

THE MILK PRODUCTION VARIABILITY OF MOLDOVAN KARAKUL EWES

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Abstract

The research purpose of this work was to identify and assess the main factors that determine the milk production variability of Moldovan Karakul ewes and selection efficiency according to this character. The research was done on lactating ewes of the Karakul sheep flock from National Institute of Animal Husbandry and Veterinary Medicine, from the village of Maximovca, Anenii Noi district, Republic of Moldova. Ewes milk production was determined, by milking control, systematically done at every ewe, once every 15 days, throughout whole lactation. Variability of ewes milk production was examined according to their age (lactation) and fodder conditions of different years. The character of ewes lactation curve, in these years, was examined, in function of the average milk quantity, obtained daily, depending of ewes calving terms. The research has shown that the ewes milk production depends on the genotype of the parents. From the ewes mothers, with increased milk production, of over 110 kg, were obtained progeny daughters, with milk production, also increased, on average of 87.10 ± 8.24 kg. The hereditary power and the influence degree of parental genotype on the variability structure of the milk production, are expressed by the heritability coefficient value (h^2), which was 0.316. The data obtained show that 2/3 of the total phenotypic variability of milk production is determined by external factors, such as forage conditions of the year and the ewes calving terms. Thus, in years when satisfactory forage conditions, ewes milk production was on average over 80 kg and in the forage conditions less satisfactory, it was comprised only up to 70 kg. The late calving ewes (February, March) had an average daily productivity for the whole lactation less (381-554 g/day) compared to early calving ewes (April, May), which had a productivity of 428-616 g/day. The ewes lactation curve, in effect, represents a line increasing slowly from 500-700 g/day at calving, up to 600-700 g/day at 6-7 weeks, and with a slowly decrease up to 100-200 g/day at 25 - 27 weeks after calving. Biological curve (theoretical) of Moldovan Karakul ewes lactation, in the optimal nutrition conditions and care represents, in our view, a straight line with a relatively high level, starting from calving with 700-800 g/day, remaining at this level up to 13 - 14 weeks, with a slow decrease after up to 150 - 200 g/day in the range of 25 to 26 weeks after calving. The ewes milk production is based on their age at calving. The maximal quantity of the milk production at this race is performed starting with the age of 4.5 years, or with the third lactation. The ewes in the first lactation reach the milk production at the level of 74.3 % and in the second lactation – at the level of 90.3 %, compared to the ewes in the third lactation.

Key words: milk, Karakul ewes, variability, heritability, lactation curve

INTRODUCTION

Given that, the ewe milk is a food product especially valuable, being used in the preparation of milk products of a large alimentary consume, particularly in the preparation of some traditional cheeses, and sheep raising for rural population is one of the most accessible agricultural occupations, not requiring large investments, ewes exploitation for milk production has become

since ancient times, and remains to this day, a tradition and a stringent occupation of the rural population in the whole world.

In particular, this occupation is practiced by the people from the Middle East countries (Turkey, Syria, Israel), Balkans (Bulgaria, Romania, Serbia, Albania) and European (Italy, France, Germany, Netherlands).

In countries, where agriculture is intensive, and where a preference for the ewe milk products as a wide range of cheeses is an ancient tradition, were created and are raised, usually, sheep races with a high milk productivity, such as Oestfriza (Germany,

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The manuscript was received: 19.06.2014

Accepted for publication: 23.08.2014

Holland), Awassi (Israel, Syria), Lacaune (France), Langhe and Sardinian (Italy), Chios and Zante (Greece). In these countries, still continues the process of improving the sheep races for milk, simultaneously, elaborating of some technologies of artificial lambs growth and mechanical milking, meant to help to increase the milk wares production [9].

Karakul race, original from Central Asia is considered one of the races with a low milk production.

This race belongs to the race group for furskin-milk. After calving and lambs slaughtering for furskin, from lactating ewes, are obtained an average of 400- 500 g of milk per day, lasting for 40-50 days of milking [10]. Therefore, according to this report, the milk production of one ewe per lactation is on average only 20-25 kg. From the biological standpoint, the low milk production of Karakul ewes race is justified by the fact, that, in the dry conditions of the Asian deserts, the ewe gained, in the evolution process, a genotype able to produce, in a short period of time, only the amount of milk needed for growing lambs in the first two months of life. This phenomenon is confirmed by the fact that a great part of Karakul ewes have a short lactation term, and another part of the ewes, are not able to provide sufficient quantities of milk to their own lamb.

According to studies done by Stefanescu C., 1959 [8], the Karakul ewes milk production, imported in Romania from Central Asia, represented, during the entire lactation, on average 43.31 kg compared to 55.21 kg at F₁ métis (Karakul x Turcana) and 63.06 kg F₂ metis.

According to the reports of other authors, Karakul ewes milk production varies on average, during the lactation period from 49.3 kg [7], up to 50 kg [4] and 55.0 kg [12].

Proceeding from this, and other similar information, we concluded that Asian Karakul race, in conditions of Republic of Moldova (country with secular traditions in ewes milking and exploitation), does not meet the economic requirements of the branch, regarding the milk production. Therefore, selection of Karakul sheep by the milk productivity has become, in our country,

one of the basic priorities and objectives of sheep breeders and growers.

In this context, the aim of this work was to identify and assess the main factors that determine the variability of Moldovan Karakul ewes milk production and selection efficiency their selection according to this character.

MATERIAL AND METHODS

The research was done on lactating ewes of the Moldovan Karakul sheep flock of the National Institute of Animal Husbandry and Veterinary Medicine, Maximovca village, Anenii Noi district, Republic of Moldova.

The ewes milk production was determined, according to the assessment instructions of Karakul sheep, with amelioration principles, approved by the Technical and Scientific Council of the Ministry of Agriculture and Food [6], by control milking, systematically done at each ewe, once every 15 days, during the whole lactation, according to the method of T. Nica [7].

The technical principle of milk production control, performed by this method, consists in the fact that the ewes are submitted to the control milking once a day, usually in the morning. In order to determine the milk amount, produced by the ewe during whole control day, the amount of milk produced in the morning of control day, will be multiplied by the *control coefficient*. This coefficient is determined by the formula:

$$K_c = \frac{P_t}{P_d} \cdot C_r$$

where:

K_c - control coefficient;

P_t - quantity of milk milking lactating ewes day control;

P_d - quantity of milk milking lactating ewes on the morning of control;

C_r - retention coefficient of milk:

- for ewes with lambs infants $C_r = 1.3$;

- for the ewes in the first two weeks

after weaning lambs $C_r = 1.2$;

- for other lactating ewes $C_r = 1.0$.

In order to control the milk quantity, each ewe was milked, individually, in a cup, subsequently, the milk was weighed to the electronic scale with a capacity of 1000 grams, and was poured into the storage drum.

The data regarding the registration number of each milked ewe, and the milk amount obtained at the control milking, were registered in the control sheet of milk production (F-8K). Subsequently, the data of the control sheet, regarding the milk amount of the control day, were transcribed in the Register records of Karakul ewes milk production (F-7K), where was done the individual calculation of milk production of every ewe, on each control period and throughout whole lactation.

In autumn, after the ewes milking cessation (October), were done the totals of milk production, throughout whole lactation period of each ewe apart, analyzing the dynamics of the lactation curve, determining the genetic parameters of sheep population, determining the independent limits of ewes selection, according to this character, in different groups and models. The best milking ewes were selected into the breeding batches.

The *heritability coefficient* (h^2) value of the milk production of the ewes was determined, by the genotype correlation of Pirson, according to the connection of 77 mother-daughter pairs.

The variability of the ewes milk production was studied, depending on their age (lactation) and forage conditions of different years. The character of ewes lactation curve, in these years, was examined by the average quantity of milk per day, depending on terms (calendar months) of sheep calving.

The obtained research data were statistically processed using computer software "STATISTICS - 6" and rated their certainty, according to variation biometric statistics, by the methods of Плохинский Н.А. 1969 [15].

RESULTS AND DISCUSSIONS

The Karakul ewes milk production, being a polygenic character, is influenced by a number of internal and external factors [1 - 5, 8 - 9, 11, 13, 14, and 16]. Among the internal factors, the most important is the genetic factor - heredity (specific for separately each race, interracial type, bloodline), parental genotype and their own genotype.

Our research has proved, that from parents with high milk production are obtained, mainly, offspring with increased milk production skills (tab. 1).

Table 1 The milk production of Moldovan Karakul ewes-daughters, depending on mothers productivity

Milk production of ewes-mothers, kg	Milk production of ewes-daughters, kg			
	N	$\bar{X} \pm S_x$	σ	$C_v, \%$
> 110	7	87.10 ± 8.24	21.77	25.0
90 - 109	13	77.69 ± 4.51	16.40	16.5
70 - 89	21	68.10 ± 5.37	24.60	36.1
50 - 69	28	65.36 ± 3.23	17.10	26.2
< 50	8	48.75 ± 5.18	14.57	29.9

Thus, from the mothers-ewes, which had a reduced milk production, up to 50 kg, were obtained progeny daughters with a milk production also reduced, on average 48.75 ± 5.18 kg. Once the milk productivity of ewes mothers increases from 50 kg up to 70 kg, the milk production of daughters enhanced, on average with 16.61 kg, or 30.0 % ($P < 0.001$). Once the milk productivity of ewes-mothers increases from 70 kg to 90 kg, the sheep milk production of ewes-daughters raised on average with 12.33 kg, or 18.9 % ($P < 0.001$). The highest milk production (87.10 ± 8.24 kg) was obtained from ewes-daughters, whose

ewes-mothers have had the highest milk productivity of over 110 kg.

The analysis of these data confirms that milk production skills at ewes are transmitted by heredity. The hereditary power and the influence degree of the parents on the progeny of the genetic variability structure by the milk production are determined by the *heritability coefficient* (h^2) value.

The research has proved, that the heritability coefficient of this trait (milk production) of Moldovan Karakul ewes is not high, but quite significant ($h^2=0.316$; $P < 0.001$).

According to the information of V. Tafta, 1997 [9], the heritability coefficient (h^2) for the milk amount of ewes, is generally 0.3-0.4 depending on the race and selection level in the flock.

The data obtained in our research, as well the information of other authors mentioned above, confirms that only a third part of the general phenotypic variability, of the milk production character, is conditioned by parental heredity, but the other two thirds of

the milk production variability, depends on other factors, mainly external, which generates a fairly wide phenotypic variability of this character. The variation coefficient (C_v) of milk production is quite high, enclosing the values from 16.5 to 48.6 %.

The research done on batches of lactating ewes, showed that the ewes milk production depends on the forage conditions of the year, as well on the terms (month) of calving (tab. 2).

Table 2 The milk productivity of Moldovan Karakul ewes depending on forage conditions of the year and the calving term (month)

Calving month	N	Lactation during, days	Milk productivity throughout lactation, kg			Average milk production, g/day
		$X \pm s_x$	$X \pm s_x$	σ	$C_v, \%$	
Year 2000 (with satisfactory forage conditions)						
February	27	191.7 ± 3.8	70.3 ± 4.2	21.7	30.9	417
March	105	173.0 ± 2.4	84.3 ± 3.1	31.6	37.5	554
April	40	162.3 ± 4.0	88.0 ± 5.2	33.0	37.5	616
Year 2002 (with less satisfactory forage conditions)						
February	24	190.5 ± 3.5	72.6 ± 3.5	17.3	23.8	381
March	51	171.0 ± 0.7	69.9 ± 2.1	15.3	21.9	409
April	91	154.6 ± 0.8	67.9 ± 1.6	15.1	22.2	439
Year 2004 (with satisfactory forage conditions)						
March	62	182.4 ± 2.7	81.0 ± 2.3	18.4	22.7	444
April	74	170.6 ± 1.7	78.4 ± 2.3	19.6	25.0	459
May	15	147.6 ± 2.8	70.4 ± 5.7	22.1	31.4	478
Year 2005 (with less satisfactory forage conditions)						
April	113	164.7 ± 0.6	70.6 ± 1.4	15.2	21.5	428
May	14	141.9 ± 1.5	73.0 ± 3.5	13.2	18.1	514

This difference is explained by the fact, that, in the first months of lactation, which coincided with the stabulation period and forage deficiency, the ewes calving in February, have not fully achieved the lactogen potential compared to their fellows calving in April, whose lactation coincided with the grazing – favorable, from point of view of complete nutrition with vitamins and proteins of herbaceous vegetation. Such a tendency of a higher productivity of ewes calving later, was registered also in 2005. The ewes calving in May, have had a tendency of a higher milk production (73.0 ± 3.5 kg), compared to the ewes calving in April (70.6 ± 1.4 kg). In other years (2002, 2004), the ewes milk production had quite different tendencies. The ewes calving early (in February-March), had a higher productivity tendency, compared to their

fellows, calving later (in April-May). This tendency can be explained by the quality forage (in this period) of ewes calving early in the stabulation period, as well their longer lactation period, compared to their fellows, calving later.

At the same time, examining the average daily milk productivity throughout lactation, we found that this is obviously, depending on the calving terms (month), and has an identical regularity, in all the years, while the research was done, especially: the ewes calving later (in April-May) had an average daily milk yield higher than the ewes calving early (in February-March).

Thus, in 2000, the ewes calving in April, exceeded after the average daily milk production throughout whole lactation period, their fellows calving in February with 199 g, or with 47.7 % ($P < 0,001$) and those

calving in March – with 62 g, or 11.2 %. In turn, the ewes calving in March had a higher daily milk yield, compared to the ewes calving in February, with 137 g, or 32.8 % ($P < 0.001$). In 2004 and 2005, ewes calving in May had a higher daily milk yield

compared to ewes calving in April, with 4.1, respectively, with 20.1 %.

Once with the daily milk productivity, also the calving terms (month) influence the dynamics and lactation curve configuration (fig. 1, 2, 3, and 4).

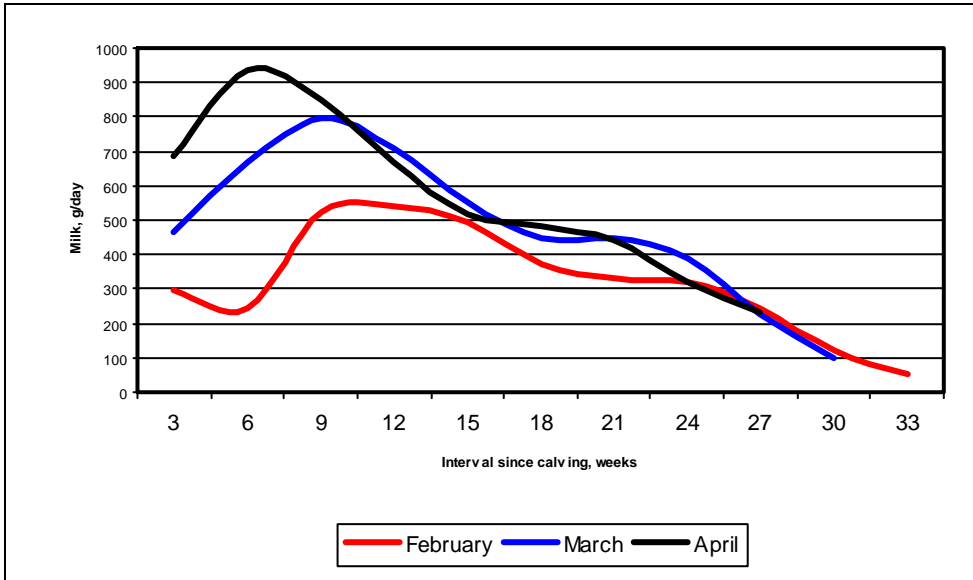


Fig. 1 Lactation curve of Moldovan Karakul ewes depending on calving month (a.2000)

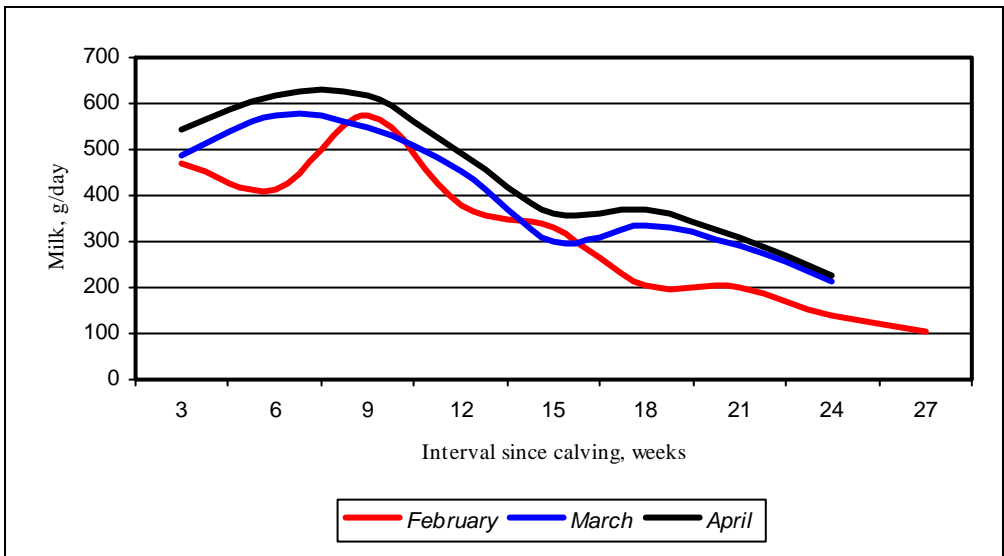


Fig. 2 Lactation curve of Moldovan Karakul ewes depending on calving month (a.2002)

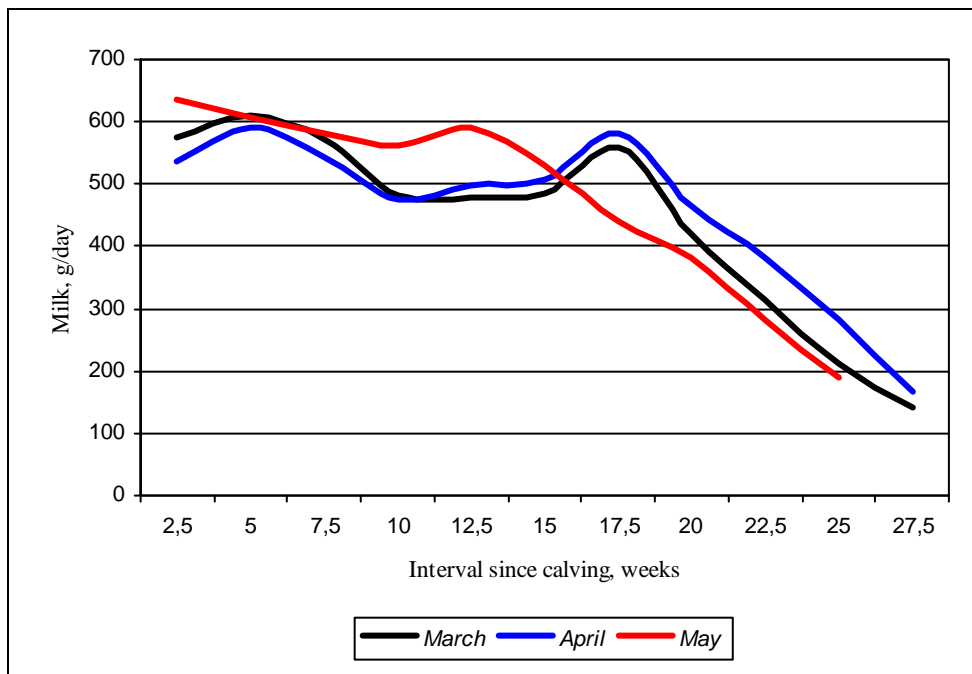


Fig. 3 Lactation curve of Moldovan Karakul ewes depending on calving month (a.2004)

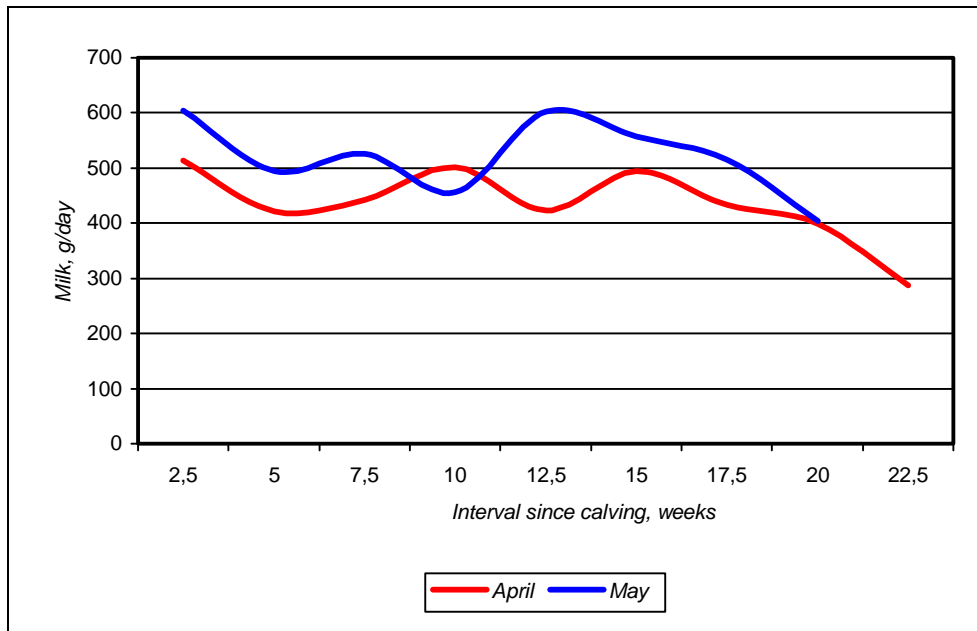


Fig. 4 Lactation curve of Moldovan Karakul ewes depending on calving month (a.2005)

Analyzing the dynamics of the lactating ewes lactation curve in 2000, according to the calving month, we found that the ewes calving in February, start lactation with the

lowest daily productivity (about 300 g/day), compared to their fellows, calving in March and April, which is down to 6-7 weeks after calving. In the range of 9-10 weeks, the lactation curve increases suddenly up to about 550 g/day, maintaining then at the same level, with a slight decrease to 500 g/day, at the interval of 15 weeks, then decreases suddenly to 350 g/day at the interval of 18 weeks, remaining at that level until the interval of 24 weeks, subsequently with an obvious decrease up to about 50 g/day at the end of lactation (31 weeks).

The ewes calving in March begin the lactation with a higher daily milk productivity (about 470 g/day), than those calving in February, which further increases, reaching the maximum (about 800 g/day) at the interval of 8-9 weeks from calving, and then decreases slowly to 450 g/day at the interval of 18 weeks, maintaining at this level until the interval of 21 weeks, so that then suddenly decreases up to 300 g/day at the interval of 24 weeks and respectively 100 g/day at the end of lactation (29 weeks).

The ewes calving in April, compared to the lactating ewes of two first batches, calving in February and March, had begun the lactation with a higher daily milk productivity (about 700 g/day), which increased suddenly, reaching the maximal level (about 930 g/day) at the interval of 4-5 weeks after calving, then decreased slowly up to 500 g/day at the interval of 15 weeks, remaining at this level with a slight decrease at the interval of 20 weeks, so that then to decrease slowly up to 250 g/day at the end of lactation (25 weeks), or, rather, until the last control, because the lactating ewes of this batch continued to be milked without a special control. The chart of this figure shows that the peak of lactation curves of the ewes calving in February, March and April are manifested at different interval since calving, which, usually, coincides with the day of control milking, carried at the grazing time (late April - early May).

Examining the lactation curves, of the lactating ewes also calving in February,

March and April, 2002, we noticed that they have similar configuration to those of 2000 year, except that have a lower level of productivity and its raise up to the peak interval is expressing slower. Here we find that the lactation curve of the ewes calving in February has a configuration identical to the lactation curve of the ewes f calving in February of 2000.

In 2004, the ewes lactation curve, has similar configurations at some intervals of lactation (at the ewes calving in March and April), but there are some peculiarities, especially at the ewes calving in May.

Thus, at the ewes calving in May, the lactation curve starts with a higher daily productivity (about 650 g/day), compared to those calving in March and April. The lactation curve of these lactating ewes does not have after calving, some raising configurations, but remains at a level, with a slight drop to 570 g/day at the interval of 9 weeks, then increases suddenly up to 600 g/day, at the interval of 12 weeks, after which decreases slowly to 200 g/day at the end of lactation (22-23 weeks). At this stage, the ewes calving in May, have continued the lactation with two times of milking a day. This year, the ewes in all batches, with different calving period, have showed a strange configuration of sudden rise of the curve, at different intervals of time after calving. In fact, the daily productivity growth was manifested simultaneous at all ewes, in August, just a few days after their treatment against helminthiasis.

The fact of the increase in daily productivity of the ewes in August, suggests the hypothesis that, from biological (theoretical) point of view, the lactogen potential Moldovan Karakul ewes is increased starting from the first week since calving, for a period much longer than that registered in the above-examined years. The level of daily milk productivity expressed in the first week after calving, in optimal forage and maintenance conditions, we suppose that it can keep for a period of 3-4 months after calving and then slowly decrease during 6-7 months (fig. 5).

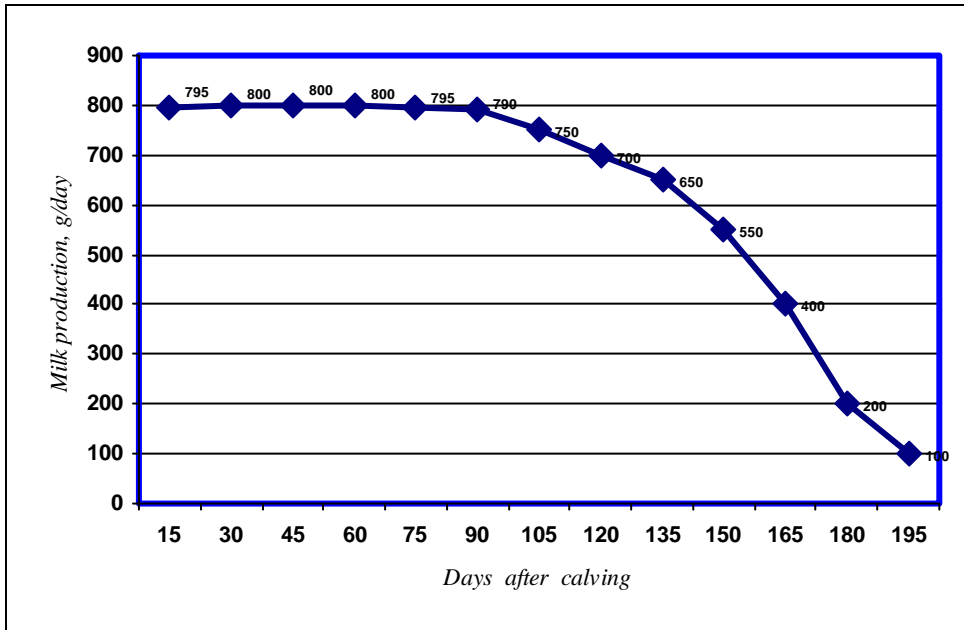


Fig. 5 Biological (theoretical) curve of lactation of Moldovan Karakul ewes

The lactation curves examination of the ewes in 2005, confirms this hypothesis, by the fact that the lactating ewes calving in May, at the interval of 12.5 weeks, have reached the level of daily productivity manifested at the first control after calving, and the ewes calving in April, have reached the daily productivity level achieved in the beginning of lactation, only at the interval of 15 weeks.

Given that, at the individual selection of the ewes producing rams, besides the total quantity of produced milk, was taken in consideration also the character of lactation curve configuration, prioritizing the ewes, which manifest a high and constant daily

productivity for a period of time as long as possible since calving.

The knowledge of these features of the biological lactation curve of Moldovan Karakul ewes, allows to the livestock specialist to guide and control the technological processes towards to the integral realization of the sheep lactogen potential, by creating adequate conditions of nutrition, maintenance and disease prevention.

The research has shown that, in addition to the above mentioned factors, the ewes milk production depends mostly on their age at calving, or lactation consecutive number (tab. 3).

Table 3 Milk production of Moldovan Karakul ewes depending on lactation number

Specification	N	$\bar{X} \pm s_x$, kg	% towards to lactation III	σ , kg	C_v , %	Max, kg
Lactation I (2.5 years)	22	64.9 ± 3.2	74.3	15.2	23.4	96.0
Lactation II (3.5 years)	28	78.8 ± 4.7	90.3	25.1	31.8	123.7
Lactation III (4.5 years)	121	87.3 ± 2.7	100.0	29.7	34.0	166.0

Thus, at the ewes with the first lactation, which coincides with the age of 2.5 years, the average milk yield in the examined flock is 64.9 ± 3.2 kg and represents 74.3 % of

productivity of the ewes with the third lactation, considered mature lactation. In the second lactation, the level of milk production increases, compared to the first lactation,

with 14.0 kg, or 21.4 % ($P < 0.05$), reaching an average of the examined ewes batch of 78.8 ± 4.7 kg, which is about 90.3 % of milk production volume, achieved by the ewes with the mature lactation. The ewes with lactation III, achieve the highest productivity, which represents in the examined flock 87.3 ± 2.7 kg, that is with 34.5 % higher than primiparous ewes and 10.8 % higher, compared to the ewes with lactation II ($P < 0.001$; $P < 0.1$). Thus, in order to recalculate the milk production of young ewes, tested early by this character, and to predict its behavior in adulthood, we can apply following coefficients:

- for the ewes tested in first lactation, milk production is multiplied by the coefficient 1.35;

- for the ewes tested in the second lactation, milk production is multiplied by the coefficient 1.11.

Regarding the age of race maturing, by the character of milk production, Huștiu C. and col. 1956 [5], established that Asian Karakul ewes, Karakul and Turcana metis reach the maximal milk production at the age of 4-7 years.

According to the research of O. Миллз 1985 [14], the Awassi sheep race has the highest milk production in lactation III, IV and V, but in the VI lactation, the milk production decreases and equalizes to the first lactation.

In our research, the essential differences between ewes milk production with lactation III, IV, and V, etc. were not registered. Therefore, we conclude that the Moldovan Karakul ewes reach the maximal level of milk production starting from lactation III inclusive.

However, the research mentioned above, found that in each milking lactating ewes batch, depending on the lactation, were individuals with a record milk production at different levels. Thus, the record milk production level in the ewes batch with the first lactation was 47.9 % higher than the average of the flock. In the ewes batch with the second lactation, this level was with 56.9% above the average, and in the ewes batch with lactation III – with 90 % higher

than the average of the batch. Thus, we found that by ewes lactation (age) increase, it is expressed a significant increase of the differential between the record milk production and the batch average.

A quite large phenotypic variability of the character indicates the reserves and possibilities to enhance the selection and accelerate the genetic amelioration process of the flock by the milk production.

CONCLUSIONS

1. The milk production variability of Moldovan Karakul ewes is conditioned by heredity of about 32% and ambient conditions, predominantly, by forage conditions, of about 68 %.

2. The actual lactation curve of Moldovan Karakul ewes represents a line slight increasingly from 500-700 g/day at foaling up to 600-700 g/day at 6-7 weeks, dropping slowly to 100-200 g/day at 25-27 weeks.

3. The biological (theoretical) curve of Moldovan Karakul ewes lactation, under the optimal nutrition and maintenance conditions, represents, in our opinion, a straight line with a relatively high level, starting since calving with 700-800 g/day, keeping at this level up to 13-14 weeks, slowly dropping to 150-200 g/day at the interval of 25 to 26 weeks after calving.

4. The maximal milk productivity of Moldovan Karakul ewes is performed from the age of 4.5 years, or from the third lactation.

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