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# Zootechnical performance of Dorper x Santa Inês lambs raised in different production systems

Daniel Gonçalves da Silva[(1)],
Olmar Antônio Denardin Costa[(2)],
Ana Carolina Fluck[(2)],
Bruna Martins de Menezes[(2)],
Andressa Radtke Baungratz[(3✉)] and
Vicente de Paulo Macedo[(2)]

(1) Universidade Federal do Rio Grande do Sul, Programa de Pós-graduação em Zootecnia, Avenida Bento Gonçalves, nº 7.712, Agronomia, CEP 91540-000 Porto Alegre, RS, Brazil.
E-mail: danielgonzootec@gmail.com

(2) Universidade Tecnológica Federal do Paraná, Programa de Pós-graduação em Zootecnia, Câmpus Dois Vizinhos, Estrada para Boa Esperança, Km 04, CEP 85660-000 Dois Vizinhos, PR, Brazil. E-mail: odenardin@gmail.com, anacarolinafluck@yahoo.com.br, bruh.menezes@hotmail.com, vicentepmacedo@utfpr.edu.br

(3) Universidade Estadual do Oeste do Paraná, Programa de Pós-graduação em Zootecnia, Rua Pernambuco, nº 1.777, CEP 85960-000 Marechal Cândido Rondon, PR, Brazil.
E-mail: zootecnistaandressa@gmail.com

✉ Corresponding author

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**Abstract** – The objective of this work was to compare the zootechnical performance of Dorper x Santa Inês crossbred lambs finished in grazing systems on *Megathyrsus maximus* Aruana cultivar pasture, with and without shading, and in a feedlot. Twenty-four non-castrated lambs were used in a completely randomized experimental design, with the three following treatments with eight replicates each: 'Aruana' pasture without shading + supplement; 'Aruana' pasture with shading + supplement; and feedlot, with diet containing ryegrass hay and concentrate at a 20:80 ratio. The treatments did not influence lamb age at slaughter, birth weight, leg compactness, true yield, and main cut yield, except that of breast tip + flank that was lower for the pasture with shading. However, average daily gain, body condition score, live weight at slaughter, carcass compactness index, cold carcass and empty body weights, and cold carcass yield differed between treatments, showing higher values in the feedlot. Termination in the feedlot increases the zootechnical performance of Dorper x Santa Inês sheep and favors a lower age at slaughter, as well as a greater weight of the main commercial cuts, but not their yield.

**Index terms**: *Ovis aries*, performance, silvopastoral system, supplementation.

## Desempenho zootécnico de cordeiros Dorper x Santa Inês criados em diferentes sistemas de produção

**Resumo** – O objetivo deste trabalho foi comparar o desempenho zootécnico de cordeiros mestiços Dorper x Santa Inês terminados em sistemas de pastejo sobre pastagem de *Megathyrsus maximus* cultivar Aruana, com e sem sombreamento, e em confinamento. Utilizaram-se 24 cordeiros não castrados em delineamento experimental inteiramente casualizado, com os três seguintes tratamentos, com oito repetições cada um: pastagem de 'Aruana' sem sombreamento + suplemento; pastagem de 'Aruana' com sombreamento + suplemento; e confinamento, com dieta contendo feno de azevém e concentrado na proporção de 20:80. Os tratamentos não influenciaram a idade dos cordeiros até ao abate, o peso ao nascer, a compacidade da perna, o rendimento verdadeiro e o rendimento dos cortes principais, exceto o da ponta do peito + flanco que foi menor na pastagem com sombreamento. Entretanto, o ganho médio diário, o escore de condição corporal, o peso vivo ao abate, o índice de compacidade da carcaça, os pesos da carcaça fria e do corpo vazio, e o rendimento de carcaça fria diferiram entre os tratamentos, com valores superiores no confinamento. A terminação em confinamento aumenta o desempenho zootécnico de ovinos Dorper x Santa Inês e favorece a menor idade ao abate, bem como o maior peso dos principais cortes comerciais, mas não o seu rendimento.

**Termos para indexação**: *Ovis aries*, desempenho, sistema silvipastoril, suplementação.

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## Introduction

Small-ruminant livestock plays a socioeconomic role, contributing to landscape management and to a growing niche market of meat and milk production, increasing the interest in evaluating and enhancing the performance of animals such as sheep, which are tolerant to changes in ambient temperature, maintaining their productive efficiency (Marino et al., 2016). However, sheep productive performance is directly affected by the feeding and physiological conditions in different production systems, which are classified according to the level of used technology (Polli et al., 2019).

In the Southern region of Brazil, different feedlot and pasture production systems have been adopted (Bungenstab et al., 2019). In the case of the feedlot system, the finishing of sheep is more efficient due to the easier handling and shorter rearing period of the animals, reducing their slaughter age and, consequently, resulting in heavier and standardized carcasses (Polli et al., 2019). Gois et al. (2019) added that the increase in animal weight gain in this system improves carcass quality in a short period of time. However, according to Polli et al. (2019), feeding costs can be relatively higher when compared with those of other systems.

In the pasture system, a promising factor is the inclusion of native tree species, which have a high potential to benefit pasture grass species, such as cultivar Aruana of *Megathyrsus maximus* (Jacq.) B.K.Simon & S.W.L.Jacobs, and whose byproducts may be commercialized by producers aiming to increase their income (Dalposso et al., 2020). To improve animal performance and carcass quality in this system, in full sun or with some type of shading, feed should be supplemented to meet the required nutrients, which are not available through plant consumption over the year (Badgery et al, 2017; Poli et al., 2020).

Currently, there are still few studies on the use of systems combining native tree species and tropical perennial pastures to raise small ruminants. The silvopastoral system was recently introduced in Brazil (Vieira et al., 2022), leading to an increase in ecological diversification due to nutrient cycling and a higher organic matter deposition, which improve forage production (Bungenstab et al., 2019). This new system can also increase the thermal comfort of animals at the hottest hours of the day by creating a better microclimate, with a lower air temperature and a lower temperature-humidity index, when compared with the conventional pasture-grazing system (Skonieski et al., 2021).

The evaluation of the silvopastoral system allows to verify how lamb finishing and performance are affected by the environment and possibly benefited by the system itself, respectively. In this context, it is also important to compare the productivity of animals kept in pasture environments, with or without shading, with that of those kept in a feedlot.

The objective of this work was to compare the zootechnical performance of Dorper x Santa Inês crossbred lambs finished in grazing systems on *Megathyrsus maximus* cultivar Aruana pasture, with and without shading, and in a feedlot.

## Materials and Methods

The experiment was carried out during 117 days at the Sheep and Goat Research and Teaching Unit of Universidade Tecnológica Federal do Paraná (UTFPR), located in a physiographic region called Terceiro Planalto Paranaense, in the municipality of Dois Vizinhos, in the state of Paraná, Brazil (25°44'S, 53°04'W, at 520 m above sea level). According to Köppen-Geiger’s classification, the climate of the region is Cfa, humid subtropical. The average values for air temperature and relative humidity were 22.74ºC and 76.19%, respectively, according to data collected at the weather station of UTFPR, at approximately 200 m from the experimental area. Procedures were approved by the ethics committee on animal use of UTFPR, under protocol number 2016/28.

The experimental design was completely randomized, with the three following treatments with eight replicates each: PASS, 'Aruana' pasture without shading + feed supplementation; PACS, 'Aruana' pasture with natural shading provided by the native laurel [*Cordia trichotoma* (Vell.) Steud.] tree species + feed supplementation; and FP, feedlot pens.

Soon after weaned, 24 uncastrated Dorper x Santa Inês crossbred lambs were used for the study, eight for each treatment. The lambs were weighed in 21-days periods both for the estimation of average daily weight gain (ADG) and the subjective evaluation of the body condition score (BCS) according to Russel et al. (1969). At the beginning of the experiment, the body weight (BW), BCS, and age (days) of the animals were, respectively: 23.54±1.53 kg, 2.43±0.16, and 139±3.62 days in PASS; 23.12±2.23 kg, 2.50±0.35, and 136±6.70 days in PACS; and 22.24±1.85 kg, 2.14±0.33, and 140±6.87 days in FP.

Feed was provided twice a day, at 8:00 a.m. and 3:00 p.m. The used commercial mineral supplement was supplied at a rate of approximately 20 g per animal per day. The diets were prepared following the nutritional requirements for lamb termination described by National Research Council (NRC, 2007), containing 18% crude protein and 73% total digestible nutrients (TDN) according to the chemical composition and distribution of the used ingredients (Table 1). The lambs remained in each treatment until reaching the weight at origin (or farm) predetermined for slaughter; in this case, 40 kg BW.

In FP, the supply of the concentrate was regulated according to the daily intake of the animals, seeking to maintain a surplus of 10% of the diet offered per day; roughage (ryegrass hay) was offered together with the concentrate at a 20:80 ratio. In the PASS and PACS treatments, the concentrate supplied corresponded to 1.5% BW based on dry matter (DM) per day.

In FP, each lamb was kept in separate 4.0 $m^2$ stalls, with automatic drinking troughs and individual feeding troughs. In PASS and PACS, the total usable area of 1.600 $m^2$ was subdivided into four equal 400 $m^2$ plots with feeding and drinking troughs. PACS, however, was implemented in each paddock in an east-west direction before the experimental period, with native laurel trees arranged in double rows, with 2.0 m between trees in the same row and 1.0 m between rows; the distance between tree rows and paddocks was approximately 10 m. The average height of the tree component was 6.20 m when the lambs were introduced into the pasture.

In the pasture treatments, the grazing method was continuous stocking with a variable stocking rate adjusted using the “put and take” technique (Mott & Lucas, 1952). Every 21 days, forage was evaluated to maintain a constant supply of 10%, representing 10 kg DM per 100 kg per animal per live weight (LW) per day. Animal consumption was estimated considering both the amount of concentrate supplied daily in the

**Table 1.** Chemical composition of the ingredients used in the diets and formulation of the concentrate offered to Dorper x Santa Inês crossbred lambs in the evaluated production systems (treatments).

| Chemical composition | Corn bran | Soybean bran | Wheat bran | Ryegrass hay |
|---|---|---|---|---|
| Dry matter (g $kg^{-1}$) | 898.30 | 873.70 | 883.80 | 898.40 |
| Crude protein (g $kg^{-1}$ DM) | 97.50 | 487.70 | 145.60 | 62.00 |
| Neutral detergent fiber (g $kg^{-1}$ DM) | 162.00 | 165.20 | 453.70 | 684.40 |
| Acid detergent fiber (g $kg^{-1}$ DM) | 38.90 | 104.10 | 154.30 | 439.80 |
| Total digestible nutrients (g $kg^{-1}$ DM) | 878.00 | 790.70 | 770.40(1) | 545.90 |

| Ingredient | Concentrate formulation | | |
|---|---|---|---|
| | PACS treatment(2) | PASS treatment(2) | FP treatment(2) |
| Corn bran (g $kg^{-1}$ DM) | 661.50 | 661.50 | 634.90 |
| Wheat bran (g $kg^{-1}$ DM) | 98.50 | 98.50 | 64.50 |
| Soybean bran (g $kg^{-1}$ DM) | 228.90 | 228.90 | 294.20 |
| Calcitic limestone (g $kg^{-1}$ DM) | 11.10 | 11.10 | 6.40 |
| Total | 1,000.00 | 1,000.00 | 1,000.00 |
| | Grazing simulation | | |
| Dry matter (g $kg^{-1}$) | 268.24 | 227.16 | - |
| Crude protein (g $kg^{-1}$ DM) | 150.97 | 138.90 | - |
| Neutral detergent fiber (g $kg^{-1}$ DM) | 551.08 | 578.86 | - |
| Acid detergent fiber (g $kg^{-1}$ DM) | 432.09 | 430.19 | - |
| Total digestible nutrients (g $kg^{-1}$ DM) | 575.93(1) | 577.26(1) | |

(1)Total digestible nutrients (TDN) estimated by the following equation of Undersander et al. (1993): TDN (%) = 87.84 - (0.70 × acid detergent fiber). (2)Treatments: PASS, 'Aruana' (*Megathyrsus maximus*) pasture with no shading; PACS, 'Aruana' pasture with shading (silvopastoral system); and FP, feedlot pens with diet with 80% concentrate and 20% ryegrass hay as a source of roughage.

trough and consumed forage determined by $TiO_2$ supply, following the method described by Ohmori et al. (2013).

Grazing was simulated and forage mass (kg $ha^{-1}$ DM) obtained using the double-sampling method (Wilm et al., 1944). The average height of the pasture was measured with the aid of a graduated ruler at random points in the paddocks. The average forage mass during the experiment was 2,440.87 kg $ha^{-1}$ DM (average height of 12.43 cm) in PASS and 2,048.89 kg $ha^{-1}$ DM (average height of 13.48 cm) in PACS.

The samples from grazing simulation were pre-dried in a forced-air oven, at 55°C, for 72 hours and ground to pass through a 1.0 mm sieve of a Wiley-type mill in order to determine DM, ash, organic matter, crude protein, neutral detergent fiber (NDF), and acid detergent fiber (ADF) contents. DM content was estimated after drying in an oven, at 105ºC, for 24 hours using method 934.01 of Association of Official Analytical Chemists (AOAC, 2000). Ash content was obtained by placing the sample on a muffle furnace, at 600ºC, for 4 hours. Organic matter (OM) content was calculated using the equation: OM = 100 - ash. In addition, crude protein content was determined by the Kjeldahl method following method 981.10 of AOAC (2000). NDF and ADF were estimated according to Robertson & Van Soest (1981), with modifications by Komareck (1993) and Senger et al. (2008).

When the lambs reached the weight of 40 kg, they were fasted on solids for up to 16 hours and weighed to determine BW at slaughter. The lambs were stunned by electronarcosis, followed by bleeding and evisceration, according to Instrução Normativa de 17 de janeiro de 2000 (Brasil, 2000).

After eviscerated, the carcasses were weighed and transferred to a cold room, at 4ºC, where they remained for 24 hours until they were weighed again to determine cold carcass weight. The yield of hot and cold carcasses, true yield, and percentage of cooling losses were calculated according to Silva Sobrinho (2006). Leg length, carcass internal length, and rump width were measured with the aid of a measuring tape. These measurements were used to obtain the carcass compactness index (CCI, kg $cm^{-2}$) and the leg compactness index (LCI, $cm^2$).

The carcasses were sectioned in half longitudinally, and the left half of the carcasses were weighed (kg). The evaluated meat cuts were: neck, shoulder, ribs, uncovered ribs, breast tip + flank, loin, and shank (Osório et al., 2014). To calculate the loin eye area (LEA), using the geometric method, and the subcutaneous adipose tissue, measurements were taken at the dorsal portion of the *Longissimus lumborum* muscle, between the last thoracic vertebra and the first lumbar vertebra, with the aid of a digital pachymeter (Silva Sobrinho et al., 2005).

Data were subjected to the analysis of variance using the PROC Mixed procedure, and, when significant, means were compared by the Tukey-Kramer test, at 5% probability. For the statistical analysis, the SAS software (SAS Institute Inc., Cary, NC, USA) was used.

## Results and Discussion

The ADG of the animals was higher in FP, as was the concentrate intake and overall intake (Table 2). Therefore, in this system, animals became heavier in a lower amount of time, resulting in slaughter at an earlier age and, consequently, in carcass standardization as to weight, conformation, and fat coverage (Leite et al., 2020).

The age and LW of lambs at slaughter and the LCI did not differ between treatments, but ADG, BCS, BW, and the CCI did (Table 3). ADG was higher for lambs finished in FP, but did not differ between those in PASS and PACS. This difference could be attributed to the fact that, in the feedlot system, lambs generally have a greater access to feed, whose supply levels are adjusted according to daily intake. Gallo et al. (2019) also found a lower daily weight gain for male and female Texel x Santa Inês crossbred lambs finished on an 'Aruana' pasture system.

The BCS is an indicator of the development of lambs both in pasture and feedlot systems, i.e., of their finishing (fat) level in vivo, meaning that BCS increases or decreases simultaneously to ADG.

The CCI differed between the pasture and feedlot systems according to the carcass morphometric measurements taken 24 hours after slaughter (Table 3). This index was 0.22 and 0.25 kg $cm^{-2}$ for lambs finished in the pasture systems and in FP, respectively. In pasture systems, Lira et al. (2017) obtained CCI values between 0.22 and 0.23 kg $cm^{-2}$ and Britez et al. (2020) of 0.24 kg $cm^{-2}$, close to those of the present study. For stabled lambs, Britez et al. (2020) found a similar value using 3.0% concentrate supplementation. Higher values per unit length (kg $cm^{-2}$) result in a better deposition of muscle tissue and, consequently, in a better carcass quality, becoming an important tool to evaluate subjective meat production. The CCI may also be an efficient alternative for evaluating carcass conformation and for LEA identification, which is important since one is related to increased carcass weight and the other contributes to improve muscle tissue prediction (Gomes et al., 2021). In the present study, LEA differed slightly between treatments (Table 3). Gallo et al. (2019) reported a LEA of 14 and 10.90 $cm^2$ for Texel x Santa Inês lambs finished in a feedlot system and in 'Aruana' pasture, respectively. Gomes et al. (2021) concluded that, in a feedlot, there is generally a high positive correlation between LEA and BW at slaughter.

Regarding carcass parameters after slaughter, it was possible to verify that the treatments did not influence the percentage of cooling losses and true yield. However, cold carcass weight, empty BW, and cold carcass yield were affected. The values obtained for cold carcass weight and empty BW were higher for feedlot lambs, not differing between PASS and PACS (Table 4). Similarly, Brant et al. (2021) reported a cold carcass weight of 15.69 kg for lambs slaughtered at 36.5 kg BW in a feedlot. Cold carcass yield varied between the studied production systems, showing better results in FP and PASS. In the literature, Brant et al. (2021) found lower values, varying from 40.22 to 43.27%, when evaluating feedlot animals, whereas Silva Sobrinho (2006) reported average values of 44.50%, close to that of 44.47% obtained for PASS,

**Table 2.** Means of the zootechnical performance variables daily weight gain (ADG), live weight at origin (LWO), and intake of Dorper x Santa Inês crossbred lambs in the evaluated production systems (treatments)[(1)].

| Variable | Treatment[(2)] | | | Mean | Error[(3)] | p-value |
|---|---|---|---|---|---|---|
| | PASS | PACS | FP | | | |
| Initial live weight (ILW, kg) | 23.54 | 23.12 | 22.14 | 22.97 | 1.86 | 0.2786 |
| LWO (kg) | 40.00 | 40.31 | 41.34 | 40.55 | 1.57 | 0.2705 |
| ADG (kg) | 0.169b | 0.147b | 0.238a | 0.184 | 0.04 | 0.0041 |
| Forage mass (kg $ha^{-1}$ DM) | 2,440.9 | 2,048.9 | - | 2,244.9 | - | - |
| Concentrate intake[(4)] (kg DM) | 0.675b | 0.613b | 0.949a | 0.746 | 0.02 | 0.0273 |
| Forage intake[(4)] (kg DM) | 0.312a | 0,324a | 0.298a | 0.311 | 0.01 | 0.0722 |
| Intake (% LW) | 3.13b | 2.95b | 3.98a | 3.35 | 0.06 | 0.0398 |

[(1)]Means followed by equal letters, in the rows, do not differ by Tukey's test, at 5% probability. [(2)]Treatment: PASS, 'Aruana' (*Megathyrsus maximus*) pasture with no shading; PACS, 'Aruana' pasture with shading (silvopastoral system); and FP, feedlot pens with diet with 80% concentrate and 20% ryegrass hay as a source of roughage. [(3)]Error, standard error of the mean. [(4)]Average consumption during the experimental period.

**Table 3.** Means of the zootechnical performance variables slaughter age, body condition score (BCS) at slaughter, live weight at slaughter (LWS), carcass compactness index (CCI), leg compactness index (LCI), and loin eye area (LEA) of Dorper x Santa Inês crossbred lambs in the evaluated production systems (treatments)[(1)].

| Variable | Treatment[(2)] | | | Mean | Error[(3)] | p-value |
|---|---|---|---|---|---|---|
| | PASS | PACS | FP | | | |
| Slaughter age (days) | 224.29 | 235.14 | 215.43 | 224.95 | 24.63 | 0.3465 |
| BCS slaughter (1–5) | 3.14b | 2.93b | 4.07a | 3.38 | 2.58 | 0.0002 |
| LWS (kg) | 36.93b | 37.26ab | 39.21a | 37.80 | 1.59 | 0.0313 |
| CCI (kg $cm^{-2}$) | 0.22b | 0.22b | 0.25a | 0.23 | 0.01 | 0.0026 |
| LCI ($cm^2$) | 0.49 | 0.50 | 0.51 | 0.50 | 0.04 | 0.4938 |
| LEA ($cm^2$) | 11.02b | 12.77ab | 13.68a | 12.49 | 1.75 | 0.0324 |

[(1)]Means followed by equal letters, in the rows, do not differ by Tukey's test, at 5% probability. [(2)]Treatments: PASS, 'Aruana' (*Megathyrsus maximus*) pasture with no shading; PACS, 'Aruana' pasture with shading (silvopastoral system); and FP, feedlot pens with diet with 80% concentrate and 20% ryegrass hay as a source of roughage. [(3)]Error, standard error of the mean.

which had the lowest yield compared with those of the other treatments.

The three evaluated treatments did not influence the yield of the main cuts, except that of breast tip + flank (Table 5). Since cold carcass yield is associated with lower fasting losses and a better feed efficiency, there is a better use of the meat product, favoring the commercialization of heavier carcasses, which facilitates obtaining commercial cuts and/or the processing of derivatives, such as sausages.

The weight of the left-half carcasses did not differ between treatments (Table 5). Despite this, the values obtained in the present study were higher than those found by Gallo et al. (2019) for lambs on 'Aruana' pasture, slaughtered at 35 kg LW. For shank and shoulder yield, the same authors obtained average values of 27.69 and 15.29%, respectively. For all three aforementioned cuts, Lira et al. (2017) reported similar yields of 35.57, 19.46, and 7.38%, respectively, for Santa Inês lambs finished on pasture.

Loin yield was not influenced by the production systems, showing a mean value of 10.62% (Table 5). This characteristic is intrinsically related to the growth and body development of an animal, which may cause certain cuts to decrease in size and, consequently, to reduce in weight. The average yields for the rib cut and uncovered ribs were 9.84 and 6.47%, close to those of 10.79 and 6.49%, respectively, reported by Cesco et al. (2017). Trindade et al. (2018), when evaluating Santa Inês crossbred lambs finished on 'Aruana' pasture, slaughtered at 33.41 kg BW, found a yield of 25.51% for the rib cut, without measuring, however, the uncovered rib.

The yield of breast tip + flank showed a significant difference between the evaluated production systems, with better values of 12.14 and 12.68%, respectively,

**Table 4.** Means of the zootechnical performance variables cold carcass weight (CCW), empty body weight (EBW), cold carcass yield (CCY), cooling losses, and real yield of Dorper x Santa Inês crossbred lambs in the evaluated production systems (treatments)(1).

| Variable | Treatment(2) | | | Mean | Error(3) | p-value |
|---|---|---|---|---|---|---|
| | PACS | PACS | FP | | | |
| CCW (kg) | 16.62b | 16.57b | 18.39a | 17.19 | 1.12 | 0.0102 |
| EBW (kg) | 33.86b | 34.21b | 37.09a | 35.05 | 1.83 | 0.0073 |
| CCY (%) | 45.02ab | 44.47b | 46.82a | 45.43 | 1.57 | 0.0294 |
| Cooling losses (%) | 3.71 | 4.09 | 3.63 | 3.81 | 0.90 | 0.6083 |
| Real yield (%) | 51.00 | 50.51 | 51.39 | 50.97 | 1.55 | 0.5786 |

(1)Means followed by equal letters, in the rows, differ by Tukey's test, at 5% probability. (2)Treatments: PASS, 'Aruana' (*Megathyrsus maximus*) pasture with no shading; PACS, 'Aruana' with shading (silvopastoral system); and FP, feedlot pens with diet with 80% concentrate and 20% ryegrass hay as a source of roughage. (3)Error, standard error of the mean.

**Table 5.** Left half-carcass weight and yield of the main commercial cuts after slaughter(1).

| Commercial cut | Treatment (2) | | | Mean | Error(3) | p-value |
|---|---|---|---|---|---|---|
| | PASS | PACS | FP | | | |
| 1/2 left carcass (kg) | 8.27 | 8.26 | 9.11 | 8.55 | 0.69 | 0.0513 |
| Shank (%) | 33.25 | 33.63 | 32.70 | 33.20 | 1.98 | 0.6867 |
| Shoulder (%) | 19.18 | 19.12 | 18.51 | 18.94 | 1.05 | 0.4385 |
| Neck (%) | 7.64 | 8.47 | 8.89 | 8.33 | 1.66 | 0.3774 |
| Loin (%) | 10.27 | 10.95 | 10.65 | 10.62 | 0.56 | 0.1041 |
| Rib (%) | 9.71 | 9.86 | 9.96 | 9.84 | 0.90 | 0.8700 |
| Uncovered rib (%) | 6.70 | 6.28 | 6.41 | 6.47 | 0.95 | 0.7003 |
| Low (%) | 12.14ab | 11.32b | 12.68a | 12.04 | 0.82 | 0.0207 |

(1)Means followed by equal letters, in the rows, do not differ by Tukey's test, at 5% probability. (2)Treatments: PASS, 'Aruana' (*Megathyrsus maximus*) pasture with no shading; PACS, 'Aruana' pasture with shading (silvopastoral system); and FP, feedlot pen with diet with 80% concentrate and 20% ryegrass hay as a source of roughage. (3)Error, standard error of the mean.

for lambs finished in PACS and FP (Table 5). Similar yields from 12.55 to 13.21% were obtained by Rozanski et al. (2017) for young crossbred Santa Inês sheep finished in a feedlot.

No significant difference was found for the yield of commercial cuts, except for that of breast tip + flank. This result can be explained by the relationship between the BW and the amount of body fat of the slaughtered animal since, in carcasses with a similar weight and amount of fat, almost all body regions show similar proportions (Trindade et al., 2018).

## Conclusion

Termination in the feedlot system improves the zootechnical performance of Dorper x Santa Inês crossbreed sheep and favors a lower age at slaughter, as well as a greater weight of the main commercial cuts, but not their yield.

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