

## REPRODUCTION INDICES IN THE BOTOSANI KARAKUL FEMALES AND THEIR EVOLUTION IN THE REPRODUCTION PERIOD

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### Abstract

The study quantifies the reproduction function in sheep belonging to the Botosani Karakul breed by means of some indices analyzing their values in their dynamics during the five years (2008-2012) within the same animal population. From the initial population, a part of animals got out of herd during the experiment (by mortalities, sterility or other causes). The three main reproduction indices (fertility, birth rate, fecundity) recorded similar values in the first two years, in order that in the last three years their levels to be higher, their evolution having an ascendant curve. The sterility is more common in the middle of reproductive period (especially in the second year), the onset of reproduction activity being characterized by low sterility and almost inexistent at its end. The abortions are more common in the first reproduction year, becoming rarer and rarer in the rest of the range. Simple parturitions are the most frequent throughout the reproduction period; double births are few in the first two years, then their incidence increases, especially in the last two years. As such, the simple lamb index shows a regression curve, while the twin lamb index presents an upward curve. Sex ratio is the unit in the first three years and higher than one in the last two years. The highest natal mortality is recorded at the beginning of reproduction activity; in the next years the natal mortality is generally low. So, the best reproduction indices were recorded in the last three years of reproduction activity.

**Key words:** reproduction indices, reproduction period, mating, Karakul sheep

### INTRODUCTION

The economic profitability of farm animal breeding is largely determined by their progeny, namely by the number of offspring born alive and healthy. To raise the productivity of sheep breeds to the requirements of national economy or of individual and associative farms the intensive reproduction is necessary because the sheep breeding is a reproduction problem in its essence [7]. Animal productivity depends on their reproduction efficiency and is often measured by the number of offspring per reproduction animal and per time unit, being quantified by some indices [4]. Achievement of some high reproduction parameters is conditioned by the influence of genetic and environmental factors and of their action mode. Generally, the genetic factors are intrinsic factors of the animal body and are related to the selection criteria applied to the

economic traits targeted and to practicing of consanguineous or heterogeneous matings [1, 2, 5, 6, 8]. Among the extrinsic factors - environmental factors - both the natural ecological factors and the artificial ones play an important role in the reproduction function manifestation, but some technological factors, such as housing, nutrition, artificial insemination technique, stress determined by animal exploitation etc. act decisively on it. However, it is necessary to ensure a balance between the heredity requirements of animal body under which it develops ontogenetically and the conditions in which the animal body lives at a certain moment. Unbalance between environment conditions and hereditary dowry causes infertility which leads to significant losses of animal productivity [9, 10, 11].

In this process, the environmental components are useful conditions to increase the animal productivity. But the genetic selection of those individuals which are compatible in the highest degree in certain mating variants is the most important factor in maximizing the reproduction rates. Improvement of reproduction rate is a logical

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approach to increase the economic efficiency of animal husbandry (2).

In this context, this study aimed to estimate the reproduction performances in the Botosani Karakul breed at different times of their production life by means of some indices and pursuing their dynamics during the reproduction period.

## MATERIAL AND METHOD

The casework regarding reproduction parameters was performed on a sheep sample belonging to the Botosani Karakul breed within the elite farm of the *Research and Development Station for Sheep and Goat Breeding Popauti-Botosani*. The experiments lasted for five years (between 2008 and 2012), being made on the same female herd. At the experiment beginning, the population was constituted of 215 primiparous females; then their numbers began to decline throughout the observations, reaching almost half (93 individuals) of the initial flock in the fifth year of production activity because of mortality, sterility or other selection or economic reasons required by the improvement works of these sheep.

The reproduction indices in the Botosani Karakul ewes were evaluated by the qualitative and quantitative parameters of their offspring. Three main reproduction indices were analysed mostly, those that give the true

extent of reproduction activity in sheep:

- fecundity index;
- birth rate;
- prolificacy index.

In addition to these, other indices that derive from the first three, but which contribute to a more accurate knowledge of the reproduction profile of ewes, also were calculated:

- sterility index;
- abortion index;
- simple lambing index;
- double lambing index;
- simple lamb index;
- twin lamb index.
- natal mortality rate;
- sex ratio;

Sheep benefited of similar feeding, care and maintenance conditions and zoo-veterinary treatments during the five experimental years.

## RESULTS AND DISCUSSIONS

The reproduction indices values are shown in the table 1. Also, their description benefits of a graphical representation too, its suggestibility being more obvious as regards the evolution of these parameters over the period analyzed.

Table 1 Reproduction indices in the Karakul Botosani females in the period 2008-2012

Index \ Year	2008	2009	2010	2011	2012
Fecundity	83.37	82.32	93.55	90.20	95.70
Birth rate	91.16	85.86	101.08	107.84	106.45
Prolificacy	103.16	104.29	108.05	117.02	119.28
Sterility	2.33	12.63	6.45	7.84	0.52
Abortion	9.09	5.78	0.00	2.13	3.26
Simple lambing	86.51	78.79	86.02	72.55	84.95
Double lambing	2.33	3.54	7.53	17.65	10.75
Simple lambs	94.90	91.76	85.11	67.27	79.80
Twin lambs	5.10	8.24	14.89	32.73	20.20
Natal mortality	10.71	1.76	6.91	1.82	2.02
Sex ratio	1.00	1.18	0.99	1.50	1.36

Of all mated sheep, the proportion of those who remained *fertile* during this period ranged between 80% and 95%. The lowest fertility occurs in the early reproduction years (82% - 83%). In the next three years, the

fecundity index recorded a progressive and appreciable increase reaching values of 94% (in 2010) and 96% (in 2012), with a slight depression in the fourth year (90.20%) (figure 1).

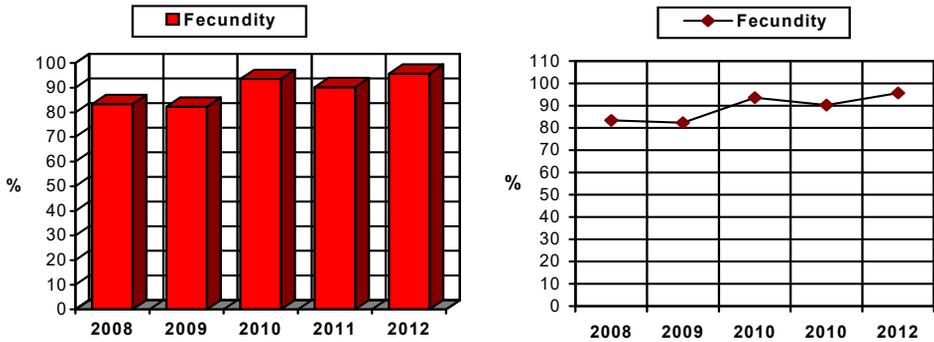


Figure 1 Fecundity index in the Botosani Karakul females in the period 2008-2012

*Birth rate* is satisfactory to primiparous females (91.16%), in order that in the second year to record a significant setback. From the third year of reproduction activity the birth

rate gradually increases (over 100%), having however the highest peak in the fourth year (107.84%) (figure 2).

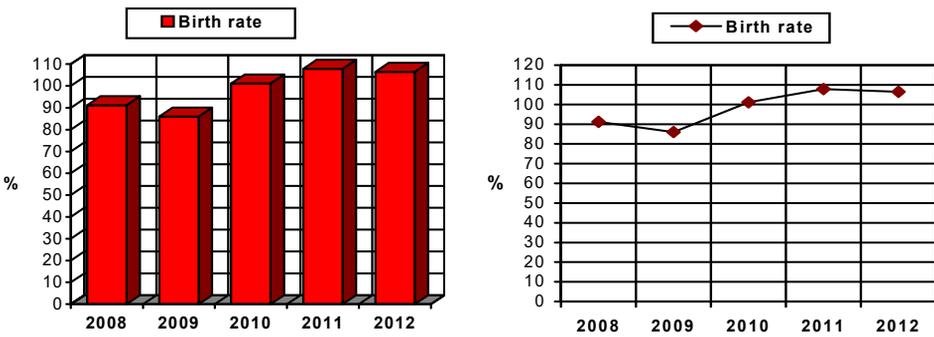


Figure 2 Birth rate in the Botosani Karakul females in the period 2008-2012

*Prolificacy index* values are above 100% throughout the reproduction period, having a steady upward line, with significant increases in

its values, evolving from 103.16% in primiparous females to 119.28% in females in the fifth year of reproduction activity (figure 3).

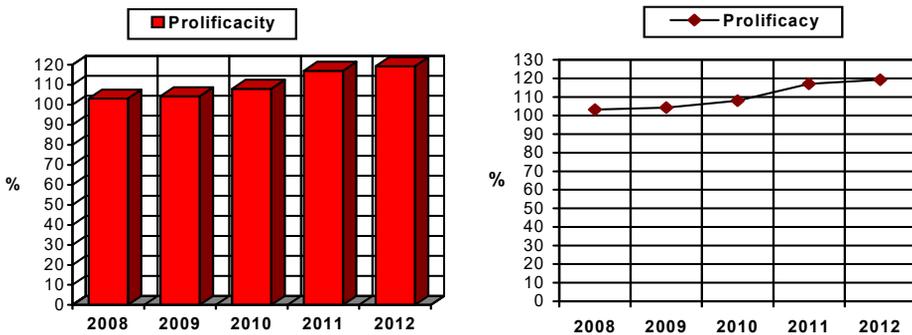


Figure 3 Prolificacy index in the Botosani Karakul females in the period 2008-2012

*Infertility* affects very little the primiparous females (2.33%) and almost not at all the females in the fifth year of reproductive activity (0.52%). The sterile female incidence (7% - 8%) throughout the period rest is unexplained, especially in the second year (12.63%). Normal asymmetric Gaussian curve is slightly affected by a downward loop of this indicator in the third year of reproductive activity (figure 4). It is possible that high sterility of females in the second year to be determined by out of synchronization of the three phases within the

sexual cycle (heat, desire for copulation and ovulation). Many cases of infertility may be due to so-called false heats that are not accompanied by ovarian follicle maturation and ovulation. Also, there is ovulation which is not accompanied by heat and desire for mating. But the fertilization will be achieved when the female organism presents simultaneously mating desire, heat and ovulation. Without ovulation, the fecundation is not possible and then the physiological sterility will occurs, so it is not determined by genetic causes.

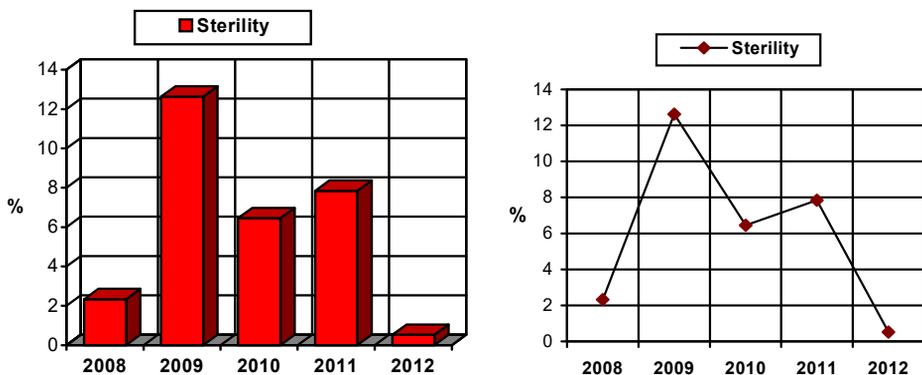


Figure 4 Sterility index in the Botosani Karakul females in the period 2008-2012

Primiparous females are the most affected by *abortion* (9.09%). Its incidence decreases markedly in the second year (5.78%) and especially in the last two years (2% - 3%). In the middle of this period all females carried the pregnancy to the end and lambed normally

(figure 5). The high incidence of abortions in primiparous ewes might be ascribed to some anatomical conformations of the uterine cavity, fully unprepared in all females to carry the foetus until the gestation end.

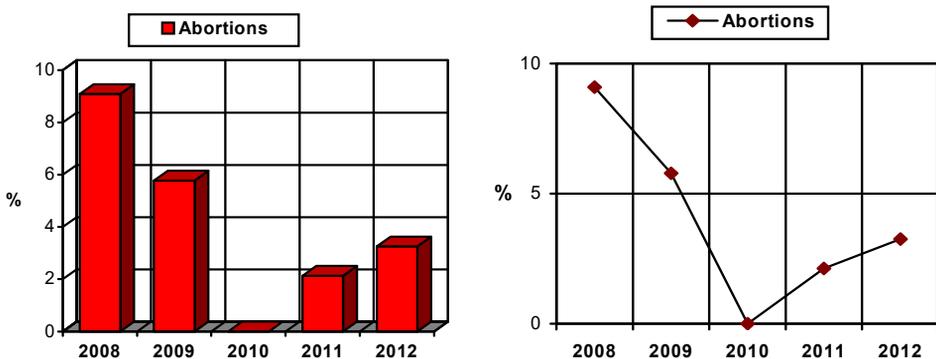


Figure 5 Abortion index in the Botosani Karakul females in the period 2008-2012

*Lambing index* shows that simple lambings are prevalent throughout the reproduction activity of females, ranging between 73% and 87%. It is noteworthy that most simple lambings are met in females which are in the first pregnancy, but their percentage decreasing over the years is not significant, except the one in the fourth year (72.55%). Twin births are less common in

primipara (2.33%), but their incidence increases gradually until the fourth year of reproductive activity, recording an appreciable value (17.65%). In the last year, their number longer decreases but remains at a relatively good level (10.75%), its incidence being higher than in the first three years (figure 6).

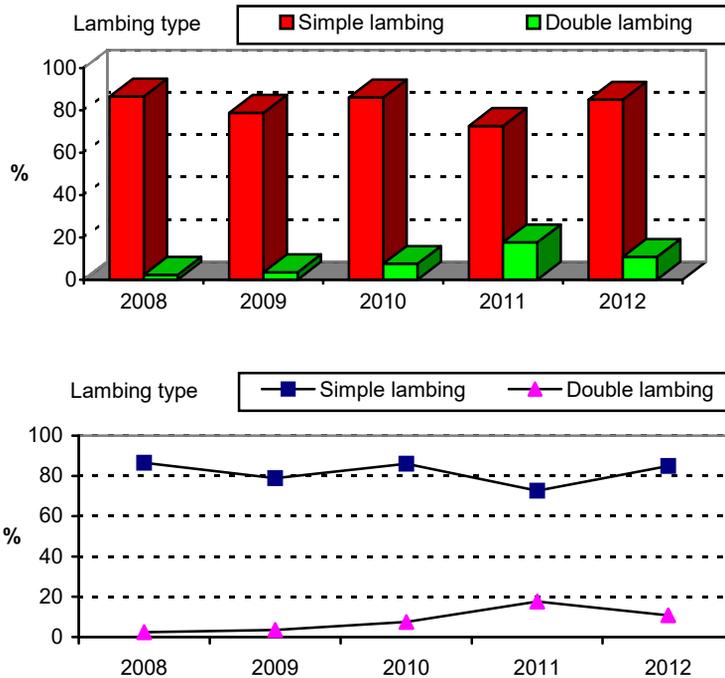


Figure 6 Lambing index in the Botosani Karakul females in the period 2008-2012

As a consequence of this last aspect the lamb index shows a similar dynamics to the lambing index. Simple lamb index shows high values throughout the period but falling in a downward until the fourth year, in order that in the last year to have a slight recovery. Instead, the twin lamb index shows a low value in primipara (5.10%) and then

gradually increases, reaching a significant peak in the fourth year (32.73%). In the last year, the curve undergoes a slight regression, but showing a significant percentage of twin lambs (approx. 20%). In fact, most of twin parturitions occur in the second part of the female reproduction activity (figure 7).

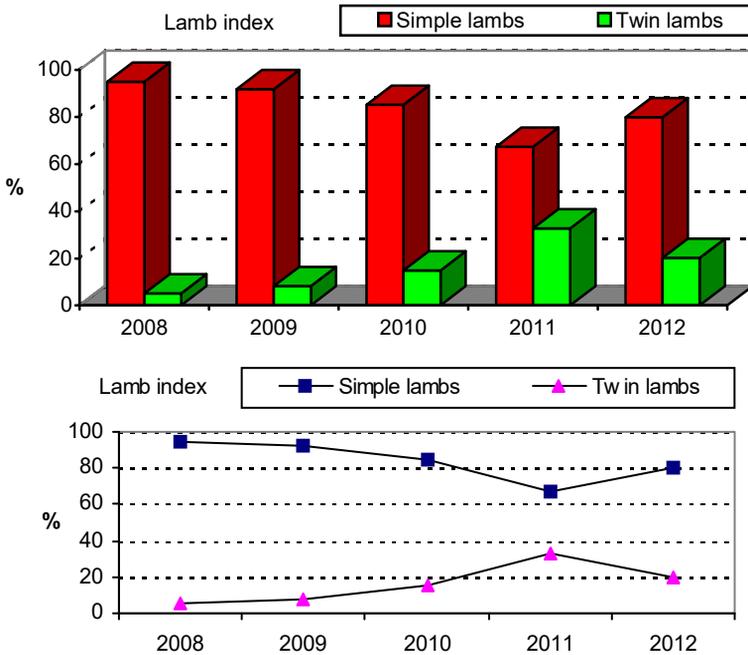


Figure 7 Lamb index in the Botosani Karakul females in the period 2008-2012

The *natal mortality* index path is very sinuous in the analyzed period. Natal mortality is quite frequent (10.76%) in females in their first year of reproduction activity. It greatly decreases in the remaining period (approximately 2%), having however an increase in the middle of this range

(6.91%) (figure 8). Natal mortality in the first year could be caused by a certain conformation of the genital tract which is not yet fully prepared for the foetus expulsion or by more frequent cases of dystocia, fact that requires the presence of sheep carer to help the young sheep lambing.

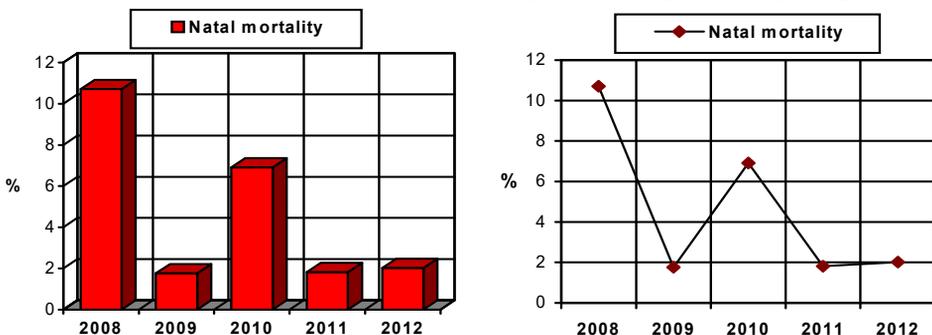


Figure 8 Natal mortality index in the Botosani Karakul females in the period 2008-2012

Analyzing the *sex ratio* index at birth (ratio ram lambs / ewe lambs), it comes out that the number of ewe lambs never exceeds the number of ram lambs. In the first part of reproduction activity the sex-ratio is almost

unite (or slightly more than 1 in the second year); instead in the past two years, the number of males born is by almost 40% (in the last year) or even 50% (in the fourth year) more numerous than of the females (figure 9).

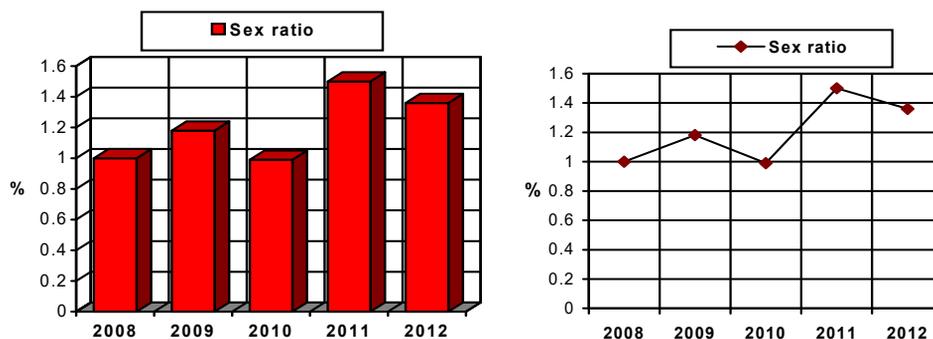


Figure 9 Sex-ratio index in the Botosani Karakul females in the period 2008-2012

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Making an insight into the reproduction indices array in the female population over the mentioned period, it is found that the best values are recorded in the last three years of reproduction activity. It is possible that this situation is correlated with two aspects. First of all, it could be some anatomical imperfections of the genital organs or physiological disorders of females especially at the beginning of their reproduction activity. On the other hand, this evolution of reproduction indices might be related to the animal exits from initial herd along the years, remaining in active status the females which are the most suitable regarding the reproduction activity and the most vigorous from physiological point of view.

These two observational statuses (quantification of the reproduction indices and assessment of their dynamics during the reproduction period of females) aim to improve the reproduction indices of the Botosani Karakul sheep taking into account their potential genetic and the environmental and technological conditions in which they are bred. The desideratum is achievable by female promoting with zoo-economic performances through the reproduction process in selection activity, efficient use of physiological reproduction parameters as well as through the sexual cycle directing in sheep and providing some practical methods that can be used by sheep farmers. Having available a general overview of the reproduction indices in their temporal evolution and the basic zootechnical records, a management program in sheep can be made (4) for the Karakul sheep farmers.

This is particularly so since the Karakul sheep has a pronounced hereditary conservatism regarding the natural reproduction season. Compared to other breeds in which the genesis instinct is manifested almost throughout the year (12), the Karakul sheep present a very short heat period, limited to autumn season (September-November) when 95% - 98% of females manifest oestrus (3).

Analysis of these reproduction parameters in sheep belonging to the Botosani Karakul breed can be extremely useful in practical activities such as:

- increasing the economic efficiency of sheep, by getting more and more offspring per sheep and per year;
- obtaining a grouped ovulation in a short time period;
- oestrus synchronization;
- oestrus induction in extra season by applying the stimulating feeding techniques when the aim is to obtain three lambings in two years;
- increasing the offspring number by early using of young ewes for reproduction, shortening the interval between lambings and improving the reproduction indices;
- organizing the natural mating in harem, having the possibility to know the lamb origin by both parents;
- estimating the reproduction performances using these indices;
- infertility prevention and its early diagnosis.

In the present study, the evaluation of reproduction indices was done under natural mating conditions. Corroborating our data with those in literature, a clear conclusion emerges:

the natural mating is the best way to get high reproduction performances compared to artificial inseminations made either with diluted sperm or refrigerated semen or frozen semen.

This study aimed the reproduction indices until the height moment of morpho-production period of females. It may be interesting to consider, in the future, which is the behavior of these indices in the downturn production phases of females.

## CONCLUSIONS

1. The experimental contribution of this study quantifies the reproduction function in females belonging to the Botosani Karakul breed by means of reproduction indices analyzing their values at a certain moment as well as pursuing their dynamics during five years of production and reproduction activity (2008 - 2012) within the same animal population.

2. The three main reproduction indices (fertility, birth rate, fecundity) recorded similar values in the first two years (plateau curve) in order that in the last three years their levels to be gradually higher, their evolution having an upward curve.

3. Sterility is more commonly met in the middle of reproduction period (especially in the second year); the reproduction activity beginning of ewes is characterized by a low sterility and almost absent at its end.

4. Abortions are more frequent in the first year of reproduction activity becoming increasingly rare in the range rest.

5. Simple births are very common throughout reproduction period of the Botosani Karakul females; double lambings are less in the first two years, then their incidences increase, especially in the last two years. As such, the simple lamb index shows a regression curve, while the twin lamb index shows an upward trend.

6. Sex ratio is unitary in the first three years and in the last two years is higher than one. The highest natal mortality is recorded at the reproduction activity beginning; in the coming years the value of this parameter is generally low.

7. The best values of reproduction indices are recorded in the last three reproduction activity years (3, 4 and 5) of females.

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