RESEARCH ON THE IMPACT OF FATTENING TECHNOLOGIES ON THE GROWTH AND DEVELOPMENT OF RAM LAMBS

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Abstract

The research was carried out at the Research and Development Institute for Sheep and Goat Breeding Palas Constanța on 4 batches of ram lambs from the Palas Merino breed and crossbreeds of the Palas Meat Breed x Palas Merino. These batches were tested for productive performance in intensive fattening, applying two feeding systems: one uniform throughout the entire period, and one differentiated across the three stages of fattening (acclimatization, proper fattening, and finishing). Each batch consisted of 20 ram lambs, which were homogeneous in terms of body weight, age and sex.

The daily average gains in the two feeding systems applied to the Palas Merino lambs were 299 ± 9g and 294 ± 12g, while the daily average gains achieved by the crossbreeds of the Palas Meat Breed x Palas Merino were 328 ± 9g and 320 ± 10g, respectively.

Following the experiments, it was concluded that for fattening lambs for meat, either of the two feeding systems can be used: a uniform system in terms of energy and protein throughout the entire period, or a system differentiated into the three phases (acclimatization, proper fattening, finishing), depending on the resources available on the farm. The protein level in the rations used for fattening lambs of genotypes (breeds) specialized for meat can be higher than 16%, calculated over the entire fattening period.

The perimeter of the gigot and the width at the coxofemoral joints showed higher values in the F1 crossbreeds of the Palas Meat Breed x Palas Merino, being 24.8% and 14.24% higher, respectively, compared to the Palas Merino breed lambs. This finding supports breeders' interest in producing crossbreed lambs for meat.

Key words: *acclimatization, breed, fattening, palas merino, yield*

INTRODUCTION

In the current sheep breeding conditions, breeders who want to produce lambs for meat in the shortest possible time must pay special attention to their feed as well as to other aspects that can influence the intensity of growth. The changes in the current exploitation systems and the reduction in the number of large complexes where lambs were intensively fattened for meat constituted the time for breeders to adapt and apply other fattening alternatives.

Many studies done in Romania [1,2,3] have proven that the biological potential for meat production differs significantly, the differences between breeds are due to the specific precocity and fattening technology used. Quantitative and qualitative sheep meat production can also be achieved by fattening (finishing) sheep intended for reformation. Thus, good fattening gains and a qualitative improvement of the carcasses obtained result from subjecting reformed sheep to fattening before slaughter [4,5].

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Research carried out in recent decades has proven that precocity is a characteristic of improved breeds that causes a simultaneous development of muscle, adipose and bone tissues.

These refer to several aspects related to the age and weight of introduction to fattening, the reduction of fattening phases, the energy and protein value of the fodder recipe used.

In order to support breeders who produce lambs for meat, 2 intensive fattening systems were compared at RDISGB Palas, namely: a system organized on the three known fattening phases (accommodation, actual fattening, finishing) and a system in which uniform feeding was applied throughout the fattening period.

MATERIAL AND METHOD

The research was carried out at R.D.I.S.G.B. Palas Constanța on lambs from the Merinos de Palas breeds and mestizos obtained from the Palas x Merinos de Palas Meat Breed introduced for fattening after weaning.

Thus, the batches of intensive fattening of young sheep were established in two feeding systems, uniform and differentiated, which lasted 70 days, respecting the experimental scheme presented below.

The accommodation phase lasted 15 days and had the role of getting the animals used to the new maintenance and feeding system, the actual fattening phase 48 days and the finishing phase 7 days.

The food administered to the groups with a differentiated regime had a protein intake of 14.5% D.P and an energy intake of 85% N.U. during the accommodation period, during the actual fattening period a ratio of 16% D.P and 100% N.U was provided, and in the finishing phase 18% D.P and 110% N.U, according to the experimental scheme presented in Table 1.

In the groups with a uniform feeding regimen, 16% D.P and 100% N.U were ensured during the entire fattening period.

Table 1 Experimental scheme

Specification	Period					
	Accommodation (15 days)		Actual fattening (48 days)		Finishing (7 days)	
	D.P %	N.U%	D.P %	N.U%	D.P %	N.U%
Uniform nutritional level	16	100	16	100	16	100
Differentiated nutritional level	14.5	85	16	100	18	110

The structure of the ration administered during the accommodation period consisted of a mixture of fibrous and concentrated, according to table 2. The nutritional level of the rations was calculated in such a way that during the entire experimental period of 70 days, in both versions, an intake of similar nutrients was ensured.

Table 2 The structure (%) of the feed mixture administered during the accommodation period

Specification	**%**
Alfalfa hay	29
Barley grains	24
Corn kernels	24
Sunflower seed	20
Salt	1
Chalk	1
Vitamin-mineral premix	1
Total	100

The actual fattening phase lasted 48 days. In this phase all groups received the same nutrient level, namely 16% D.P and 100% N.U, as the groups with uniform feeding, according to the experimental scheme.

The compound feed recipe administered during the actual fattening phase is shown in table 3.

Table 3 The structure (%) of the combined feed mixture used in the fattening phase itself

Specification	**%**
Maize	35.7
Wheat stalks	18
Wheat	15
Sunflower seed	10.5
Soybean meal	**5**
Beetroot noodles	4
Alfalfa	6
Palm oil	1
Vitamin-mineral premix	0.5
Calcium carbonate	2.8
Ammonium bicarbonate	0.5
Sodium chloride	0.5
Salt	0.5
Total	**100**

Differently fed groups received during the period of accommodation and finishing a concentrated feed mixture consisting of barley, corn, meal and alfalfa granules in the amounts established to ensure the projected energy and protein requirements.

The finishing phase lasted 7 days and ensured a percentage of 18% D.P and 110% N.U in batches with differentiated levels. The lambs received a daily fodder ration based on a mixture of concentrates and 0.3 kg of alfalfa hay (table 4).

Table 4 The structure (%) of the feed mixture administered during the finishing period

Specification	%
Barley grains	10
Corn kernels	67
Sunflower seed	18
Salt	3
Chalk	1
Vitamin-mineral premix	1
Total	100

The food administered was weighed daily, per batch, and the leftovers were collected every 2-3 days. The animals were kept in lots, in collective boxes ensuring a surface of 0.7 m^2 /head. The feeding was done in the feeding troughs, the feeding front being 20-30 cm/head. Before starting the experiment, the animals were individually subjected to the deworming and scab prevention process.

The increase in weight gain, the daily and specific consumption of feed and nutrients were determined, at the same time experimental slaughters were carried out to establish some quantitative and qualitative indices of the carcasses.

After finishing the fattening, experimental slaughters were made, choosing three lambs from each batch, since the body development of the lambs was not influenced by the feeding system within the breed. Slaughter yield 1 and yield 2 were determined according to the following formulas:

$$\text{Yield 1} = \frac{\text{Cooled carcass weight (kg)}}{\text{Live weight (kg/head)}} x\ 100$$

$$Yield\ 2 = \frac{\text{Chilled Carcass Weight (kg)}}{\text{Empty Live Weight} * \text{(kg/head)}} x\ 100$$

*Empty live weight from which the gastrointestinal mass has been subtracted. [6,7]

Measurements were carried out and determined on the case, and specific indices were calculated at the same time.

The compactness indices of the leg, the muscularity index of the gigot and the muscularity index of the thigh were calculated according to the following formulas:

$$\text{C.I.G} = \frac{\text{Width of coxofemural joints}}{\text{Length of gigot}} x100$$

Muscularity index of the gigot [8]

$$\text{M.I.G} = \frac{\text{Perimeter of the gigot}}{\text{Lenght of gigot}} x100$$

Thigh muscularity index [9]

$$T.M.I. = \frac{\sqrt{\frac{G}{F}}}{LF}$$

G.- the weight of the thigh muscles.
F. – femur weight (in grams)
LF. - femur length (cm).

To test the statistical significance of the differences between the mean values of the studied parameters, the variable analysis algorithm (ANOVA Single Factor) was used.

RESULTS AND DISCUSSIONS

The evolution of the body weight of the lambs from the four experimental groups, during the 70 days of intensive fattening, is presented in table 5.

Table 5 The dynamics of weight gain of lambs during the fattening period

No	Batches	$\frac{x \pm s_{\bar{x}}}{V\%}$	Body weight at the beginning of the experience (kg)	Body weight at the end of the experience (kg)	Average daily gain (g)	Average daily gain - accommodation period (d)	Average daily gain actual fattening period (g)	Average daily gain- finishing period (g)
1	Palas Merino uniform feeding	$x \pm s_{\bar{x}}$	20.63±1.315	41.143±1.667	299±9	-	-	-
		V%	24,686	15.0991	11.2670	-	-	-
2	Palas Merino differentiated feeding	$x \pm s_{\bar{x}}$	19.52±0.671	39.533±1.2073	294±12	313±18	284±12	324±35
		V%	13,307	11,821	15,384	22,699	16,585	42,404
3	Palas Meat Breed x Palas Merino uniform feeding	$x \pm s_{\bar{x}}$	18.053±0.866	40.333±1.120	328±9	-	-	-
		V%	18,586	10,753	11,117	-	-	-
4	Meat Palas Breed x Palas Merino differentiated feeding	$x \pm s_{\bar{x}}$	20.660±0.876	42.433±1.355	320±10	341±16	330±14	213±18
		V%	16,428	12,365	12,360	17,723	16,204	33,43

Thus, the experimental groups from the Palas Merino breed at the time of introduction to fattening had a body weight of 19.52 ± 0.671kg and 20.63 ± 1.315kg, and the mixed groups of the Palas Meat Breed x Palas Merino had a body weight of 18.053 ± 0.866kg and 20.660 ± 0.876kg. At the end of fattening, the body weight of the Palas Merino lambs was 41,143 ± 1,667kg and 39,533 ± 1,207kg respectively, the lambs from the two groups registering similar average daily gains, respectively 299 ± 9g in the case of uniform feeding and 294 ± 12g in the case of differentiated feeding.

Anova: Single Factor

SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Palas Merino Uniform	20	4.191176471	0.299369748	0.001137781
Palas Merino Differentiated	20	4.414705882	0.294313725	0.002050132
ANOVA				
Source of Variation	*SS*	*df*	*P-values*	*F crit*
Between Groups	0.000185114	1	0.737236782	4.210008468
Within Groups	0.043492997	27		
Total	0.043678111	28		

Following the ANOVA analysis, the results obtained indicate a P value of 0.7372, significantly higher than the standard significance threshold of 0.05. This suggests that the probability that the observed differences between the two groups are due to chance factors is very high, over 73%. Consequently, there is insufficient evidence to reject the null hypothesis, which states that there are no significant differences between the means of the two groups.

P value of 0.7372 shows us that the differences between Palas Merino Uniform and Palas Merino Differentiated group are not statistically significant.

In crossbred lambs from the Palas Meat Breed x Palas Merino breed, the average daily gain was 328 ± 9g in the case of uniform feeding and 320 ± 10g in the case of differentiated feeding. From the data obtained from both breeds, no significant differences were revealed in terms of the growth gains achieved in relation to the type of feeding administered during the intensive fattening period, but significant differences ($p<0.05$) were recorded between the two genotypes within each feeding system, in favor of F1 crossbreeds (Rasa de Carne Palas x Merinos de Palas).

The data obtained in the present experiment are superior compared to those obtained by crossing sheep from the Merino breed of Transylvania with rams from breeds specialized for meat production (Suffolk, Merinofleisch and Berrichon du Cher) [10]. Thus, from their study, it is found that the groups subjected to fattening recorded average daily gains, which are presented in table 6.

Table 6 Results obtained during the fattening of crossbred and purebred lambs (Maier, R., cited by Pascal C., 2007)

Variant	Initial weight (kg)	Final weight (kg)	Average daily gain (g)
	$\bar{x} \pm s_{\bar{x}}$	$\bar{x} \pm s_{\bar{x}}$	$\bar{x} \pm s_{\bar{x}}$
Suffolk x Transylvanian Merino	18.011 ± 0.97	43.117 ± 1.80	209 ± 8.92
Merinofleisch x Transylvanian Merinos	15.864 ± 0.53	41.382 ± 1.04	212 ± 7.81
Berrichon du Cher x Transylvanian Plain Merino	15.864 ± 0.53	41.342 ± 1.04	212 ± 7.81
Transylvanian plain merino	18.305 ± 0.35	42.147 ± 0.76	198 ± 6.08

From the presented table, the four batches achieved similar weight gains, oscillating between 198 ± 6.08g for the Transylvanian Merino of the saddle and 212 ± 7.81g for the crossbred Merinofleisch x Merinos Transylvanian of the Saddle and Berrichon du Cher x Transylvanian plain Merino. It should be noted that the relative differences between the crossbreeds resulting from crossing the Transylvanian Merino with the Merinofleisch and Berrichon du Cher breeds achieved a higher average daily gain by 1.43% compared to the Suffolk x Transylvanian Merino variant and by 7.07% higher compared to the daily average obtained by fattening the Transylvanian Merino breed. Also, the crossbreeds Merinofleisch x Transylvanian Merinos and Berrichon du Cher x Transylvanian Merinos achieved the same average daily increase in weight, which was 212 ± 7.81g in both batches.

From the data on the consumption of feed and nutrients (Table 7) it emerged that the uniformly fed groups achieved a higher intake of dry matter, energy and protein compared to the differentially fed groups, in both breeds. As a result, in the conditions of achieving similar growth increments within each breed between the two feeding systems, it was found that in the case of differentiated feeding, a better efficiency of feed conversion into growth increment was achieved. Thus, in the Merinos de Palas breed with uniform feeding at an intake of 1 kg of SU, 260 g of increased growth was achieved, and in the differentiated fed group at an intake of 1 kg of SU, 285 g of increased growth was achieved.

In the F1 crossbreeds Rasa de Carne Palas x Merinos de Palas in the case of uniform feeding, the conversion efficiency was 257 g for 1 kg of SU ingested and 287 g/kg SU ingested in the case of differentiated feeding. This can be explained by the fact that the transition to a new level of feed, between the component periods of fattening, involves a period of accommodation with the new system which affects to some extent the daily intake of feed and nutrients and although the consumption is lower the degree of precocity of the race is manifested.

The obtained data reveal a better efficiency of the conversion of feed into growth boost in the case of the differentiated feeding system and regarding the two genotypes, for the F1 Rasa de Carne Palas x Merinos de Palas crossbreeds.

Table 7 Specific consumption of feed and nutrients

No.	Specification	Palas Merino uniform feeding	Palas Merino differentiated feeding	F_1 Palas Meat Breed x Palas Merino uniform feeding	F_1 Palas Meat Breed x Palas Merino differentiated feeding
1.	Dry matter (Kg)	3,849	3,509	3,891	3.48
2.	Energy/kg gain (N.U)	4,816	4.39	4.89	4.57
3.	Digestible crude protein/kg gain (g)	686	625	643	576
4.	Conversion efficiency (g) gain/kg D.M	259.8	285.0	257.0	287.0

In table 8, the data obtained after the slaughters performed revealed that the yield 1 at slaughter was higher by 4.44 percentage points in the F_1 Palas Meat Breed x Palas Merino crossbreeds (48.29%) compared to the yield 1 of the Palas Merino (43.85%), the differences being significant ($p<0.05$). The yield 2 at slaughter shows a similar difference of 4.43 percentage points in favor of the mixed-breed lambs F_1 Palas Meat Breed x Palas Merino, the differences also being significant ($p<0.05$).

Table 8 Slaughter yield in crossbred lambs F1 Meat Breed Palas X Merinos de Palas and to those from the Merinos de Palas breed

No. crt.	genotype	Yield at slaughter		± Difference between genotypes
		Y1	Y2	
		$\bar{x}\pm S\bar{x}$	$\bar{x}\pm S\bar{x}$	
1.	Palas Merino lamb	43.85±0.5448	52.11±1.7386	4.43 ($p<0.05$)
2.	Crossbreed lambs F1 Palas Meat Breed x Palas Merino	48.29±0.8184	56.54±0.7632	4.44 ($p<0.05$)

The main dimensions of the carcasses as well as some calculated constitution and conformation indices show higher values in the crossbreed group F1 Rasa de Carne Palas x Merinos de Palas (table 9).

Table 9 The main dimensions and indices on the carcass in lambs of the Merinos de Palas breed and crossbreeds F1 Meat Breed Palas x Merinos de Palas

No. crt.	Specification	Palas Merino	F1 Palas Meat Breed x Palas Merino
		$\bar{x}\pm S\bar{x}$	$\bar{x}\pm S\bar{x}$
1.	Case length (cm)	60.33±0.4387	61.67±1.0091
2.	Shoulder width (cm)	18.17±0.3102	21.17±0.6476
3.	Width at joints coxo-femoral (cm)	18.67±0.3102	21.33±0.5046
4.	Perimeter of gigot (cm)	40.33±1.2408	50.33±0.7136
5.	gigot length (cm)	24.33±0.6204	21.67±0.4387
6.	Gigot compactness index (C.I.G)	76.81±1.0975	98.56±1.3945 *
7.	Gigot Muscularity Index (M.I.G)	165.39±1.9565	232.54±2.1020 *
8.	Thigh Muscularity Index (T.M.I.)	0.467±0.0110	0.556±0.037 *

* compactness index of the gigot (C.I.G.) $p < 0.001$ - very significant differences
* muscularity Index Gigot (M.I.G.) $p < 0.001$ - highly significant differences
* thigh muscularity index (T.M.I.) $p < 0.001$- highly significant differences

The analysis of the measurements on the carcass revealed that for all the dimensions analyzed, the F_1 Palas Meat Breed x Palas Merino mixed breed lambs had superior values compared to the Palas Merino lambs. The biggest differences were recorded in the width dimensions. Thus, the perimeter of the gigot in mixed-breed lambs F_1 Palas Meat Breed x Palas Merino was 50.33 cm, 24.8% higher than its value in lambs from the Palas Merino breed (40.33 cm).

Carcass width at the coxo-femoral joints was also 14.24% greater in F_1 Palas Meat Breed x Palas Merino crossbred lambs (21.33cm) compared to Palas Merino lambs (18.67cm).

The three indices calculated, namely: the gigot compactness index (C.I.G), the Jig Muscularity Index (M.I.G) and the Thigh Muscularity Index (T.M.I), had higher, highly statistically significant values compared to the lambs from the Merinos de Palas breed. Thus, the compactness index of the jock (C.I.G.) was 98.56, the Muscularity Index of the gigot (M.I.G.) was 232.54 and the Thigh Muscularity Index (T.M.I.) was 0.556 in the F_1 crossbred lambs Palas Meat Breed x Palas Merino, while the same indices had values of 76.81, 165.39 and 0.467 respectively in Palas Merino lambs.

CONCLUSIONS

Following the experiments carried out, the conclusion was drawn that in the case of fattening lambs for meat, one of the two feeding systems can be used, namely - uniform in terms of energy and protein throughout the period or a system differentiated into 3 phases (accommodation, fattening proper, finishing) depending on the existing possibilities in the farm.

The protein level of the rations used for fattening lambs from genotypes (breeds) specialized for meat can have a value higher than 16%, calculated over the entire fattening period

The performances regarding the quality of the carcasses, respectively the perimeter of the jig and the width at the coxo-femoral joints, had superior values in the F1 crossbreds between the Palas Meat Breed x Palas Merino, these being 24.8% higher and 14.24% respectively compared to the lambs of the breed Palas Merino, a fact that can support the breeders concern for the production of crossbred lambs for meat.

The applied fattening technology must respect the existing elements in the technology used in this regard regarding the density of animals per surface unit, the provision of the feed and watering front, the performance of other works specific to the batches of lambs subjected to fattening.

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