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Performance of intact and castrated nelore steers grazing *Brachiaria humidicola* (Rendle) Schweick (Poaceae) alone and intercropped with forage peanut

Desempenho de novilhos nelore castrados e não-castrados sob pastejo em *Brachiaria humidicola* (Rendle) Schweick (Poaceae) exclusiva e em consórcio com amendoim forrageiro

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Abstract
This study aimed to assess the performance of intact and castrated beef cattle on the pasture of *Brachiaria humidicola* alone and intercropped with *Arachis pintoi* cv. BRS Mandobi. The experiment was carried out from February to June 2016 on the private property of a partner of Embrapa Acre. The experimental design was completely randomized in a 2×2 factorial arrangement, with two sex classes (intact and castrated) and two types of pasture (alone and intercropped). The leaf to stem ratio was high (P<0.05) in the pasture alone. No significant difference was found for stocking rates. Dry matter intake was high (P<0.05) in the intercropped pasture compared to that alone, with means of 8.96 and 6.66 kg/day, respectively. Animals managed in intercropped pastures had better performance (P<0.05) than those castrated under pasture alone. Nelore steers castrated at 20 months of age, managed under intercropped pastures, showed similar productive performance (P>0.05) to intact animals.
Keywords: *Arachis pintoi*, koronivia grass, productivity, weight gain, Western Amazon.

Resumo
O objetivo deste trabalho foi avaliar o desempenho de bovinos de corte castrados e não castrados em pasto exclusivo de *Brachiaria humidicola* e consorciado *Arachis pintoi* cv. BRS Mandobi. O experimento foi conduzido em propriedade particular de produtor parceiro da Embrapa Acre, de fevereiro a junho de 2016. O delineamento experimental foi inteiramente casualizado, em arranjo fatorial 2x2, sendo duas classes sexuais (castrados e não-castrados) e dois tipos de pasto (exclusivo e consorciado). A relação folha/caule foi superior (P<0,05) no pasto exclusivo. Não houve diferença significativa para as taxas de lotação. O consumo de matéria seca foi superior (P<0,05) no pasto consorciado em relação ao exclusivo, com médias de 8,96 e 6,66 kg/dia, respectivamente. Os animais manejados nos pastos consorciados tiveram desempenho superior (P<0,05) aos castrados do pasto exclusivo. Novilhos Nelore castrados aos

20 meses de idade, manejados em pastos consorciados, apresentam desempenho produtivo similar (P>0,05) a animais não castrados.
Palavras-chave: Amazônia Ocidental, *Arachis pintoi*, *Braquiária humidícola*, Ganho de peso, Produtividade.

Introduction

The intensification of production systems, mainly beef cattle, is a fact in several regions of Brazil. Achieving maximum production potential by making the use of production factors more efficient is the result of economically viable technologies that can be implemented without high risk. Traditionally, Brazilian livestock has a low technological level and its production is based on the use of large areas of natural or cultivated pastures[1].

Tropical grasses of the genus *Brachiaria* often lack adequate nutritional quality to animal requirements despite their excellent adaptability and high dry matter production. Other materials that can complement the diet are used due to their protein, energy or mineral contribution, depending on the nutritional needs of the herd[2].

Crude protein (CP) content in *Brachiaria* plants may not be satisfactory, especially in the driest periods of the year, when forage quality and dry matter production decrease significantly. CP contents below 7% limit the fermentation rate by altering rumen microbial activity, also affecting dry matter intake[3].

Several strategies can be used to increase nitrogen contribution in cattle diet. The most commonly used is protein supplementation by providing urea or protein-rich foods such as soybean meal. However, this practice is often not economically viable due to its high cost, particularly in the states of the North region of Brazil, with difficult access and expensive freight. Thus, pasture intercropping becomes an option, as two plant species, usually a grass and a forage legume are settled in the same area, diversifying the forage environment and reducing the potential impacts of pests and diseases, improving soil physical, chemical, and biological characteristics and optimizing nutrient cycling and cleavage, besides participating directly in the diet selected by animals.

Forage peanut (*Arachis pintoi* Krapov. & W.C. Gregory (Fabaceae)) is a forage legume that has been studied for this purpose for a long time. This species has 13 to 22% of CP and 60 to 67% of *in vitro* dry matter digestibility (IVDMD)[4], justifying the growing interest of researchers for its use intercropped with forage grasses. Nevertheless, few studies have addressed the performance of cattle on pastures intercropped with this legume in the Western Amazon, a region lacking in technologies that could be applied to livestock.

Adequate animal nutrition is undoubtedly one of the main factors that can influence herd performance. However, other factors, such as sex, breed, age, genetics, and environment, may significantly affect production results[5]. Castration is a management technique traditionally used in Brazilian livestock with the justification that the animal becomes more docile, which facilitates the management and improves the final carcass quality[6].

Intact animals are more efficient using food and tend to gain weight faster than those castrated. However, the carcass quality of these animals is often poor, especially regarding backfat and marbling. Castration favors the uniform carcass finishing, resulting in a soft and superior-looking meat[7].

In this context, this study aimed to assess the productive performance and nutritional parameters of intact and castrated Nelore steers on the pasture of Brachiaria humidicola alone and intercropped with Arachis pintoi cv. BRS Mandobi in Acre State, Brazil.

Material and methods

The experiment was conducted from February 16, 2016, to June 30, 2016, on the private property of a partner producer of Embrapa Acre (Agropecuária Guaxupé, Rodovia AC 90 km 33, Rio Branco, AC), located at 9°57'52.33" S and 68°6'4.27" W, with 203 m of altitude. The soil of the region is classified as a plinthic dystrophic red Argisol of epieutrophic character[8]. Soil chemical analysis of the experimental area was performed at a depth of 0–20 cm (Table 1).

The site has mean precipitation of 1,900 mm, with a well-defined rainy season from October to April, especially in February, mean temperature of 26.7 °C and relative air humidity of 87%[9].

Table 1. Contents of pH in water, phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), aluminum (Al), sum of bases (SB), cation exchange capacity (CEC), and base saturation (V) in samples collected at a depth of 0–20 cm in the experimental area

Plinthic dystrophic red Argisol, epieutrophic										
pH	**P**	**K^+**	**Ca^{2+}**	**Mg^{2+}**	**$Ca^{2+}+Mg^{2+}$**	**Al^{3+}**	**H^++Al^{3+}**	**SB**	**CEC_{pH7}**	**V**
H_2O	**mg/dm³**	**cmol$_c$/dm³**								**%**
4.62	1.74	0.10	2.53	1.37	3.90	0.63	3.46	4.00	7.46	53.54

The experimental area consisted of 6 modules with a mean area of 1.431 ha each, three of them formed exclusively with *Brachiaria humidicola* cv. Tully (pasture with more than 30 years of establishment and never fertilized) and the other three formed with the intercropping between this grass and *Arachis pintoi* cv. BRS Mandobi. Each experimental module (field replication) was divided into three paddocks for rotational grazing management, with a grazing period of seven days and 14 days of resting.

The legume species was introduced in the area in March 2010. Planting was carried out using seeds in 70 cm wide strips by placing three seeds per pit, which were spaced 25 cm between pits and 3 m between strips. Base fertilization was performed at planting, following the result of soil analysis and using the NPK 8–28–16 formulation at a dose of 150 kg/ha.

Thirty-six Nelore animals, 18 intact and 18 castrated, with a mean initial age and weight of 20 months and 324 kg (±9.3 SD), respectively, were used. Animals from the same birth season were used, aiming at homogeneity of the group. The animals were selected after initial weighing, according to the mean lot weight criterion, with the lowest possible coefficient of variation within and between lots, randomly and evenly distributed among treatments.

Surgical castration was performed according to the practice adopted in the property, when the animals reached the mean weight of 11 arrobas and approximate age of 20 months, by the traditional method of testicular ablation, by removing the apex of the scrotum. The experiment was approved by the Animal Ethics Committee of the Federal University of Acre, registered under the process 23107.003960/2017-94 and protocol 07/2017.

The structural, chemical, and physical characteristics of pastures with Brachiaria humidicola alone and intercropped with Arachis pintoi cv. BRS Mandobi and variations in pasture carrying capacity to support adjustments in the paddock stocking rates were assessed on the first day and every 28 days. The rotational grazing method, with paddock entry and exit height of 20 and 10 cm, respectively, was used according to grass management.

Thirty areas, delimited by a metallic square of 0.25 m² randomly placed at each experimental paddock, were selected to assess pasture physical and structural characteristics.

The estimation of the botanical composition of pastures, based on the dry weight of species present in the area, was performed by the Botanal[10] method, using the derived multipliers 70.1, 21.1, and 8.7.

Paddock entry and exit heights were recorded at each grazing period using a 100-cm graduated stick that was inserted in the center of an acetate slide, thus obtaining the height values at 30 points per paddock[11].

Total dry matter availability (TDMA) was determined by a close-to-ground cut of five areas delimited by a metallic square of 0.25 m² at each paddock. Each sample was individually weighed, subsampled, and immediately taken to a forced-air ventilation oven at 55 °C for 72 hours to determine the total DM availability of the pasture.

The remaining samples were grouped to prepare composite samples, in which the five collected samples resulted in a composite sample, from which another subsample was taken to determine pasture physical composition by separating the forage morphological components, such as leaves, stems, dead material, and weeds.

The nutritional quality of available forage was determined by manual collections simulating grazing every 28 days. These samples were analyzed for dry matter (DM), organic matter (OM), total nitrogen (TN), neutral detergent fiber (NDF), acid detergent fiber (ADF), and lignin contents, according to techniques described by Detmann et al[12].

Crude protein (CP) was calculated by multiplying total nitrogen content (TN) by the factor 6.25. Neutral detergent insoluble nitrogen (NDIN) was obtained as described by

Van Soest, Robertson, and Lewis[13].

Neutral detergent insoluble protein (NDIP) was determined by multiplying NDIN values by 6.25[14]. *In vitro* dry matter digestibility (IVDMD) was obtained according to the recommendations of Tilley and Terry[15], using the two-stage method.

Mean daily weight gain (MDG) was determined by weighings performed every 30 days, always at the same time of the day, after absolute fasting for 14 hours. All animals were trapped in a seven-part management pen, where the squeeze chute and scale were installed to ensure fasting conditions.

Total weight gain was determined by the difference between final and initial body weight. Animal productivity was calculated by multiplying the number of animals per day in each paddock and the mean daily gain of each lot and dividing this result by the paddock area.

The stocking rate was obtained by the ratio between the sum of the total weight of animals in the paddock and the area of each paddock. For conversion to animal unit (AU), the resulting value was divided by 450, which represents the weight at maturity of an adult animal.

Five animals from the pasture alone and the other five from the intercropping system were used to assess the intake and total digestibility of the diet. These animals were submitted to a digestion test for ten days, in which the first seven days were destined for animal adaptation and stabilization of the indicator flow.

Fecal DM excretion (FE) was estimated using the external indicator chromic oxide, according to Smith and Reid[16] recommendations, applied in a single daily dose (10 g/animal), stored in a paper cartridge, and introduced using an applicator directly into the animal esophagus for ten consecutive days. After seven days of adaptation, fecal samples were collected from animals on the seventh (16:00 h), eighth (13:00 h), ninth (10:00 h), and tenth (7:00 h) days.

The FE calculation was performed based on the ratio between the amount of indicator provided and its concentration in the feces, according to the equation:

$$FE\ (g)=[Cr_{in}(g)/Cr_{out}\ (\%)]\ \times 100$$

where Cr_{in} is the amount of chromium supplied (g) and Cr_{out} is the concentration of indicator in the feces (%).

The estimation of voluntary intake was calculated by the relationship between fecal excretion and diet indigestibility, using the equation:

$$CMS=[FE \div (1-IVDMD \div 100)]$$

where FE is the fecal dry matter excretion (kg/day) and IVDMD is the *in vitro* dry matter digestibility of the consumed diet. Laboratory analyses were performed according to techniques described by Detmann et al[12].

Total apparent digestibility of diet and nutrients was calculated by the ratio between the intake of each nutrient and its excretion in the feces:

DIGDM=(DMI-FE)÷DMI

where DIGDM is the total apparent digestibility of dry matter, DMI is the dry matter intake, and FE is the fecal excretion.

Nutrient digestibility was calculated as follows:

DIGNUT=(NUTIN-NUTEXC)÷NUTIN

where DIGNUT is the total apparent digestibility of nutrient (e.g., CP and NDF), NUTIN is the estimated nutrient intake, and NUTEXC is the nutrient excretion in feces.

The experimental design was completely randomized in a 2 × 2 factorial arrangement, with two sex classes (intact and castrated) and two types of pasture (alone and intercropped), with nine replications to assess individual performance (mean daily gain and total weight gain) and three replications to assess variables related to pasture (stocking and productivity).

The data from the assessment of productive and structural characteristics of pastures were assessed in a completely randomized design with 15 replications for dry matter and other component production, such as leaves, stems, weeds, and dead material, and 30 replications for height and botanical composition assessments.

Statistical analyses of the studied variables were performed using the software SISVAR version 5.6[17]. Comparisons between treatment means were carried out using the t-test at 5% probability level.

Results and discussion

Total dry matter availability (TDMA) were similar (P>0.05) between treatments as a consequence of the adopted pasture management strategy using regulating animals, indicating the efficiency of management aiming to equate both pastures regarding forage availability. No significant difference (P>0.05) was also observed for variables green stem, dry leaves, dry stems, and weeds in both pastures (intercropped and alone).

Green leaf availability in the pasture alone was higher (P<0.05) than the intercropped pasture, with means of 1.17 and 0.86 t/ha (±0.078 SD), respectively. The leaf/stem ratio was higher (P<0.05) in the pasture alone than in that intercropped, which may be explained by the low production of green leaves in the intercropped pasture (Table 2).

The lawn height for animals to enter and leave the paddocks was pre-set at 20 and 10 cm, respectively, aiming at not compromising the structure and recovery of koronivia grass during the resting period of 30 days.

In general, the pasture with *B. humidicola* alone remained at a higher mean height than that intercropped with *A. pintoi*. Even during the dry season, pasture height management was efficient, with mean heights of 20.7 and 18 cm in the pasture alone and intercropped, respectively (Figure 1).

Table 2. Availability of total dry matter (TDMA), green leaves, green stems, dry leaves, dry stems, dead material, weeds, and leaf/stem ratio of *Brachiaria humidicola* at different cutting seasons. Data shown as mean (± standard deviation); N = 15

Pasture	Intercropping	Alone
	kg/ha	
TDMA^{ns}	8,322.70 (±1,940.25)	7,631.14 (±1,859.86)
Green leaves	855.88b (±207.89)	1,167.44a (±372.13)
Green stems^{ns}	1,327.30 (±303.72)	1,119.25 (±340.51)
Dead material^{ns}	5,907.30 (±1,554.20)	5,120.77 (±1,119.67)
Weeds^{ns}	232.21 (±111.28)	223.68 (±98.29)
Leaf/stem ratio	0.66b (±0.14)	1.04a (±0.04)

Means followed by distinct letters differ from each other by the t-test at 5% probability (P<0.05). ns = not significant at 5% probability level.

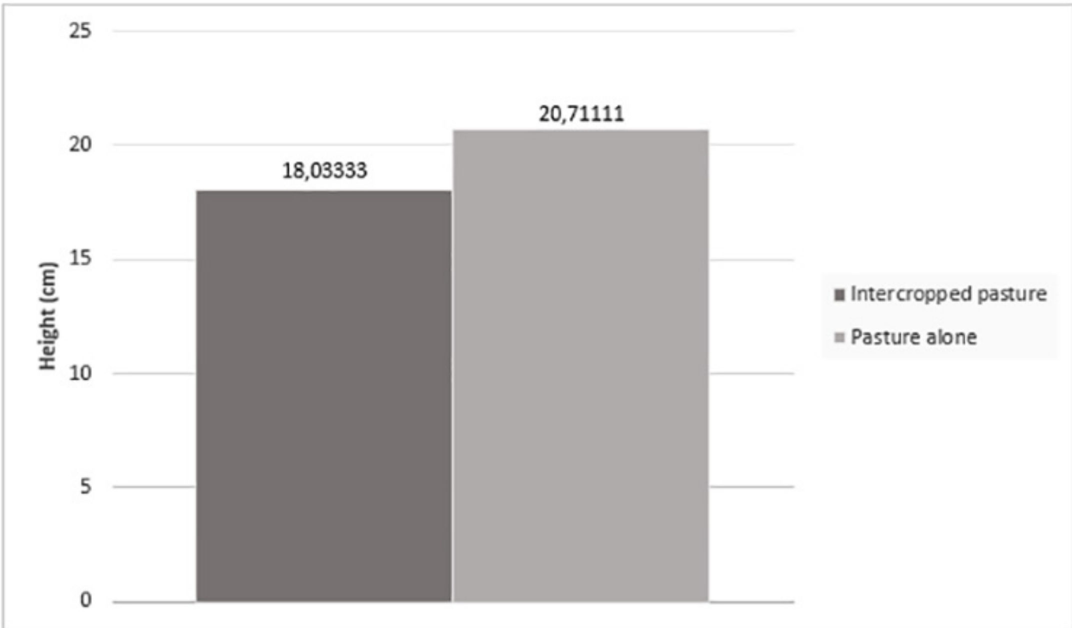

Figure 1. Mean lawn heights (cm) in paddocks of pastures alone and intercropped during the experiment.

The botanical composition of a pasture is influenced by several factors, especially the grass species and the associated legume. Figure 2 shows the percentages of the botanical composition of pastures alone and the intercropping between *B. humidicola* and *A. pintoi* cv. BRS Mandobi. Grass in the pasture alone had a proportion of 94.5% in the botanical composition, with the presence of 5.5% of weeds, mainly those of the genus *Cyperus*. In the intercropped pasture, forage peanut reached 6% of the botanical composition, with a small reduction in the proportion of koronivia grass in relation to the pasture alone, probably due to competition for water and nutrients between both species.

Urbanski[18] reported a decrease from 14.6 to 7.9% in the proportion of forage peanut in the pasture of the same area of this study, intercropped between July and September 2015. It occurred due to the water deficit caused by the dry season and a severe attack of red mite (*Tetranychus ogmophallos*).

Thus, the low proportion of *A. pintoi* cv. BRS Mandobi in the intercropped pasture is due to the recovery of stress caused by drought and pest attack in the year before the start of the experiment, also leading to a low green matter production of *B. humidicola* due to competition for water and nutrients necessary for the restoration of the legume in the pasture.

The proportion of *B. humidicola* in the pasture alone was slightly higher (5.29%) than in the intercropped pasture, but weed presence was 29.41% higher than that observed in the intercropped pasture (Figure 2). The presence of legumes in the intercropped pasture may have inhibited weed growth, reducing their proportion in the botanical composition.

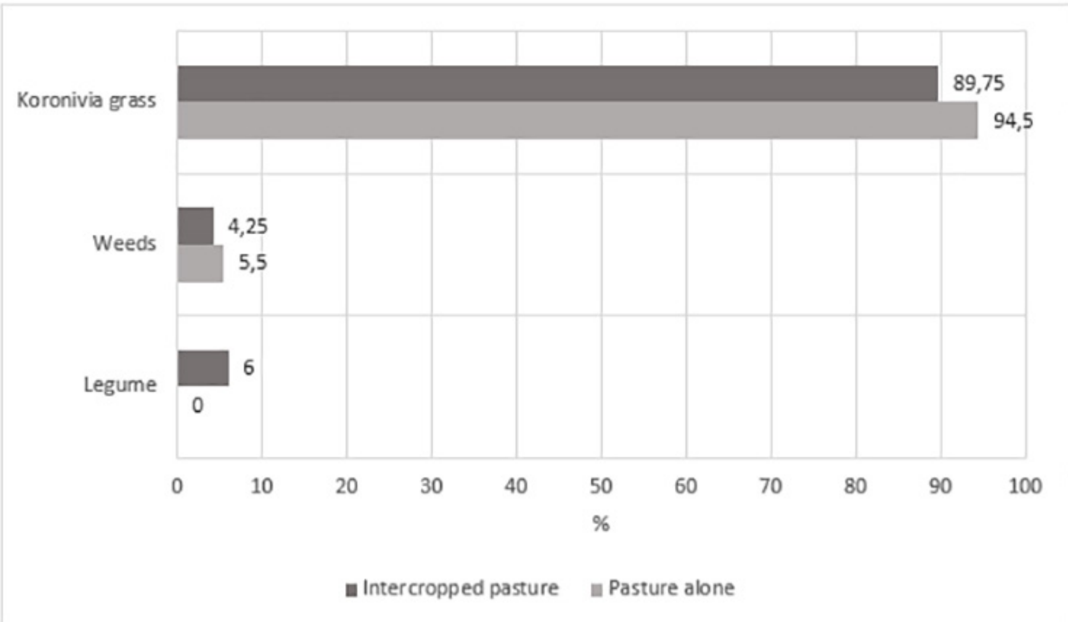

Figure 2. Mean botanical composition (%) of pastures alone and intercropped during the experimental period.

Table 3 shows the mean contents resulting from the bromatological analysis of B. humidicola from pasture alone and intercropped, as well as from A. pintoi cv. BRS

Mandobi. In both pastures, the grass presented similar means (P>0.05) for its chemical characteristics, with little difference between intercropping and pasture alone. CP and IVDMD contents of forage peanut stood out, with contents of 15.64 and 72.95%, respectively.

Table 3. Contents of organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), neutral detergent insoluble protein (NDIP), and in vitro dry matter digestibility (IVDMD) of *B. humidicola* samples from pastures alone and intercropped, as well as from *A. pintoi* BRS cv. Mandobi. Data shown as mean (± standard deviation); N = 3

Forage		*B. humidicola* (intercropping)	*B. humidicola* (alone)	*Arachis pintoi* cv. BRS Mandobi*
OM	%DM	90.97 (±0.38)	91.21 (±0.06)	91.22
CP		6.65 (±0.98)	6.77 (±0.58)	15.64
NDF		73.8 (±0.87)	74.13 (±1.01)	55.95
ADF		35.66 (±0.21)	35.18 (±0.89)	33.40
NDIP		2.00 (±0.26)	2.13 (±0.58)	7.44
IVDMD		56.81 (±1.78)	58.58 (±3.05)	72.95

There was no significant effect by the t-test at 5% significance level for *B. humidicola* variables. *N = 1; data for comparative purposes only.

The NDIP contents were also higher in the legume (7.44%) than in the grass (2–2.13%). According to Balsalobre et al.[19], about 50% of CP is composed of NDIP, as the higher the values for these variables, the lower CP degradation.

The CP contents in the koronivia grass in both treatments were below the minimum of 7%. CP contents below this value lead to a growth impairment of cellulolytic bacteria, thus impairing adequate rumen fermentation[20].

Values below 7% include only the content in the grass, not including the CP content of the legume, which is usually high. In this case, the use of protein supplements in the diet of cattle on pasture alone would be advisable to meet the minimum CP contents.

The NDF levels were similar to those described in the literature[21] for *B. humidicola*, with values ranging from 74.6 to 75.51%. The mean values of ADF were below the results found by Crispim and Barioni Júnior[22], who obtained a variation from 37.9 to 41.6%.

A chemical analysis of koronivia grass samples collected in the same area of this work during the drought season of 2015 had mean values of NDF and ADF ranging from 73.67 to 75.87% and 36.21 to 37.38%, respectively[19].

Brito et al.[23] studied the chemical profile of the cell wall of *B. humidicola* and found 74.69% of NDF, 53.49% of *in situ* dry matter digestibility, and 31.53% of NDF, respectively.

An extensive study on *A. pintoi*, Lascano[4] found mean CP contents from 13 to 22%, corroborating the contents found in this study. Thus, the CP found in the forage peanuts from intercropped pastures is more than enough to meet the protein demand of animals and optimize rumen fermentation, even if the grass does not satisfy this demand.

Table 4 shows the estimations of fecal excretion (FE), dry matter intake (DMI), and digestibility (DIG) of nutrients of koronivia grass during the experimental period. A significant difference (P<0.05) was observed for the variables FE, DMI, DIGCP, and DIGNDF.

The DMI in the intercropped pasture was higher (P<0.05) than in the pasture alone. Nitrogen increase through forage peanut in the diet of animals may have enhanced rumen fermentation and increased the process efficiency, increasing the passage rate and hence forage intake. Martins et al.[24], compared the cultivars BRS Tupi and common of *B. humidicola* in the dry season of Campo Grande, MS, and did not find differences in DMI, with values of 1.81 and 2.10 kg of dry matter per 100 kg live weight per day.

Therefore, the addition of a forage legume in the pasture may increase dry matter intake, promoting an improved protein contribution of the diet without a significant increase in costs compared to protein-rich foods, which are often expensive.

The digestibility of CP and NDF of koronivia grass was also high in the intercropped pasture. Nitrogen cycling promoted by forage peanuts in the soil-plant system may have contributed to grass growth, developing young plants with soft leaves and good nutritional quality.

No statistically significant difference (P>0.05) was observed between treatments for ADF and cellulose digestibility (Table 4).

Table 4. Means for fecal excretion (FE), dry matter intake (DMI, kg/day and % of LW), and digestibility of crude protein (DIGCP), neutral detergent fiber (DIGNDF), acid detergent fiber (DIGADF), and cellulose (DIGCEL) of *B. humidicola* in each pasture type. Data shown as mean (± standard deviation); N = 5

Pasture	Intercropping	Alone	CV%
FE (kg/day)	2.79a (±0.32)	2.33b (±0.22)	10.61
DMI (kg/day)	8.96a (±1.02)	6.66b (±0.62)	10.80
DMI (%LW)	2.31a (±0.08)	1.73b (±0.20)	7.35
	B. humidicola		
DIGCP (%)	65.31a (±1.07)	58.41b (±4.43)	5.21
DIGNDF (%)	70.45a (±1.04)	66.22b (±1.39)	1.80
DIGADF (%)	70.98 (±1.89)	67.66 (±1.78)	2.65
DIGCEL (%)	79.31 (±1.93)	77.54 (±1.39)	2.14

Means followed by distinct letters in the row differ from each other by the t-test (P<0.05).

gain (TWG) and mean daily gain (MDG) (Table 5). However, a statistically significant difference (P<0.05) was found when treatments were analyzed separately.

Table 5. Total weight gain (TWG) and mean daily gain (MDG) of castrated and intact animals grazing on pastures of *B. humidicola* alone and intercropped with *A. pintoi* cv. BRS Mandobi. Data shown as mean (± standard deviation); N = 9

Pasture	**Alone**		**Intercropping**		**CV%**
Sex class	**Intact**	**Castrated**	**Intact**	**Castrated**	
TWG (kg)	59.66ab (±17.55)	49.33b (±5.55)	72.38a (±11.12)	67.50a (±15.51)	21.24
MDG (kg/dia)	0.442ab (±0.130)	0.365b (±0.038)	0.536a (±0.082)	0.500a (±0.115)	

Means followed by distinct letters in the row differ from each other by the Tukey test at 5% significance.

Castrated animals from the intercropped pasture had 37% higher weight gains (P<0.05) than those from pasture alone (365 and 500 g/day, respectively). Intact animals showed statistically equal performance in both pastures, even with a 21% difference in the productive performance. Also, intact animals from the intercropped pasture presented a performance 46.8% higher than those castrated from pasture alone, while castrated animals from the intercropped pasture showed a 13% higher gain than those intact from pasture alone.

Several studies have addressed the high performance of intact animals compared to those castrated. An experiment conducted in Paraná compared the performance of castrated and intact cattle on an integrated crop-livestock system showed that intact animals were superior to those castrated for the mean daily gain (0.907 and 0.698 kg, respectively) and highest slaughter weight (490.9 and 442.2 kg, respectively), but castrated animals had a good finishing of backfat and high subcutaneous fat thickness (3.45 and 2.70 mm, respectively)[(25)]. It corroborates the thesis of superior carcass quality in castrated animals. A similar study with Nelore cattle in the dry season showed mean daily gains of intact animals higher than those castrated (0.506 and 0.412 kg, respectively), besides reaching earlier slaughter weight (480 kg at 330 and 409 days, respectively)[(26)].

Although the literature has shown that intact animals are more efficient in weight gain, Restle, Grassi, and Feijó[(27)] did not find any difference (P>0.05) for the weight gain of intact animals compared to those castrated at 8 or 12 months of age. In the present study, animals were castrated at 20 months of age, a time considered too late in relation to studies of the same nature. It may have significantly influenced the weight gain of castrated animals to the point of leveling their performance in relation to intact animals.

Animals finished in less than 24 months do not require castration because, due to the short time interval, the animal needs androgen hormones produced in the testicles to reach slaughter weight faster. However, castration is recommended for animals slaughtered late because it facilitates the management, fattening, and improvement of meat quality, especially regarding the carcass backfat[6].

Despite the low proportion in the botanical composition of the intercropped pasture, the presence of the legume species may have influenced animal selectivity. In this case, steers showed a preference for forage peanut, which also has high digestibility, a determining factor that can be observed in the differences in animal gains in the pasture alone and intercropped. Animal preference for legume species can reach a selection index of 0.65 and 0.79 during the dry and rainy seasons, respectively, being selectivity favored by the previous animal exposure to the intercropping system[28].

Therefore, the compensatory gain effect of castrated animals, which return to the normality of gains after the castration surgical procedure, has equated the performance in relation to intact animals when the comparison occurs within the same pasture type (Table 5). Intact animals from intercropped pasture were superior ($P<0.05$) only to those castrated from pasture alone, with no difference when compared to those intact from the same pasture.

Table 6 shows the mean productivity and stocking rate of pastures, which showed no difference ($P>0.05$). Although without statistical significance, animals from the intercropped pasture had a 14.9% increase in productivity compared to those kept in pastures alone. Carrying capacity was similar ($P>0.05$) between pastures alone and intercropped (2.61 and 2.72 AU/ha, respectively), showing that the legume effect was restricted to the improvement of diet quality, not interfering with grass growth rates, an expected effect due to the high nitrogen contribution.

Table 6. Productivity (kg/ha) and stocking rate (AU/ha) in pastures of *B. humidicola* alone and intercropped with *A. pintoi* cv. BRS Mandobi during the experimental period. Data shown as mean (± standard deviation); N = 3

Pasture	Intercropping	Alone	CV%
Productivity (kg/ha)	225.53 (±46.7)	196.30 (±26.71)	18.04
Stocking rate (AU/ha)	2.61 (±0.29)	2.72 (±0.07)	8.01

No significant effect was observed by t-test at 5% significance level.

Conclusions

Animals managed on intercropped pastures have higher dry matter intake than those kept on pastures of *B. humidicola* alone.

Nelore steers castrated at 20 months of age, kept on intercropped pastures, presented similar productive performance to intact animals.

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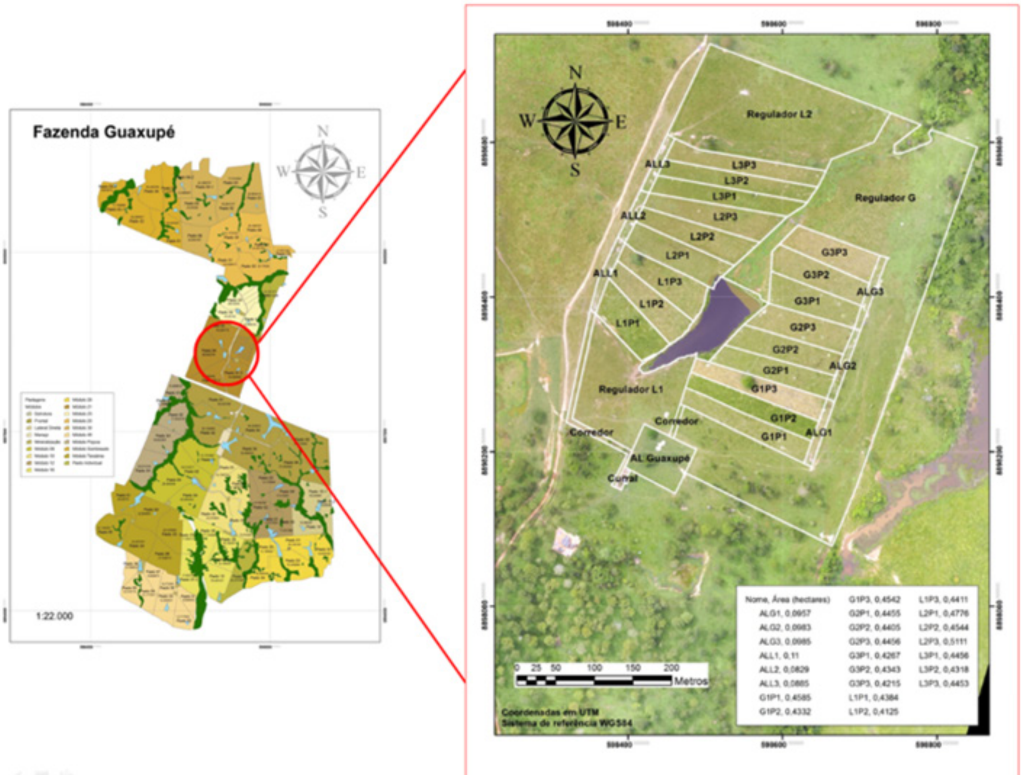
Appendix



APPENDIX A – General map of Guaxupé Farm highlighting the location of the experimental area and division of paddocks.