Financial evaluation of Bovine Tuberculosis eradication in Argentine dairy herds

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Abstract

A Reed-Frost model was used to assess the financial impact of caudal fold (*CFT*), single cervical and γ-interferon tests to control bovine tuberculosis in Argentine dairy herds. Expected benefits and costs included increase in the production and value of milk and cost of testing and difference between the value of culled and replacement cows, respectively. The highest net present value for the three assessed scenarios (high prevalence: 22%; medium prevalence: 11%, low prevalence: 5%) was obtained using the *CFT*. The initial investment required until benefits are realized may negatively impact successful implementation of control activities in a herd.

Introduction

Bovine tuberculosis is an infectious disease of cattle caused by *Mycobacterium bovis*. Many countries initiated bovine tuberculosis eradication campaigns during the last century. Reasons for commencing such campaigns include the risks of zoonotic infection and the economic impact of the disease (de Kantor and Ritacco, 1994; Cousins, 2001). However, published estimates of the economic impact of bovine tuberculosis are scarce (Pritchard, 1988). Financial costs of the program in Argentina are entirely borne by the producer. Therefore, there is a need to conduct cost-benefit studies at a herd-level to estimate the economic impact of eradicating bovine tuberculosis in herds and subsequently, its likely success in Argentina. As bovine tuberculosis is more prevalent in dairy herds and the dairy industry in Argentina is substantial, such studies should focus on this production system. This study presents a financial evaluation of bovine tuberculosis eradication in Argentine dairy herds.

Material and Methods

A previously described stochastic modification of the Reed-Frost model (Perez et al., 2002a, b) was used to estimate the number of herd tests needed and cows that must be culled to eradicate bovine tuberculosis in three different scenarios (high prevalence: 22%; medium prevalence: 11%; low prevalence: 5%). The model was developed using field observations and simulated a standard operation in Santa Fe Province, Argentina, with an average production of 5000 liters per lactation and 200 cows in milk. The impact of three different strategies was assessed: 1. caudal fold test (*CFT*), 2. single cervical test (*SCT*) during the first herd test and *CFT* thereafter, and

3. γ-interferon test (γ-*IFN*), highly sensitive on the first herd test and highly specific thereafter. Sensitivity and specificity were assumed to be 0.81 and 0.98 (*CFT*), 0.95 and 0.80 (*SCT*), 0.97 and 0.90 (highly sensitive γ-*IFN*) and 0.80 and 0.99 (highly specific γ-*IFN*), respectively. Additional model variables included time between consecutive herd tests (3 months), immediate culling of test-positive cattle, and a constant replacement rate of 2% with tuberculosis free cattle.

The benefits of eradication included a 2% increase in the value of milk ($0.4 per liter) after eradication and a 10% increase in milk production of cows, weighted by the prevalence of tuberculosis in the herd at the beginning of the simulation. The cost of eradication included testing ($2 per animal tested for *CFT* and *SCT* and $22 for γ-*IFN*) and the difference between the value of culled and replacement cows ($1200 per cow). The differences between benefits and costs of eradication were estimated yearly and the net present value (*NPV*) of each control strategy and scenario was estimated considering a time horizon of 20 years. The real interest rate (6%) was estimated as the difference between the interest rate (49%) and the inflation rate (43%). All the values were obtained in field in March 2003 and are expressed in Argentine pesos (exchange rate in Argentina, August 2003: $1=US$2.90).

Results

The highest *NPV* and lowest initial investment for the three scenarios was obtained using the *CFT* (Table 1). The initial investment required was >$40,000 in all the assessed scenarios and strategies. The *SCT* and γ-*IFN* were not financially feasible in the low prevalence scenario (losses of $51,300 and $11,300 respectively). The highest benefits were estimated in the high prevalence scenario, using the *CFT* test ($168,000).

Table 1: Initial investment and net present value ($000s) of tuberculosis eradication in three scenarios of prevalence (low, 5%; medium, 11%; high, 22%) using three different tests (*CFT*, caudal fold test; *SCT*, single cervical test; γ-*IFN*, γ-interferon test) in Argentina.

Scenario	Test	Initial Investment	NPV
Low Prevalence	CFT	40.9	3.5
	SCT	95.8	-51.3
	γ-IFN	70.4	-11.3
Medium Prevalence	CFT	51.1	65.3
	SCT	77.2	26.5
	γ-IFN	62.3	24.5
High Prevalence	CFT	80.9	168.2
	SCT	108.3	136.2
	γ-IFN	92.9	129.7

Discussion

Use of the *CFT* was found to be a cost-effective strategy in Argentine dairy herds. This finding supports previous reports indicating that the *CFT* is more suitable for detecting bovine tuberculosis in Argentine dairy cattle than the *SCT* or γ-*IFN* (Perez

et al, 2002a). The *CFT* has been used in test-and-cull programs in many countries to control bovine tuberculosis.

The initial investment required to control tuberculosis during the first year of testing was high. In the scenario of high prevalence, this initial investment was $ 80,900, representing >20% of the annual income due to milk production in the simulated herd ($400,000). In Argentina, producers are responsible for the entire cost of the animals' replacement. Subsequently, it is possible that producers may not be able to afford the initial investment required until benefits are realised. The replacement of test-positive cattle is the most important cost during an eradication campaign (Bernués et al., 1997). Compensating producers for compulsory culling of cattle is one of the most important factors influencing the success of an eradication campaign (Cousins, 2001).

Although a tuberculosis eradication campaign is financially feasible at a herd level in Argentina, further research should be directed to identify the factors that influence campaign success and to design ancillary strategies that help to reduce initial investment and minimize the financial impact of the program during the first years of implementation in a herd

References

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