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COMPARATIVE STUDY ON THE INTENSIVE FATTENING OF PALAS MERINO LAMBS AND PALAS MERINO × PALAS MEAT BREED HYBRIDS

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Abstract

Given the rising interest in sheep meat, this study aims to explore fattening technologies and improve meat production by crossing local breeds with specialized meat breeds. Research was conducted at R.D.I.S.G.B. Palas-Constanța to test the fattening performance of F1 hybrids (Palas Meat Breed x Palas Merino) compared to Palas Merino lambs. Two groups were intensively fattened for 100 days using granular feed with 87.9% dry matter, 2570 kcal, and 16% digestible crude protein. Initial body weights were similar (20.48-22.78 kg), with no significant differences ($p<0.05$). At the end, body weights ranged from 36.14 kg to 45.07 kg, with hybrids weighing 24.71% more ($p<0.01$). Average daily gain was 157-223 g, 42.04% higher in hybrids. Specific energy and protein consumption were 27.66% and 27.54% lower, respectively, in the F1 hybrid group. Conformation and constitution indices were superior in hybrids compared to Palas Merino lambs.

Key words*: body weight, Merino, meat, hybrids, yield.*

INTRODUCTION

Romanian research in the field of sheep breeding has long focused on improving meat production in local sheep breeds. This emphasis arises from the fact that attempts to breed and adapt specialized meat-producing sheep imported from other countries have not realized the expected results in Romania. These attempts have led to significant losses due to high mortality rates and a dramatic decline in reproductive parameters (Vicovan et al., 2009).

To enhance meat production quality in Romanian sheep breeds, the solution lies in developing F1 and R1 crossbreeds specifically for meat production. This involves using local sheep breeds crossed with genetically improved meat-producing breeds, thereby harnessing the benefits of heterosis (hybrid vigor), which results in increased vitality and performance in hybrid offspring compared to the parental lines (Dima et al., 2006; Draganescu, 2006; Pascal et al., 2009).

Given the current economic context, sheep breeding and production must be aligned with market demands while maintaining environmental sustainability. There is a growing trend toward refining rearing and fattening technologies for lambs, with a focus on developing breeds and genetic lines with superior meat production traits. Additionally, efforts are being made to produce high-quality carcasses that meet both quantitative and qualitative standards (Gutierrez et al., 2005; Kukovics et al., 2013).

Furthermore, it is necessary to reassess the profitability of sheep farming by creating highly productive crossbreeds. In developed countries, such as the United Kingdom, France, Spain, New Zealand, Australia and the United States, the preferred method involves industrial crossbreeding to obtain first-generation hybrids (F1) with superior carcass quality parameters (Pascal et al., 2009).

To support the advancement of meat-oriented sheep production, strategic emphasis must now be placed on integrating these genetic improvements into scalable and economically viable production systems. This involves not only the selection of superior genotypes but also

the adaptation of flock management practices that optimize reproductive efficiency, health status, and feed utilization across diverse production environments in Romania.

Equally important is the need to strengthen breeder networks and data collection infrastructures, which can facilitate the monitoring of performance indicators and accelerate genetic gain across herds. Partnerships between research institutions, breeding associations, and commercial farms are essential in this regard, enabling the dissemination of best practices and the alignment of genetic progress with market expectations.

Furthermore, Romania's geographic and ecological diversity offers an untapped opportunity for the regional specialization of meat sheep systems. Zones with favorable pasture availability and access to markets could be designated for intensive lamb fattening operations, while more extensive systems may be optimized for dam lines and hybrid lamb production. Developing such regional strategies would enhance both production efficiency and environmental sustainability.

Investing in farmer training, technical advisory services, and value chain development including slaughter, processing, certification, and marketing will be critical for transforming genetic potential into measurable economic outcomes. By fostering an integrated approach that combines genetics, technology, and market orientation, Romania can position itself as a competitive player in the European and international lamb meat sectors.

MATERIALS AND METHODS

The research was conducted at Research and Development Institute for Sheep and Goat Breeding Palas-Constanta on two groups, each consisting of 20 males from the current year, as follows: the first group it is consisted in Palas Merino lambs and the second group - F1 (Palas Meat Breed × Palas Merino) lambs.

The study focused on evaluating the growth performance of these groups by assessing the following aspects: weight gain, nutrient intake and the calculation of body conformation and constitution indices.

Body measurements on live animals were performed using a zoometer, caliper and measuring tape on shorn animals: the hip joint width was measured with a caliper between the coxofemural joints; the perimeter of the gigot was measured with a tape passing over the knee joint and the rump point; the length of the gigot was measured with a tape stretched along the inner side of the right hind limb, from the ischiopubic symphysis to the middle of the tibiometatarsal joint. Before taking this measurement, the animal was slightly lifted by the tail to relax the hind limbs.

Based on these body measurements, the following constitution indices were calculated:

- Compactness Index of the Gigot (according to Laville et al., 2002):

$$\text{C.I.G.} = \frac{Width\ of\ coxofemural\ joints}{Length\ of\ gigo}\ x\ 100$$

- Muscularity Index of the Gigot (Vicovan et al., 2009):

$$\text{M.I.G.} = \frac{Perimeter\ of\ the\ gigot}{Length\ of\ gigot}\ x\ 100$$

For the intensive lamb fattening phase, which lasted 100 days, a pelleted feed was used with the following nutritional content: 2,570 kcal/kg energy, 16% crude protein, 3.5% crude fat and 8.5% crude fiber, in accordance with nutritional standards. The fattening control was carried out by daily weighing of the administered feed, with leftover feed being collected every 3-4 days.

To test the statistical significance of the differences between the parameter values studied, one-way ANOVA (single-factor analysis of variance) was used.

RESULTS AND DISCUSSIONS

At the beginning of the experimental period, the body weight of the individuals ranged between 20.48 kg and 22.78 kg (Table 1).

The F1 crossbred lambs (Palas Meat Breed x Palas Merino) had an average body weight of 22.79 kg at the beginning of the fattening period, and at the end of the fattening period, their average body weight was 45.07 kg, achieving an average daily weight gain of 223 g. In the batch of lambs from the Palas Merino breed, the initial body weight was 20.48 kg and the final average body weight was 36.14 kg, resulting in an average daily weight gain of 157 g.

Table 1. The evolution of lambs body weight during the fattening period

Genotype	Body weight (kg/head)				Average daily gain (g/head)	
	At the beginning of the fattening		At the end of fattening			
	$X \pm s_{\bar{x}}$	V%	$X \pm s_{\bar{x}}$	V%	$X \pm s_{\bar{x}}$	V%
F1 crossbred lambs (Palas Meat Breed × Palas Merino	22.79± 1.24	24.60	45.07 ± 1.44	14.45	223± 5.98	11.98
Palas Merino lambs	20.48± 0.63	13.56	36.14 ± 0.83	10.22	157± 6.04	17.16
Difference between F1 crossbreed and Palas Merino average daily gain	g				+66	
	%				+42.04	
Significant difference	p < 0.001 (very significant difference)					

The observed difference in average daily gain (average daily gain) between the F1 crossbreeds and the Palas Merino breed is both substantial and statistically highly significant. Specifically, the F1 lambs recorded an increase of +66 grams/day, representing a +42.04% improvement over the performance of the purebred Palas Merino lambs. The very significant p-value ($p < 0.001$) confirms that this difference is not due to random variation but is instead attributable to the genetic advantage conferred by crossbreeding, likely through heterosis (hybrid vigor).

The ANOVA results highlight a very significant difference between the two groups analyzed: F1 crossbred (Palas Meat Breed × Palas Merino) and Palas Merino lambs. The F1 crossbred group achieved a higher average performance (223 g) compared to the Palas Merino (157 g), indicating a substantial advantage in productivity. Furthermore, the statistical test confirms that this difference is not due to random variation, as the p-value is extremely low (3.66), far below the 0.05 significance threshold. Additionally, the calculated F-value (322.67) far exceeds the critical F-value (4.098), reinforcing the robustness of the observed differences. These findings strongly suggest that F1 hybrids significantly outperform purebred Palas Merino sheep. This result underscores the potential benefits of hybrid breeding programs, which could be leveraged to enhance productivity and efficiency in sheep farming. Given these insights, incorporating F1 crossbreds into breeding strategies may lead to improved economic returns and enhanced genetic performance, making them a valuable choice for sustainable sheep farming.

This result highlights the effectiveness of using F1 crossbreeds in meat-oriented sheep production systems. The improved growth performance has direct economic implications, including shorter fattening periods, better feed efficiency, and increased carcass yield, all of which contribute to enhanced profitability for commercial producers. Such findings support the strategic use of controlled crossbreeding as a viable tool for improving meat production traits in Romanian sheep populations.

The data obtained in the present experiment are comparable to other experiments, where the effects of crossbreeding Transylvanian Merino ewes with rams from various breeds were examined, including Suffolk, Merinofleisch and Berrichon du Cher (Maier, 1975). The groups subjected to fattening showed relatively similar growth increases, which is mirrored in the present research, where the growth performance of the different experimental groups was closely comparable.

The average feed consumption per head, per day, and the specific consumption (feed intake per kg of live weight gain) are presented in Table 2, with the data expressed both per head per day and per kg of live weight gain.

F1 crossbred lambs (Palas Meat × Palas Merino) consumed, on average, 1.06 kg of feed per head per day, while Palas Merino lambs consumed 1.03 kg. This suggests that Palas Merino lambs had slightly lower feed consumption compared to the F1 crossbred lambs. Regarding feed consumption per kg of weight gain, F1 crossbreds required 4.75 kg of feed to gain 1 kg of weight, whereas Palas Merino lambs required 6.56 kg, which is 38.10% higher. This is an indicator of feed conversion efficiency, and the data suggest that F1 crossbreds have better feed conversion, needing less feed to gain the same amount of weight. F1 crossbreds consumed, on average, 2724 kcal of metabolizable energy per head per day, while Palas Merino lambs consumed 2647 kcal. The difference in energy consumption is relatively small, but F1 crossbreds appear to have slightly higher consumption, indicating a greater energy requirement for their growth. Regarding metabolizable energy per kg of live weight gain, F1 crossbreds required 12197 kcal to gain 1 kg

of weight, compared to 16860 kcal for Palas Merino lambs, with the latter having 38.23% higher specific energy consumption. This highlights a better energy utilization efficiency in F1 crossbreds, as they need less energy to achieve the same weight gain (specific consumption). F1 crossbred lambs consumed 170 g of digestible crude protein per head per day, while Palas Merino lambs consumed 165 g. The difference is minor (only 3.03%), but F1 crossbreds appear to benefit from a slightly higher protein intake, which may support faster muscle tissue development. Regarding digestible crude protein per kg of live weight gain, F1 crossbreds need 760.5 g of digestible protein to achieve 1 kg of live weight, while Palas Merino lambs need 1049.6 g, which is about 38.02% higher compared to F1 crossbreds. This suggests that F1 crossbreds have greater efficiency in utilizing protein for weight gain (Table 2).

Table 2. Feed and nutrient consumption in the lamb lots undergoing fattening

Genotype	Combined feed (kg)		Metabolizable energy (Kcal)		Digestible crude protein (g)	
	Per head and day	Per kg of weight gain	Per head and day	Per kg of weight gain	Per head and day	Per kg of weight gain
F1 crossbred lambs (Palas Meat Breed × Palas Merino)	1.06	4.75	2724	12197	170	760.50
Palas Merino lambs	1.03	6.56	2647	16860	165	1049.60

After the completion of the growth and fattening process, the main body composition and conformation indices of the fattened lambs were determined, focusing on the development of the hindquarters based on genotype.

For the width of the coxofemoral joints, F1 crossbred lambs had an average of 22.53 ± 2.16 cm, with a coefficient of variation (V%) of 16.57, while the Palas Merino lambs had slightly wider joints, measuring 23.22 ± 2.13 cm, with a lower variation of 15.90%. This suggests that Palas Merino lambs have a slightly wider hip structure.

Regarding the perimeter of the gigot, both groups had similar measurements: F1 crossbred lambs had 55.22 ± 3.88 cm, while Palas Merino lambs had 55.17 ± 3.53 cm. The variation for F1 crossbreds was 12.16%, while for Palas Merino lambs it was slightly lower at 11.07%, indicating a more consistent circumference in the Palas Merino lambs.

For the length of the gigot, F1 crossbred lambs had an average length of 25.83 ± 2.17 cm, which was 1.89% larger than the length of the Palas Merino lambs' gigot, which measured 25.35 ± 2.15 cm. The variation in length was greater for F1 crossbreds (14.52%) compared to Palas Merino lambs (4.72%), indicating that the length of the hind limbs was more variable in the F1 crossbreds.

The compactness index of the gigot (C.I.G.), which measures the proportional development of the hindquarters, was 87.22 ± 5.79 for F1 crossbreds, with a coefficient of variation of 11.49%. For Palas Merino lambs, the C.I.G. was slightly higher (by 4.37%), measuring 91.59 ± 5.25, with a lower variation of 9.93%, indicating that the hindquarters of the Palas Merino lambs were more compact.

Finally, the muscularity index of the gigot (M.I.G.), which reflects the degree of muscular development of the hindquarters, was 213.78 ± 9.98 for F1 crossbreds, with a variation of 8.08%. In comparison, Palas Merino lambs had an M.I.G. of 217.63 ± 8.96, with a slightly lower variation of 7.12%, suggesting that Palas Merino lambs had slightly greater muscular development in the hindquarters, with more compactness.

Overall, while the F1 crossbred lambs presented slightly larger and longer gigots, the Palas Merino lambs demonstrated a more compact and consistent morphology of the hindquarters, particularly in terms of muscularity and compactness indices (Tabel 3).

Table 3. Body measurements and morphological indices on live animals, with reference to hindquarter development based on genotype

Genotype / Specification	F1 crossbred lambs (Palas Meat Breed × Palas Merino)		Palas Merino lambs	
	$X \pm s_{\bar{x}}$	V%	$X \pm s_{\bar{x}}$	V%
Width of coxofemural joints (cm)	22.53±2.16	16.57	23.22±2.13	15.90
Perimeter of gigot (cm)	55.22±3.88	12.16	55.17±3.53	11.07
Length of gigot (cm)	25.83±2.17	14.52	25.35±2.15	4.72
Compactness index of the gigot (C.I.G.)	87.22±5.79	11.49	91.59±5.25	9.93
Muscularity index of the gigot (M.I.G.)	213.78±9.98	8.08	217.63±8.96	7.12

CONCLUSIONS

Crossbreeding local breeds with specialized meat breeds has proven to be an effective method for improving meat production both quantitatively and qualitatively. This demonstrates the benefits of using heterosis, which helps achieve higher yields in lamb growth and fattening.

F1 hybrid lambs (Palas Meat Breed x Palas Merino) had a final body weight 24.71% higher compared to lambs from the Palas Merino breed. During the fattening period, hybrid lambs had an average daily gain 42.04% higher than lambs from the Palas Merino breed, with very significant differences ($p<0.001$).

The lower specific consumption of energy and protein in F1 hybrid lambs resulted in lower values of metabolizable energy and digestible protein. Energy consumption was 27.66% lower, and digestible protein consumption was 27.54% lower compared to lambs from the Palas Merino breed.

The evaluation of the main body structure and conformation indices in lambs from both groups showed higher values for F1 hybrid lambs compared to lambs from the Palas Merino breed, indicating greater suitability for meat production.

These conclusions suggest that crossbreeding the Palas Merino breed with specialized meat breeds can lead to significant improvements in growth and fattening performance in lambs, with important economic benefits for farmers.

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