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# RESEARCH ON THE INFLUENCE OF AGE ON REPRODUCTIVE INDICES IN KARAKUL OF BOTOȘANI SHEEP

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***Abstract***

*The research on the influence of age on the reproduction indices in Karakul of Botoșani sheep was carried out by processing the data found in the breeding and calving registers, the lamb register and the existing breeding registers within the S.C.D.C.O.C. Popăuți for the period 2017-2019. Following the research carried out on the influence of the age of Karakul of Botoșani sheep on the reproduction indices, the obtained results indicated a statistically significant link between the age batch of which the sheep belong and the reproductive indices analyzed. The data obtained indicated values of higher reproduction rates in the 52-56 months' age batch (107.8% fertility rate, 96.4% fecundity rate, 95.5% birth rate and 112.9% prolificacy rate) compared to the results obtained by sheep in the 16-21 months' age batch (94.6% fertility rate, 90.6% fecundity rate, 89.1% birth rate and 106.1% prolificacy rate).*

***Key words****: age, Karakul of Botoșani, pelts, reproduction indices.*

## INTRODUCTION

The researches regarding the influence of age on the reproduction indices for the sheep from the Karakul of Botoșani breed were carried out in the creative unit of this breed of sheep, respectively "Research and Development Station in Sheep and Goat Breeding - Popăuți Botoșani". The study carried out aim at researching some aspects regarding the reproductive indices of the specialized sheep for the production of pelts. The proposed study started from the research hypothesis represented by the way in which the technological factors underlying the breeding works of the Karakul of Botoșani breed can intervene in increasing the reproduction indices and have a positive influence on the productive parameters of the sheeps from this breed.

Reproductive function can be considered as a physiological basis for animal husbandry, as it directly contributes to the numerical increase of livestock, and through the use of breeders of high zootechnical value there is not only an improvement of breeds but also an increase in production obtained from the new generations (Pascal, 2015).

In the sheep species, the sexual maturity of individuals usually appears before that of body weight and is influenced both by the precocity of the breed, individuality but also by specific technological conditions. In sheep, it is estimated that sexual maturity occurs at the age of 8-9 months in males and at 7-10 months in females, although sex cells are suitable for fertilization from the age of 5-6 months (Fecioru, 2008; Pascal et al. 1995).

Technological factors through the level of nutrition and body development of sheep have a high influence on reproductive activity. The calving season has an influence on the age at the first calving, so by obtaining early calvings that allow the intensification of the breeding activity by using the young sheep from the first year at calving.

Karakul of Botoșani breed have breeding characteristics which are characteristic to the parents that formed the basis of formation of this sheep breed. Separation of young sheep by sex should be done from the age of 4-5 months with the emergence of the genetic instinct. In this breed of sheep, sexual maturity is established at the age of 7-9 months for males and at 8-9 months for females, at which time the sexual cell is suitable for fertilization. A consequence of the lateness of the breed is the use for breeding at the age of 16-18 months, respectively in the autumn of the second year of life as a result of

staggered calvings and improper development until the breeding season of the first year of life. Karakul of Botoșani sheep have a sexual activity up to the age of 9-11 years with an average operating age of about 7.5 years. Due to the specific production of this breed, respectively the production of pelts, they are exploited as long as they can produce a lamb from which a pelt is obtained. Breeding systems used in sheep of this breed and how these systems increase breeding rates by obtaining a high number of products of high biological value through the rational use of breeders.

## MATERIALS AND METHODS

The biological material studied for the assessment of the influence of age on the reproduction indices in Karakul of Botoșani sheep is represented by the Karakul of Botoșani sheep from the Research and Development Station in Breeding Sheep and Goats Popăuți Botoșani, creative unit of this sheep breed. The study batch was represented by the sheep from the unit from August 2017 to December 2020, composed at the beginning of the study of 920 sheep from the Karakul of Botoșani breed. The processing of data on the reproduction indices of Karakul sheep and the influence of age on them were assessed for the breeding seasons 2017, 2018, 2019.

Assessment methods and techniques used in recording, observing, assessing reproduction indices, investigating, simulating and reporting to standards. The qualitative variables studied are: category of sheep, sex, color varieties, age at the time of introduction to reproduction.

For the statistical processing of the study data obtained as a result of the appreciation of the reproduction indices, the Microsoft Excel program was used, which allowed the planning, collection, access, preparation, data management and presentation of results and version 26 of IBM SPSS (Statistical Product and Service Solutions). Continuous variables were analyzed for normality and then expressed by mean ± standard deviation, minimum and maximum (Popa, 2008). The Student's t test (when comparing 2 batches) and the ANOVA One-Way method (for multiple batches) were used to compare the averages of the parameters between batches. A value of statistical significance coefficient $p<0.05$ was considered significant.

In order to highlight the influence of the age of the Karakul of Botoşani sheep in the breed on the analyzed reproduction indices, they were distributed over the 3 years of study taken into account by age batches expressed in months at the time of use for breeding, 7 batches were prepared with sheep of the Karakul of Botoșani breed: 16-21 months, 29-33 months, 39-45 months, 52-56 months, 64-68 months, 75-79 months, over 89 months. The results obtained converge in a sense with other studies done on other breeds in Romania (Pascal, 2007).

## RESULTS AND DISCUSSIONS

The influence of the age of the Karakul of Botoșani sheep at the time of their use in breeding was assessed for the following reproduction indices: fertility index, fecundity index, prolificacy index and birth rate.

The studied batch with sheep from Karakul of Botoșani breed was distributed by age categories in the breeding season specific to each reference year. The largest share of the sample was in sheep aged between 29 and 33 months (21.4%), followed by those aged between 39 and 45 months (20.8%) and those aged between 16 and 21 months (19.6%). Slightly lower shares were sheep aged between 52 and 56 months (16.2%) and those aged between 64 and 68 months (15.1%). The lowest shares in the total sample were sheep aged between 75 and 79 months (5%) and those over 89 months (2%) (Table 1).

Table 1. Karakul of Botoşani sheep by batches' age

| Karakul of Botoşani sheep age at breeding | | | | | | |
|---|---|---|---|---|---|---|
| | | | Year | | | Total |
| | | | 2017 | 2018 | 2019 | |
| Karakul of Botoşani sheep age at breeding | 16-21 months | N | 176 | 147 | 82 | 405 |
| | | % | 20.1% | 26.1% | 13.1% | 19.6% |
| | 29-33 months | N | 174 | 129 | 139 | 442 |
| | | % | 19.9% | 22.9% | 22.1% | 21.4% |
| | 39-45 months | N | 156 | 140 | 134 | 430 |
| | | % | 17.8% | 24.9% | 21.3% | 20.8% |
| | 52-56 months | N | 100 | 101 | 133 | 334 |
| | | % | 11.4% | 17.9% | 21.2% | 16.2% |
| | 64-68 months | N | 177 | 39 | 95 | 311 |
| | | % | 20.2% | 6.9% | 15.1% | 15.1% |
| | 75-79 luni | N | 63 | 5 | 35 | 103 |
| | | % | 7.2% | 0.9% | 5.6% | 5.0% |
| | >89 months | N | 29 | 2 | 10 | 41 |
| | | % | 3.3% | 0.4% | 1.6% | 2.0% |
| Total | | N | 875 | 563 | 628 | 2066 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% |

The evaluation of the fertility index is done by assessing the number of products obtained from the total number of sheep distributed during the breeding season. The standard of the Karakul of Botoșani breed regarding the fertility index according to the specialized literature is estimated at a minimum of 92.6%.

The fertility index obtained by the sheep in the studied batch for the reference period 2017-2019, compared to the entire sample is 1.018 lambs for each sheep distributed at the breeding or, as a percentage, 101.80%. Thus, it can be observed that out of a total of 2066 Karakul of Botoșani sheep heads distributed during the three years, 2104 products were obtained (Table 2).

Table 2. Karakul of Botoșani sheep fertility index

| Fertility index | |
|---|---|
| Number of sheep distributed at breeding | 2066 |
| Fertility index | 101.8% |
| Number of products obtained | 2104 |

In order to highlight the influence of the age of the Karkaul de Botoșani sheep on the fertility index, we applied the ANOVA One-Way analysis method. A significantly lower fertility rate can be observed at 16 to 21 months of age and between 29 and 33 months compared to sheep aged between 39 and 68 months.

The highest value of the fertility index being registered in the age category 52-56 months with a number of 360 products obtained from 334 sheep distributed at the breeding, with a value of the fertility index of 107.8% (Table 3).

Table 3. Fertility index by age category

| Fertility index | | | | |
|---|---|---|---|---|
| Sheep age at the breeding | Number of sheep distributed at breding | Fertility index | Number of products obtained | P |
| 16-21 months | 405 | 94.6% | 383 | <0.001 |
| 29-33 months | 442 | 97.7% | 432 | |
| 39-45 months | 430 | 106% | 456 | |
| 52-56 months | 334 | 107.8% | 360 | |
| 64-68 months | 311 | 105.5% | 328 | |
| 75-79 months | 103 | 100% | 103 | |
| > 89 months | 41 | 102.4% | 42 | |
| | | | | |

The lowest value of the fertility index was registered in the 16-21 months' age batch with a number of 383 products obtained from 405 sheep distributed for reproduction, obtaining a value of 94.6% of the fertility index. The results of the statistical analysis also show that the differences are statistically significant between the different age categories of Karakul of Botoșani sheep in terms of fertility index ($p<0.001$) (Figure 1).

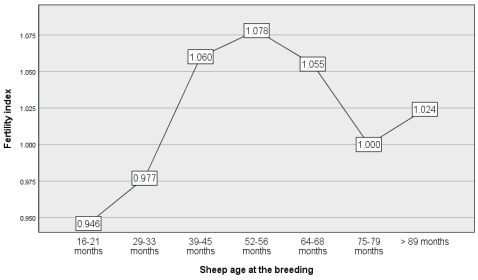


Figure 1. Karakul of Botoșani fertility index

Data on differences in the number of products obtained in relation to each age batch of Karakul of Botoșani sheep are presented in Table 4. It can be seen that among all the existing age batches in the studied batch, the differences in the fertility index of sheep are statistically significant with a value of $P<0.005$. Age batch 52-56 months obtaining the best values of the fertility index.

Table 4. Multiple comparisons obtained products

| Multiple comparisons | | | |
|---|---|---|---|
| Dependent variable: Obtainded products | | | |
| Bonferroni | | | |
| (I) Sheep age at the breeding | (J) Sheep age at the breeding | Mean difference (I-J) | P |
| 16-21 months | 39-45 months | -.115* | .001 |
| | 52-56 months | -.132* | .000 |
| | 64-68 months | -.109* | .007 |
| 29-33 months | 39-45 months | -.083* | .046 |
| | 52-56 months | -.100* | .012 |
| 39-45 months | 16-21 months | .115* | .001 |
| | 29-33 months | .083* | .046 |
| 52-56 months | 16-21 months | .132* | .000 |
| | 29-33 months | .100* | .012 |
| 64-68 months | 16-21 months | .109* | .007 |
| *. The difference between the averages is statistically significant at a threshold of 0.05. | | | |

The fecundity rate is expressed by the ratio of the number of ewes that gave birth and aborted to the total number of sheep inoculated. The standard of the Karakul of Botoșani breed regarding the fecundity index according to the specialized literature is between 92.6% and 98.9%.

The appreciation of the fecundity index for the reference period 2017-2019, compared to the entire sample is 0.938 or, in percentage, 93.80%. So, from 2066 inoculated sheep, a number of 1938 products were obtained (Table 5).

In order to highlight the influence of the age of the Karakul of Botoșani sheep in the breeding on the fecundity index, we applied the analysis of Anova One-way variance.

By analyzing the results of the statistical analysis it can be seen that the best value in terms of fecundity index was obtained in sheep aged 52-56 months, by obtaining a fecundity rate of 96.4% with a number of 322 sheep that gave birth and aborted out of a number of 334 inseminated sheep (Table 6).

Table 5. Fecundity rate Karakul de Botoșani

| Fecundity rate | |
|---|---|
| Total number of sheep inseminated | 2066 |
| Fecundity index | 93.8% |
| Total number of sheep that gave birth and had an abortion | 1938 |

Table 6. Fecundity index by age category

| Fecundity index | | | | |
|---|---|---|---|---|
| Sheep age at the breeding | Total number of sheep inseminated | Fecundity index | Total number of sheep that gave birth and had an abortion | P |
| 16-21 months | 405 | 90.6 % | 367 | 0.009 |
| 29-33 months | 442 | 93.0 % | 411 | |
| 39-45 months | 430 | 95.8 % | 412 | |
| 52-56 months | 334 | 96.4 % | 322 | |
| 64-68 months | 311 | 94.5 % | 294 | |
| 75-79 months | 103 | 90.3 % | 93 | |
| > 89 months | 41 | 95.1 % | 39 | |

The lowest value of the fertility index was recorded in sheep belonging to the age batch 75-79 months with an index of 90.3% with a number of 93 sheep that gave birth and aborted out of a number of 103 inseminated sheep (Figure 2).

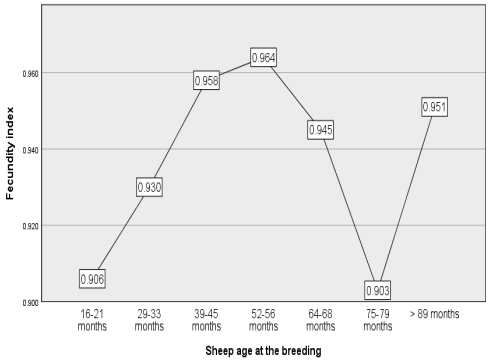


Figure 2. Karakul of Botoșani fecundity index

It can be seen that the differences between the age batches of the sheep in the study batch, in terms of the number of calvings and abortions are statistically significant ($p<0.05$).

The highest differences were achieved between the age category 16-21 months and the category 52-56 months. The age batch 52-56 months obtaining the highest values of the fecundity index (Table 7).

Table 7. Fecundity index by age category

| Multiple comparisons | | | |
|---|---|---|---|
| Dependent variable: Number of births and abortions | | | |
| Bonferroni | | | |
| (I) Sheep age at the breeding | (J) Sheep age at the breeding | Mean difference (I-J) | p |
| 16-21 months | 39-45 months | -.052* | .038 |
| | 52-56 months | -.058* | .024 |
| 39-45 months | 16-21 months | .052* | .038 |
| 52-56 months | 16-21 months | .058* | .024 |
| *. The difference between the averages is statistically significant at a threshold of 0.05. | | | |

The evaluation of the birth rate is done by reporting the number of ewes that have calved to the total number of sheep distributed at breading during one breeding season. According to the specialized literature, the birth rate for sheep belonging to the Karakul of Botoșani breed is 101.5%. The assessment of the birth rate for the reference period 2017-2019, for the Karakul of Botoșani sheep compared to the entire sample is 0.928 or, in percent, 92.80%. ewes calved during the study period (Table 8).

Table 8. Karakul of Botoșani birth rate

| Birth rate | |
|---|---|
| Total number of sheep distributed at breeding | 2066 |
| Birth rate | 92.8% |
| Number of sheep that gave birth | 1917 |

In order to highlight the influence of the age of Karakul of Botoșani sheep in the breeding campaign on the birth rate, we applied the analysis of variance Anova One way. We observe a significantly lower birth rate at the ages between 16 and 21 months where out of a number of 405 sheep distributed in the breeding only 361 heads gave birth, obtaining a birth rate of 89.1%, compared to sheep aged 39-45 months where out of a number of 430 sheep heads distributed during the breeding, 411 heads gave birth thus obtaining a birth rate of 95.6% also the category aged 52-56 months where out of a total number of 334 ewes distributed in the herd, 319 heads gave birth, obtaining a birth rate of 95.5% (Table 9).

Table 9. Birth rate by age category

| Birth rate | | | | |
|---|---|---|---|---|
| Sheep age at the breeding | Total number of sheep distributed at breeding | Birth rate | Number of sheep that gave birth | P |
| 16-21 months | 405 | 89.1% | 361 | 0.002 |
| 29-33 months | 442 | 91.9% | 406 | |
| 39-45 months | 430 | 95.6% | 411 | |
| 52-56 months | 334 | 95.5% | 319 | |
| 64-68 months | 311 | 93.6% | 291 | |
| 75-79 months | 103 | 88.3% | 91 | |
| > 89 months | 41 | 92.7% | 38 | |

Regarding the results of the statistical analysis, they also show that the differences are statistically significant between the different age categories in terms of birth rate (p = 0.002). Therefore, the age of the Karakul of Botoșani sheep at the time of use for reproduction influences the birth rate. Sheep in the age batch 39-45 months obtaining the highest value in terms of birth rate (95.6%) (Figure 3).

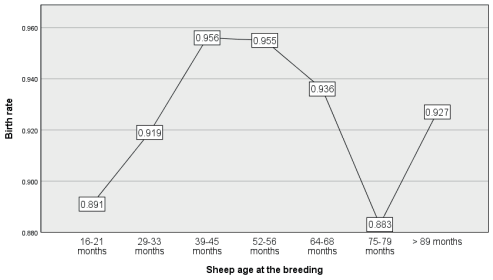


Figure 3. Karakul of Botoșani birth rate

The prolificacy index is expressed by relating the total number of products obtained to the number of ewes that gave birth. The standard of the Karakul of Botoșani breed regarding the fertility index according to the specialized literature is between 101.1% and 107.3%.

The assessment of the prolificacy index for the reference period 2017-2019, compared to the entire sample is 1,098 or, as a percentage, 109.80%. Thus, from 1917, ewes that gave birth were obtained a number of 2104 products (Table 10).

Table 10. Prolificay index Karakul of Botoșani

| Prolificacy index | |
|---|---|
| Number of ewes that gave birth | 1917 |
| Prolificacy index | 109.8% |
| Number of products obtained | 2104 |

In order to study the influence of the age of the Karakul of Botoșani sheep in the breed on the prolificacy index, we used the analysis of variance Anova One way. A slightly lower prolificacy index can be observed in young sheep aged between 16 and 21 months, where out of a total of 361 ewes that gave birth, a number of 383 products were obtained, obtaining a value of the prolificacy index of 106.1% compared to sheep over 39 months of age. The highest value in terms of prolificacy index was recorded in the age batch 75-79 months where out of a total of 91 ewes that gave birth, a number of 103 products was obtained (Table 11).

Tabel 11. Prolificacy index by age category

| Prolificacy index | | | | |
|---|---|---|---|---|
| Sheep age at the breeding | Number of sheep that gave birth | Prolificacy index | Number of products obtained | p |
| 16-21 months | 361 | 106.1% | 383 | 0.004 |
| 29-33 months | 406 | 106.4% | 432 | |
| 39-45 months | 411 | 110.9% | 456 | |
| 52-56 months | 319 | 112.9% | 360 | |
| 64-68 months | 291 | 112.7% | 328 | |
| 75-79 months | 91 | 113.2% | 103 | |
| > 89 months | 38 | 110.5% | 42 | |

The results of the statistical analysis show that the differences are statistically significant between the different ages in terms of the prolificacy index (p = 0.004). In view of all the aspects presented, related to the influence of the age of the sheep on the prolificacy index, it is confirmed that the age of the Karakul of Botoșani sheep in the mountain influences the value of the prolificacy index (Figure 4).

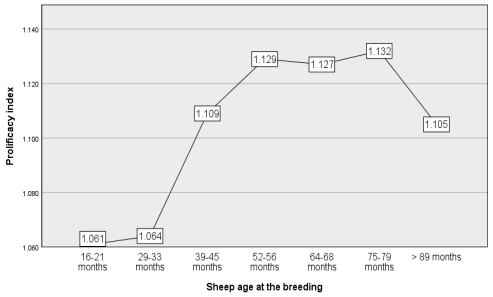


Figure 4. Karakul of Botoșani prolificacy index

## CONCLUSIONS

As a result of the age distribution of the Karakul of Botoșani sheep herd during the 3 breeding seasons, it was found that the largest share of the sample had sheep between 29 and 33 months of

age (21.4%), followed by those aged between 39 and 45 months (20.8%) and those aged between 16 and 21 months (19.6%).

Statistical processing of data on the influence of Karakul of Botoșani sheep age on fertility index indicated that differences are statistically significant between different age categories of Karakul of Botoșani sheep in terms of fertility index ($p<0.001$).

Significantly lower fertility rates at 16 to 21 months of age and 29 to 33 months of age compared to sheep aged 39 to 68 months.

Regarding the influence of the age of sheep from the Karakul of Botoșani breed on the fecundity index, the statistical analysis of the data shows that there are statistically significant differences between different age categories in terms of fecundity index ($p = 0.009$).

Following the interpretation of the results of the statistical analysis regarding the influence of the age of sheep from the Karakul of Botoșani breed on the birth rate, they show that the differences are statistically significant between the age categories within the batch studied in terms of birth rate ($p = 0.002$).

Regarding the influence of the age of sheep from the Karakul of Botoșani breed on the prolificacy index, the results of the statistical analysis show that the differences are statistically significant between the different age categories within the study batch ($p = 0.004$).

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# TECHNOLOGIES OF ANIMAL HUSBANDRY