The Age and Physiological State Influence in Merino of Cluj Sheep on Reproductive Performance

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Abstract

The purpose of the present study is to identify the reproductive performance of the Merino of Cluj sheep according to their age and physiological status. The sheep breeding activity of the SDE-USAMV Cluj-Napoca, under study, takes place under the conditions of the natural season of mating and is described by the structure of the entire live stock in operation, pursued for eight years. To determine the reproductive skills of sheep, the following were taken into account: sexual maturity, repetition of the sexual cycle, reproduction indices and sterility. The dynamics of breeding performance in females of Merino of Cluj, according to their age, was established by monitoring 18 breeding indexes, the most important ones being: fertility, fecundity, birth rate and abortion index. Following the calculation of reproduction indices, medium values were obtained, 96% for fertility, 92% for fecundity, 96% for birth rate and 4% for abortion index. In relation to these indices, we observe maintenance in normal values over the years of study regardless the sheep's age and the fluctuations are thought to be due to climate change.

Keywords: Merino of Cluj, physiological status, reproduction indices, sheep.

1. Introduction

To run a profitable sheep operation, producers must understand the details of many different disciplines and how they interrelate. One of the basic aspects of a sheep farming operation is to make sure that ewes become pregnant and have lambs [1, 2]. It is important to understand the basic physiology of the reproductive cycle to ensure that management decisions do not prevent ewes from becoming pregnant [3]. Several factors are reported to influence reproductive performance, and the number of lambs marketed per ewe in the breeding flock is a major contributor to profitability [4]. The weight of the sheep together with the heath, genetics, stress, feeding and body conditions, weather and seasons, lambing interval and ram, have all been reported to influence reproductive performance [4, 5]. Each of these factors can have a significant effect on reproduction indexes, in some cases, a combination of factors causes conception problems. Reproductive indexes do reflect in the best way the biological and economic efficiency of reproduction in farm animals [6, 7]. Maximizing breeding indexes is considered the most synthetic index for assessing sheep farm economy because it underlies both the workforce and increases their production [1].

In sheep, the ovulation rate increases with age and reaches a maximum at 3 to 6 years, then declines gradually [3]. Age has also been shown to influence the performance of ewes, especially their reproductive performance [8]. The main objective of this study is to determine the effect of age and physiological status of Merino of Cluj ewes on their reproductive performance. Because until now, the breeding activity was not monitored, we considered it necessary to determine the most important reproduction indexes for the entire flock of sheep for 8 years.

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2. Materials and methods

The study was carried out at the Research and Development Station for sheep of the University of Agricultural Science and Veterinary Medicine from Cluj-Napoca (SDE-USAMV Cluj-Napoca, 46°46'N-23°23'E) on entire flock of sheep breed Merino of Cluj (300 ewes per year). To take account of the between-year variability, and also get a sufficient number of animals in the data set, the study lasted 8 years, from 2008 to 2015 [9]. In figure 1 are presented the percentage variability of the number of sheep exploited annually by age at mating group for the period of study. The proportion of number of ewes is relatively constant each year, and the mean value of percentage recorded in the eight years of study is: primiparous ewes (≤ 1.5 years) a value of 27%, multiparous ewes: (1.5 ≥ age at mating ≤ 6.5) a value of 64% and (≥ 6.5 years) a value of 9%.

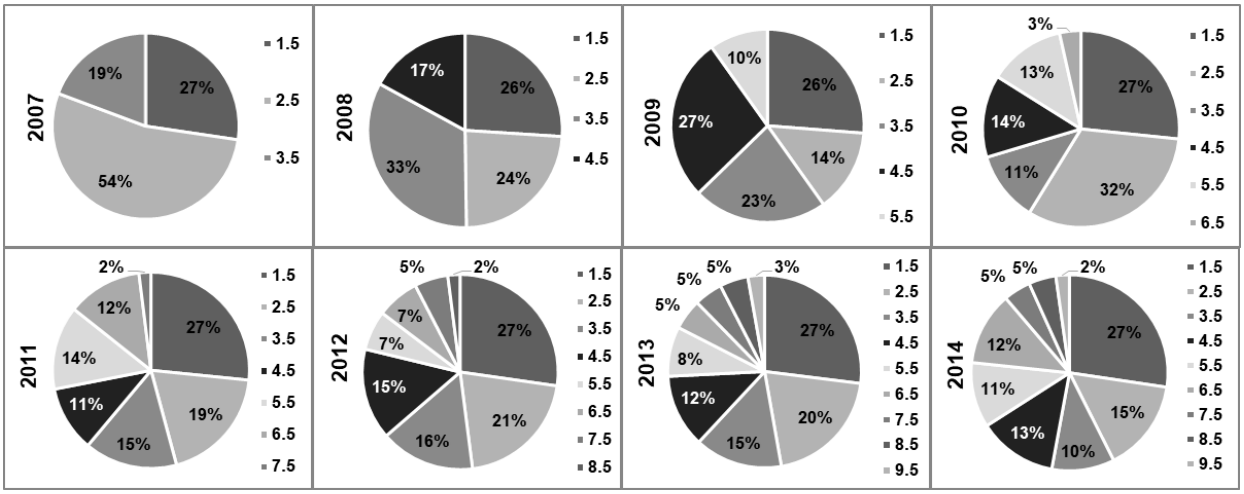


Figure 1. The percentage variability of the number of sheep exploited annually by age at mating group for the period of study, 2007 - 2014 (1.5 – 9.5 –sheep age at mating)

Ewes were mated for the first time at 18 months of age and were group mated on pasture to rams for 42 days starting the second week in September after exposure to teaser ram for 2 weeks. The ram-to-ewe ratio was 1:25 with rams periodically replaced with fresh rams. Ewes usually lamb starting the end of January until the end of March with an average of 112% prolificacy. The average birth weight of the lambs is equal to 3.88 ± 0.14 kg, value between the limits 1,80 and 5,80 kg, depending on the lambing type, sex of lamb and physiological status of ewes [10]. The breed is renowned for easy lambing, the ewes are dedicated mothers and also good milk producers.

Information regarding the reproductive activity of the ewes was taken from the farm records, and followings were involved in the study as: sheep in oestrus (E%), fecundity (Fn%) embryonic mortality (Me%), pregnancy (Pg%), abortions (A%), pregnancy rate (G%), fertility (F%), sterility (Sm%), prolificacy (Pf%), conception rate (N%), lamb survival rate from birth until weaning (Cp%), productivity (Cm%) [1, 6, 11].

The mathematical equations used to analyse the reproduction indexes were as follows:

$$E(\%) = \frac{Ewes}{Breaded\ ewes} * 100 \quad (1)$$

$$Fn(\%) = \frac{Pregnant\ sheep}{Breaded\ sheep} * 100 \quad (2)$$

$$Me(\%) = \frac{Number\ of\ matings}{Farrwed\ sheep} * 100 \quad (3)$$

$$Pg(\%) = \frac{Farrwed\ sheep}{Pregnant\ sheep} * 100 \quad (4)$$

$$A(\%) = \frac{Aborted\ sheep}{Pregnant\ sheep} * 100 \quad (5)$$

$$G(\%) = \frac{Pregnant\ sheep}{Breaded\ sheep} * 100 \quad (6)$$

$$F(\%) = \frac{Lambed\ sheep}{Ewes} * 100 \quad (7)$$

$$Sm(\%) = \frac{Infertile\ ewes}{Ewes} * 100 \quad (8)$$

$$Pf(\%) = \frac{Resulted\ lambs}{Lambed\ ewes} * 100 \quad (9)$$

$$N(\%) = \frac{Resulted\ lambs}{Ewes} * 100 \quad (10)$$

$$Cp(\%) = \frac{Weaned\ lambs}{Resulted\ lambs} * 100 \quad (11)$$

$$Cm(\%) = \frac{Weaned\ lambs}{Ewes} * 100 \quad (12)$$

All data was analysed using GraphPad Prism7 and Excel program. The effect of age and physiological status in Merino of Cluj sheep on reproductive performance was analysed by an analysis of variance (ANOVA) using least squares means. All decisions about the acceptance or rejection of statistical hypothesis have been made at the 0.05 level of significance.

3. Results and discussion

Merino of Cluj sheep are in the patrimony of the animal genetic reserves and falls into the category: endangered populations, fall the number of females between 101 and 1000 heads [11, 12]. The effective was multiplied by reproductive isolation and developed independently and through this system it was intended to keep the breed relatively constant in parallel with the improvement of the morpho-productive traits for the next generation [7, 10]. Knowing the breeding activity of the Merino of Cluj sheep was a necessity given the fact that it is intended to increase both herd and their production. In another train of thoughts, this work is a continuation of the previous research in which the Merino of Cluj breed was characterized in terms of production performance [13-15]. They related to the level and characteristics of milk, wool and meat production, determined by the body mass of sheep and rams and the growth dynamics of the lambs [10, 16-18]. In order to characterize the reproductive potential on Merino of Cluj sheep, all reproduction indexes were analysed during 2007 – 2014 regarding entire flock analysed yearly and in Table 1 are presented the mean values calculated for all eight years of study.

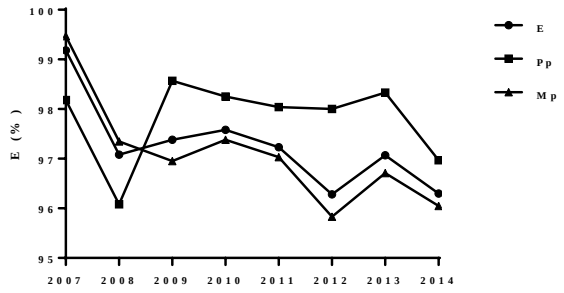
It is noted that, under the climatic conditions of the main mating season in sheep, the spontaneous manifestation of oestrus was 97.26% for the entire sheep flock. Primiparous ewes showed oestrus in 97.8% of the cases, 0.7% higher than the mean oestrus manifestation in multiparous ewes (97.1%), and the differences are insignificant.

Table 1 The average reproduction indexes, the coefficient of variation and the significance of the statistical differences recorded in eight years of study according to the physiological state of the parturients

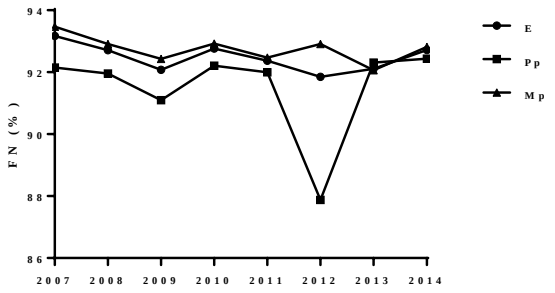
Reproductive indices	Symbol U.M.	N	Physiological status			Level of significances Pp vs. Mp		
			Ewes	Primiparous	Multiparous			
			$\bar{X} \pm s_{\bar{X}}$ CV%	$\bar{X} \pm s_{\bar{X}}$ CV%	$\bar{X} \pm s_{\bar{X}}$ CV%	± d	P value	Signif.
Sheep in oestrus	E (%)	8	97.26 ± 0.32 0.93	97.80 ± 0.30^{ns} 0.86	97.10 ± 0.39^{ns} 1.15	0.71	0.32	ns
Fecundity	Fn (%)	8	92.47 ± 0.16 0.48	91.51 ± 0.54^{ns} 1.66	92.75 ± 0.15^{ns} 0.46	-1.24	0.05	*
Embryonic mortality index	Me (%)	8	1.62 ± 0.17 29.37	2.69 ± 0.61^{ns} 64.24	1.32 ± 0.16^{ns} 34.14	1.37	0.05	*
Pregnancy	Pg (%)	8	96.10 ± 0.13 0.38	96.11 ± 0.16^{ns} 0.48	96.09 ± 0.13^{ns} 0.39	0.02	0.99	ns
Abortions	A (%)	8	3.90 ± 0.13 9.35	3.89 ± 0.16^{ns} 11.76	3.91 ± 0.13^{ns} 9.55	-0.02	0.10	ns
Pregnancy rate	G (%)	8	95.78 ± 0.43 1.27	95.36 ± 0.56^{ns} 1.66	95.89 ± 0.49^{ns} 1.44	-0.53	0.84	ns
Fertility	F (%)	8	96.05 ± 0.45 1.33	95.66 ± 0.63^{ns} 1.86	96.52 ± 0.49^{ns} 1.43	-0.86	0.60	ns
Sterility	Sm (%)	8	2.74 ± 0.32 33.12	2.20 ± 0.30^{ns} 38.33	2.90 ± 0.39^{ns} 38.29	-0.71	0.40	ns
Prolificacy	Pf (%)	8	112.8 ± 1.53 3.83	110.1 ± 1.90^{ns} 4.88	113.6 ± 1.67^{ns} 4.16	-3.45	0.42	ns
Natality	N (%)	8	96.06 ± 1.56 4.61	93.22 ± 1.92^{ns} 5.81	96.89 ± 1.65^{ns} 4.82	-3.67	0.31	ns
Lamb survival index	Cp (%)	8	92.41 ± 0.44 1.36	93.72 ± 0.93^{ns} 2.82	91.98 ± 0.45^{ns} 1.39	1.74	0.17	ns
Productivity	Cm (%)	8	92.47 ± 1.55 4.73	91.14 ± 2.18^{ns} 6.76	92.80 ± 1.58^{ns} 4.83	-1.66	0.79	ns

Pp – primiparous; Mp – multiparous; $\bar{X}$ – Mean, $s_{\bar{X}}$ –Std. Error of Mean; CV% - Coefficient of variation; ^{ns} – p>0.05; * – p<0.05

Age at first behavioural oestrus in medium wool and meat type sheep has been reported to average from 205 to 254 days, depending upon breed and management conditions. Thus, ewe lambs are potentially capable of mating at seven months of age and of lambing at one year of age [19]. Hohenboken et al., (1977) compared performance through five years of farm flock Hampshire ewes lambing first at one versus two years of age. The results agreed in most aspects with previous studies. Ewes bred as lambs were lighter than their pair mates at 18 months of age, but the difference disappeared at later ages [20]. In the case of the fecundity index, a significant difference between primiparous and multiparous ($p < 0.05$) is observed and the value register on whole sheep flock is 92.47%. The infertility index shows a significant difference between the two groups of sheep, the primiparous registering a higher value of 1.37% than the multiparous sheep. Regarding the infertile sheep which did not lamb during the years 2012, 2013, 2014, were 9, 8, 6, 5 years old (fig. 1). This data reflects the fact that after 6 years old, infertility in sheep is rising tremendously and culling would represent the optimal decision. The same results were obtained by Pădeanu et al. (2009) [6]. The same thing can be observed for abortion index which is found at a value higher for multiparous sheep, but the difference between the two categories is insignificant. Conception rates of the ewes in this study were not affected by either the age of the ewe that means the sheep were in good body condition. Results are in accordance with those published by Orji et al. (1981), which reported conception rates ranging between 94.7% and 97.9%, based on different production systems under highland conditions [21]. Age has been shown to influence conception rate of ewes, for example, Annett et al. (2011) and Orji et al. (1981) reported significant increases in conception rate between first and second parity ewes when they were first mated as adolescents [8, 21]. Aktaş et al. (2015) observed that the effect of ewe live weights was reported to be greater than the effect of premating ewe age on the ewe reproduction efficiency [4]. Prolificacy values are 112.8% for the entire sheep flock, and between the two categories of sheep is not a significant difference. The birth rate index shows higher values in multiparous of 96.89% than in the case of primiparous 93.22%. Lamb survival rate was not influenced ($p \geq 0.05$) by age of ewes or their physiological status. Generally, older ages at breeding are associated with higher reproductive performance in ewe lambs [5]. Aktaş et al. (2015), Gaskins et al. (2005) and Orji et al. (1981) observed that the primiparous can have similar reproductive activity to the multiparous ones if they have a good management system, nutrition, and feeding [4, 5, 21]. The results obtained at reproduction indexes, for each year, are presented in figure 2 (a – l).



(a)



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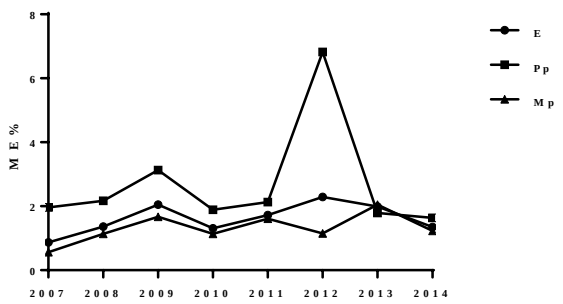

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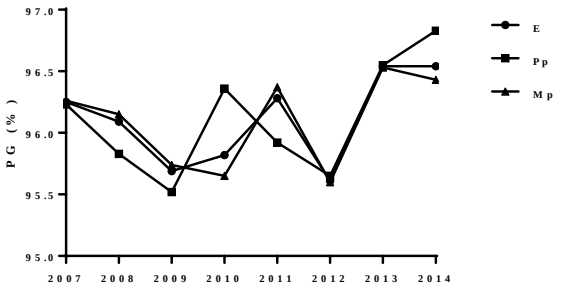

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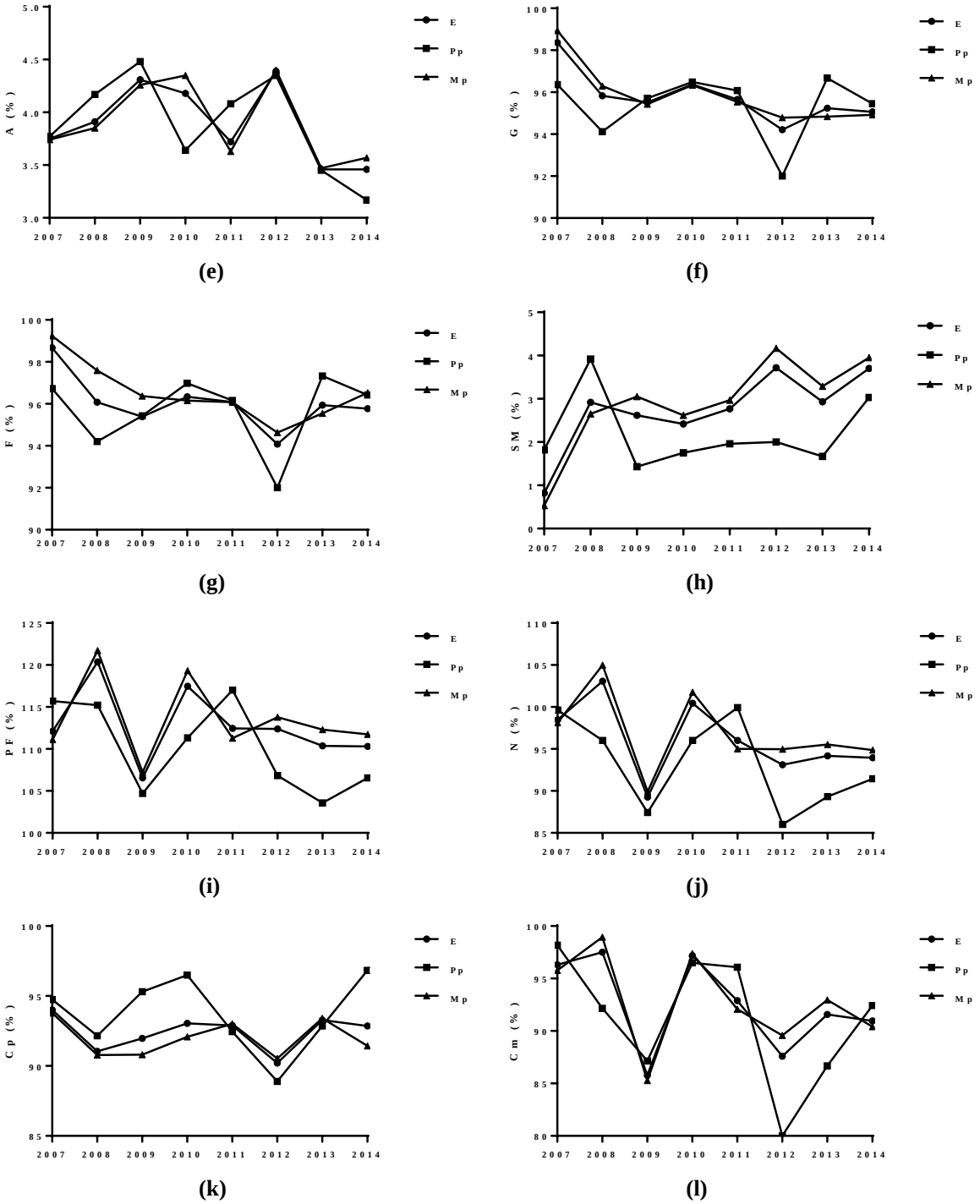

Figure 2. The value of reproduction indices (a – l) recorded annually over the study period (2007 – 2014) of ewes (E), primiparous (Pp) and multiparous (Mp)

Sexual maturity depends on the maintenance state, nutrition level, precocity of the race and also the influence of natural climatic factors [7, 22]. The variability of reproductive parameters recorded at year-on-year is based on climate change and maintenance. The lowest values for every reproduction indexes are recorded in 2012 – 2014, when the age of the sheep flock is higher than in the first 5 years of the study. It can also be noticed that the differences between primiparous and multiparous are relatively small, so it can confirm those told by other authors about the small influence of age, and that maintenance, body score, season are more important than age.

4. Conclusions

This study is unique in providing a comprehensive data set on the performance of Merino of Cluj sheep over 8 successive lamb crops. It should be noted that the age effects reported here are confounded by culling and mortality and do not represent the true biological effects of ageing in sheep, but rather its effects on ewe performance at farm level. Good conception rates are essential for the profitability of a sheep farm. If conception rates are not high, consider and review the many factors that influence the number of ewes lambing and the number of lambs born, including age, breed, lambing interval, health, nutrition, stress and the ability of the ram. In conclusion, this study has demonstrated the importance of improved nutrition and good management pre-and post-weaning on the reproductive potential of ewe lambs of the Merino of Cluj sheep.

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