

PHENOTYPIC AND GENETIC PARAMETERS FOR FERTILITY AND GROWTH RATE IN SLOVENIAN AUTOCHTHONOUS SHEEP BREED JEZERSKO-SOLČAVSKA**

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**Original scientific paper

Abstract: Phenotypic and genetic parameters were studied in Slovenian autochthonous sheep breed Jezersko-Solčavska. The data originate from Slovenian selection program. The number of sheep in Slovenia, especially of autochthonous breeds is increasing due to abandoning of intensive farming on many farms. Another reason are subsidies, favouring low intensity production and autochthonous breeds. The breed is fertile during the whole year. Estimated heritabilities are: 0.078 for birthweight, 0.401 for weight at 60 days and 0.390 for weight at the end of the test at average age of 185.35 days.

Key words: sheep, Jezersko–Solčavska breed, fertility, growth, phenotypic parameters, genetic parameters

Introduction

Jezersko-Solčavska is Slovenian autochthonous breed of sheep from alpine area. The breed was reared on alpine pastureland where the conditions for rearing of animals are suboptimal. It is the second most important breed in Slovenia where the most important breed is JSR, which originated from the crossbreds of Jezersko-Solčavska and Romanovska breed.

The number of sheep in Slovenia increased in last two decades. The number of breeding sheep was 15,029 in year 1985 (*Statistični letopis ...*, 1996) and 89,667 in year 2005 (*Statistični letopis ...*, 2006). In the same period the number of cows and pregnant heifers has fallen from 268,127 in

year 1985 to 188,456 in year 2005, but milk production was increased. The subsidies stimulate low intensity of production because of environment protection. Autochthonous breeds are much better adapted on local environment as breeds, selected on high productivity. As a consequence the proportion of animals of Jezersko - Solčavska breed increased in comparison to more productive breeds (*Grabrijan et al., 2007*).

The choice of that breed in conditions of low productivity is probably the best, but that doesn't mean that the breeders are satisfied with all the traits of the breed. Moderate selection on production traits is necessary to increase the economics of production and to satisfy the consumers.

Genetic parameters for growth traits were studied very extensively on breeds with high and low productivity. Jezersko-Solčavska breed was not included in the studies. The only known heritability for growth parameters of Slovenian sheep is 0.33 for gain of JSR breed in 100 days test (*Kompan et al., 1992*) The range of heritabilities for birth weight in extensive production is very wide: from 0.08 in Turkish Merino (*Oczan et al., 2005*) to 0.39 in African Djallonké sheep (*Bosso et al., 2007*). The heritabilities for weight at weaning are slightly lower: 0.01 at the age of 60 days and 0.10 at the age of 120 days in Targhee breed (*Notter and Hough, 1997*) and 0.24 ± 0.08 in Awassi breed (*Mavrogenis, 1996*). More uniform heritabilities can be found for weights at higher ages: 0.21 in Djallonké sheep at the age of 360 days (*Bosso et al., 2007*), 0.25 at the age of one year in Turkish Merino (*Oczan et al., 2005*), 0.26 at the age of 12 months and 0.37 at the age of 18 months in Sabi sheep (*Matika et al., 2003*) and 0.26 in composite terminal breed at the age of 19 months (*Mousa et al., 1999*).

In this work the production and genetic parameters for growth of Jezersko – Solčavska breed in non-intensive conditions in Slovenia are studied.

Material and methods

The data come from Slovenian selection program. Data were collected during the last 20 years. Three variables are studied in this work: birth weight of the animals which was recorded in first week of life, the weight at the age of 60 ± 15 days and the weight of the rams at the end of the test at the age of 185.35 ± 47.94 days. Birth weight and weight at the age of 60 days were recorded in both sexes. The data were analyzed with the next models:

$$y_{ijklmno} = \mu + F_i + P_j + G_k + B_l + S_m + b(W_{ijklmno} - \bar{W}) + a_{ijklmno} + e_{ijklmno}$$

$$y_{ijklmno} = \mu + F_i + P_j + G_k + B_l + S_m + a_{ijklmno} + e_{ijklmno}$$

$$y_{ijklmo} = \mu + F_i + P_j + B_l + S_m + b(T_{ijklmo} - \bar{T}) + c(I_{ijklmo} - \bar{I}) + a_{ijklmo} + e_{ijklmo}$$

Where: $Y_{ijklmno}$, Y_{ijklmo} are weights at birth, at weaning and at the end of the test; F_i is effect of flock; P_j is effect of parity; G_k is effect of sex of the animal; B_l is effect of litter size; S_m is effect of season of birth; $W_{ijklmno}$ is weight at weaning; T_{ijklmo} is weight at the beginning of the test; $a_{ijklmno}$, a_{ijklmo} are direct additive genetic effects and $e_{ijklmno}$, e_{ijklmo} are residuals.

The basic statistic was evaluated with SAS BASE procedure Means. Genetic parameters were estimated with program PEST.

Results and discussion

Jezerško-Solčavska breed is like other alpine breeds permanently fertile during the year. The lambings are unequally distributed during the year. In hot summer months from 1st of June to the end of September only 16.40 % of total lambings with litter size 1.31 were recorded. In next period between beginning of October and the end of January 48.60 % of lambings occurred. Litter size was the same as in the previous period. In the last period between beginning of February and the end of May, 35.0 % of lambings were recorded. Litter size was in that period 1.43. The smaller percentage of lambings is a consequence of genetic heritage of sheep, but also a consequence of breeding technology. Some breeders wanted seasonal lambings because of less work and shortage of feed during the summer months.

Number of recorded lambings increased from 993 in year 1995 to 2,771 in year 2000 and 3,715 in year 2006. Breeders are interested for Jezerško-Solčavska breed because of higher subsidies for breeding of autochthonous breeds and because the animals are less sensitive comparing to other breeds. Average litter size decreased from 1.32 in year 1995 to 1.21 in year 2000 and 1.18 in year 2007. The estimated trend for litter size was -0.01 born lamb per litter. Many hobby breeders or less intensive producers joined selection program.

Till the year 2000 only small number of animals was weighted - around 110 animals per year. In year 2006 4,030 newborn lambs were weighted.

Although the litter size decreased, the newborn lambs were in year 2005 on average lighter (4.20 kg) than lambs in year 1995 (4.40 kg). Estimated trend for birth weight is -0.02 kg per year. In the first period only the animals of the best breeders were weighted. As the number of weighted animals increased, the average weight dropped. The number of weighted animals at the age of 60 days increased from a few hundred at the beginning of the period to nearly two thousand in the last two to three years. The average weight at the age of 60 days dropped in that period from 24.53 kg to only 18.78 kg and the trend was -0.68 kg per year. The reason is the same as in both other traits - the increase of number of breeders in selection program. The average weight of rams at the end of the test at the average age of $185 \pm$ days was 51.24 kg.

The smallest litter size - only 1.19 born lambs per litter - was observed in first parity. The average litter size increased very rapidly from first to third litter; later on the increase of litter size was only moderate. The largest litter size was observed in parities eight and nine, when the opposite process started. Around eight thousand males and females were weighted at birth and three thousand animals of both sexes were weighted at the age of 60 days. The males were heavier as females in both cases.

Average birthweight of animals in the whole period was 4.18 kg. The weight of females was slightly lower (4.11 kg) than the weight of males (4.26 kg). The weight at weaning was 19.90 kg – 20.56 kg for males and 19.21 kg for females. The average weight at the end of the test was 51.24 kg. As expected the animals from smaller litter size were heavier than the animals from larger litters. The average birth weight of singles was 4.33 kg comparing to 3.86 kg of twins and 3.06 kg of triples. Weaning weight of singles (20.54 kg) was still higher than the weaning weight of twins (18.58 kg) and triples (16.73 kg). At the end of the test the weight of the singles (51.05 kg) and twins (51.76 kg) was nearly the same. Only the best rams are selected for the test and general conclusions about the growth.

The average birthweight of lambs from the first litter was slightly lower (4.01 kg) than from the later litters. Only exceptions were litters from thirteen on. The average birthweight of that litters was only 3.99 kg. The weight at the age of 60 days increased from first (18.56 kg) to fourth litter (20.46 kg). The average weights of lambs at the age of 60 days were at litter 10 and later lower than 20 kg. As for the other traits only small number of animals was weighted at late litters.

The weight of lambs at 60 days depending on litter size shows different tendency. The weight increases from litter one with the lowest weight at the

age of 60 days to litter four when the absolute maximum is reached. From litter five to litter nine the weight is stable. After that litter, the weight has fallen. The data from the test show different tendency – the highest weight at the end of the test was observed at the lambs from the first litter. The weight at the end of the test decreased from the first litter to litter six. After that it increased and started to decrease at litter 10. The trait is biased because of small number of weighted animals and because of preselection of animals (phenotypically best animals are tested).

Although the litter size was in first parity only 1.19 and only one fifth of animals lambs more than one lamb, the average weight at birth and at the age of 60 days was the lowest. From litter one to five there was an increase not only in average litter size and percentage of twins and triples, but also in the average weight at the age of 60 days.

In the table 1, the genetic and phenotypic variances and heritabilities are presented. Heritability for birth weight is low, but the other two are moderate to high. Some low heritabilities were found in literature (*Oczan et al.*, 2005; *Mousa et al.*, 1999), but the other heritabilities were much higher. The reason is not known, but it is assumed that the weighing at birth is not accurate enough because of inaccurate size of weighing machine and because the time of weighing is not standardized.

Table 1: Genetic and phenotypic variances and heritabilities for birth and test weight at the age of 60 days

	birth weight	weaning weight	test weight
genetic variance	0.02454	4.02886	0.02624
phenotypic variance	0.314	10.056	0.0673
heritabilities	0.078±0.035	0.401±0.042	0.390±0.043

The heritabilities - 0.401 for weight at the age of 60 days and 0.390 for weight at the end of the test are relatively high also comparing to results of other authors. That high heritabilities show possibility for successful selection on growth rate of the animals. The heritabilities are probably too high because some maternal effect is included in the genetic variance.

The performance test is done on relatively intensive conditions. Animals are fed with supplement of concentrates like rams of breed JSR. In new economical conditions where many of Jezersko - Solčavska animals are used in less intensive production system it is necessary to find out, if some less intensive procedures for testing of rams would be more appropriate.

Conclusions

Phenotypic and genetic parameters were studied on Slovenian autochthonous sheep breed Jezersko - Solčavska. The breed is fertile during the whole year, but the results in summer months are lower than in other periods of the year. The phenotypic results for growth parameters and fertility did not increase in last years. The most important reason is that large number of breeders entered the selection program. Estimated heritabilities are: 0.078 for birthweight, 0.401 for weight at 60 days and 0.390 for weight at the end of the test at the average age of 185.35 days.

FENOTIPSKI I GENETSKI PARAMETRI PLODNOSTI I BRZINE PORASTA SLOVENAČKE AUTOHTONE JEZERSKO- SOLČAVSKE RASE OVACA

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Rezime

Poljoprivredne subvencije i napuštanje intenzivne poljoprivredne proizvodnje menjaju strukturu slovenačke poljoprivrede. Odgoj ovaca, posebno slovenačke autohtone Jezersko – Solčavske rase postaje sve popularniji. Odgoj ovaca ima pozitivan efekat jer doprinosi boljem korišćenju zemlje u poljoprivredne svrhe.

Podaci korišćeni u istraživanju potiču iz slovenačkog selekcijskog programa. Jezersko - Solčavska rasa je plodna tokom cele godine. U letnjim mesecima od juna do avgusta registrovana su jagnjenja ali u manjem broju. Zbog sve većeg broja životinja i odgajivača koji su uključeni u program selekcije i zbog manjeg intenziteta proizvodnje, fenotipski progres u proizvodnji poslednjih godina nije registrovan. Veličina legla, težina na rođenju i težina u uzrastu od 60 dana su neznatno smanjene. Veličina legla ove rase se povećava tokom prva tri jagnjenja. Nakon toga, prosečna veličina legla ostaje do jedanaestog jagnjenja, kada počinje sa padom. Tokom tog stabilnog perioda prosečna veličina legla ostaje veća od 1,4. Mužjaci su u proseku bili teži na rođenju i u uzrastu od 60 dana nego ženke. Veličina legla

utiče na težinu na rođenju i u uzrastu od 60 dana. Relativna razlika u težini između jedinaca i blizanaca je smanjena do uzrasta od 60 dana u poređenju sa razlikom na rođenju. Nije utvrđena razlika na kraju testa ovnova jer su samo najbolje životinje uključene u test.

Nizak heritabilitet (0.078) je utvrđen za težinu na rođenju. Razlog može biti tehničke prirode – nestandardizovano vreme merenja težine i nedovoljno precizne vage za merenje tako malih težina. Heritabilitet za mase u uzrastu od 60 dana i na kraju testa su neznatne - oko 0.4. Uspešna selekcija na porast životinja je moguća, ali postoji dilema po pitanju selekcije ove rase. Zbog promene načina na koji se koristi ova rasa, neophodne su neke promene u proceduri testiranja ovnova.

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