

Economic impact in the system of production of the canton El Panguí, for the leptospira incidence



Impacto económico en los sistemas de producción del cantón El Panguí, por la incidencia de leptospira

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Abstract.

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Leptospirosis caused by bacteria is a disease that affects bovine production and can also impact humans due to the zoonotic nature of its causative agent. In bovine production, leptospirosis causes a high economic impact, which is one of the main agents that cause abortions, fetal reabsorption, infertility, weak neonates and decreased milk production. To corroborate the aforementioned, the study was carried out in the south of the Ecuadorian Amazon, in the parishes: Tundayme, El Güismi, El Panguí and Pachicutza of the canton El Panguí, province of Zamora Chinchipe, Ecuador, located at 820 meters above sea level, with a sample of 213 bovine females older than 2 years of age, not vaccinated against leptospirosis. Once the study is completed, it can be concluded that 12.21% of leptospirosis is found in the canton of El Panguí for bovine females of reproductive age; the incidence being relatively low, compared to other studies. In the financial analysis projected to 7 years of productive activity of dual purpose cows, the financial profitability indicators TIR, VAN, B / C were positive, as long as good sanitary practices are carried out and the animals are not affected by any reproductive disease such as this is the case of leptospirosis. The economic impact of leptospirosis on the producer's family economy is evident in the generation of abortions, with which the approximate value of \$ 300 per year is lost by

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the offspring, there is a loss in milk production and, in addition, the sick animal can be transform into a contagious focus of infection for the entire bovine and human population, assuming greater losses in the squalid peasant economy.

Keywords: Leptospirosis, cattle, production costs, economic impact

Resumen.

La leptospirosis causada por una bacteria, es una enfermedad que afecta a la producción bovina y también puede impactar al ser humano por el carácter zoonótico de su agente causal. En la producción bovina, la leptospirosis origina un alto impacto económico ya que es uno de los principales agentes que provocan abortos, reabsorciones fetales, infertilidad, neonatos débiles y disminución de la producción de leche. Para corroborar lo antes mencionado, se realizó el estudio al sur de la Amazonía ecuatoriana, en las parroquias: Tundayme, El Güismi, El Pangui y Pachicutza del cantón El Pangui, provincia de Zamora Chinchipe, Ecuador, ubicada a 820 msnm., con una muestra de 213 hembras bovinas mayores de 2 años de edad, no vacunadas contra leptospirosis. Una vez culminado el estudio se puede concluir que, en el cantón El Pangui se registró el 12,21% de leptospirosis para hembras bovinas en edad reproductiva; siendo la incidencia relativamente baja, en comparación a otros estudios. En el análisis financiero proyectado a 7 años de actividad productiva de vacas doble propósito, resultaron positivos los indicadores de rentabilidad financiera TIR, VAN, B/C, siempre y cuando se realice buenas prácticas sanitarias y los animales no sean afectados por alguna enfermedad reproductiva como es el caso de leptospirosis. El impacto económico de la leptospirosis en la economía familiar del productor está evidenciado en la generación de abortos, con lo cual se pierde el valor aproximado de 300 dólares anuales por las crías, existe pérdida en la producción lechera y, además el animal enfermo se puede transformar en un foco de infección contagiosa para toda la población bovina y humana, asumiendo mayores pérdidas en la escuálida economía campesina.

Palabras claves: Leptospirosis, bovinos, costos de producción, impacto económico

Introduction.

The leptospirosis is an infectious disease caused by certain pathogens of the genus *Leptospira* (OIE, 2014); It produces a high economic impact in the cattle activity since it is one of the main agents causing abortions (Cantón et. al., 2014), fetal reabsorption, infertility, weak hatchlings and decreased milk production. Furthermore, its diagnosis is essential to differentiate this pathology from other reproductive diseases that affect the herd (Rodríguez & Ramírez, 2011).

The pathology is caused by a spirochete; there are more than 250 pathogenic serovars for its antigenic differences, so that each serovar has a typical antigenic shape. The main sign of the disease is the loss of gestation, a complex and multicausal phenomenon that is only diagnosed in 25 to 40% of cases; In addition 90% of cases are of infectious origin (Meléndez, et al., 2010). The disease has a worldwide distribution; appears with a higher incidence in the subtropical regions of humid climate, the transmission of the disease increases in rainy periods (WHO, 2008).

Reproductive illnesses are among the most important causes of economic losses in the livestock industry, due to the cost of treatments, veterinary services, and decreased production (Caravaca, et al., 2003). In Ecuadorian livestock among the most impactful bovine diseases that have been diagnosed are brucellosis and leptospirosis, which are more relevant because they are transmissible to the human being. (Benítez, 2011).

On the other hand, this pathology would be transmitted to the human through manipulation of body fluids from infected cows, transforming it into a zoonotic disease. Hence, it is of crucial importance to know its incidence in order to take preventive measures in the management of bovine spike in general.

Methodology

The study was realized south of the Amazon Ecuador, in parishes: Tundayme, El Güismi , El Pangui and Pachicutza of Pangui's canton, Zamora Chinchipe province in Ecuador, located at 820 meters above sea level.

Sample Size.

It required 213 female bovines over 2 years of age, selected by a two-stage sampling. The first stage consisted of the random selection of clusters represented by the farms (primary sampling units), proportionally to the number in each parish, the sampling frame consisted of the list of bovine holdings; while the secondary sampling units were the bovine females selected according to the inclusion criteria, randomly and according to the size of the holding (not less than 25% of the animals of interest) (Ron 2012, cited by Díaz and Lamiña, 2013). The inclusion criteria for the selection of animals within the study were as follows: bovine females older than two years of age, not vaccinated against leptospirosis, who did not receive antibiotic treatment in the last month with reference to the date of sample collection, without race breed.

Analyzed variables

After analyzing the samples, the prevalence of the test was calculated using the mathematical expression of (Ahlbom and Norell , 1992) :

$$P (\%) = (N^{\circ} \text{ of seropositive sera} / N^{\circ} \text{ of sampled sera}) \times 100$$

To determine the unit cost of production of each lactating cow (cow in milk production and with normal reproductive activity), descriptive statistic was used to process the data collected in each of the production units; and the costs were determined in each item, during a year of exercise for each cow. Subsequently, the total investments in 7 years of productive life of a bovine mother were established, as well as the potential income it would produce in that period (calves and milk), in order to compare the projected costs, projected revenues and establish the indicators: NPV, IRR and B / C.

Results

Leptospirosis prevalence

In El Pangui canton , 12.21% of leptospirosis was registered for bovine females of reproductive age (Table 1) ; the incidence is relatively low, compared to the studies by Román F & Chávez R & Luna J. 2014 , which obtained 75% , and Albarracin C., 2011, found 48.10% of infected bovine in Loja . This result shows a lower level, reports from the year 2006 in the Gualaquiza canton of the Morona Santiago province (36.77%) , probably due to maintenance hosts, the realized period of time, and the number of serovars analyzed in the laboratory (Pillacela , 2006)

Table 1. Prevalence of bovine leptospirosis in El Pangui canton

Parishes	Negative		Positive		Total
	Number	%	Number	%	
El Guismi	45	21,13	8	3,76	53
El Pangui	60	28,17	6	2,82	66
Pachicutza	63	29,58	7	3,29	70
Tundayme	19	8,92	5	2,35	24
Total general	187	87,79	26	12,21	213

Source: Own elaboration

Economic Analysis

In Table 2, the breakdown of production costs to maintain a lactating bovine female in a total of 7 years of reproductive useful life can be seen; the same that on average would have 6 live and weaned calves. The first year due to the initial investment requires approximately \$ 1,009, to stabilize from the second at \$ 210 / year / cow.

Table 2. Unit cost of production for an adult lactating bovine in 7 years of reproductive life in the El Pangui canton, in US dollars.

Detalle	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Bovine acquisition								
Bovine female value	800,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Rope	18,00	18,00	18,00	18,00	18,00	18,00	18,00	18,00
halter includ chain	20,00	20,00	20,00	20,00	20,00	20,00	20,00	20,00
Hose	11,36	11,36	11,36	11,36	11,36	11,36	11,36	11,36
Workforce								
Cowboy salary	90,75	90,75	90,75	90,75	90,75	90,75	90,75	90,75
Feeding								
Lea	34,28	34,28	34,28	34,28	34,28	34,28	34,28	34,28
Treacle	1,89	1,89	1,89	1,89	1,89	1,89	1,89	1,89
Mineral salts	2,43	2,43	2,43	2,43	2,43	2,43	2,43	2,43
Medicines								
FMD vaccine	1,20	1,20	1,20	1,20	1,20	1,20	1,20	1,20
Rabies vaccine	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Anthax vaccine	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
External dewormer x 3 applications	5,16	5,16	5,16	5,16	5,16	5,16	5,16	5,16
Internal dewormer x 1 aplicación	0,86	0,86	0,86	0,86	0,86	0,86	0,86	0,86
Vitamin x 1 application	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68
Antibiotic Products	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00
Healing / slaughterhouse	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
Other costs								
Corral managment sleeve	7,14	7,14	7,14	7,14	7,14	7,14	7,14	7,14
Chainsaw	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14
Motor-scythe	2,85	2,85	2,85	2,85	2,85	2,85	2,85	2,85
Machetes	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28
Horse (means of transport)	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85
Total Costs	1.009,87	209,87	209,87	209,87	209,87	209,87	209,87	209,87

Source: Own elaboration

Table 3 expresses the incomes projected that would be obtained during the production of a cow raised in Canton The Pangui; From the second year they initiate the childbirth with 90 days of production and 2 liters of milk on average, which would indicate 180 liters in their first lactation; later in the third year the projected production would stabilize at 610 liters for 305 days of production per lactation; in addition, in the sector milk is delivered at a rate of 60 cents per liter at farm level. For this analysis, the production of approximately 1 calf per year was also counted; the same that weaned can cost 300 US dollars on the

market. With this antecedent, revenue in the productive dynamics of a healthy cow in El Pangui; they are between 483 and 741 dollars per year.

Table 3. Income for an adult lactating bovine in 7 years of reproductive useful life in the El Pangui canton , in US dollars

Detail	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Milk production (lt/lactation)	0,00	0,00	108,0	366,0	366,0	366,0	366,0	366,0
Breeding production at weaning	0,00	0,00	300,0	300,0	300,0	300,0	300,0	300,0
Amortization for discard cow	0,00	0,00	75,0	75,0	75,0	75,0	75,0	75,0
Total income	0,00	0,00	483,0	741,0	741,0	741,0	741,0	741,0

Source: Own elaboration.

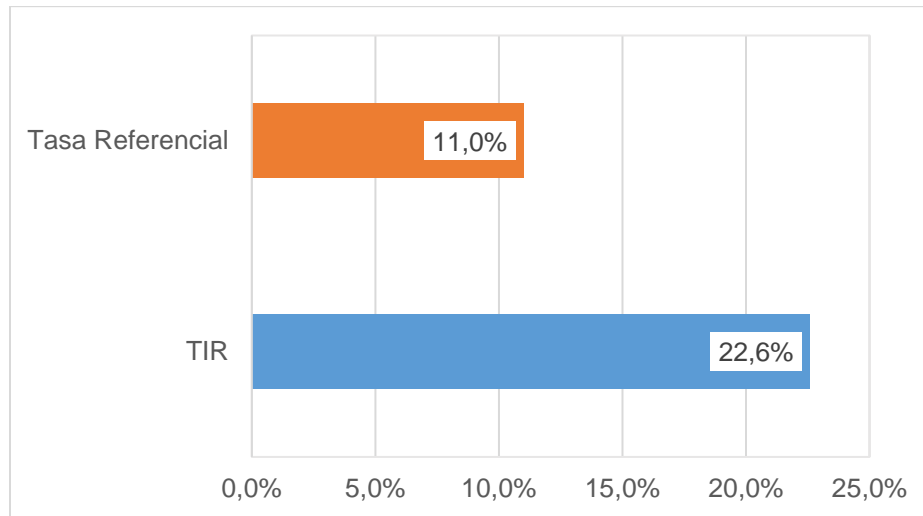
For the financial projection (table 4) an update factor of 11% was used, which is the average rate in Ecuador's financial dynamics; there being appreciated an updated clear revenue for 615,95 American dollars in 7 years of economic exercise. In reference to the cost benefit was 1.31, which would indicate a profit of 31 cents for each monetary unit invested, the net present value (NPV) was located at \$ 2,822.92, while the internal rate of return was 22 6%, that is, 11.6% more than that determined in the country's financial market (figure 1), which would express great potential for the production of cattle in a sector as remote as El Pangui.

Table 4. Financial projection for an adult lactating bovine in 7 years of reproductive life in the canton El Pangui , in US dollars

Years	Update Factor	Updated Income	Updated Costs	Updated Net income
0	1,000	-	1.009,87	- 1.009,87
1	0,901	-	189,07	- 189,07
2	0,812	392,01	170,34	221,68
3	0,731	541,81	153,46	388,36
4	0,659	488,12	138,25	349,87
5	0,593	439,75	124,55	315,20
6	0,535	396,17	112,21	283,96
7	0,482	356,91	101,09	255,82
	<i>Total</i>	<i>2.614,77</i>	<i>1.998,82</i>	<i>615,95</i>

Source: Own elaboration

Figure 1. Comparison of the referential financial rate with the IRR in bovine production of Pangui



Source: Own elaboration.

If we consider the financial analysis we could indicate with certainty that bovine production in El Pangui is very important, and could energize the peasant family economy, as long as they remain exemplary in good health, free of infectious diseases such as the leptospirosis, and with adequate nutrition.

Otherwise, if the contaminated area is maintained without a good prophylactic program, the economic and social impact will be very significant. In the first case the presence of this pathology, causes abortions occur, weak or dead neonates (mummified); leading on the one hand to the loss of \$ 300 annually per concept of the young and on the other hand would not be available from milk production, although this is relatively low compared to dairy breeds, but if strongly influences the family economy; On the other hand, socially the limitation is presented to be able to offer zootechnical products, as well as the disease can become a focus of contagious infection for the entire bovine population, and its surroundings, as for the humans since this disease is zoonotic, it can be transmissible, entering a serious global health problem.

Conclusions.

- In El Pangui canton, 12.21% of leptospirosis was registered for bovine females of reproductive age; the incidence being relatively low, compared to other studies.
- The production cost for keeping a bovine female infant in a total of 7 years of reproductive shelf life, the same as on average would have 6 live and weaned

calves, is: in the first year \$1,009, due to the initial investments and from the second year \$210/year/cow.

- In the financial analysis projected to 7 years of productive activity of dual - purpose cows, the financial profitability indicators IRR, NPV, B / C were positive, as long as good sanitary practices are carried out and animals are not relevant affected by any reproductive disease as is the case of leptospirosis.
- The economic impact of leptospirosis on the producer's family economy is evidenced by generation of abortions, with which the approximate value of \$ 300 per year is lost by the producer, there is also a loss in milk production and, in addition the sick animal would become a focus of contagious infection for the entire bovine population, having greater economic losses.

Bibliographic references

Ahlbom A & Norell S. 1992. Fundamentos de epidemiología. Madrid: Siglo XXI, 1987:VIII-IX. A, clínica e a epidemiologia. Salvador de Bahía: Apce-Abrasco. 26. Disponible en <https://books.google.com.ec>

Benítez, J., 2011 Evaluación de la incidencia de brucelosis bovina e las haciendas “ElPrado” y “Aycha picho”, localizadas en laprovincia de Pichincha-Ecuador, mediante aplicación de técnicas inmuno diagnósticas. Tesis Médico Veterinario. Recuperado desde <http://dspace.udla.edu.ec/handle/123456789/667>

Cantón, G, et al., 2014. Alta incidencia de *Leptospira interrogans* en la casuística de abortos bovinos registrados durante 2013-2014 en INTA EEA Balcarce. Reunión Científico Técnica de La AAVLD. San Miguel de Tucumán. AR. Recuperado desde <http://www.cmva.com.ar/Leptosпита.pdf>

Caravaca, F. Castel JM. y otros (2003 – 2005) “Bases de la Producción Animal” primera edición 2003 y primera reimpresión 2005 Secretariado de publicaciones de la Universidad de Sevilla pág. 147 Fertilidad.

Díaz, R., & Lamiña, O. (2013). Determinación de la Seroprevalencia y Análisis de Factores de Riesgo de Brucelosis en Bovinos, en las Provincias de Zamora Chinchipe, Loja y el Oro. Trabajo de grado. Universidad Central de Ecuador. Facultad de Medicina Veterinaria y Zootecnia. Quito, Ecuador.

- OIE. 2004. Manual para el diagnóstico de la leptospirosis. Recuperado desde:
http://int/eng/normes/mmanual/A_00041.html. (10/10/2018).
- Organización Mundial de la Salud. (2008). Guía para el diagnóstico y control de la leptospirosis humana. Brasil: Centro Panamericano de Fiebre Aftosa. Recuperado desde:https://iris.paho.org/bitstream/handle/10665.2/51096/01016970N12_spa.pdf?sequence=1&isAllowed=y
- Pillacela, A, 2006. Prevalencia de la leptospirosis bovina en el cantón Gualaquiza, provincia de Morona Santiago. Tesis de pregrado. Universidad Nacional de Loja.
- Rodríguez, P.H., & Ramírez, A. P. G. (2011). Leptospirosis: una zoonosis que afecta a la salud pública y la producción pecuaria. Revista Ciencia Animal. Recuperado desde: <http://revistas.lasalle.edu.co/index.php/ca/article/view/313>
- Román F & Chávez R & Luna J. 2014- Determinación de anticuerpos leptospirales en bovinos y en personal vinculado a la ganadería. Centro de Biotecnología.2014; 3(1): Recuperado desde: http://unl.edu.ec/sites/default/files/investigación/revistas/2014-12-1/bio_art2.pdf

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