the lactation had a high significant influence ($P < 0,001$) regarding all the traits from the annual milk production of sheep.

The month of lambing had a highly significant influence ($P < 0,01$) on the lactation, the amount of commercial milk and lactation length, significant influence ($P < 0,05$) on the amount of milk suckled by the lambs, while this factor did not have any influence on the length of suckling period.

Regarding the four traits, the fertility did not have any influence ($P > 0,05$).

The determination coefficient for the tested traits in these crossbreeds was from 0.347 for the length of the suckling period up to 0.761 for annual milk production.

The influence of these factors is shown separately in the following tables (Table 5 - Table 8).

Table 4. Factor influence on the annual milk production in F₁ crossbreeds, F-test and its significance (F-statistics)

Tablica 4. Faktor utjecaja na godišnju proizvodnju mlijeka u križanaca F₁, F-test i njegova važnost (F-statistika)

Factor Faktor	Df Df	Lactation milk Mlijeko u laktaciji	Suckling milk Sisano mlijeko	Commercial milk Komerrijalno mlijeko	Suckling period length Sisanje trajanje	Lactation length Laktacija duljina
Year Godina	3	5.816***	29.440***	4.340**	100.190***	35.611***
Lactation Laktacija	6	37.497***	27.264***	10.326***	4.533***	4.079***
Month of lambing Mjesec janjenja	3	84.971***	3.387*	99.620***	2.219 ^{ns}	265.511***
Fertility Plodnost	1	0.615 ^{ns}	1.050 ^{ns}	0.766 ^{ns}	1.451 ^{ns}	0.085 ^{ns}
R ² - Coeff. Determination R ² - koef. određivanja	/	0.761	0.553	0.612	0.347	0.736

ns — P>0,05, * - P<0,05, ** - P<0,01, *** - P<0,001

Annual milk production in the tested sheep population

According to the data in Table 5, the average lactation milk in crossbreeds from F₁ generation between Awasi population and domestic population of sheep for the two testing years was 109±0.479 l, while the amount of milk, consumed by the lambs was on average 37±0.253 l. Commercial milk

production in this population in two years was on average 72±0.421 l, while the average length of the suckling period was 54±0.377 days. The duration of the lactation period in crossbreeds in two years of testing was on average 203±0.61 days. High variation between the minimal and maximal amount of lactation produced by these crossbreeds is shown in Table 5.

Table 5. Annual milk production in the tested sheep population, LS – middle ± SE

Tablica 5. Godišnja proizvodnja mlijeka testiranih ovaca populacije, LS-sredina ± SE

Year Godina	Parameter Parametar	Lactation milk production, l Proizvodnja mlijeka u laktaciji, l	Suckling milk, l Sisano mlijeko, l	Commercial milk, l Komerrijalno mlijeko, l	Suckling period length, (days) Duljina razd. sisanja (dani)	Length of lactation (days) Duljina laktacije (dani)
2004	\bar{x}	103	33	70	49	195
	Cv	28.54	30.43	28.11	18.62	8.93
	min-max	38.09 – 171.04	16.66 – 61.74	11.53 – 117.07	34 – 63	185 – 237
2005	\bar{x}	115	41	74	59	211
	Cv	15.44	29.48	27.88	28.08	3.03
	min-max	80.64 – 167.61	19.00 – 76.00	16.40 – 136.61	33 - 109	211 – 232
Ø		109±0.479	37±0.253	72±0.421	54±0.377	203±0.61

The determined annual milk production (109 l) in our testing was a little lower in comparison with the examinations of Tokovski et al. (1977) that determined lactation of 128.5 l. The other group of crossbreeds was tested in the first lactation and the authors determined lower lactation (83.89 l) compared to the one determined in our testing. Very high lactation in comparison to ours was determined in several consecutive testings in these crossbreeds (Todorovski et al., 1979, Todorovski et al., 1985, Todorovski et al., 1996), where on average the determined lactation was 180 l.

Considering that Awassi as a breed improver is used in other countries too, the lactation in crossbreeds of Awassi ram and Kazakhstan fat tail sheep is 119.2 l, while of Kazakhstan sheep is only 42.6 l (Malmakov et al., 2006). According to Iniguez et al., (2006), the lactation in Turkish Awassi and Syrian sheep crossbreed is 119.18 kg, while in the Syrian sheep milk production of 109.41 kg was determined. Generally these results are close to ours.

The influence of the year on the annual milk production in the tested sheep populations

The year has a highly significant influence ($P<0,001$) on all the traits of annual milk production in the tested crossbreeds (Table 4).

According to the data in Table 6, the average lactation milk in Awassi and domestic population crossbreeds is from 103 l in 2004 up to 115 l in 2005.

During the two testing years maximal lactation milk in these crossbreeds is determined, from 171 l in 2004 and 167 l in 2005.

During the two years the quantity of milk, consumed by the lambs of these crossbreeds was

similar and it was from 33 l in 2004, up to 41 l in 2005. The quantity of produced commercial milk was also calculated in this population. According to the data in Table 6, the average production of commercial milk from these crossbreeds was from 70 l in 2004, up to 74 l in 2005. Having in mind that the proportion of suckling and commercial milk depends on the breeding period, the average length of this period is shown in the same table (Table 6). On average, the length of the suckling period for the two productive years in the tested crossbreeds was 49 and 59 days, for the two years, respectively. The lactation length of these crossbreeds lasted 195 days in 2004, and 211 days in 2005.

Lactation influence on the annual milk production of the Awassi breed

The lactation i.e. the age has a highly significant influence ($P<0,001$) on all the tested traits of the annual milk production, in the F_1 crossbreeds between Awassi and domestic population sheep (Table 4). According to Table 7, the quantity of lactation milk from these crossbreeds is insignificantly higher in the second (102 ± 1.53 l) in comparison with those from the first lactation (99 ± 1.31 l).

Unlike the lactation milk, the quantity of commercial milk is higher in the crossbreeds in the first lactation (64 ± 1.41 l). This is because those in the second lactation have 66 days longer period of suckling, and that is why the quantity of suckling milk in these sheep is higher and it is 44 ± 1.03 l. The lactation length is from 219 ± 2.13 days in the crossbreeds in the first, and 236 ± 2.70 days in the crossbreeds in the second lactation.

Table 6. The year influence on the annual milk production in F_1 crossbreeds, LS - mean \pm SE

Tablica 6. Utjecaj godine na godišnju proizvodnju mlijeka križanaca F_1 , LS-sredina \pm SE

Year Godina	n	Lactation milk, l Mlijeko u laktaciji, l	Suckling milk, l Sisano mlijeko, l	Commercial milk, l Komerrijalno mlijeko, l	Length of suckling period, (days) Duljina razd. sisanja (dani)	Lactation length, days Duljina laktacije (dani)
2004	89	103 ± 0.97	33 ± 0.53	70 ± 1.05	49 ± 0.66	195 ± 1.16
2005	88	115 ± 0.97	41 ± 0.53	74 ± 1.06	59 ± 0.67	211 ± 1.17

Table 7. The lactation influence on the annual milk production from F₁ crossbreeds, LS - mean \pm SE

Tablica 7. Utjecaj laktacije na godišnju proizvodnju mlijeka križanaca F₁, LS-sredina \pm SE

Lactation length, days Duljina laktacije	n	Lactation milk, l Mlijeko u laktaciji, l	Suckling milk, l Sisano mlijeko, l	Commercial milk, l Komerrijalno mlijeko, l	Length of suckling period, (days) Duljina razd. sisanja (dani)	Lactation length, (days) Duljina laktacije (dani)
1	575	99 \pm 1,31	35 \pm 0,89	64 \pm 1,41	53 \pm 1,08	219 \pm 2,13
2	570	102 \pm 1,53	44 \pm 1,03	58 \pm 1,65	66 \pm 1,26	236 \pm 2,70

The influence of the month of lambing on the annual milk production in Awassi sheep

The month of lambing has a highly significant influence ($P < 0.001$) on the lactation and commercial milk, as well as on the lactation length in the F₁ crossbreeds. This factor influences significantly ($P < 0.05$) the quantity of consumed milk by the lambs, while it does not have an influence ($P > 0.05$) on the length of the suckling period (Table 4).

According to the data in Table 8, the crossbreeds lambing in January have a significantly higher lactation milk (112 \pm 1.25 l), than the ones lambing in February (91 \pm 1.70 l).

The case with the commercial milk which in the crossbreeds lambing in the first month of the year (January) is 75 \pm 1.35 l, while in those lambing in the second month (February) is 50 \pm 1.83 l. The length of the suckling period is 55 days for the sheep lambing in January and 65 days for those lambing in February. The length of the lactation is from

200 \pm 3.23 days in crossbreeds lambing in February up to 225 \pm 1.84 days in those lambing in January.

The influence of the fertility on the annual milk production in Awassi sheep

The fertility does not influence either one of the examined traits in the F₁ crossbreeds (Table 4). According to Table 9, crossbreeds with one lamb have higher lactation milk (106 \pm 0.73 l), than those that gave birth to two (99 \pm 2.41 l). The crossbreeds with one lamb have higher production of commercial milk (68 \pm 0.78 l) in comparison with those with two lambs (59 \pm 2.59 l). The quantity of milk consumed by the twins is little higher (40 \pm 1.62 l), in comparison with those sheep that lambing one lamb (38 \pm 0.49 l).

The suckling and lactation period is longer in the crossbreeds with two than the ones with one lamb. On average, the length of the suckling period in crossbreeds with one lamb is 57 days, and those with two 63 days. The length of the lactation period of crossbreeds with one and two lambs is 212, i.e. 220 days.

Table 8. The influence of the month of lambing on the annual milk production in F₁ crossbreeds, LS - mean \pm SE

Tablica 8. Utjecaj mjeseca janjenja na godišnju proizvodnju mlijeka križanaca F₁, LS-sredina \pm SE

Month of Lambing Mjesec janjenja	n	Lactation milk, l Mlijeko u laktaciji, l	Suckling milk, l Sisano mlijeko, l	Commercial milk, l Komerrijalno mlijeko, l	Length of suckling period, (days) Duljina razd. sisanja (dani)	Lactation length, days Duljina laktacije, (dani)
1	924	112 \pm 1.25	37 \pm 0.85	75 \pm 1.35	55 \pm 1.04	225 \pm 1.84
2	221	91 \pm 1.70	41 \pm 1.14	50 \pm 1.83	65 \pm 1.40	200 \pm 3.23

Table 9. The influence of the fertility on the annual milk production in F₁ crossbreeds, LS - mean ± SE

Tablica 9. Utjecaj plodnosti na godišnju proizvodnju mlijeka križanaca F₁, LS-sredina ± SE

Fertility Plodnost	n n	Lactation milk, l Mlijeko u laktaciji, l	Suckling milk, l Sisano mlijeko, l	Commercial milk, l Komerrijalno mlijeko, l	Length of suckling period, days Duljina razd. sisanja (dani)	Lactation length, (days) Duljina laktacije, (dani)
1	1083	106±0.73	38±0.49	68±0.78	57±0.60	212±1.56
2	62	99±2.41	40±1.62	59±2.59	63±1.99	220±3.71

CONCLUSIONS

Based on the results of these researches done on F₁ crossbreeds of Awassi and domestic population sheep in Macedonia, the following conclusions can be made:

1. The year and the lactation have a highly significant influence ($P < 0.001$) on all the traits in annual milk production on the tested crossbreeds. The other factors (month of lambing, fertility) have an influence on some of the tested traits.

2. The average lactation milk in the analyzed cross-breeds in the period of two years was 109±0.479 l, while the amount of milk, consumed by the lambs on average 37±0.253 l.

3. The production of commercial milk in this population during the two years was on average 72±0.421 l, while the average length of suckling period was 54±0.377 days. The duration of the lactation period in crossbreeds in two years of studying was on average 203±0.61 days.

4. Analyzed by years, the average lactation milk was from 103 l in 2004, up to 115 l in 2005. The maximal lactation in this population was measured in 2004 and it was 171 l.

5. The big variation (min-max) in milk production of these crossbreeds point to the possibility and need of further selection in direction of milk production.

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SAŽETAK

Istraživanje nekih proizvodnih značajki (ukupna proizvodnja mlijeka, komercijalno mlijeko, razdoblje laktacije) na ukupno 89 križanaca awassi ovce i domaće populacije ovaca u Makedoniji provodilo se tijekom dvije godine (2004, 2005). Ovce su bile u prvoj i drugoj laktaciji i na njima je obavljeno 1145 pojedinačnih kontrola laktacije tijekom dvije godine. U vezi statističke analize, osim osnovne statistike, svi su podaci analizirani fiksnim modelom više značajki. Odvojeni utjecaj značajki istraživan je pomoću F-testa, a razlike između LS procjena svakog učinka određene su T-testom. Analize su obavljene paketom SPSS programa.

Nekoliko faktora (godina i laktacija) visoko značajno je utjecalo ($P < 0.00$) na sve značajke godišnje proizvodnje mlijeka. Ostali faktori kao mjesec janjenja pokazuju visoko značajan utjecaj ($P < 0.01$) na neke značajke (laktacija, količina komercijalnog mlijeka i duljina laktacije), dok ovaj faktor nema nikakav utjecaj na ostale značajke (duljina sisanja). U vezi sa četiri značajke, plodnost nije imala utjecaja ($P > 0.05$).

Ključne riječi: Križanci awassi, proizvodne značajke, faktor utjecaja (godina, laktacija, mjesec janjenja, plodnost)