



## Productive and economic performance of goats of different genetic groups

### *Desempenho produtivo e econômico de cabritos de diferentes grupos genéticos*

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## SUMMARY

This study aimed to evaluate the bio-economic performance in confinement crossbred goats from different genetic groups. Were used 30 goats, crossbred (F1) intact male, 10 goats Boer x SPRD (undefined breed), 10 x Savannah SPRD and 10 Oberhasli x SPRD, with an average weight of 15 kg and an average age of 100 days. The initial weight was evaluated, final body weight, average daily gain, total weight gain, dry matter intake, water intake, feed conversion and days on feed. As an economic indicator was calculated gross profit margin (MB), the average dry matter intake, the confinement period, the cost of each diet and the cost of vaccines and medicines. We used the 5% Tukey test for comparisons between treatment means. For the variables weight gain, dry matter intake, water intake and body condition score averages observed did not differ between the genetic groups. There was significant effect ( $P > 0.05$ ) of genetic groups on days on feed. The biological performance of the goats finished in feedlot was not influenced by genetic group. In bioeconomic analysis was no significant difference ( $P > 0.05$ ) between the evaluated racial groups. Gross profit margin was negative for the mestizos Pardo Alpine x SPRD. The cross between the Boer breed and without defined breed results in premature animals, reaching slaughter weights with reduced confinement period. In the feedlot finishing system crossbred Boer goats x SPRD showed better economic performance, providing greater profitability to the creator.

**Keywords:** bioeconomic analysis, Boer goats, Pardo Alpine, production system, Savannah

## RESUMO

Objetivou-se avaliar o desempenho bioeconômico em confinamento de cabritos mestiços, de diferentes grupamentos genéticos. Foram utilizados 30 cabritos, mestiços (F1), machos não castrados, sendo 10 cabritos Boer x SPRD (Sem Raça Definida), 10 Savana x SPRD e 10 Pardo Alpino x SPRD, com peso médio de 15 kg e idade média de 100 dias. O delineamento utilizado foi o inteiramente casualizado com três tratamentos (genótipos) e 10 repetições. Avaliou-se o peso inicial, peso vivo final, ganho de peso médio diário, ganho de peso total, consumo de matéria seca, consumo de água, e conversão alimentar e dias de confinamento. Como indicador econômico foi calculado a margem bruta de lucro (MB), o consumo médio de matéria seca, o período de confinamento, o custo de cada dieta e as despesas com vacinas e medicamentos. Utilizou-se o teste de Tukey a 5% para as comparações entre as médias dos tratamentos. Para as variáveis, ganho de peso, consumo de matéria seca, consumo de água e escore corporal, as médias observadas não diferiram entre os grupos genéticos. Houve efeito significativo ( $P > 0,05$ ) dos grupos genéticos sobre os dias de confinamento. O desempenho biológico dos cabritos terminados em confinamento não foi influenciado pelo grupo genético. Na análise bioeconômica houve diferença significativa ( $P > 0,05$ ) entre os grupos raciais avaliados. A margem bruta de lucro foi negativa para os mestiços Pardo Alpino x SPRD. O cruzamento entre a raça Boer e animais sem padrão racial definido resulta em animais mais precoces, alcançando pesos ao abate com período de confinamento reduzido. No sistema de terminação



em confinamento, os cabritos mestiços de Boer x SPRD apresentaram melhor desempenho econômico, proporcionando uma maior lucratividade para o criador.

**Palavras-chave:** análise bioeconômica, caprinos Boer, Pardo Alpino, sistema de produção, Savana

## INTRODUCTION

The goat breeding in Brazilian northeast semiarid is a very relevant economic and social activity, contributing to feed generation, increasing of incomes and social insertion (CARTAXO et al., 2013). Traditionally, in this region, the systems of goat production are characterized by the realization of the complete circle of production.

Brazilian northeast region concentrates 90,6% of effective national goat herds (IBGE, 2009), but the productive indexes are still low due some factors, such genetic quality of the herd and feed condition, which is the great bottleneck in production. The low zootechnical indexes obtained has leded many producers to seek other genetic options of goats, looking for obtain better results in their breedings.

The genetic group without defined racial pattern (WDRP) is the one with higher concentration in Brazilian northeast, from the mixing of several breeds. These animals were always used in matings, as maternal race as breeding, as much as meat production or milk production (CARTAXO et al., 2013).

Bazerra et al. (2000) observed a great variability in deposition of protein for native breedings, such *Moxotó*. These differences in tissue deposition probably result in differences in the composition and nutritional composition of these animals; however, there is a lack of information in literature about the

nutritional exigencies for WDRP animals (TEIXEIRA, 2004).

In dry period of the year, the performance and productive potential presented by this genetic group do not suit it as appropriated to production and sale of goat meat, since, although they do not suffer so hardly the rigors of weather such exotic specialized breedings, the WDRP do not present high productive indexes, mainly in confinement.

To attend the needing of consumer market of goat meat, as quantitative as qualitative, it is important to use animals with good genetic potential to weigh gain characteristics, mainly in confinement system (OLIVEIRA et al., 2007).

The improvement of herds, through selection inside the breed and using mating among breeds or different genetic groups, it has been constituted in an important tool to increase the production and productivity of the herds, besides providing higher incomes and quality of carcasses.

The specialized genotypes for meat production, as Boer and Savana breeds, in mating systems with animals without defined racial pattern (WDRP) or animals with milking ability, such Pardo Alpino breed, allied to an adequate feeding, would promote an important increment in goat meat production in northeast; however, it is few known about productive and economic characteristics of these breeding, besides the usage of goats that, most of times, are discarded in milk production.

Thus, it is necessary to increase the actual systems of production; mainly those related to feeding and sanity of animals, as well the genetic constitution of the herds.

After what has been exposed, it was aimed, from this study, to evaluate the productive and economic performance of goats crossbreed for cut, from different genetic groupings.



## MATERIAL AND METHODS

The present study was conducted in Experimental Station of Pendency, which belongs to EMEPA (Farming Research Enterprise of Paraíba S.A), located in Cariri region, mesoregion of Paraíba Wilderness, microregion of Ocidental Curimataú, in Soledade city, Paraíba State, in 07°08'18"S and 36°21'02"W, Gr, at an altitude around 521 meters and area of 727 hectares.

The weather, according to Koppen classification, is hot semi-arid – Bsh, with average annual temperature of 30°C and relative humidity around 50%. The pluvial precipitation is, in average, of 400 mm/year, according to meteorological data obtained in the experimental station itself. The experiment was realized in the period between the months from March to May, 2013.

They were used 30 breed goats, not castrated male, from three genetic groups, being 10 breed goats (F1) of Boer x WDRP, 10 breed (F1) of Savana x WDRP and 10 breed (F1) of Pardo Alpino x WDRP. In all breeding, the patterns were WDRP and the reproducers were Boer, Savana and Pardo Alpino races, respectively. The initial weight was 15kg± 110g and initial age of approximately 100 dias.

The designing used was entirely casualized, with 10 repetitions in each genetic group.

In the beginning of adaptation period, the animals were treated against endo and ectoparasites with more than 200 mg/kg of live weight of ivermectina 1% injectable (Ivomec<sup>®</sup>, Merial, São Paulo) and vaccinated against clostridiosis with 3 mL underskin (Hertamax-10<sup>®</sup> Hertape Calier Saúde Animal S.A., Minas Gerais) and also received a vitamin and mineral complex.

The animals were properly identified with plastic earings, set on their ears. Then, they were randomly distributed in individual covered bays, with slatted and lifted floor, with 0,80 x 1,20 meters, equipped with individual feeders and drinking fountains.

The experimental period was preceded by 14 days of animals adaptation to the installations, feeding and management. At the beginning of the experiment and each 14 days, the animals were weighted, always at 7 a.m, after fasting food for 16 hours. It was established as culling criterion the live weight of 25 kg, or, if this first criterion would not be reached, it would be considered the maximum period of 64 days of confinement, in which we would have animals with 5 months old, approximately, with the purpose of we obtain meat from very young animals. The ration used was elaborated according to NCR (2007), containing 16,5% of crude protein and being formulated to a weight gain of 150 g/day, based on exigencies for goats with 15 kg of living weight and moderated growing, whose feeding and chemical composition is presented on Table 1, in which the values are according to CQBAL (2013).

The goats received the diets *ad libitum* during all experimental phase, twice a day, at 7 a.m and 3 p.m. The consumption of dry matter was daily determined by quantifying the offer and the lefts along the period.

The water consumption (WAC) was determined by quantifying the offer and the lefts, in the period of five days. The observation begun at 7 a.m, moment in which the water was offered, and after complete 24 hours from providing. At 7 a.m on the following day, the left was weighted for estimate the daily consumption.

Finished the experimental period, after fasting solids of 16 hours, the animals were weighted to be obtained the body



weight at slaughter (BWS), total weight gain (TWG), daily average weight gain (DAWG) and feeding conversion (FC). The slaughter followed the Normative Instruction #3 of 17/01/2000 from Ministry of Agriculture, Livestock and Supply (BRASIL, 2000), which deals with Humanitarian Slaughter of Butchery Animals and consisted of stunning, by cerebral concussion, followed by sangria, esofla and evisceration, besides head and paws removal.

Table 1. Feed and chemical composition of the experimental diet dry matter based

Feed composition (g/kg)	
Ground corn	498,00
Soybean meal	162,00
Weath bran	100,00
Tifton hay	200,00
Soy oil	20,00
Mineral salt	10,00
Chemical composition (g/kg)	
Dry matter (g/kg)	892,80
Crude protein (g/kg)	165,00
Fiber in neutral detergent (g/kg)	287,60
Ethereal Extract (g/kg)	50,30

The evaluation of body score was made in the last day of confinement, by two trained examiners, according methodology described by Cezar & Souza (2007). To attribute the scores were made before the slaughter, by visual and tactil examination, by palpation of lombar region and in insertion of goats tail, with scores from 1 to 5, with intervals of 0,5 point, being: score 1 – very thin animal; score 2 – thin; score 3 – moderate; score 4 – fat; and score 5 – very fat.

According to Cartaxo et al. (2008), the gross profit margin was obtained by the following equation:  $GM = (WGC \times 5,00) - [(CP \times ACDM \times DC) + EVM]$ , in which: GM is the gross profit margin

(R\$/animal); WGC is the wheight gain during confinement; 5,00 is the price per kilo of live animal practiced in region (R\$); CP is the confinement period; ACDM is the average consumption of dry matter; DC is the diet cost; and EVM is the expenses with vaccines and medicines.

To evaluate the studied variables it was considered a linear model, containing only fixed effects, and it was applied the method of minimum squares, throught the analysis of variance (ANOVA), bu the using of GLM procedure (General Linear Models) by SAS (1999), and compared to treatment averages through Tukey's test at 5% of probability. The conaidered mathematic model was:

$$Y_{ij} = \mu + G_i + \epsilon_{ij}$$

In which:  $Y_{ij}$  = value observed to each variable in study;

$\mu$  = general average;

$G_i$  = genotype i effect;

$\epsilon_{ij}$  = random error j associated with each observation.

## RESULTS AND DISCUSSION

It was not observed significant effect ( $P > 0,05$ ) of the genetic group over WGC, ADWG, FC and dry matter consumption, as can be seen in Table 2.

The genetic group did not have significant influence ( $P > 0,05$ ) over the total weight gain; however, these results differ from the observed by Cartaxo et al. (2013), which, working with different genetic groups, observed that significant diferences about total weight gain among the genotypes Boer x WDRP, Anglo Nubiano x WDRP and WDRP, being the higher total weight gain of Boer x WDRP goats.

However, the result obtained in this study, for total weight gain, in genetic



group Boer x WDRP (10,13 kg), is similar to the one verified by Cartaxo et al. (2013), in which the authors quote the value of 9,78 kg to the same measure, in the same genetic group. It was expected that the breeds Boer and Savana, which were originated from

racas with aptitude for meat, by their higher potential of growing and muscle deposition in carcasses, present a weight gain higher than the breed genotype of Pardo Albino, which were originated from races with aptitude for milk; however, this fact was not observed.

Table 2. Performance values of terminated goats in confinement, in genetic groupment function

Variable	Genotype			VC(%)	P
	WDRP x B	WDRP x S	WDRP x PA		
IW(kg)	15,02	14,68	14,58	11,76	0,839
FLW(kg)	24,80	24,88	25,00	7,020	0,967
TWG(kg)	9,78	10,2	10,42	13,39	0,570
ADWG(g/day)	184,73	163,31	166,66	18,35	0,297
CDM(g/day)	862,50	812,80	944,60	11,17	0,121
CDM(g/ kg <sup>0,75</sup> )	86,84	81,97	88,96	9,240	0,149
CDM(% LW)	4,04	3,81	4,10	9,730	0,233
WAC(kg/day)	2,35	2,50	2,45	25,34	0,848
WAC(g/kg <sup>0,75</sup> )	236,09	252,39	240,82	23,06	0,801
WAC(% LW)	10,99	11,74	11,11	22,73	0,780
WAC(%CDM)	2,71	3,04	2,70	17,87	0,247
FC(g/g)	4,87	5,00	5,50	16,53	0,236
CD (days)	55,20b	62,60a	62,60a	12,45	0,054
FE(1-5)	2,55	3,55	2,35	14,44	0,368

B = Boer; S = Savana; PA = Pardo Alpino; WDRP= without defined racial pattern; IW = initial weight; FLW =final live weight; ADWG=average daily weight gain; CDM<sup>0,75</sup>= consumption of dry matter per metabolic weight; CDMLW =consumption of dry matter per live weight; CDM = consumption of dry matter; WAC = water consumption; WAC <sup>0,75</sup>= water consumption per metabolic weight; WAC LW= water consumption per live live weight; WAC CDM= water consumption per consumption of dry matter; TWG = total weight gain; FC= feed conversion; CD = confinement days; FE = final body score; VC= variation coefficient; P = probability.

The growth and development of the animal are directly related with age, gender, genotype, feeding and productive system where the animal is inserted. Takin on account that the animals used in this essay were contemporary and similar weights at slaughtering and received the same diet; this possibly caused the inexistence of effect (P>0,05) in weight gain among genetic groups. Besides, due to genetic base matrices to meat production have suffered feed restriction in final third of gestation, they might have

influenced the fetal development and weight gain of goats.

The genotypes did not present differences (P>0,05) about daily weightgain. However, although weight gain did not have been significant among the different genetic groups, the breed Boer presented 6,63% more weight gain than the other genotypes, fact expected because it is about animals originated from a race with more potential meat production.

Oliveira et al. (2007),evaluating breed goats ½ Anglo Nubiana x WDRP, ½





Boer x WDRP,  $\frac{3}{4}$  Anglo Nubiana x WDRP and  $\frac{3}{4}$  Boer x WDRP in confinement, with initial age of nine months old, receiving diets with high energetic value, to daily weight gain of 150g, also did not find difference in the performance, with values to average weight gain of 139 g/day, 132 g/day, 130 g/day and 167 g/day, respectively, values next to the observed in the present research.

The ADWG obtained in this work, in the different genetic groups, were found among the related in national literature to breed goats Boer. Works realized by EMEPA (2002) describe ADWG in confinement of 162 and 144 g/day, respectively, to goats breed Boer x WDRP and Anglo Nubian x WDRP. However, studies evaluating breeding with races Savana and Pardo Albino are still scarce in literature. Urge et al. (2004), evaluating four different terminated goat genotypes (Pardo Alpino, Angorá, Boer and Spanish) in confinement systems, observed superiority to Boer breed, in relation to other genotypes.

The results to ADWG verified in this study are close to the ones quoted by several authors, evaluating different breeding involving the races Boer, Savana and Pardo Alpino, also evaluated in this work. Among them, they can be quoted the studies of Fernandes et al. (2005), Pereira Filho et al. (2005) and Hashimoto et al. (2005), that evaluated the breeding between Boer and Saanen and the study of Menezes et al. (2005), that evaluate the breed between Boer and Alpino.

The similarity in weight gain among breed goats Savana, Boer and Pardo Alpino with WDRP was not expected, considering that Boer and Savana are specialized in meat production. An important aspect we could observe in the present study was the similarity in potential daily weight gain among the

animals, because, according recommendations of NRC (2007), the diet offered to the animals was formulated to moderate weight gain of 150 g/day, to goats with average live weight of 15 kg, since the results were superior than the estimated by the NCR. Differing from results obtained in this study, analyzing the performance of native Moxotó and Canindé goats in confinement, with live weight of 15,29 kg and feed with diets similar to the present study, in Paraíba semi-arid, Barreto (2012) verified daily weight gain of 55,54 and 71,23 g/day, respectively. These results demonstrate the importance of the use of breeding with races that produce meat, including animals WDRP, as alternative to improve the productive performance of the Brazilian northeast herds.

The daily consumption of dry matter per metabolic weight and consumption of dry matter per percentage of live weight, among studied groups, was similar. To dry matter consumption, in live weight percentage, it was observed value of 3,98% to breed of Boer, Savana and Pardo Alpino. These values are higher than estimated in NRC (1981), which advocates the values of 2,5 to 3,0% of live weight, to growing animals. This fact may be associated to the high quality of the diet used in this study.

The average consumption of water was not influenced ( $P>0,05$ ) by evaluated genetic groups. In the study of Loiola Filho et al. (2012), also there were not observed difference in water consumption by growing WDRP goats, confined and fed with ration composed by maniocoba silage and different portions of cottonseed.

This value of 2,8 g/day is close to the found in the present study, in which was verified the average value of 2,93 g/day, when the consumption of dry matter was 873,27 g/day/animal.



There was not significant differences ( $P>0,05$ ) among the genetic groups evaluated, in relation to FC. The breed (F1) Boer x WDRP and Savana x WDRP did not presented better FC, even being more efficient in feed conversion because they are animals specialized in meat production and that present higher capacity of change the food in body tissues, as muscle and fat. Then, although the races Boer and Savana provide high weight gains, did not overcame breed animals with Pardo Alpino, that are of the multifunctional biotype. The explanation to feed conversion did not have been efficient among different genetic groups is due to the fact of the consumption of dry matter and DWG expressed in kg/day also have presented significant difference.

Values similar to the reported in this study are presented by Sousa et al. (2012), evaluating the biological performance of pure and breed lambs of races Santa Inês and Dorper, in confinement, found average values of 5,82g/g, 5,28g/g, and 6,39g/g, to VC of animals Santa Inês, Santa Inês x Dorper and Dorper, respectively. Therefore, the values found in the present research are considered acceptable when it is working with goat species.

It was not verified also significant effect ( $P<0,05$ ) of genetic group over body score variable. Mendonça et al. (2003) affirmed that the level of termination of the animal is correlated to the carvasse and also directly related to body score of live animal, in way of the animals of different genotypes or genetic groups will present different taxes of tissues development and, still, differentiations about different tissues groups.

The confinement days were statistically inferior ( $P>0,05$ ) to the animals of genetic group Boer x WDRP (Table 2). However, there was not differences

among genetic groups Savana and Pardo Alpino, to the same value, in way that these genetic groups may be considered more late, when compared to breed Boer, because they spent more days to reach the slaughter weight of 25 kg, what represents the elevation of production costs.

These results are according to the ones found by Menezes et al. (2012), who, evaluating weight gain and biometric measures of young goats in function of racial group, affirm that breed animals Pardo Alpino are more late and high the production costs. Results found by Pulz et al. (2002), in comparative evaluation of productive performance of pure goats Pardo Alpino and breed half Pardo Alpino x half Boer, concluded that the higher weight gain presented by breed animals may reduce the slaughtering time.

Although the breed half Boer x WDRP have presented ADWG similar to other genetic groups, it was verified higher tax of gain of weight for this genetic group, demonstrating the precocity to reach the weight for slaughter, reducing, then, the confinement time and the costs related to feeding.

Such results, inclusive, incorporate better results to genetic group breed with Boer, though they did not statistically differ in relation to variable CDM, ADWG, FC and CD, which are related to the better performance of the animal, reflecting, directly, in total profit margin of production.

As we can observe in Table 3, the total profit margin was positive to animals breed with Boer and Savana, and negative to animals breed with Pardo Alpino. Milch races animals, because they do not have their development directed to muscle production, demands higher periods of confinement to reach determined weight to slaughter, it means more consumption of dry matter and



more labor costs, consequently higher production costs and less profitability of the system.

This consideration may explain, inclusive, why, although the period of confinement has been similar to genetic group breed of Savana and Pardo Alpino, only the genetic group of Pardo Alpino presented

negative profit total margin; it may be also highlighted the variables Weight gain, Consumption of dry matter, Feed conversion and Average daily weight gain, that, although do not present statistical difference, were better to breed animals of Savana and Boer.

Table 3. Averages to performance and profitability characteristics of the system, to breed goats from different genetic groups

Variable	Genotype		
	WDRP x B	WDRP x S	WDRP x PA
N <sup>o</sup>	10	10	10
IW (kg)	15,02	14,68	14,58
FW (kg)	24,80	24,88	25,00
TWG (kg)	9,78	10,2	10,42
LGE (kg)	5,00	5,00	5,00
DC (R\$/kg MS)	0,96	0,96	0,96
ACD/DM/Goat (Kg)	0,862	0,812	0,944
CP (days)	55,2	62,6	62,6
CVM (R\$/Animal)	0,98	0,98	0,98
TMP (R\$)	2,24	1,22	-5,61

B = Boer; S = Savana; PA = Pardo Alpino; N<sup>o</sup> = number of animals; IW = initial weight; FW = final weight; TWG = total weight gain; LGW = live goat weight; DC = diet cost; ACD/MS/Goat (kg) = average consumption of diet; PC = confinement days; CVM = costs with vaccines and medicines; TMP = total margin of profit.

In termination phase it must be assured adequate food to the animals for a faster obtaining of the wished weight, in way to reach the slaughter weight in a short time. Siqueira et al. (2001), evaluating full male lambs and females, with different weights at slaughtering, observed liquid profit varying from R\$ 6,17 to R\$ 17,73. Cartaxo et al. (2013) found average values of total margin of profit of R\$ 6,27/ animal to animals breed of Boer x WDRP and R\$0,54/animal to WDRP, when compared with animals Anlgo Nubiano x WDRP, which had otak margin of profit of R\$ 0,52/animal.

According to the results found in the present study, there are the results reported by Sousa et al. (2012), that evaluating the bioeconomic performance of terminated lambs in confinement,

related less total margin of profit to animals breed WDRP, when compared to breed with specialized races for meat production, demonstrating that the breed with races with aptitude for meat production, as the case of the animals used in this study, Boer and Savana, increases the liquid profit, because they consume less food to reach the ideal weight for slaughter.

Adopting breeds, it is possible to use the contribution of heterosis, to characteristics with economic importance, aiming to reach optimal levels of development, compatible with systems of intensive production, even in the first generation, as well as the utilization of genetic resources available in production systems.

The results obtained in this study to breeding of races Boer, Savana and





Pardo Alpino with animals WDRP point to benefits, as in relation to weight gains, as to the precocity of termination, to breeding of Boer and Savana, which might represent great alternatives to the exploration of goat meat in Brazilian northeast, reducing production costs and taking advantage of local genetic resources.

The biological performance of the goats terminated in confinement is not influenced by the genetic group. However, in the system of termination in confinement the breed goats of Boer x WDRP present better economical development, providing better profitability to the creator.

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