Evaluación económica del control de garrapatas Rhipicephalus microplus en México

Economic evaluation of tick (Rhipicephalus microplus) control in Mexico

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Resumen

Se evaluó un programa de control integral en 15 ranchos con el fin de cuantificar los costos de producción asociados con el control químico de garrapatas. Bajo un programa combinado de control químico e inmunológico se inmunizaron 587 animales de 15 ranchos,

El costo del control químico de las garrapatas en la región fue de $408.3 pesos por animal, mientras que el programa combinado fue de $128 pesos por animal, lo que significó una reducción de 68.63 % por concepto de la compra de ixodicidas. La extrapolación de estos datos a la ganadería nacional con un hato estimado en 30 millones de cabezas de ganado bovino, puede significar una pérdida que equivale a 12 248 994 889 millones de pesos mexicanos. El uso de un programa combinado de control disminuiría estas pérdidas hasta 3843 015 332, es decir, 68.63 % de las pérdidas en la ganadería nacional.

Palabras clave: control integral, Rhipicephalus, garrapatas.

Abstract

We evaluated a program of comprehensive control on 15 ranches in order to quantify the costs of production associated with the chemical control of ticks. Under a combined chemical and immunological control program 587 15 farms animals are immunized. The cost of chemical control of ticks in the region was $408.3 pesos per animal, while the combined program was $128 pesos per animal, which meant a reduction of 68.63% for the purchase of ixodicides. Extrapolation of these data to the national livestock with a herd estimated at 30 million head of cattle, could mean a loss amounting to 12248.7 million pesos (MXP). The use of a combined program of control would reduce these losses to 3843.7 million, i.e., 68.63% of national livestock losses.

Key words: comprehensive control, Rhipicephalus, ticks.

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Introduction

Parasitic diseases are a global problem that limited health and productive performance of cattle, due to a large amount of ectoparasites such as: flies, mites, ticks and fleas; and endoparasites such as: nematodes and cestodes. Ticks are the most important group of pathogens that cause disease in domestic and wild animals and can survive for many years without feeding (Furman y Loomis, 1984; de la Fuente et al., 2008).

It is estimated that approximately thousand million heads of cattle are found in tropical and subtropical areas of the world exposed to the ticks infestations and/or diseases transmitted, causing significant losses in livestock production (Pegram et al., 1993). The tick *R. microplus*, is the kind of major economic and health due to its wide distribution, vectorial capacity, blood-sucking habits and the amount of cattle that affects. Despite efforts to control these parasites and the diseases that spread, they are still a concern and a threat to human and animal health in the world (de la Fuente and Kocan, 2006), due to the direct physical damage of ticks on the skin of animals and its detrimental effects on weight gain and milk production, as well as the transmission of infectious agents as *Babesia bigemina*

Babesia bovis and *Anaplasma marginale* (Solorio et al., 1999; Rodríguez-Vivas 2004; de la Fuente et al., 2007).

Ticks and the diseases that spread is an issue which is of concern to all countries, including Latin American, due to the significant economic losses caused in health and animal production in tropical and subtropical areas around the world (Snelson, 1975; Estrada-Peña et al., 2006; de la Fuente et al., 2008). Ixodicides are the most important tool that has been used for the control of ticks (George et al., 2004), however, their intensive use has become the main selection pressure that has generated resistance to these, due to the plasticity of the genome of the ticks (Rosario-Cruz et al. 2009). In some cases multiple resistance has appeared (Martins et al., 1995). On the other hand, the pollution of the environment and food, such as meat and milk for human consumption are also collateral consequences of the use and abuse of chemical control of ticks (Jongejan and Uilenberg, 2004).

The ixodicide resistance has been highlighted the need to resume the research approaches, directed toward the search for molecular of the tick, immunologically important targets for the development of vaccines that can be incorporated into programmes of integrated control to prevent infestations by ticks.

In Mexico there is no recent data that will allow us to assess the economic impact of losses that produce the infestations of ticks or the estimate of the cost-benefit of the application of new technologies incorporated in an integrated control program, that will allow us to mitigate the effects of resistance to pesticides, reduce transmission of pathogens transmitted by ticks, as well as environmental pollution and food intended for human consumption.

The objective of the present study was to evaluate the economic impact of the alternating application of methods for monitoring chemical and immune, with the purpose of estimating the benefits of generating new technologies and control programs, to prevent infestation by ticks.

Materials and methods

Location of the study site

The study was conducted in the municipality of Coyuca de Benitez, in the region of the Costa Grande of Guerrero, located southwest of Chilpancingo, its municipal head is on the Federal road Acapulco-Zihuatanejo, about 32 kilometers from Acapulco.

Inclusion criteria and implementation of surveys

For this study the total cattle ranches in the municipality of Coyuca de Benitez Gro, registered in the census of Local Livestock Association of Coyuca de Benitez, who are registered to PROGAN and with a number of animals within the range considered between 20 and 75 cattle. 15 ranches were selected, with a total of 587 cattle. The owners were interviewed to fill out a survey with the basic information required to obtain estimates of production costs and the effects of the implementation of the program: number of animals, ticks on the ranch, number of bathrooms per year (before and after application of the control program), local costs of the products used in each ranch, and annual records of the number of deaths attributable to tick (data not included) diseases.

Tick Collection

20 ticks each farm were collected and transported to the facilities of the National Center for Parasitology INIFAP, in a plastic bottle with screw cap with small holes to allow oxygenation of it. There were placed in incubators, with a temperature of 28oC and a relative humidity of 80% until ticks and oviposited eggs hatched. Larvae 10 days old were sent to the laboratory bioassay SENASICA in Jiutepec, Morelos, Mexico, where they carried out the toxicological bioassay package larvae (Stone and Haydock, 1962) to determine the susceptibility to organophosphate (3), pyrethroids (3) and amidines (1).

Tick control program

A comprehensive control program based on strategic chemical treatments and the application of a commercial Bm86 vaccine, applied in doses of 2 ml containing a protein concentration of 50 ug / ml was used. The vaccine was applied at the beginning of the program and two doses were applied with a difference of 30 days. After the 30th day the application was suspended and only ixodicides bathrooms were applied by spray on infested animals, based on bioassays for each ranch.

Results

Fifteen production units are immunized with a total of 587 animals (Table I). The total number of applications before the program acaricides was 208 applications / year, and only 42 applications / year for the combined program (Table I), resulting in a total reduction in the number of applications 80%.

Each ranch ixodicides traditionally applied in this region of the state of Guerrero, on average 14 times a year. After the program combined control only 2.8 ixodicides annual applications (Table I) were made. This means a reduction of 80% of applications acaricides.

The total annual expenditures of chemical control (based on data obtained from 587 animals vaccinated in the 15 ranches) was $ 239,672 pesos, while during the combined program was only $ 75,195 Mexican pesos ($ 39,975 pesos cost of chemical control and $ 35,220 pesos cost of the vaccine, given two doses to 587 cattle at a cost of $ 30 pesos per dose. These data show that the use of combined control method decreased by 68.62% of production costs relative the traditional chemical method (table I).

The cost-benefit program combined ratio was 1: 3 (239672/75195 = 3.18) in favor of the combined program; ie the combined program reduced to one third (1: 3) expenditures for chemical tick control.

The average annual cost of chemical control strategy per animal is $ 408.29 Mexican / animal pesos, while the combined cost of the program is $ 128.10 Mexican / animal weights, which means a reduction of 68.62%.

Given that in Mexico it is estimated that the herd is 30 million cattle, based on this estimate annual losses of livestock due to misuse of chemical control could amount to $ 12,248,700,000 Mexican pesos considering a herd national livestock of 30 million cattle ($ 942,207,692 USD) and an exchange rate of $ 13 pesos / dollar.

The use of this combined strategy can reduce losses at 68.62%, which means that losses could drop $ 12 248.7 million Mexican pesos to $ 3,843 million Mexican pesos, and produce an economy $ 8 405.7 Mexican pesos to the domestic livestock.

Proportionately similar reduction should be reflected in environmental pollution and food for human consumption, since the use of this combined program reduced by 80% the use of acaricide to control ticks.

Tabla I. Muestra el número total de animales vacunados, el total de aplicaciones de acaricidas anuales, el intervalo de tiempo entre cada aplicación en días, el costo total por animal y por rancho y las diferencias en los costos realizados antes y después de la aplicación del programa integrado de control inmunológico y químicos (la tabla no muestra el costo de la vacuna).

ID	RANCHO	animales Immuni zados	Aplicación anual del acaricida		Intervalo de la aplicación del acaricida (días)		Costo anual de la aplicación del acaricida				
			antes	después	antes	después	Costo total antes	Costo/animal después	Costo total antes	Costo/animal después	Diferencias de los costos
1	El Rio Chiquito	36	12	2	30	183	$11,760.00	$326.67	$2,960.00	$82.22	$8,800.00
2	El Rio Chiquito	36	12	2	30	183	$11,760.00	$326.67	$1,989.00	$55.25	$9,771.00
3	Laguna Seca	35	12	2	30	183	$11,760.00	$336.00	$2,112.00	$60.34	$9,648.00
4	La Aceitera	89	17	3	21	183	$15,342.00	$172.38	$2,960.00	$33.26	$12,382.00
5	La Ilusion	39	12	2	30	183	$13,546.00	$347.33	$1,147.00	$29.41	$12,399.00
6	La esperanza	38	17	3	21	122	$20,660.00	$543.68	$4,128.00	$108.63	$16,532.00
7	Milla	27	15	1	24	365	$10,646.00	$394.30	$2,766.00	$102.44	$7,880.00
8	El Camaron	74	12	3	30	122	$32,417.00	$438.07	$3,376.68	$45.63	$29,040.32
9	La Mayeya	24	17	5	21	73	$15,816.00	$659.00	$2,777.00	$115.71	$13,039.00
10	Rancho Ibares	19	12	4	30	91	$10,477.10	$551.43	$1,964.16	$103.38	$8,512.94
11	El limonal	27	12	4	30	91	$9,758.20	$361.41	$1,685.20	$62.41	$8,073.00
12	Bajial	57	15	2	24	183	$37,651.00	$660.54	$6,294.48	$110.43	$31,356.52
13	El Gallito	50	17	3	21	122	$14,756.12	$295.12	$2,103.80	$42.08	$12,652.32
14	La Huerta	20	13	3	28	122	$10,560.00	$528.00	$1,751.40	$87.57	$8,808.60
15	La Hiervabuena	16	13	3	28	122	$12,762.65	$797.67	$1,960.00	$122.50	$10,802.65
	TOTAL	587	208	42	398	2328	$239,672	$6,738	$39,975	$1,161	$199,697
	AVERAGE		14	2.8	27	155	15,978	449.2	2,665	77.41	13,313.16

Discussion

Cattle ticks are the biggest problem affecting the livestock industry in tropical and subtropical regions of the world due to the economic losses (Snelson, 1975;. Estrada-Peña et al, 2006; de la Fuente et al. , 2008).

Control cattle ticks traditionally takes place through strategies based on the application of miticides, however, the constant application and lack of coping mechanisms and biology of vectors have promoted the appearance of lines resistant ticks . In some states, multidrug resistance is a constant threat affecting domestic livestock and its allies in the pharmaceutical industry, because farmers completely rely on the use of acaricide but do not have access to technical advice or have information to develop programs control to the steady decline and loss of effectiveness of acaricides used to fight the tick (George et al., 2000). In this study the use of a vaccine against cattle tick R. microplus, in a comprehensive control program decreased the frequency of pesticide use was included extending the average working time of 27 to 155 days, which decreased the number annual applications of 14 to 2.8 which means a reduction in the use and purchase of pesticides in 80%. This data allowed us to infer the decrease in production costs due to the purchase of pesticides but not to the purchase of antibiotics to control babesiosis and anaplasmosis, which were not included for calculation purposes.

Ticks produce significant losses related effects their blood-sucking habits, such as damage to the skin, disease transmission (de la Fuente et al., 2008) and losses associated with decreased weight gain and low production milk (L'Hostis and Seegers, 2002; Peter et al., 2005). However, there are no precise figures on the contribution of each of these components to the complex network of interactions between the host, the tick and transmits pathogens.

The most reliable figures on global economic losses dating back to the early eighties, where it is estimated that one billion head of cattle are exposed to tick infestations in tropical and subtropical regions of the world. In 1984, economic losses were estimated at 8000 million US dollars (Brown and Askenase, 1984).

The data reported in the literature do not include losses of human lives due to ticks and the diseases they transmit, for example, thousands of cases of Lyme disease that occur annually in Europe and North America (Jaenson, 1991; Piesman , 1987), cases of tick-borne encephalitis in Europe (Weissman, 1978) and cases of spotted fever tick-borne Rockies also in the United States.

In the context of animal health, it is the most important tick R. microplus, which are attributed to lost productivity quantified in more than one billion dollars annually in South America in 1987 (Horn, 1987) while in 1974 in Australia's annual losses Boophilus microplus tick infestation were estimated at 62 million USD (Springuel, 1983). Recent studies report that Brazil lost 2000 million (Grisi et al., 2002). In this same study it estimated that losses to Mexico amounted to 942 million USD, although it should be noted that these figures do not include other losses caused by the death of animals generated transmitted by this vector nor for costs in medicine diseases for the control of these diseases, which could double the annual losses.

Conclusions

Based on the number of annual bathrooms before and after application of an integrated control program, a reduction of 80% was observed in the number of bathrooms, 208 applications / year (before the program), it was reduced to 42 applications / year for the combined program of integrated control.

The average annual cost of chemical control strategy per animal was estimated at $ 408.29 Mexican / animal pesos, while the combined cost of the program was estimated at $ 128.10, Mexican pesos / animal, which means a reduction of 68.62%.

Based on this calculation and a national herd of 30 million cattle, the annual losses of the National livestock due to misuse of chemical control could amount to $ 12 248 995 000 pesos ($ 942.23 million USD) considering the exchange rate 13 pesos / dollar.

The use of a combined strategy for tick control could reduce these losses of $ 12 248 995 000 Mexican pesos to $ 3,843 million Mexican pesos, which means a reduction of 68.62% and a cost-benefit ratio of 3: 1.

The use of this control program reduced by 80% the use of acaricide to control ticks and, therefore, a proportionate amount of pesticides stopped contributing to pollution of the environment and foods intended for human consumption derived from this activity.

Losses due to deaths tick as anaplasmosis and babesiosis and costs of medicine for treatment borne diseases were not included in this study and could double annual losses.

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