

INFLUENCE OF CERTAIN FACTORS ON THE ANNUAL MILK PRODUCTION OF THE AWASSI BREED

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During four productive years (2002, 2003, 2004 and 2005), several productive characteristics of total of 170 sheep from the Awassi breed have been researched. The sheep age was between the first and the eleventh lactation and they had in total 1130 lactations finished, during these four control years. As for statistical processing, except the basic statistics, all data were analyzed applying the multifactorial fix model. The influence of the separate factors has been researched using the F-test, and the differences among the LS-estimates of each effect, have been determined using the T-test. The analysis has been made by applying the SPSS programme package. More of the analyzed factors (year, lactation, month of lambing, fertility) had significant influence on different levels ($P < 0.001$, $P < 0.01$, $P < 0.05$) on the annual milk production of the researched sheep population. The average lactation yield at the controlled breed of sheep for the analyzed for years was 325 ± 14.864 litres, while the quantity of milk, consumed by the lams, in average was 89 ± 1.374 litres. The maximum lactation yield at this population was measured in the year 2002 (635 litres). The production of commercial milk from this population, in average for these four years was 236 ± 14.737 litres, while the average length of nursing was 74 ± 1.145 days. The length of lactation at this population for these four research years in average was 234 ± 3.90 days. The fertility had significant influence ($P < 0.05$) on the lactation milk of the Awassi sheep.

Key words: Awassi; productive characteristics; influence of factors (year, lactation, month of lambing, fertility)

ВЛИЈАНИЕ НА ОДРЕДЕНИ ФАКТОРИ ВРЗ ГОДИШНАТА ПРОДУКЦИЈА НА МЛЕКО КАЈ РАСАТА АВАСИ

Испитувани се неколку производни својства кај вкупно 170 овци од расата аваси во текот на четири производни години (2002, 2003, 2004 и 2005). Овците беа на возраст од прва до единаесетта лактација и во текот на четирите контролни години кај нив беа реализирани вкупно 1130 лактации. Во однос на статистичката обработка, освен базичната статистика, сите податоци беа анализирани со помош на многуфакторијален фиксен модел. Влијанието на одделните фактори е проучувано со помош на F-тестот, а разликите помеѓу LS-оцените на секој ефект се утврдени со помош на T-тестот. Анализите се правени со помош на пакет програми SPSS. Повеќето од испитуваните фактори (година, лактација, месец на јагнење, плодност) имаа сигнификантно влијание на различни нивоа ($P < 0,001$, $P < 0,01$, $P < 0,05$) врз годишната продукција на млеко кај испитуваната популација овци. Просечната лактациска млечност кај контролираните грла за четирите испитувани години изнесуваше $325 \pm 14,864$ литри, додека количеството на млеко, конзумирано од страна на јагнињата, во просек изнесуваше $89 \pm 1,374$ литри. Максималната лактациска млечност кај оваа популација беше измерена во 2002 година (635 литри). Производството на комерцијално млеко кај оваа популација во просек за четирите години изнесуваше $236 \pm 14,737$ литри, додека просечната должина на дојниот период е $74 \pm 1,145$ дена. Должината на лактацискиот период кај оваа популација за четирите испитувани години во просек изнесуваше $234 \pm 3,90$ дена. Плодноста имаше сигнификантно влијание ($P < 0,05$) врз лактациското млеко кај овците од расата аваси.

Клучни зборови: аваси; производни својства; влијание на фактори (година, лактација, месец на јагнење, плодност)

1. INTRODUCTION

Breeding of sheep means a system of actions, oriented to productivity increase and increase of the breeding value. The basic principles of breeding are based on the breeders' will, and that means that the next generation animals, more or less should surpass parents in their production qualities (Petrović, 2000).

With the National animal breeding programme of the Republic of Macedonia for the period from 2000 to 2009, the Awassi breed has been determined as a basic meliorate in sheep breeding. This breed is the most productive in the Middle East, and after the East-Friesian sheep, in the world (Gursoy et al., 1992).

The selection of the Awassi breed as a meliorate of the domestic population sheep in the Republic of Macedonia is made on the basis of four decade practical experience, and on the basis of the past selection aim in the sheep breeding in our country, presented by improved and increased sheep milk production. The paper shows the influence of several factors on the annual milk production of the Awassi breed.

2. MATERIAL AND METHODS

The Awassi sheep were used as research material, located on the farm in the village Gradište, Kumanovo, a place that at the same time represents a reproductive centre of this breed in the Republic of Macedonia. Researches of the Awassi sheep lasted 4 years (2002–2005). The research in 2002 included in total 33 Awassi sheep, in 2003 included 37 sheep, in 2004 included 38 sheep and in 2005 included 62 Awassi sheep, or in total in four productive years 170 Awassi sheep were controlled (Tab. 1).

Table 1

Number of controlled sheep in years

Population	Year				Total
	2002	2003	2004	2005	
Awassi	33	37	38	62	170

A great part of the controlled sheep were in 1st lactation (46), in 2nd lactation were 26 sheep, in 3rd lactation 23 sheep, in 4th lactation 24 sheep, etc.

The age structure of the researched sheep are presented in Table 2.

Table 2

Age structure of the researched sheep in years

Year	Awassi sheep											Total sheep
	Lactation											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	
2002	–	9	6	11	–	1	3	2	1	–	–	33
2003	11	–	8	5	11	–	–	2	–	–	–	37
2004	15	5	–	8	3	7	–	–	–	–	–	38
2005	20	12	9	–	8	2	8	–	–	2	1	62
Total	46	26	23	24	22	10	11	4	1	2	1	170

When analyzed by age, the sheep were among the first and eleventh lactation, or exactly for these sheep were made in total 274 individual lactation controls in the first lactation, 176 in the second, 158 in the third, 168 in the fourth, 160 in the fifth, 69 in the sixth, 73 in the seventh, 28 in the eighth, 9 in the ninth, 10 in the tenth and 5 controls in the eleventh lactation (Tab. 3).

Table 3

Individual lactation controls of sheep

Period (year)	Awassi sheep											Total lactation controls
	Lactation											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	
2002–												
2005	274	176	158	168	160	69	73	28	9	10	5	1130

The breeding system implemented on the farm was combined (cots-pasture), utilising the available pasture during the great part of the year (7–8 months). The other part of the year, the sheep additionally were fed with meadow hay (November–February) and concentrate (November–August), because of the high genetic capacity for milk production.

The milking period started after weaning the lambs, that usually happened 2–2.5 months after the lambing (beginning of April) and depending on the individual milk production, lasted till August–October. The individual sheep lactation was followed by the standard A4 method (ICRPMA, 1990), that means measurement of the daily quantity of milk in a 28–34 days interval. The milk controls started 10 days after the lambing and lasted

till the day of drying, that happened till mid October.

The number of accomplished milk controls were 8 in total and in each milk control 50 ml total individual milk sample was taken (at least 25 ml from each milking) for the purposes of the milk fat analysis.

On the basis of these measurements of the lactation, the following has been measured:

- Total milk production in one lactation in litres (l);
- Total commercial milk production in one lactation in litres (l);
- Quantity of milk, consumed by the lambs in litres (l);
- Length of the suckling period in days;
- Length of lactation.

The average values of all these traits are determined on the basis of about 1130 individual lactation controls of purebred Awassi sheep (Tab. 3).

Concerning the statistical analysis, the traits of the annual milk production (lactation milk, suckling and commercial milk, length of the suckling period, length of lactation) are analyzed using the following multi-factorial fix model.

$$Y = \mu + Y_j + L_k + MBl + F_m + eijklm \text{ where:}$$

Y – is individual observation of each trait on the annual control (lactation milk, suckling and commercial milk, length of the suckling period, length of lactation);

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

Y_j – is the effect of the j year with ($j = 2002, 2003, 2004$ and 2005);

L_k – is the effect of the k lactation with ($k = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11$);

MBl – is the effect of the 1st month of lambing with ($l = \text{November, December, January, February, March, April, May, June, July}$);

F_m – is the effect of the m number of newborn lamb with ($m = 1, 2$);

$eijklm$ – residual influence.

The influence of the separate effects has been analyzed using the F-test, and the differences among the LS-estimations of each effect have been determined using the T-test.

The analysis has been made using the package programmes SPSS.

3. RESULTS AND DISCUSSION

According to the data in the Table 4, significant influence ($P < 0,001$) in correlation to the other traits of the annual milk production of the sheep, has the lactation and the month of lambing. The year has high important influence ($P < 0.001$) on the quantity of suckling milk by the lambs and on the length of the suckling and lactation period. Concerning these three traits, fertility has no influence ($P > 0.05$), but shows significant influence on the quantity of lactation ($P < 0.05$) and the commercial milk ($P < 0.01$).

The coefficient of determination of researched traits of the purebred Awassi sheep is between 0.286 for the commercial milk and 0.616 for the length of lactation.

Table 4

Influence of the factors on the annual milk production, F-test and its importance (F-statistics)

Factor	Df	Lactation milk	Suckling milk	Commercial milk	Length of suckling period	Length of lactation
Awassi						
Year	3	2.872 ^a	39.849 ^c	2.427 ^{ns}	39.849 ^c	124.439 ^c
Lactation	10	9.890 ^c	7.573 ^c	7.159 ^c	7.573 ^c	5.793 ^c
Month of lambing	8	11.153 ^c	75.451 ^c	11.200 ^c	75.451 ^c	143.649 ^c
Fertility	1	4.344 ^a	2.032 ^{ns}	6.810 ^b	2.032 ^{ns}	0.335 ^{ns}
R ² – Koef. determinat.	/	0.301	0.387	0.286	0.387	0.616

ns — $P > 0.05$, a — $P < 0.05$, b — $P < 0.01$, c — $P < 0.001$

The influence of all these factors in specific, for this population is presented in the following tables (Table 5 – Table 9).

*Annual milk production
of researched population of sheep*

According to the data in Table 2, the average lactation of the Awassi sheep for the four analyzed

years is 325 ± 14.864 litres, while the quantity of milk, consumed by the lambs in average is 89 ± 1.374 litres. The production of commercial milk at this population in average for the four years is 236 ± 14.737 litres while the average length of the suckling period is 74 ± 1.145 days. The length of the lactation period at this population for the four analyzed years in average is 234 ± 3.90 days.

Table 5

Annual milk production of analyzed sheep population, LS – middle \pm SE

Genotype	<i>n</i>	Lactation milk (l)	Suckling milk (l)	Commercial milk (l)	Length of suckling period (days)	Length of lactation (days)
Awassi	43	325 ± 14.864	89 ± 1.374	236 ± 14.737	74 ± 1.145	234 ± 3.90

Observational results for the lactation milk (325 litres) at the Awassi sheep are in coordination with the statements and results of a big number of other authors that have been working on determination of milk production of this breed of sheep (Hristov, 1983; Todorovski et al., 1984; Epstein, 1985; Gootwine, 1995; Elicin and Ertugrul (quote Gursoy et al., 1995); De la Fuente et al., 2006; Kukovics et al., 2006; Amin and Peters, 2006 and others).

However, some new authors (Gootwine, 1995) have determined significantly higher lactation of this breed, while others (Ozer et al., 2006) significantly lower. The fact, that Gootwine (1995) has determined average lactation of about 500 l milk in the most famous flock of the Awassi sheep in Israel (Ein Harod), indicates that the maximum genetic capacity for milk production of this breed has not been reached and there are conditions for further improvement of this trait. On the other hand, Ozer et al. (2006) have determined relatively low lactation of the Turkish Awassi sheep, from 90 to 155 kg milk. Other authors have also determined similar lactation of the Turkish Awassi sheep (Gursoy et al., 1992; Pollott et al., 1998; Gursoy et al., 1998; Darcan and Guney, 2000; Gursoy et al., 2001; Galal et al., 2006; Iniguez et al., 2006); However, according to Gursoy et al. (1992), there is an opportunity for further selection of this breed in Turkey, towards increase of the milk production in the breed itself. Besides that, in order to increase the milk production, the Turkish Awassi sheep have

been cross-bred with the East-Friesian breed and Chios breed. This cross-breeding resulted with Cukurova Assaf breed (75% Awassi + 25% East-Friesian) and Cukurova milk sheep (50% Awassi + 50% Chios) (Darcan and Guney, 2000).

*Influence of the year on the annual milk
production of the Awassi sheep*

The year has significant influence ($P < 0.001$) on the consumed milk by the lambs and the length of the suckling and lactation period, as well as significant influence on the lactation milk of these sheep. This factor had no influence ($P > 0.05$) on the quantity of the commercial milk at this population of sheep (Tab. 1).

According to the data in Table 6, the average lactation milk of the Awassi sheep is between 310 liters in 2003 and 342 litres in 2005. The maximum milk production of this sheep has been measured in 2002 (635 litres).

During the four analyzed years, the quantity of milk at the Awassi sheep, suckling by the lambs is similar and it is from 88 litres in 2003 and 2005, to 90 litres in 2004. According to the quantity of suckling milk, also the quantity of produced commercial milk has been measured of this population. Pursuant to the data in Table 6, the average production of commercial milk of this population is from 222 litres in 2003 to 254 litres in 2005. Taking into consideration that the ratio between the

suckling and the commercial milk depends on the suckling period, in the same table (Tab. 6) the average length of the suckling period is presented. In average, the length of the suckling period for the four productive years of the Awassi sheep is 74

days, or more precisely it is between 73 days in 2003 and 2005, till 75 days in 2004. The longest lactation these sheep had in 2004 (246 days), and the shortest in 2002 (217 days).

Table 6

Influence of the year on the annual milk production of the Awassi sheep, LS – medium ± SE

Year	<i>n</i>	Lactation milk (l)	Suckling milk (l)	Commercial milk (l)	Length of suckling period (days)	Length of lactation (days)
2002	33	323±12.85	89±1.19	234±12.74	74±0.99	217±3.37
2003	37	310±15.36	88±1.42	222±15.23	73±1.18	231±4.03
2004	38	325±17.47	90±1.62	235±17.32	75±1.35	246±4.58
2005	62	342±19.02	88±1.76	254±18.86	73±1.47	242±4.99

Influence of the lactation on the annual milk production of the Awassi breed

Lactation, respectively the age had significant influence ($P < 0.001$) on all analyzed traits on the annual milk production of the Awassi breed (Tab. 1). According to the data in Table 7, the quantity of lactation milk has slight increase from the first till the second lactation, and then slight decrease in the third and fourth lactation, and then again increase in the following lactations, till the ninth lactation. The highest lactation of the thoroughbred Awassi sheep was noticed at the sheep in the seventh lactation (395 litres). After the ninth

lactation, in the tenth and eleventh, the quantity of milk rapidly decreases.

The quantity of the suckling milk was mainly evened and was between 85 litres in the 11-th lactation to 94 litres in the 7-th. The quantity of the produced commercial milk has the same trajectory as the quantity of the lactation milk, and the length of the suckling period in average for all 11 lactations was 74 days. The sheep had the longest lactation in the 7-th lactation (242±4.95 days), and the shortest those in the 8-th and 11-th lactation (220 days).

Table 7

Influence of the lactation on the annual milk production of the Awassi sheep, LS – middle ± SE

Year	<i>n</i>	Lactation milk (l)	Suckling milk (l)	Commercial milk (l)	Length of suckling period (days)	Length of lactation (days)
1	274	347±15.40	88±1.42	259±15.26	73±1.19	227±4.04
2	176	373±16.61	90±1.54	283±16.47	75±1.28	232±4.36
3	158	354±16.86	89±1.56	265±16.72	74±1.30	234±4.42
4	168	354±15.50	89±1.43	265±15.36	74±1.19	224±4.06
5	160	375±15.49	91±1.43	284±15.35	76±1.19	231±4.06
6	69	372±18.43	90±1.70	282±18.27	75±1.42	230±4.83
7	73	395±18.89	94±1.75	301±18.72	78±1.45	242±4.95
8	28	366±21.89	92±2.02	274±21.70	77±1.69	220±5.74
9	9	328±33.91	86±3.13	242±33.62	72±2.61	236±8.89
10	10	176±33.90	86±3.13	90±33.60	72±2.61	238±8.89
11	5	134±42.97	85±3.97	49±42.60	71±3.31	220±11.27

Influence of the month of lambing on the annual milk production at the Awassi sheep

The month of lambing has shown significant influence ($P < 0.001$), on all analyzed traits of the annual milk production of the Awassi sheep (Tab. 1). The highest lactation has been noticed at those sheep lambing in November (448 ± 37.57 litres), and the lowest at the sheep lambing in June (149 ± 58.15

litres). According to this, the sheep lambing in these months have the highest, respectively lowest production of commercial milk. The same findings also refer to the quantity of the consumed milk by the lambs and the length of the suckling period (Tab. 8). The sheep lambing in November had the longest lactation (313 ± 9.85 days) and those lambing in July the shortest (113 ± 11.00 days).

Table 8

Influence of the month of lambing on the annual milk production of the Awassi sheep, LS – middle \pm SE

Year	n	Lactation milk (l)	Suckling milk (l)	Commercial milk (l)	Length of suckling period (days)	Length of lactation (days)
11	8	448 ± 37.57	102 ± 3.47	346 ± 37.25	85 ± 2.89	313 ± 9.85
12	24	300 ± 22.45	96 ± 3.08	204 ± 22.25	80 ± 1.73	275 ± 5.89
1	318	352 ± 8.92	90 ± 0.82	262 ± 8.84	75 ± 0.69	296 ± 2.34
2	400	346 ± 10.34	89 ± 0.96	257 ± 10.26	74 ± 0.80	275 ± 2.71
3	230	312 ± 12.24	88 ± 1.13	224 ± 12.13	73 ± 0.94	229 ± 3.21
4	89	330 ± 18.78	89 ± 1.74	241 ± 18.62	74 ± 1.45	199 ± 4.93
5	50	286 ± 23.70	86 ± 2.19	200 ± 23.49	72 ± 1.83	155 ± 6.21
6	3	149 ± 58.15	83 ± 5.38	66 ± 57.65	69 ± 4.48	114 ± 15.25
7	8	152 ± 41.93	78 ± 3.88	74 ± 41.57	65 ± 3.23	113 ± 11.00

Influence of fertility on the annual milk production of the Awassi sheep

Fertility, or the number of lambs per sheep has significant influence ($P < 0.01$) on the quantity of the commercial milk and significant influence ($P < 0.05$) on the lactation milk of the Awassi sheep. Those factors had no influence ($P > 0.05$) on the other analyzed traits (suckling milk, length of suckling and lactation period) (Tab. 1).

The sheep having two lambs, had higher lactation milk (335 ± 16.35 litres) than the ones having one (315 ± 14.91 litres) (Tab. 9). The same refers to all other traits, which means that sheep with higher fertility had a higher value for all other analyzed traits (suckling milk, commercial milk and length of suckling period). The sheep from this breed with one lamb had an insignificantly longer period of lactation.

Table 9

Influence of fertility on the annual milk production of the Awassi sheep, LS – middle \pm SE

Year	n	Lactation milk (l)	Suckling milk (l)	Commercial milk (l)	Length of suckling period (days)	Length of lactation (days)
1	996	315 ± 14.91	90 ± 1.38	225 ± 14.78	75 ± 1.15	237 ± 3.91
2	134	335 ± 16.35	94 ± 1.51	241 ± 16.21	78 ± 1.26	231 ± 4.29

4. CONCLUSIONS

On the basis of the gained results from the analysis of the productive traits of the purebred Awassi sheep, the following conclusions can be taken:

1) Lactation and month of lambing have high significant influence ($P < 0.001$) referring to all traits from the annual milk production of the Awassi sheep. The other factors have influence on some of the analyzed traits and on some of them they don't.

2) The average lactation milk of the controlled sheep for the four analyzed years is 325 ± 14.864 litres, while the quantity of milk, consumed by the lambs in average is 89 ± 1.374 litres.

3) The production of the commercial milk by this population in average for the four years is 236 ± 14.737 litres, while the average length of the suckling period is 74 ± 1.145 days. The length of the lactation period of this population for the four analyzed years in average is 234 ± 3.90 days.

4) Analyzed by years, the average lactation milk of the Awassi sheep is between 310 litres in 2003 and 342 litres in 2005. The maximum lactation milk of this population has been measured in 2002 (635 litres).

5) Taking into consideration that the year has a significant influence on the milk production, the fact is that the feeding as a paragenetic factor has the key role in the milk production of the sheep.

6) Determination of the influence of lactation of the Awassi sheep refers to its the capability of the high milk production during a longer period of time, till farther age.

7) Besides the fact that the month of lambing has a significant influence, which means early lambing, more milk, it is recommended that lambing should be in the months that are traditionally for lambing in our region (January and February), because the sheep largely are tired out by the long lactation and then they are not ready till the next lactation.

8) Fertility has a significant influence ($P < 0.05$) on the lactation milk of the Awassi sheep, precisely the sheep that have two lambs, have higher lactation milk (335 ± 16.35 litres) than those with one lamb ($315 \pm 14,91$ litres).

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