

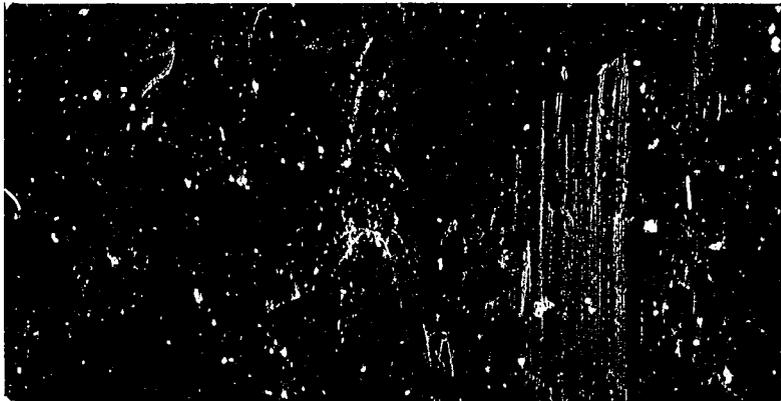
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**FERTILITY OF CRIOLLO AND JUNIN FEMALE
SHEEP IN THE CENTRAL SIERRA OF PERU**

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FERTILITY OF CRIOLLO AND JUNIN FEMALE
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SUMMARY

A group of 120 Criollo and 120 Junin ewes (30 each of 1.5, 2.5, 3.5 and 4.5 years of age) were used to measure the fertility levels under the traditional management system of SAIS Tupac Amaru, Central Sierra, Peru (12° South latitude, 76° West longitude, 3,600 - 4,200 m elevation). During three years (April 1981 - April 1984), all animals were managed and grazed on native pasture as a single flock. Natural matings by breed for 65 days beginning on May 3, with 4 - 5% of fertile rams, were conducted. The second and third years, each age group was assigned to the next older age group, a new group of 1.5 year old ewes was added and the older group removed from the study for each breed. The overall fertility was 74.5%, 1.45% abortion and 1.01 prolificacy. The Criollo sheep showed significantly ($P < 0.01$) lower fertility rate (64.7%) compared to Junin (84%). The abortion and prolificacy rates were low and similar among breeds. No differences ($P > 0.05$) of fertility rates were found between age groups within

the Junin breed but significant differences ($P < 0.01$) occurred within the Criollo breed. Criollo lamb birth weights (2.6 kg) and ewe lambing body weights (25.8 kg) were significantly lower ($P < 0.05$) than the Junin (3.8 and 41.2 kg). Ewes 1.5 years old produced significantly ($P < 0.05$) lighter lambs compared to ewes 2.5 - 4.5 years old. When the lamb birth weights were adjusted by lambing weight of the dam, both breeds produced the same weight of lamb per unit of body weight of the ewes parturiting.

FERTILIDAD DE OVEJAS CRIOLLA Y JUNIN EN LA SIERRA CENTRAL DEL PERU

RESUMEN

Un grupo de 120 ovejas criollas y 120 ovejas Junín (30 de 1.5, 2.5, 3.5 y 4.5 años de edad) fueron utilizadas para medir los niveles de fertilidad bajo el sistema tradicional de manejo de la SAIS Tupac Amaru, Sierra Central, Perú (12° Latitud sur, 76° Longitud oeste, 3,600 - 4,200 m de elevación). Durante tres años (Abril 1981 - Abril 1984), todas las ovejas reunidas en un rebaño fueron manejadas y pastoreadas en pradera nativa. La monta natural, en grupos separados por raza, fue conducida por 65 días, iniciándose el 3 de mayo, con una proporción de 4-5% de carneros. En el segundo y tercer año, los animales de 1.5, 2.5 y 3.5 años de edad fueron asignados a los grupos de 2.5, 3.5 y 4.5 años de edad, por raza, respectivamente. Un nuevo grupo de ovejas de 1.5 años de edad para cada raza fue incorporado cada

año, y los animales que cumplieron 5.5 años de edad fueron descartados del rebaño experimental. En promedio general, la fertilidad fue de 74.5%, 1.45% de abortos y 1.01 de prolificidad. La raza Criolla mostró una significativa ($P < 0.01$) baja fertilidad (64.7%) comparada con Junín (84%). La incidencia de abortos y la prolificidad fue similar entre razas. La fertilidad entre edades dentro de la raza Junín fue estadísticamente similar ($P > 0.05$), mientras que en la raza Criolla estas diferencias alcanzaron el nivel de significación ($P < 0.01$) estadística. Los pesos al nacer de los corderos (2.6 kg) y los pesos al parto de las ovejas Criollas (25.8 kg) fueron estadísticamente inferiores ($P < 0.05$) a los obtenidos en la raza Junín (3.8 y 41.2 kg). Ovejas de 1.5 años de edad produjeron corderos significativamente más livianos ($P < 0.05$) que aquellos corderos nacidos de ovejas de 2.5 - 4.5 años de edad. Cuando los pesos al nacer de los corderos fueron ajustados por covariancia con pesos al parto de sus madres, ambas razas produjeron el mismo peso de cordero por unidad de peso de oveja madre al parto.

Introduction

Criollo and Junin sheep are indigenous to the Peruvian Los Andes range. The Criollo sheep constitute the majority of the sheep population. They originated from Churra and Merino brought initially by the Spanish colonizers (Flores Ochoa, 1977). The Junin sheep is a breed developed in Peru, based on Criollo and Corriedale ewes and Romney, Columbia, Panama and Corriedale rams

(Calle, 1968). This breed is mainly utilized by the large sheep enterprises in the Central Sierra and to a lesser extent by the small sheep growers.

Information on sheep reproduction and production performance in Peru is scarce. However, the SAIS Tupac Amaru reported 86 percent fertility at lambing under improved management conditions. The level of fertility and lamb crop at the small community flocks is unknown, but seems to be far below its potential.

The reproductive efficiency in sheep results from the interaction of many factors. It is determined primarily by levels of fertility, prolificacy and lifetime productivity of the ewes and survivability and growth rate of the lambs.

This study was carried out under high Central Sierra range conditions with the aim of evaluating the influence of age at breeding on fertility, prolificacy and birth weight of lambs at birth and ewes at parturition in the Criollo and Junin breeds.

Materials and Methods

This study was conducted from April 1981 to April 1984 at the SAIS Tupac Amaru, Consac, Central Sierra of Peru (12° South latitude and 76° West longitude; 3,600-4,200 m elevation). Ninety Criollo ewes were selected at random (30 for each age group: 1.5, 2.5 and 3.5 years) from small community flocks near SAIS Tupac Amaru. Ninety Junin ewes (30 each of 1.5, 2.5 and 3.5

years of age) were selected at random from SAIS Tupac Amaru flock as indicated in Table 1.

All animals were managed and grazed on native pasture as a single flock during the study. Natural matings were conducted by breed for 65 days beginning on May 3 of each year, with 4 - 5 % rams previously determined to have good semen quality. The breeding season and management techniques were those used routinely by the SAIS Tupac Amaru in order that the lambings should occur during the regular lambing period of October and November.

The second and third year, each age group was assigned to the next older age group. A new group of 1.5 year old ewes was added each year. The older age group was kept providing a group 4.5 years of age for years 2 and 3. The statistical analysis was performed using the following model:

$$Y_{ijk} = \mu + B_i + A_j + AB(ij) + E \text{ where}$$

B = Breed (Criollo, Junin)

A = Age (1.5, 2.5, 3.5, 4.5 years)

Results

Table 2 shows the levels of fertility, abortion, prolificacy and live body weight of ewes and birth weight of lambs by breed and age groups and their interactions. The overall fertility rate was 74.5 percent, 1.45 percent abortion, and 1.01 prolificacy. The Criollo sheep showed significantly ($P < 0.01$) lower values for fertility rate (64.7%), live body birth weights of lambs (2.6

± 0.05 kg), and body weights at parturition of ewes (25.8 ± 0.29 kg) compared to Junin sheep (84%, 3.8 ± 0.04 kg and 41.2 ± 0.27 kg). The abortion and prolificacy rates were low and similar among breeds.

The fertility rates were statistically different ($P < 0.01$) between age groups of ewes. Younger animals showed lower fertility than older ewes. No differences ($P > 0.05$) of fertility rates were found between age groups within the Junin breed. Statistically significant ($P < 0.01$) breed x age interaction was found in the Criollo than Junin characterized by a lower growth rate. The birth weight was significantly ($P < 0.05$) lighter for lambs born from 1.5 year old ewes, than for lambs born from ewes of 2.5, 3.5 and 4.5 years old; the older age groups did not differ statistically ($P > 0.05$). The mean weight at parturition of 2.5 and 3.5 year old ewes (34.8 ± 0.4 and 34.7 ± 0.33 kg) was statistically ($P < 0.05$) heavier than of 1.5 and 4.5 year old ewes (32.4 ± 0.49 and 32.2 ± 0.35 kg). When the birth weights of lambs were adjusted using the parturition weight as a covariable, no statistical differences were found among breeds, ages and interactions (Table 3). This indicates that the differences shown in Table 2 are due primarily to the size of the breed. A positive significant correlation ($r = 0.711$) among lamb birth weights and ewe parturition weights was found. Consequently, both breeds are producing the same amount of lamb per unit of body weight of the ewe parturiating.

Discussion

The overall fertility rate obtained in the Central Sierra of Peru was low (74.5%). The lowest fertility was found in Criollo sheep due primarily to the low fertility of 1.5 year old ewes (37.3%). No differences in fertility rate were found between ages in Junin sheep. However, Turner (1969) indicated that the reproductive performance is affected by the age of the ewe. Moreover, Bindon and Piper (1978) suggested that records of first lambings should be ignored and evaluation of fertility performance should be based on successive lambings. The age effect on fertility seems to be expressed more in Criollo sheep than in Junin presumably because of the slower growth rate of Criollo. The reproductive efficiency is the result of a complex genetic-environmental interaction. It is difficult to isolate the factors responsible. Reports on the relationship between live body weight of the ewe and ovulation rate (Cumming, 1977) disagree with Coop (1966) who sustained the low effect of ewe body weight on prolificacy. This seems to be in agreement with the findings that the lighter Criollo breed and heavier Junin breed had similar ($P > 0.05$) lambing rates. On the other hand, body weight as a reflection of nutritional state was probably too low for full genetic potential to be experienced.

The high elevation has been shown to exert a negative influence on embryo survival (Grahn and Kratchman, 1963; Mazess, 1965). If this factor plus a low ovulation rate in high Central

Sierra are involved, the reduced fertility is a consequence of ova loss and/or embryo/fetal mortality.

The influence of live body weight within breed on fertility rate seems to be important (Killeen, 1967). Criollo sheep of 4.5 years old had the heaviest body weight and consequently higher fertility. Junin ewes of 2.5 and 3.5 years old had significantly heavier body weights and higher fertility rates compared to 1.5 and 4.5 year old ewes. The ovulation and lambing rates in both breeds and ages were similar, indicating an overall low twinning potential of these breeds in the high Central Sierra of Peru as has been demonstrated by Vivanco et al. (1984).

In conclusion, fertility is lower in young Criollo sheep but improves as the age increases. In Junin sheep, no influence of age on fertility rate was found. The Junin sheep showed a higher fertility rate than Criollo sheep. No differences were found among breeds and ages on lambing rates. Both breeds produce the same quantity of lamb at birth per unit of body weight of ewes lambing. It is still unclear why the lambing rate of these two breeds of sheep is low.

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Table 1. Experimental design and number of ewes by breed and age.

Breed	Age (years)				Total
	1.5	2.5	3.5	4.5	
Criollo	30	30	30	30	120
Junin	30	30	30	30	120
Total	60	60	60	60	240

Table 2. Mean (\pm SE) reproduction traits of ewes in the Central Sierra of Peru (April 1981 - April 1984).

Variables	Fertility %	Abortions %	Prolificacy n	Live Body Weights (kg)	
				Birth	Lambing
Overall	74.5	1.45	1.01	3.4 \pm 0.05	35.0 \pm 0.43
Breed (X ² , F) ¹	26.6**			**	**
Criollo	64.7a	1.41	1.01	2.6 \pm 0.05a	25.8 \pm 0.29a
Junin	84.0b	1.49	1.00	3.8 \pm 0.04b	41.2 \pm 0.27 ^b
Age ² (X ² , F)	48.3**			**	**
1.5	49.5a	3.81	1.00	2.9 \pm 0.95a	32.4 \pm 0.49a
2.5	71.3b	0.74	1.01	3.3 \pm 0.64b	34.8 \pm 0.40 ^b
3.5	82.3c	0.00	1.01	3.4 \pm 0.53b	34.7 \pm 0.33b
4.5	85.2d	2.22	1.01	3.2 \pm 0.60b	32.2 \pm 0.35 ^a
Breed x Age (X ² , F)	9.7**			*	**
Criollo x 1.5	37.3a	5.33	1.00	2.3 \pm 0.15a	24.2 \pm 0.63a
Junin x 1.5	80.0c	0.00	1.00	3.6 \pm 0.12d	40.6 \pm 0.74 ^d
Criollo x 2.5	60.5b	0.00	1.02	2.6 \pm 0.10b	26.1 \pm 0.62b
Junin x 2.5	85.0cd	1.67	1.00	4.0 \pm 0.09e	43.5 \pm 0.51 ^e
Criollo x 3.5	76.5c	0.00	1.00	2.7 \pm 0.08c	26.7 \pm 0.52b
Junin x 3.5	87.8cd	0.00	1.01	4.1 \pm 0.07e	42.7 \pm 0.40 ^e
Criollo x 4.5	93.6d	0.00	1.02	2.7 \pm 0.10bc	26.1 \pm 0.56b
Junin x 4.5	80.7c	3.41	1.00	3.6 \pm 0.07d	38.2 \pm 0.41 ^c

1 X² = Chi square for fertility and F test for weights.

2 Age of the ewes in years.

* P < 0.05, ** P < 0.01

P < 0.05 for means with different superscript letters by columns within main effects.

Table 3. Least square means (\pm SE) of birth weight adjusted by regression of the others parturition weight.

Variables	n	Birth Weights
Overall	347	3.45 \pm 0.04
<u>Breed</u>		
Criollo	130	2.75 \pm 0.47a
Junin	217	3.87 \pm 0.64a
<u>Ages (years)</u>		
1.5	37	3.14 \pm 0.78a
2.5	80	3.53 \pm 0.86a
3.5	124	3.62 \pm 0.78a
4.5	106	3.29 \pm 0.73a
<u>Breed x Ages</u>		
Criollo x 1.5	13	2.39 \pm 0.42a
Junin x 1.5	24	3.55 \pm 0.60a
Criollo x 2.5	32	2.81 \pm 0.38a
Junin x 2.5	48	4.01 \pm 0.74a
Criollo x 3.5	47	2.85 \pm 0.38a
Junin x 3.5	77	4.10 \pm 0.54a
Criollo x 4.5	38	2.68 \pm 0.58a
Junin x 4.5	68	3.63 \pm 0.57a

P > 0.05 for means with same superscript lettes within main variables.