Use of Biocelerator in drinking water of confined sheep

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Technical Report

Introduction

Sheep farming is of great economic and social importance for the states of the northeast of Brazil and is often the main source of animal protein for many inhabitants of the region.

In the local economy, sheep herds represent an extra source of income for producers, who can sell their animals at critical times of the year, when income from their properties is affected by climatic conditions.

Such periods bring adverse conditions for the commercial exploitation of ruminants, with the availability and quality of pasture deteriorating due to a lack of rain. This leads to weight loss among animals, reducing the quality of the carcass and the producer's income.

One of the options available in such situations is the use of confinements, where the animals remain in collective pens or corrals, and food is provided in troughs, along with freely available water. The feed used in these systems is usually composed of conserved forage and concentrated feed.

The conserved forage can be produced by producers in the rainy season, when there is an abundant availability of natural pastures, in the form of silage or hay. In sheep farming the confinement system gives the producer greater certainty about the diet and quality of their animals, which can result in greater profitability.

In order to optimise this system, several forms of technology can be used to achieve greater efficiency and profitability for the producer. One of these is the use of products that aim to increase the efficiency of the use of nutrients present in the diet of animals, increasing the gains in body weight, reducing the length of confinement and enabling slaughter at a younger age. This is the initial purpose of the use of Biocelerator in the drinking water of such animals.

Biocelerator is a state-of-the-art biostimulator, produced via cutting-edge molecular processing technology, which naturally stimulates the microbiological activity of the environment in which it is applied.

With a chemical composition similar to that of drinking water, Biocelerator consists of an aqueous solution of inorganic nanoparticles, which change the speed at which substances dispersed in the aqueous medium (oxygen, nutrients, organic material, etc.) pass through the cell and intracellular walls, resulting in greater energy and metabolic conversion in bacteria. As a result, there is a natural increase in microbiological activity within the rumen fermentation process, bringing several economic benefits for the nutrition of ruminants.

Methodology

The present study was carried out in the Goat and Sheep sector of the Ceará Federal Institute of Education, Science and Technology (the Instituto Federal de Educação, Ciência e Tecnologia do Ceará, or IFCE), Crato campus, Crato, Ceará. The proposed methodology was submitted to and approved by the IFCE Animal Experimentation Ethics Committee (CEUA/IFCE) under number 5945290520.

The Goat and Sheep Sector of the IFCE Crato campus, where the animals were kept, is equipped with individual stalls, covered with ceramic tiles and cement floors, which contain individual feeders and drinkers, and also possesses natural ventilation. Light is provided by the sun during the day and by artificial lighting at night.

Twenty-four sheep were used in the study, of which 12 were female and 12 were male, with no defined breed pattern (NDBP), a mean age of ninety days and an initial mean body weight of 17.12 kg. First, the animals were identified with tags and collars, weighed, treated against ectoparasites and endoparasites, and after selection by draw, distributed into individual stalls with troughs and drinkers.

The animals' diet had a roughage:concentrate ratio of 60:40 and was composed of corn silage and concentrated feed based on ground corn, soybean meal, mineral supplement and NaCl.

The evaluated treatments were defined based on the inclusion or absence of Biocelerator, in groups of both sexes, resulting in the following treatments: T1- Females with Biocelerator, T2- Females without Biocelerator, T3- Males with Biocelerator, T4- Males without Biocelerator. The Biocelerator was administered directly in the drinking water at an amount of 9 ml per animal/ day. The water was replenished daily, and after evaluation of water intake, the Biocelerator was added in the amounts described. The diets were balanced to provide a mean daily weight gain of 150 grams, based on the nutritional requirements for the category of animal under study, according to the NRC (2007).

Feed was provided at 8:00 am and 3:00 pm, in total diet form, which consisted of corn silage plus concentrated feed, according to the pre-established treatments, with water permanently available in plastic containers with a capacity of 9.3 liters, which were used to measure the daily water consumption of the animals. To do this, when feed was provided the volume of water in all the drinkers was restored to the maximum volume of the container, and the replacement volume, considered the volume ingested by the animal, was recorded.

Before the morning feeding, the remaining food from each experimental unit was collected, and after being weighed and recorded, was stored at temperatures below freezing (-10ºC), together with samples of silage and the concentrated feed. The amount of total feed was adjusted daily to provide a consumption *ad libitum* with a 10% surplus. The animals were weighed weekly to monitor the gain in body weight during the experimental period, with the first seven days used to adapt the animals to the facilities and the experimental routine and the remaining period used for data and sample collection. When the mean body weight (BW) of the group, according to the treatment, reached 30 kg, all the animals receiving that treatment were slaughtered.

For postmortem assessments, the animals were slaughtered in the slaughterhouse of the IFCE Crato Campus, by means of cerebral concussion, followed by cutting of the jugular vein, and all the blood was removed. The hot carcass weight was measured by removing the head, extremities of the limbs and genitals, including the tail. The hot carcasses were weighed (HCW) to determine the hot carcass yield (HCY=HCW/BWS × 100, where BWS is the body weight at slaughter). To obtain the cold carcass weight (CCW), the carcasses were identified and kept in a cold chamber (4ºC) and hung by the tarsometatarsal joints, for 24 hours. Cooling weight loss (CWL) and cold or commercial carcass yield were determined by the expressions: CWL (%) = (HCW - CCW/HCW)*100; CCY(%) = (CCW/BWS)*100, respectively.

In addition to the analyzes described above, the feces of all the animals were examined before the slaughter of the first group, and the gastrointestinal parasite egg count per gram of feces, popularly known as fecal egg count or FEC, was carried out in accordance with the methodology described by Hassum (2008).

The data were subjected to analysis of variance and test of means, taking into account the treatments, using the GLM procedure of the Statistical and Genetic Analysis System (or SAEG) (UFV, 2001). A 5% level of probability was adopted.

Results and Discussion

Table 1 shows the results of the mean final body weight, the mean daily weight gain and the mean number of eggs of *Strongyloides* and *Haemonchus* per gram of feces of male and female confined sheep receiving or not receiving Biocelerator in their drinking water.

According to the statistical analysis of the data, the parameters mean daily weight gain (DWG) and number of eggs per stool/fecal egg count (FEC) differed significantly (P<0.05), with the best results obtained by the animals given Biocelerator in their drinking water.

Table 1: Measurements of final body weight, mean daily weight gain and mean number of eggs for *Strongyloides* and *Haemonchus* per gram of feces of male and female confined sheep given or not given Biocelerator in their drinking water after 66 (sixty six) days of confinement.

	FBW	DWG	FEC
With Biocelerator	28.55a	157.06a	130.00b
Without Biocelerator	25.76a	125.75b	208.33a
CV	16.28	25.87	98.42
P value	0.136	0.0479	0.028

(1) FBW: Final body weight, DWG: Mean daily weight gain, FEC: Fecal Egg Count or number of eggs of *Strongyloides* and *Haemonchus* per gram of feces.
(2) Means in the same column, followed by different letters, differ from each other in the Tukey test, at a 5% level of significance.

The DWG obtained for the group of animals that ingested Biocelerator (considering males and females) was very close to what was expected from the formulation of the diet based on the nutritional requirements determined by the NRC (2007), with the result 19.93% greater than that of the control group.

In terms of FEC, the animals in the test group had a statistically (P<0.05) lower parasitic load than animals in the control group, thus showing the efficiency of Biocelerator in reducing the infestation of bloodworms in the gastrointestinal tract of sheep. It is worth noting that, according to the parasitological attack index, the number of eggs per gram of feces, which ranged from 0 to 500, is considered low. According to Hassum (2008) when the average result found in the examinations is less than 500 eggs per gram of feces for sheep and goats, treatment of the animals is not required.

Both groups of animals were in such condition due to treatment with an ivermectin-based antiparasitic, to which all the animals were subjected as part of the pre-experimental management. It can therefore be inferred that the animals in the control group may reach a level of infestation where treatment is recommended more quickly than the test group, and therefore, if confinement is prolonged, the producer will have the additional cost of antiparasitic treatment.

Figure 1 shows the evolution of the body weight of the animals submitted to the evaluated treatments. It can be seen that throughout the experimental period animals that received Biocelerator in the drinking water had a higher body weight than the animals in the control group.

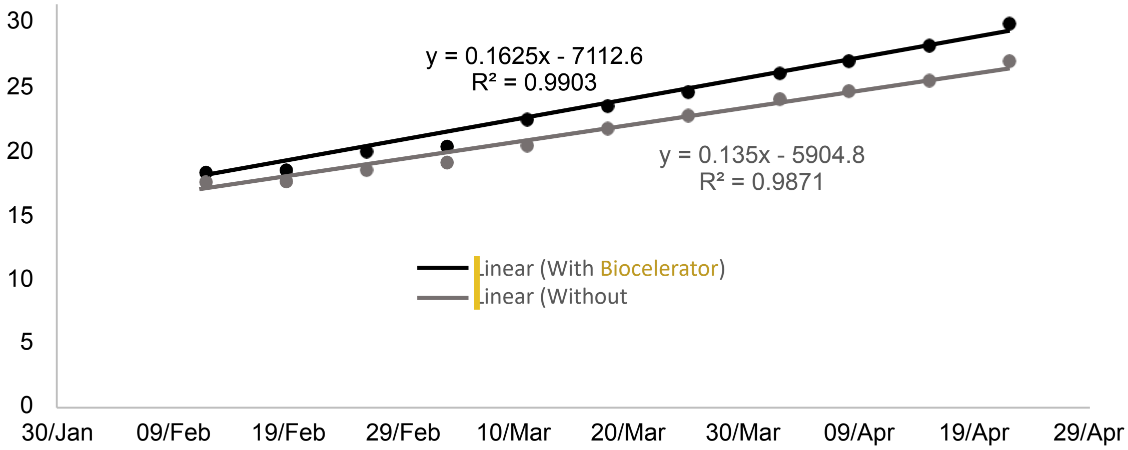

Figure 1: Body weight of male and female sheep given or not given Biocelerator in drinking water.

Based on the regression equations of the lines shown in Figure 1, the slope coefficient value for the line of the sheep receiving Biocelerator in drinking water (0.1625) was greater than that observed for the control group, which was 0.135. This difference confirms the positive effect that Biocelerator has on the body development of the animals, due to the more effective use of the nutrients available in their diet.

Table 2: Time needed to reach a mean body weight of 30 kg, final body weight, fasting body weight and carcass characteristics of male and female confined sheep receiving Biocelerator in drinking water.

	D30M	D30F	FBW	PCJ	HCW	CCW	HCY	CCY	CWL
With Biocelerator	70	80	30.76	28.40	13.21	12.65	46.51	44.54	1.81 b
Without Biocelerator	77	113	30.11	28.17	13.31	13.15	46.96	46.68	1.24 a
CV			14.65	14.04	17.86	17.91	6.25	6.03	31.99
P-value			>0.05	>0.05	>0.05	>0.05	>0.05	0.129	0.006

(1) D30M: days that the group of males took to reach a mean body weight of 30 kg, D30F: days that the group of females took to reach a mean body weight of 30 kg, FBW: Final body weight, DWG: Mean daily weight gain, HCY: Hot carcass yield in %, CCY: Cold carcass yield in %, CWL: Cooling weight loss in %.

(2) **Means** in the **same** column, **followed** by different **letters**, differ from each other in the Tukey test, at a 5% level of significance.

The final body weight shown in Table 2 comprises the slaughter weight determined in the methodology, that is, 30 kg. It is important to note that the number of days for the groups to reach this pre-determined value differed, with males and females who received Biocelerator reaching the estimated mean body weight in 70 and 80 days, respectively. The two groups, male and female, who did not receive Biocelerator in their drinking water, required 77 and 113 days, respectively, to reach the slaughter weight.

It can be seen that the carcass characteristics did differ significantly (P> 0.05) except for CWL. The values obtained in this experimental test proved to be close to those observed in the literature. For example, Cunha et al. (2008), identified HCW, CCW, HCY and CCY values of 15.35; 15.02 kg; 47.64 and 46.60%, respectively. Santos et al. (2006) obtained values of 46.28 and 45.70% for hot and cold carcass yields in finished Santa Inês sheep provided with a diet based on granola in grains and its by-products.

A lower CWL was observed in the test group, reflecting the longer confinement time of these animals, both males and females, which resulted in a greater accumulation of subcutaneous fat, which provides greater protection for the carcass in relation to moisture loss due to cooling. According to Martins et al. (2000) cooling loss rates in sheep are generally around 2.5%, with oscillations between 1 and 7%, depending on the uniformity of fat cover, sex, weight, temperature and the relative humidity of the cold room.

The final body weight, mean daily weight gain and carcass characteristics parameters of male confined sheep given Biocelerator in their drinking water are shown in Table 3, where it can be seen that the animals that ingested Biocelerator exhibited statistically superior results (P<0.05) for the parameters mean daily weight gain (DWG) and hot carcass yield (HCY), with the mean daily weight gain being 13.21% higher than the control group.

Table 3: Final body weight, mean daily weight gain and characteristics of carcasses of male confined sheep given Biocelerator in their drinking water.

	FBW	DWG	HCY	CCY	CWL
With Biocelerator	30.01[a]	180.55[a]	46.26[a]	45.22[a]	2.24[a]
Without Biocelerator	28.11[a]	156.69[b]	45.80[b]	45.21[a]	1.29[a]
CV	13.75	22.9	7.45	7.51	17.67
P value	0.681	0.031	<0.005	1.094	0.823

(1) FBW: Final body weight in relation to the period from the start of the experiment until the slaughter of the first group, DWG: Daily weight gain, HCY: Hot carcass yield in %, CCY: Cold carcass yield in %, CWL: Cooling weight loss in %.
(2) Means in the same column, followed by different letters, differ from each other in the Tukey test, at a 5% level of significance.

The DWG for male sheep (180.55 g/day) obtained in the present study can be considered a positive result, since it was achieved with animals without a definite breed pattern, that is, with low genetic merit for weight gain. Despite this the result for this parameter was close to that reported by Remos et al. (2010) for Santa Inês sheep, where the authors identified a DWG of 188 g/day.

According to Silva Sobrinho (2001), the slaughter body weight must be in the range of 30 to 32 kg for males, with carcass yield varying from 40 to 50%, taking into account carcass conformation, which involves the development and profile of muscle masses and the amount and distribution of fat cover. Based on the values shown in Table 2, it can therefore be observed that the animals in the test group reached the ideal weight for slaughter more quickly, with the hot and cold carcass yields obtained for both groups within the range recommended by the author.

It should be noted that the control group exhibited a DWG that was very close to that estimated in the formulation of the experimental diets, based on the spreadsheets of nutritional requirements of the NRC (2007), as described in the methodology. With the use of Biocelerator, therefore, the animals had a higher than estimated DWG (180.55 g/day (observed) and 150 g/day (estimated)), from which it can be inferred that there was a more efficient use of nutrients contained in food by animals in the test group.

Figure 2 shows in linear format the body growth of male sheep either given or not given Biocelerator in their drinking water. It appears that the group that ingested Biocelerator had a faster growth rate than the control group, reaching the recommended weight for slaughter of 30 kg more quickly.

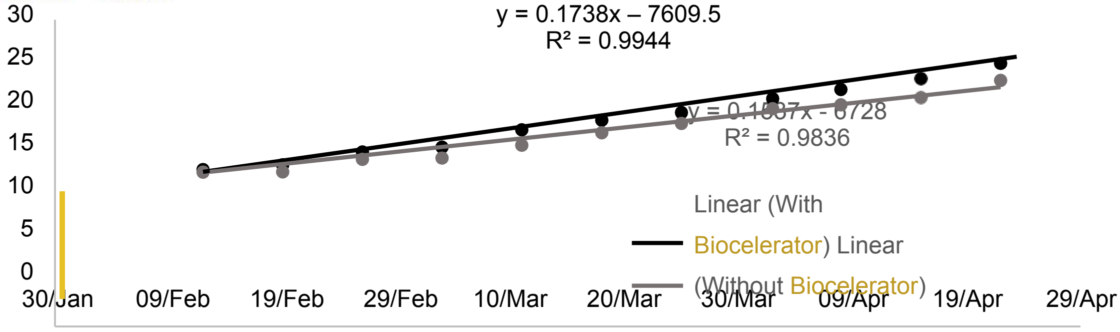

Figure 2: Body weight of male sheep during experimental period.

Based on the regression equations shown in Figure 2, a faster growth rate can be seen for the animals in the test group than the control group, with a higher slope coefficient value. The values in question were 0.1738 for the test group and 0.1537 for the control group.

The values obtained for the female group are shown in Table 4. It should be noted that the mean final body weight for the control group is related to the day on which the test group, which was given Biocelerator, was slaughtered and the other values refer to the entire confinement period of the group that was not given Biocelerator, with the animals in this group being slaughtered with a mean body weight equal to 30.00 kg. Based on this body weight value, the values of hot and cold carcass yield and loss due to cooling were obtained.

Table 4: Final body weight, mean daily weight gain and characteristics of carcasses of female confined sheep given Biocelerator in their drinking water.

	FBW	DWG	HCY	CCY	CWL
With Biocelerator	30.24a	144.83a	46.55	45.80	1.61
Without Biocelerator	25.37b	124.33b	48.12	47.56	1.18
CV	16.38	23.14	4.87	5.14	35.23
P value	0.094	0.028	0.265	0.233	0.157

(1) FBW: Final body weight in relation to the period from the start of the experiment until the slaughter of the first group, DWG: Daily weight gain, HCY: Hot carcass yield in %, CCY: Cold carcass yield in %, CWL: Cooling weight loss in %.
(2) Means in the same column, followed by different letters, differ from each other in the Tukey test, at a 5% level of significance.

As in the male group, the females in the test group also exhibited greater weight gain, that is, the animals that received Biocelerator in drinking water had a DWG 14.21% higher than those in the control group.

Figure 2 shows the body growth of female sheep given or not given Biocelerator in their drinking water in linear form. As a reflection of the higher DWG mentioned in Table 4, the animals in the test group exhibited a higher growth rate, similar to the male group.

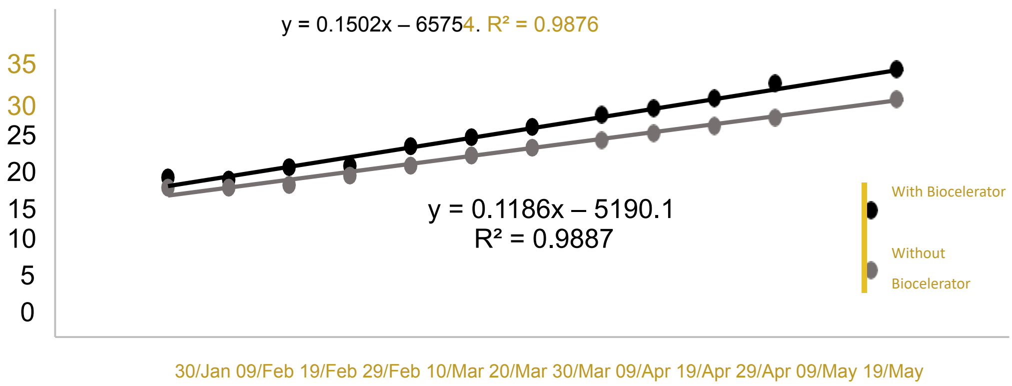

Figure 3: Body weight of female sheep during the experimental period.

In the regression equations shown in Figure 3, a greater slope coefficient value was found for line (b) for the equation relating to the female sheep that received Biocelerator, reflecting faster weight gain, which allows for a shorter required confinement time for the animals to reach the recommended weight for slaughter.

Table 5 shows the proximate composition of the concentrated feed and the respective values attributed to the ingredients. Based on these values, Tables 6, 7, 8 and 9 were created, where the economic analyzes of the performance of the animals can be seen.

Table 5: Proximate composition of concentrated feed, costs of ingredients and total cost.

Ingredient	(%)	Cost per kg[1](R$)	Cost in feed (R$)
Soybean meal	21.50	1.75	0.45
Ground corn	75.00	1.50	1.13
Mineral-vitamin core	3.00	3.20	0.10
NaCl	0.50	2.00	0.01
Cost of kg of concentrated feed (R$)			1.68

[1]Cost calculated based on a value of a 50 kg bag of soybean meal of R$105.00, a 50 kg bag of ground corn of R$75.00, a 25 kg bag of vitamin-mineral core of R$80.00 and a R$2.00 bag of NaCl.

For the economic analysis of the performance of the animals, two scenarios were considered. In the first, the number of days that the first group needed to reach a mean body weight equal to 30 kg were considered, which in this case was the test group, with the values shown in Table 6. In both scenarios it was assumed that the animals were raised on the property, a characteristic of family farms, with no expenditure required for their acquisition.

The average cost of corn silage produced on the property was also considered, in plastic bags with a mean weight of 30 kg, equivalent to R$ 0.12 for both scenarios.

Table 6: Economic analysis of the animal performance of male sheep considering the number of days required for the first group to reach a mean body weight of 30 kg.

	Costs			
	With Biocelerator	Without Biocelerator	CV	P value
Consumption[1]	3.24^a	3.14_a	16.28	0.136
Qtd. Silage (60%)	1.944	1.884		
Qtd. Conc.(40%)	1.296	1.256		
Kg silage (R$)[2]	0.12	0.12		
Kg conc. (R$)[2]	1.68	1.68		
Silage cost(R$)	0.23	0.23		
Conc. cost (R$)	2.19	2.12		
Total/daily cost (R$)	2.42_a	2.35_a	20.351	0.235
D70[2]	169.40	164.50		
	Income			
CC Weight[2]	13.57	12.70		
Value of CC per kg (R$)[2]	15.00	15.00		
Income/animal (R$)r	203.55	190.50		
Profit/animal (R$)	34.15	26.00		

(1) Average consumption of natural matter over the experimental period.
(2) Kg silage (R$): average cost per kilo of corn silage, in *reais*, being produced on the property, Kg conc. (R $): average cost per kilo of concentrated feed according to the values in Table 3 , D70: total cost/animal considering 70 days of confinement, the time required for the first group to reach a mean body weight of 30 kg, CC Weight: cold carcass weight considering the cold carcass yield in accordance with Table 2, Value of CC per kg (R$): amount currently paid per kilo of cold carcass in the region of Cariri, Ceará.

In the first scenario, where it was considered that animals from both groups would spend 70 days in confinement, it was observed that when using

Biocelerator the producer would make a profit of R$34.15 compared to a profit of R$26.00 for the group that was not given the product. Individually a difference of R$8.15 per animal may not seem great, but extrapolating this to the confinement of one hundred animals would result in a gain of R$815.00.

In the second scenario, shown in Table 7, the observed number of days for the animals to reach a mean body weight of 30 kg was considered. The group that received Biocelerator in the drinking water took 70 days to reach the stipulated mean body weight, whereas the control group took seven days longer, or 77 days.

Table 7: Economic analysis considering the number of days for both groups of male sheep to reach 30 kg.

	Costs			
	With Biocelerator	Without Biocelerator	CV	P value
Consumption[1]	3.24[a]	3.14[a]	16.28	0.136
Qtd. Silage (60%)	1.944	1.884		
Qtd. Conc.(40%)	1.296	1.256		
Kg silage (R$)[2]	0.12	0.12		
Kg conc. (R$)[2]	1.69	1.69		
Silage cost(R$)	0.23	0.23		
Conc. cost (R$)	2.19	2.12		
Total/daily cost (R$)	2.42[a]	2.35[a]	20.35	0.235
D30[2]	70	77		
Total cost/animal(R$)	169.40	180.95		
	Income			
CC Weight[2]	13.57	13.65		
Value of CC per kg (R$)[2]	15.00	15.00		
Income/animal (R$)r	203.55	204.75		
Profit/animal (R$)	34.15	23.80		

(1) Average consumption of natural matter over the experimental period.
(2) Kg silage (R$): average cost per kilo of corn silage, in *rea is*, being produced on the property, Kg conc. (R $): average cost per kilo of concentrated feed according to the values in Table 3, D30: number of days that the group of animals required to reach a mean body weight of 30kg, CC Weight: cold carcass weight considering the cold carcass yield in accordance with Table 2, Value of CC per kg (R$): amount currently paid per kilo of cold carcass in the region of Cariri, Ceará.

In the second scenario of economic analysis, there is a profit of R$34.15 for the group of animals that received Biocelerator, compared to a profit of R$23.80 for animals in the control group, a difference of R$10.35, corresponding to an increase of 43.49%. As shown for the first scenario, extrapolating the difference in profit in scenario two for the confinement of one hundred animals results in an increase in profit of R$1,035.00 when using Biocelerator in the drinking water of animals.

In terms of the profitability that the producer can achieve from using Biocelerator with confined sheep, another important finding in this experimental test is the reduction of the time needed for the animals to reach the recommended weight for slaughter, which allows the producer to raise more finished lambs in the same time interval. In other words, in 360 days a producer will be able to produce up to five lots, while, based on the results of the control group only four production cycles would be possible.

It should be pointed out that revenues from the sale of hides, wool and other non-edible components were not included in the two scenarios of the economic analysis of animal performance.

As was carried out for the male animals, two scenarios were simulated for the economic analysis of the female sheep. The results for the first, considering only females, are shown in Table 8.

Table 8: Economic analysis of the animal performance of female sheep considering the number of days required for the first group to reach a mean body weight of 30 kg.

	Costs			
	With Biocelerator	Without Biocelerator	CV	P value
Consumption[1]	2.99[a]	2.88[a]	20.16	>0.05
Qtd. Silage (60%)	1.627	1.525		
Qtd. Conc.(40%)	1.296	1.256		
Kg silage (R$)[2]	0.12	0.12		
Kg conc. (R$)[2]	1.69	1.69		
Silage cost(R$)	0.20	0.18		
Conc. cost (R$)	2.19	2.12		
Total/daily cost (R$)	2.39[a]	2.30[a]	19.44	>0.05
D80[2]	191.12	184.00		
	Income			
CC Weight[2]	12.87	12.07		
Value of CC per kg (R$)[2]	15.00	15.00		
Income/animal (R$)r	203.55	190.50		
Profit/animal (R$)	1.85	-2.95		

(1) Average consumption of natural matter over the experimental period.
(2) Kg silage (R$): average cost per kilo of corn silage, in *reais*, being produced on the property, Kg conc. (R $): average cost per kilo of concentrated feed according to the values in Table 3, D80: total cost/animal considering 80 days of confinement, the time required for the first group to reach a mean body weight of 30 kg, CC Weight: cold carcass weight considering the cold carcass yield in accordance with Table 2, Value of CC per kg (R$): amount currently paid per kilo of cold carcass in the region of Cariri, Ceará.

In the comparison between the two groups for the first scenario, it can be seen that for the group of females that received Biocelerator there was a profit of R$1.85 (one *real* and eighty-five cents), while for the group without Biocelerator, the profit margin resulted in a loss of R$2.95 (two *reais* and ninety-five cents).

The results of the second scenario for females, where the number of days for the animals to reach a mean body weight of 30 kg was considered, are shown in Table 9.

In this scenario, as in the first, the females of the test group were economically more profitable than the control group, with a difference of 33 (thirty-three) days between the slaughter of the two groups, resulting in a negative profit of R$56.95 (fifty-six *reais* and ninety-five cents) in the performance of female sheep that were not given Biocelerator.

Table 9: Economic analysis considering the number of days for both groups of male sheep to reach 30 kg.

	With Biocelerator	Without Biocelerator	CV	P value
Costs				
Consumption1	2.99ª	2.88a	20.16	>0.05
Qtd. Silage (60%)	1.627	1.525		
Qtd. Conc.(40%)	1.296	1.256		
Kg silage (R$)2	0.12	0.12		
Kg conc. (R$)2	1.69	1.69		
Silage cost(R$)	0.20	0.18		
Conc. cost (R$)	2.19	2.12		
Total/daily cost (R$)	2.39a	2.30a	19.44	>0.05
D302	80	113		
Total cost/animal(R$)	191.20	259.90		
Income				
CC Weight2	12.87	13.53		
Value of CC per kg (R$)2	15.00	15.00		
Income/animal (R$)r	193.05	204.75		
Profit/animal (R$)	1.85	-56.95		

(1) Average consumption of natural matter over the experimental period.
(2) Kg silage (R$): average cost per kilo of corn silage, in *reais*, being produced on the property, Kg conc. (R $): average cost per kilo of concentrated feed according to the values in Table 3 , D30: number of days that the group of animals required to reach a mean body weight of 30kg, CC Weight: cold carcass weight considering the cold carcass yield in accordance with Table 2, Value of CC per kg (R$): amount currently paid per kilo of cold carcass in the region of Cariri, Ceará.

It is important to note that even with a small profit margin (R$1.85), the improved zootechnical performance of the female sheep that received Biocelerator, observed in the greater weight gain (144g/day), may result in a shorter waiting period until the first heat of the nulliparous female, causing the animal female to produce more lambs throughout her reproductive life, if not destined for slaughter.

It is also important to consider the higher difference in profit per animal in males than in females. This is a reflection of the anabolic performance of the male sex hormone, testosterone, which is produced in the testicles from the embryonic stage onwards, resulting in faster formation of muscle tissue, and thus, greater weight gain, which considerably reduced confinement time.

Conclusion

Biocelerator is a promising product for use in sheep confinement systems, resulting in improved weight gain and reducing the confinement time needed for animals to reach a mean body weight of 30 kg.

In the economic analysis scenarios, the use of Biocelerator resulted in greater profits for the producer.

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