

## INCLUSION ITEMS AND FINANCIAL RISK ASSESSMENT IN SYSTEMS WITH GRAZING SHEEP UNDER THE CONCENTRATED SUPPLEMENTATION

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SAP 28536 Received: 08/09/2021 Accepted: 20/03/2022

Sci. Agrar. Parana., Marechal Cândido Rondon, v. 20, n. 4, oct./dec., p. 419-423, 2021

**ABSTRACT** - The aim of this study was to evaluate the sensitivity and financial risk in two production systems of beef sheep, in grazing, with and without the use of concentrate, in Santa Teresa County - Espírito Santo State, Brazil. A cash flow spreadsheet was prepared. Through the sensitivity analysis it was shown that greater attention should be directed to the sale of finished animals and their acquisition. These, in descending order of relevance, followed by labor, in the system with no concentrate, and concentrated supplementation, in the system where it was present. Then, the Monte Carlo simulation was performed. Probabilities of 37.9 and 33.3% that the systems without and with the concentrate, respectively, were financially unfeasible were observed. Considering the alternative remuneration of 6%, there is a considerable risk for both options, perhaps because the proposed scenarios consider the need to implement all the infrastructure for the activity, in addition to the reduced size of the production module. The strategic use of concentrated supplement as a complement to pasture presents itself as an alternative that can reduce financial risk and increase income in intensive systems of production of beef sheep in grazing. The labor efficiency is an item that affects the financial efficiency of beef sheep production systems on pasture, especially in situations of weight gain of animals without the use of concentrated supplementation. The reduction of financial risk with the use of concentrated supplementation. Intensive grazing sheep production systems can be financially advantageous and the strategic use of concentrate can result in increased income and reduced financial risk associated with this type of production.

**Keywords:** sensitivity analysis, net present value, internal rate of return, Monte Carlo simulation.

### *ITENS DE RELEVÂNCIA E AVALIAÇÃO DE RISCO FINANCEIRO EM SISTEMAS COM OVINOS EM PASTEJO SOB SUPLEMENTAÇÃO CONCENTRADA*

**RESUMO** - Buscou-se avaliar a sensibilidade e o risco financeiro em dois sistemas produtivos de ovinos de corte, em pastejo, com e sem o uso de concentrado, em Santa Teresa (ES), Brasil. Foi elaborada uma planilha de fluxo de caixa, a partir da qual, calcularam-se o valor presente líquido e a taxa interna de retorno. Por meio da análise de sensibilidade demonstrou-se que maior atenção deva ser direcionada à venda de animais terminados e a aquisição deles. Estes, em ordem decrescente de relevância, seguidos pela mão de obra, no sistema com ausência do concentrado e, suplementação concentrada, no sistema onde essa se fez presente. Em seguida realizou-se a simulação de Monte Carlo. Observaram-se probabilidades de 37,9 e 33,3% de que os sistemas sem e com o concentrado, respectivamente, fossem inviáveis financeiramente. Considerando a remuneração alternativa de 6%, há um risco considerável para ambas as opções, talvez porque os cenários propostos considerem a necessidade de implantação de toda a infraestrutura para a atividade, além do tamanho reduzido do módulo de produção. O uso estratégico de suplemento concentrado como complemento à pastagem apresenta-se como uma alternativa que pode reduzir o risco financeiro e aumentar a renda em sistemas intensivos de produção de ovinos de corte em pastejo. A eficiência da mão de obra é um item que afeta a eficiência financeira dos sistemas de produção de ovinos de corte a pasto, principalmente em situações de ganho de peso dos animais sem o uso de suplementação concentrada. A redução do risco financeiro com o uso da suplementação concentrada. Sistemas de produção intensiva de ovinos em pastejo podem ser vantajosos financeiramente e o uso estratégico do concentrado pode resultar em aumento da renda e redução do risco financeiro associado a este tipo de produção.

**Palavras-chave:** análise de sensibilidade, valor presente líquido, taxa interna de retorno, simulação de Monte Carlo.

#### INTRODUCTION

In the context of the growing increase in the world population, the demand for animal protein, especially meat, one of the population's preferred sources, has increased and sheepmeat has room to rise in this market. Lamb meat presents beneficial properties for human nutrition, is a

source of proteins and essential amino acids, and has low concentration of lipids and saturated fat (ALVES et al., 2014). In addition, its flavor, color and smell are more accepted by consumers compared to those of older animals. For these reasons, farmers seek to finish young ovines, with a short life between birth and slaughter compared to other

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ruminants. Thus, producers need to properly plan and execute their production system. In order to help producers in their decision-making, studies on production systems are necessary, taking into account different breeds, nutrition and climate (OSÓRIO et al., 2012; GALLO et al., 2019).

Precisely because of that the acceptance of sheepmeat is growing, but still floating. This makes one of the decisive factors for the financial viability of physical production models to be the price paid per kilogram of the product.

However, the financial viability of a system depends not only on the price of meat, but also on a series of other factors, such as the genetic potential of the animals, feed conversion, the ideal slaughter weight and the affordable price of inputs intended for these systems (POMPEU et al., 2009; CARVALHO; MEDEIROS, 2010).

A highlight is the technological evolution in the production of grazing ruminants, which makes this a relevant alternative, as pasture is one of the cheapest foods, in addition to the high participation of the food item in production costs in systems with animals.

Furthermore, as demonstrated by Potter et al. (2000), despite all the existing knowledge, most scientific works do not include financial evaluations of the new technologies studied and do not address their increases in profitability. Thus, studies that aim to study the profitability of investments in beef sheep farming, in addition to the participation of its items, as well as the risk assessment of investments in these systems, are rare.

Through this work, the choice to invest in the production of grazing beef sheep was financially evaluated, two systems being studied, with and without the use of concentrated supplementation. Furthermore, using sensitivity analysis and Monte Carlo simulation, we sought to identify those items of greater financial relevance in each system, and to comparatively evaluate, under financial risk conditions, the two proposed systems. In defining the monetary values for each of the items in the systems, the market conditions of Santa Teresa (ES) were used.

## MATERIAL AND METHODS

For the simulation of the productive system, the minimum size of three hectares was observed, as a basic module to carry out the proposed activity. This, through the characterization and information obtained from sheep producers in the municipality of Santa Teresa. As a result of such information, a system model was recommended in which the condition of a producer who wanted to start in the activity was simulated, having such an area, where four modules of 0.6 ha would be built, added by another 0.6 ha intended for the planting of sugar cane for use during the drought. All would be irrigated and intensively used to manage the animals.

As a general feature of the project, it was determined that each system would be based on the acquisition of lambs at weaning age -70 to 90 days of age - with an average weight of  $15 \pm 3$  kg, and on carrying these to slaughter weight, with  $32 \pm 3$  kg mean, in two distinct systems: The first, with the animals conducted exclusively

on pasture, with only a white line mineral supplement (NaCl) and water at their disposal ad libitum, and; the second system in which the animals, in addition to accessing the conditions of the other system, had at their disposal in the trough, a commercial protein-energy supplement.

The results of weight gain and animal performance were obtained in a weight gain trial carried out at the Medium Size Animal Sector at the Federal Institute of Education, Science and Technology of Espírito Santo (IFES), *Campus* Santa Teresa, in Santa Teresa County, Espírito Santo State, Brazil, in a module of 0.3 ha, occupied with *Panicum maximum* cv. Aruana, irrigated and intensively managed, during the year 2020. Animal gain<sup>-1</sup> day<sup>-1</sup> and stocking values recorded in the study (60 male sheep per hectare, each with an average weight of 25 kg) were also used in the simulation. As voluminous supplementation for the dry season (May to September) sugarcane corrected with urea was used. Thus, each of the investment, expenditure and revenue items in the system was duly considered in the description of the foreseen scenarios.

In addition to the infrastructure of the existing systems, the construction of a management corral that could hold the lots of animals described in the potential recorded in observations of the production system at IFES Santa Teresa, designed for the 3 ha, was considered for the simulation.

After characterizing the systems, cash flow sheets were prepared for each of them, considering a project horizon of eight years. In the composition of the items, it was assumed that the systems did not previously exist, with all the items necessary for their development being acquired. In order to obtain the prices of the project items, a survey was carried out in three commercial establishments in the municipality of Santa Teresa. The values for the item of revenue from the sale of animals (BRL 5.00 per kg of live weight of lamb) and replacement (BRL 7.00 per kg of live weight of newly weaned lamb) were also defined according to information from average prices practiced in the municipality, on the considered base date.

Once the cash flow was assembled, the net present value (NPV at 6%) and the internal rate of return (IRR) were calculated, these being deterministic for the two proposed systems. These indicators were chosen because they consider the effect of time on cash flow (NORONHA, 1987), in an attempt to better assess the financial efficiency in each of the systems. Then, a sensitivity analysis was performed, which consisted of verifying the effect of isolated pessimistic variations of 10% on the profitability indicators of the proposed systems (6% NPV and IRR) and using the Monte Carlo simulation method, considering the effect of risk on the profitability indicators of projects (HADDADE et al., 2005). This last method is based on the principle that the indicator's relative frequency of occurrence approximates its mathematical probability when the experiment is repeated many times. Analyzes were performed using an Excel spreadsheet.

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## RESULTS AND DISCUSSION

The calculated financial indicators, assuming the exact knowledge of the values that make up the cash flow (NORONHA, 1987), are presented in Table 1. The feasibility of the proposed systems was perceived,

especially when using concentrated supplementation, where the IRR and the 6% NPV surpassed by values more than three and four times, respectively, these same indicators for the system without the use of concentrate.

**TABLE 1** - Calculated financial indicators for the proposed systems, with and without the presence of concentrate, considering the deterministic scenario for them.

Financial indicator	System without concentrate	System with concentrate
Net present value at 6%	U\$ 106,426.02	U\$ 480,476.28
Internal rate of return	11.69%	36.49%

It is noteworthy that, with the scenarios presented, the full implementation of the activity was predicted, and not the improvement of an existing structure, which highlighted the feasibility of systems with sheep conducted in intensified pastures, even for situations of small properties (predicted scenario of three hectares), or even in conditions where, at first, it is not possible to use concentrated supplementation (values of 11.69% and U\$ 106,426.02, for IRR and NPV at 6%, respectively, in the system without using the concentrate). The fact may indicate a chronological order of activities for systems of this nature, with initial priorities for the production of quality forages and the acquisition of animals, followed by their supplementation, using the concentrate as a complement, and not as a substitute for voluminous in the pasture.

The IRRs of 11.69% and 36.49%, for the systems without and with the use of concentrate, respectively, represent the return on the balance of capital tied up in the project during its useful life. Such values proved to be expressive and advantageous, for example, to what would be obtained by applying the same capital in savings accounts (real interest around 6% per year).

Considering this rate of 6% for the discount in the calculation of the NPV, values of U\$ 106,426.02 and U\$

480,216.8 were observed, respectively, for systems without and with the use of concentrate, which indicated positive values for both situations, when considering their future flows and returns, after discounting them to date at 6% (updated), which represented an increase in wealth due to investments in the proposed scenarios, even discounted from their value in use alternative.

Through the sensitivity analysis (Table 2), it was observed which items were most important for the systems' financial return. When considering both scenarios, the sale of finished animals and the purchase of newly weaned animals stood out as the main ones. These results reinforce the importance of using specialized animals with proven genetics, which can generate weight gains compatible with the scenarios described. In addition, the use of strategies that make it possible to obtain better prices for both the acquisition and sale of animals for slaughter was highlighted, which are the main points for financial success in sheep farming systems.

The importance of evaluating scenarios that use the complete cycle, from birth to termination, is also highlighted, which reduces the risk of obtaining newly weaned animals, in addition to the fact that they do not need to be adapted beforehand, when arising from situations other than those of the reality of pre-established systems.

**TABLE 2** - Percentage reductions in the projects' financial indicators, given the pessimistic variations, in 10%, for each one of the items, separately (Sensitivity analysis).

Project items	Reduction percent		Relevance order	
	NPV at 6%	IRR	NPV at 6%	IRR
<b>System without concentrate</b>				
Sale of finished animals	186.29%	87.58%	1	1
Acquisition of newly weaned animals	93.14%	45.27%	2	2
Labor (producer's salary)	27.55%	13.74%	3	3
Other items	14.93% <sup>b</sup>	8.52% <sup>b</sup>	4	4
<b>System using concentrated supplementation</b>				
Sale of finished animals	106.81%	88.12%	1	1
Acquisition of newly weaned animals	53.41%	49.18%	2	2
Concentrate	24.83%	24.51%	3	3
Other items	6.06% <sup>b</sup>	6.29% <sup>b</sup>	4	4

<sup>a</sup>Items sorted according to their financial exemption, given as higher percentage reductions in the project's financial indicators.

<sup>b</sup>Greater awareness achieved by other items in the systems' financial profitability.

In the system with the use of concentrated supplementation, this item stood out for representing purchased food, a factor with the greatest weight in

production costs, which agrees with the reports by Haddade et al. (2005). However, Deminicis et al (2008) analyzed the economic viability of different dairy goat production

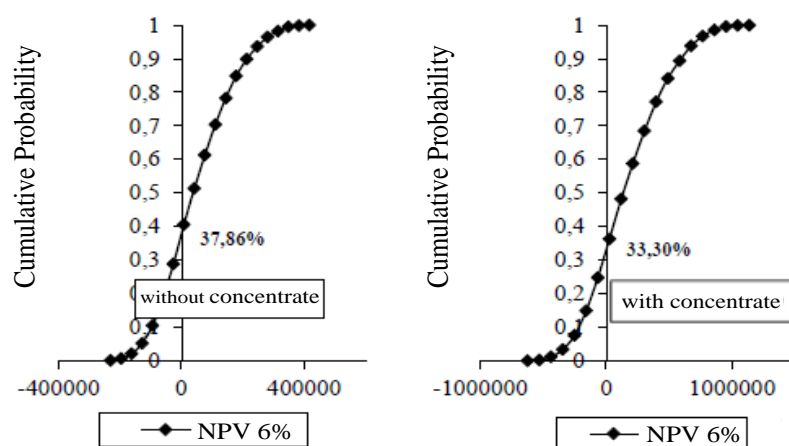
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systems in the State of Rio de Janeiro, Brazil. The systems studied were: confined sows receiving concentrate and sows on pasture without supplementation, and concluded that the system of confined sows receiving concentrate presented greater viability and lower economic risk.

The other items had a lower financial impact, with relevance to the item "bulky food", noting that, with the efficiencies, fertilization, pasture management and the use of supplementary sugarcane in the dry season, pessimistic variations of this item did not represent major risks in the financial performance for both systems. In addition, it was noteworthy that, despite considering all the necessary vaccinations and medications, in addition to deworming every 24 days, the item sanitary management was also not relevant in terms of the financial performance of both systems.

As for the financial risk results, it was found a 37.86 and 33.30% probability that the NPVs at 6% discount presented negative or null values, in the systems without and with concentrated supplementation, respectively (Figure 1), the which demonstrated the risk percentages that the systems were not profitable, considering the alternative investment in savings accounts.

Comparing with the results of the financial evaluation carried out by Haddade et al. (2005), for a dairy cattle production system on pasture (39% probability of NPV at 6% nil or negative), the values obtained with the investment opportunity in the scenarios for sheep were very close. In this regard, the fact that for both systems were considered a condition for starting the activity, where all necessary infrastructure would be built, including land acquisition.



**FIGURE 1** - Cumulative probability distributions for the Net Present Value of grazing beef sheep systems, without and with the use of concentrate, at a 6% discount rate.

Thus, the high investment of capital applied to fixed assets (facilities, fences, irrigation, among others) and the reduced size of the production module (three hectares) raised the risk conditions for both systems proposed for beef sheep. Another fact that deserves to be highlighted was the lower financial risk in the system with the use of concentrated supplementation, compared to that without the use of this alternative. Thus, even with the increase in operating expenses, given the acquisition of the supplement, the accelerated growth of animals, the possible greater number of lots in the same period and the increase in weight gain surpassed the increases in expenses, resulting in higher income. And lower risks with the option to use the concentrate. Thus, both proposed scenarios showed financial feasibility, with emphasis on the system with the use of concentrate.

In conducting both systems, greater attention should be devoted to the commercialization of animals. In addition, there is a need for greater attention regarding the items labor and concentrate, respectively, for systems with and without the use of concentrate.

## CONCLUSIONS

Considering the alternative remuneration of 6%, there is a considerable risk for both options, perhaps because the proposed scenarios consider the need to implement all the infrastructure for the activity, in addition to the reduced size of the production module.

The strategic use of concentrated supplement as a complement to pasture presents itself as an alternative that can reduce financial risk and increase income in intensive systems of production of beef sheep in grazing.

The labor efficiency is an item that affects the financial efficiency of beef sheep production systems on pasture, especially in situations of weight gain of animals without the use of concentrated supplementation.

This result demonstrated the reduction of financial risk with the use of concentrated supplementation.

Intensive grazing sheep production systems can be financially advantageous and the strategic use of concentrate can result in increased income and reduced financial risk associated with this type of production.

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**REFERENCES**

ALVES, L.G.C.; OSÓRIO, J.C.S.; FERNANDES, A.R.M.; RICARDO, H.A.; CUNHA, C.M. Produção de carne ovina com foco no consumidor. **Enciclopédia Biosfera**, v.10, n.18, p.2399-2415, 2014.

CARVALHO, S.; MEDEIROS, V. Características de carcaça e composição da carne de cordeiros terminados em confinamento com dietas com diferentes níveis de energia. **Revista Brasileira de Zootecnia**, v.39, n.6, p.1295-1302, 2010.

DEMNICIS, B.B.; VIEIRA, H.D.; KNIFIS, A.L.; PONCIANO, N.J.; SOUZA, P.M.; BLUME, M.C. Economical analysis of systems of production of goat milk in Rio de Janeiro state. **Arquivos de Zootecnia**, v.57, n.219, p.377-380, 2008.

GALLO, S.B.; ARRIGONI, M.B.; LEMOS, A.L.S.C.; HAGUIWARA, M.M.H.; BEZERRA, H.V.A. Influence of lamb finishing system on animal performance and meat quality. **Acta Scientiarum. Animal Sciences**, v. 41, e44742, 2019.

HADDADE, I.R.; SOUZA, P.M.; BARROS, E.E.L.; ALVES, G. R.; SCOLFORO, L.; CORDEIRO, M.D. Avaliação econômica sob condições de risco em sistema produtivo de gado de leite na região Norte do Estado do Rio de Janeiro. **Arquivo Brasileiro de Medicina Veterinária e Zootecnia**, v.57, n.3, p.361-366, 2005.

NORONHA, J.F. **Projetos Agropecuários - administração financeira: orçamento e viabilidade econômica**. São Paulo: Atlas, 1987. 95p.

OSÓRIO, J.C.S.; OSÓRIO, M.T.M.; VARGAS JÚNIOR, F.M.; FERNANDES, A.R.M.; SENO, L.O.; RICARDO, H.A.; ORRICO JUNIOR, M.A.P. Critérios para abate do animal e a qualidade da carne. **Revista Agrarian**, v.5, [s.n.], p.433-443, 2012.

POMPEU, R.C.F.F.; ROGERIO, M.C.P.; CÂNDIDO, M.J.D.; NEIVA, J.N.M.; GUERRA, J.L.L.; GONÇALVES, J.S. Comportamento de ovinos em capim tanzânia sob lotação rotativa, com quatro níveis de suplementação concentrada. **Revista Brasileira de Zootecnia**, v.38, n.2, p.374-383, 2009.

POTTER, L.; LOBATO, J.F.P.; MIELITZ NETO, C.G. Análises econômicas de sistemas de produção de novilhas de corte primíparas, aos dois, três e quatro anos de idade. **Revista Brasileira de Zootecnia**, v.29, n.3, p.861-870, 2000.