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Reproductive Performance of Kivircik Ewes on Accelerated Lambing Management

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Abstract: The aim of the study was to determine the effects of accelerated lambing scheme of three lambing in two years. Ewes were bred at 8 month intervals; July (J), March (M) and November (N). Lambing rates for J, M and N were found 89.6, 90.5 and 92.2%, respectively. Litter size at birth in J (1.56) and M (1.54) differed ($p<0.01$) with respect to N (1.31). Lamb survival at weaning in J (94.7%) was higher ($p<0.05$) than M (90.4%) and N (91.3%). Weaning rate was affected ($p<0.01$) by breeding date; N-ewes had fever lambs weaned than J and M-ewes. In general, both prolificacy and weaning rate were consistently higher ($p<0.05$) as ewe's age increased. This accelerated lambing scheme generated a ewe productivity, on an annual basis, of 1.33±0.07 lambing, a litter size of 1.77±0.22 at birth and 1.66±0.21 at weaning. Considering the July values as those representing an annual breeding, the accelerated lambing scheme increased lamb production 15% at birth and 19% at weaning. The results indicated that Kivircik ewes have a good potential for production systems requiring improved prolificacy or accelerated lambing management.

Key words: Sheep, accelerated lambing, reproductive efficiency, productivity

INTRODUCTION

The profitability of sheep farm has a close relationship with produced lamb number per year. An increase in this number can be obtained by using accelerated lambing system. For this aim, it has been developed different accelerated lambing systems such as twice lambing in a year, three lambing in two years, four lambing in three years[1]. However, the capability of different sheep breeds for frequent lambing are not the same. Robinson[2] observed that the high annual lamb output of the Finn and Finn-cross ewe was not only the result of a large litter size, but also arose from their reduced lambing interval. It is believed to be easier to achieve an increased lambing frequency with sheep normally associated with higher than a low litter size, even though that particular breed is thought to have the merit of an extended breeding season. There is perhaps some support for this in the fact that Booroola Merino ewes continue to show breeding activity when inhibitory seasonal factors have suppressed the normal Merino type[3].

Seasonal reproduction is a serious problem for the sheep industry, reducing effectiveness of accelerated lambing programs, restricting flexibility to integrate lambing into other farm activities and limited access to favorable seasonal markets. Environmental or hormonal stimulation of reproduction requires increased investment in feed, labor and facilities, increases cost of production, often requires access to products that are not readily available or not approved for use in sheep and may not be feasible in extensive or semi-extensive production systems. However, substantial evidence exists to document genetic differences in seasonality of breeding, leading to opportunities to reduce seasonality by selection.

Sheep productivity is the most important criteria for the evaluation of total profitability in sheep enterprises. High productivity is achieved through the optimization of reproduction of ewes, as well as survival and growth of lambs.

Natural and economical conditions, agricultural characteristics, pasture areas and traditions which are made suitable condition for to generalize of sheep breeding in Turkey. The main native sheep breed of Thrace and Marmara region is Kivircik.

In this context, an increase in the number of lambing per ewe per year seems to be a plausible reproductive strategy to achieve that goal. In fact, other studies have demonstrated that obtain more than one lambing per ewe per year is feasible in some sheep breeds[4-6].

The aim of this study was to evaluate under stall-fed conditions the reproductive efficiency of Kivircik ewes in accelerated lambing schemes during a 2 year period.

MATERIALS AND METHODS

The experiment was conducted at the Research Farm of Uludag University in Bursa province, Turkey. The study considered a total of 111 Kivicik ewes, 2 to 4 years old, with an average live weight of 51.4±9.4 kg. Ewes were bred to lamb every eight months, three times in 24 months.

Experimental breeding began at July (n = 111), the second breeding initiated at March (n = 107), while the last one initiated on November (n = 86). The observed drop (-22.5%) in the number of ewes mated between the first and the last experimental breeding occurred because of the normal discarding process of ewes with reproductive and other problems. Both ewes and rams were kept under stall-fed conditions during the experimental period and allowed to natural grass hay *ad libitum* and mineral licks. Before and after mating, last period of gestation and after birth ewes received concentrate supplement (200-300 g/head/day) consisting of 75% wheat, 23% sunflower oil cake, 1.4% limestone, 0.5% salt and 0.1% premix. Average diet composition was 16.7% CP and 11.3 MJ Digestible Energy (DE) per kg DM.

Six Kivircik rams, 3 to 5 years old and proven libido and fertility were joined experimental breeding group at the beginning of each breeding date. Ewes and rams were kept together during a 45-days period within experimental groups. Ewes about to lamb were placed either in drop pens or lambing corrals, depending upon the flock size and available facilities. After lambing, ewes and lambs were placed in lambing pens for better care and then moved to mixing pens within 1-3 days. Problem cases required longer stays in lambing pens. If it was determined that the ewe could not rear all her lambs, lambs were fostered or transferred to a nursery facility. In addition to the ewe's milk, the lambs were offered hay and a concentrate mixture (max. 300 g per lamb per day to weaning). Management and feeding procedures for different seasons born lambs were quite similar until weaning. Within each flock, lambs reared by ewes were weaned at approximately 8 weeks of age and nursery lambs at the age of 6 weeks. After weaning the lambs born in springtime were reared cultivated grass pasture without any supplements. The lambs born in other seasons were fed in doors hay *ad libitum* supplemented with concentrates. At birth, lamb identification number, birth date, type of birth and sex were recorded for each lamb.

Least squares analysis was used to evaluate the significance and magnitude of the effects. All analyses were performed using the GLM procedure[7].

RESULTS AND DISCUSSION

Breeding date affected litter size at birth ($p<0.01$), weaning lamb survival ($p<0.05$), weaning rate ($p<0.01$) and productivity index ($p<0.05$), but not lambing rate over the two-year experimental period. July breeding (in-season) displayed the highest overall reproductive efficiency (Table 1). While lambing rate was similar over the three breeding dates, the lowest prolificacy was observed in those ewes bred during the November breeding. In fact, both July and March breeding dates generated the largest ($p<0.01$) litter size at birth as in the study of Urritia *et al.*[8]. The reverse tendency was recorded by Walton and Robertson[9] who found that the prolificacy of ewes lambing in the autumn was higher than that of ewes lambing in spring. The reductions in litter size have been shown to be associated with reductions in ovulation rate[10]. Frequency of oestrus and conception rate is associated with season and they are highest in autumn[9,11]. On the contrary, Notter and Copenhaver[5] reported that the season of maximum conception rate did not correspond to the season of maximum litter size. Hulet *et al.*[10] observed embryonic mortality associated with season. High temperature and poorer feeding management in Summer time may increase embryonic mortality and thus decreased litter size[12]. Also male fertility i.e. exhibition of libido and semen quality affect litter size, both being best at autumn[13]. Lamb survival at weaning was also affected by breeding date but displayed a different trend; while there was not difference between the March and November breeding, the highest ($p<0.05$) survival was observed from these ewes bred during July, which was the first breeding of the experimental scheme.

Table 1: Reproductive performance of Kivircik ewes

	Breeding season		
	July	March	November
Ewes (No.)	111	107	86
Lambing rate (%)[1]	89.60±6.2	90.50±01.6	92.20±2.50
Litter size at birth	1.56±0.12[a]	1.54±0.22[a]	1.31±0.13[b]
Lamb survival at weaning (%)	94.70±0.4[d]	90.40±1.7[e]	91.30±4.6[e]
Weaning rate (%)[2]	147.60±10.9[a]	139.40±18.3[a]	120.00±13.3[b]
Productivity index (%)[3]	1.32±0.10[d]	1.26±0.15[d]	1.11±0.11[e]

[1]Lambing rate, expressed as the number of (lambed ewes per ewe exposed) 100, [2]Weaning rate, expressed as the number of (lambs weaned per ewe lambed) 100, [3]Productivity index, expressed as the number of (lambs weaned per ewe exposed) 100, [a,b]Values within line with different superscripts, differ ($p<0.01$), [d,e]Values within line with different superscripts, differ ($p<0.05$)

Lamb survival at weaning depicted a slightly decrease as number of lambing advanced, situation that could reflect a possible handicap when more intensive reproductive schemes are developed. In fact, Fogarty *et al.*[6] stated that a slightly depression in reproductive efficiency in a proportion of ewes exposed to an 8 mounth lambing intervals seems to be an integral feature of an accelerated lambing system.

Ewe's parturition number did not affect lambing rate, prolificacy was affected ($p<0.05$) by this variable, showing a positive relationship between them (Table 2). Due to the fact that lamb survival at weaning was not affected by ewe's age, weaning rate depicted a similar trend to that displayed by prolificacy (Table 3).

Table 2: Lambing rate and prolificacy according to ewe's age and breeding season for Kivircik ewes

Ewe's age (year)	Breeding season: July	March	November	Average
Lambing rate (%)				
2	94.9	90.0	92.1	92.3±2.5
3	91.3	92.3	94.7	92.8±1.7
4	82.8	89.3	89.7	87.3±3.9
Prolificacy				
2	1.43[a]	1.44[a]	1.26[b]	1.38±0.10
3	1.67[a]	1.39[b]	1.22[b]	1.43±0.23
4	1.58[b]	1.80[a]	1.46[b]	1.61±0.17

[a,b]Values within line with different superscripts, differ ($p<0.05$)

Table 3: Lamb survival at weaning and weaning rate according to ewe's age in Kivircik ewes

Ewe's age (year)	Breeding season: July	March	November	Average
Lamb survival at weaning (%)				
2	95.0	92.3	86.4	91.2±4.4
3	94.3	90.0	95.5	93.3±2.9
4	94.7	88.9	92.1	91.9±2.9
Weaning rate (%)				
2	135.7[a]	133.3[a]	108.6[b]	125.9±15.0
3	157.1[a]	125.0[b]	116.7[b]	132.9±21.3
4	150.0[a]	160.0[a]	134.6[b]	148.2±12.8

[a,b]Values within line with different superscripts, differ ($p<0.05$)

Table 4: Number of lambing, litter size at birth and litter size at weaning according to ewe's age in Kivircik ewes

Ewe's age (year)	Number of lambing per year	Litter size at birth	Litter size at weaning
2	1.27±0.20[c]	1.68±0.10[b]	1.56±0.15[c]
3	1.32±0.18	1.73±0.23[b]	1.63±0.21
4	1.41±0.17[d]	1.91±0.37[a]	1.78±0.13[d]

[a,b]Values within column with different superscripts, differ ($p<0.01$),
[c,d]Values within column with different superscripts, differ ($p<0.05$)

Table 5: Number of lambing, litter size at birth and litter size at weaning from Kivircik ewes breeding a yearly breeding scheme (July breeding) and ewes breed under three cycles of accelerated breeding (annual basis)

	Yearling breeding	Accelerated breeding
Lambing per year	1.00±0.0[b]	1.33±0.07[a]
Litter size at birth	1.56±0.12[d]	1.77±0.22[c]
Litter size at weaning	1.48±0.11[d]	1.66±0.21[c]

[a,b]Values within line with different superscripts, differ ($p<0.01$),
[c,d]Values within line with different superscripts, differ ($p<0.05$)

The three lambing per two-year production system generated, on an annual basis, an average of 1.33±0.07 lambing per ewe, with a production of 1.77±0.22 lambs born and 1.66±0.21 weaned lambs per ewe per year (Table 4 and 5). Lambing frequency was lower to the 1.44 lambing per ewe per year reported by Urutia *et al.*[8] for Merino Rambouillet ewes bred to lamb three times in 2 years and was higher to the 1.21 lambing per ewe per year reported by Land and McClelland[14] for Finn x Dorset ewes and to the 1.18 lambing per ewe per year reported Sormunen-Cristian and Suvela[15] for Finnish Landrace ewes. In litter size at birth and litter size at weaning significant differences ($p<0.05$) were obtained between the accelerated and yearling breeding flocks.

The generated reduction in the lambing interval of this accelerated breeding scheme, promoted an increased lamb production at birth (15%) and at weaning (19%) per ewe per year when compared to the July breeding. The calculations based on the above data showed that the profitability of the conventional breeding system was clearly better than that of the accelerated lambing system[15].

Lambing frequency and litter size are important components of an efficient lamb production system. The accelerated lambing system discussed in this study three lambing in two years as opposed to the normal single season production system- is designed to increase the number of lambs produced per ewe per year as a more economical alternative for the producer to market an even supply of lambs over the year. However, not all breeds of sheep are suitable for year-round breeding. Therefore it would be obvious that the accelerated lambing with prolific ewes should provide an excellent opportunity to increase the efficiency of lamb meat production. Nevertheless, the out-of-season breeding system is not generally used in our country, because little has been done to characterize the productivity of frequently lambing Kivircik ewes maintained in the Kivircik environmental conditions. But the present study Kivircik ewes showed good production potential in a system requiring improved prolificacy or accelerated lambing schedules.

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