Cost Evaluation of the Use of Conventional and Electronic Identification and Registration Systems for Cattle in Chile

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Abstract

With the aim of evaluating the cost of the individual identification and registration of the Chilean cattle population, three strategies were analyzed: 1) conventional identification (CID) with two ear tags; 2) electronic identification (EID) with one electronic ear tag and one conventional ear tag; and, 3) electronic identification (BID) with one ceramic bolus and one conventional ear tag. All animal events considered relevant were included in the analysis which calculated the total annual costs and the annual cost per animal identified. The results show that the electronic strategies have the highest annual cost per animal identified (US$27.80 and US$30.12 for EID and BID, respectively), compared to the CID strategy which costs US$8.10. The implementation of alternative identification options brings down electronic identification costs by around 60% making this technology a viable alternative for Chilean producers and industry.

Introduction

On November 1st 2004, the Chilean Ministry of Agriculture implemented the Sanitary Traceability Program for Bovines (SAG, 2006) through the Agriculture and Livestock Service (SAG). This program seeks to provide the necessary tools to protect the zoosanitary assets of the country and face the increasing demands of the export markets.

The Program establishes the mandatory individual identification of cattle born in: a) farms belonging to the PABCO A Program (official sanitary control program) or any disease prevention, control and erradication program; b) farms that export to countries that require compliance with the Program; c) farms that import live animals; c) farms that use Andean mountain grazing grounds; and/or d) farms that border neighboring countries. It also includes a record of all bovine establishments, a record of animal movements among establishments, the list of bovine livestock transport and a national database (SIPEC) that records all the relevant information.

The Program recognizes the conventional flaps and button type ear tags placed on the right and left ears of the animal respectively, as identification devices. These devices carry the name of the country (CL), the name of the Agriculture and Livestock Service (SAG) and an individual nine digit code. The button type ear tag may be replaced by a radio-frequency device (ear tag or ceramic bolus) that complies with the regulations issued by the SAG.

Objective

The aim of this work is to evaluate the cost of implementation of a cattle identification and registration system in Chile and to evaluate different strategies including the use of electronic identification devices in compliance with the Sanitary Traceability Program for Bovines.

Materials and Methods

Bovine population and industry in Chile

According to the VI National Agricultural Census of 1997 (INE, 2006), the estimated number of bovines in Chile in 2003 is 3,989,851. Out of these, 1,571,735 are reproductive age females

(1,005,910 devoted to milk production and 565,825 to meat production). Given these figures and considering replacement rates of 0.26 and 0.22 for milk and meat producing females, respectively, 0.65 animals born per female and perinatal mortality rates of 0.03 for milk producing calves and 0.05 for meat producing calves, the estimated birth rate for that year is 980,345 animals. There were 160,218 bovine farms (INE, 2006), 61 livestock fairs and 112 abattoirs (Hervé, 2004).

Cost calculation

A Microsoft Excel 2000 spreadsheet program was used to calculate the total annual cost and the annual cost per animal identified. The strategies evaluated were: a) conventional identification (CID) using two conventional ear tags; b) electronic identification (EID) using a conventional ear tag and an electronic ear tag; and c) electronic identification (BID) using a ceramic bolus and a conventional ear tag. The cost components included were: 1) cost of the identification and re-identification devices; 2) manpower used in identification and re-identification; 3) cost of the reading and registration of animal movements; 4) cost of the reading, registration and recovery of the devices in the abattoir; 5) implementation and maintenance costs of the database; and 6) depreciation of the equipment required.

Identification devices

All the identification devices considered in the cost calculation comply with the characteristics stipulated by the SAG and differ according to the identification strategy used. In the case of the CID, a pair of plastic ear tags were used (flaps and button) with a market price of US$2.37 (US$1 equals $513 Chilean pesos, at 13th April 2006). According to the available literature, the percentage annual retention of these devices is 94% and 97% for the flaps and button type ear tags, respectively (Saa et al., 2005; Ghirardi et al., 2004, Ribó et al., 2003).

In the case of the EID, the button type ear tag used in the CID was replaced by an electronic one recorded with a unique and unrepeatable code linked to the conventional ear tag code in the database. The price of both devices was US$ 3.51. For the BID, the button type ear tag was replaced by a ceramic bolus, which contains a numeric code inside linked to the conventional ear tag code. The price of both devices was US$ 3.90. According to the available literature (Ghirardi et al., 2004, Ribó et al., 2003), the percentage retention of these electronic devices is 97% and 99.3% for the electronic ear tag and the ceramic bolus, respectively.

Manpower and operational times

Table 1 shows the activities linked to the identification and registration of animals, and the corresponding times required.

Table 1. Cost of manpower and operational times used to calculate the cost of three identification and registration strategies (CID, EID and BID) of bovine livestock in Chile.

	Identification and registration strategies		
	CID	EID	BID
Cost of manpower, US$/minute	0.1	0.1	0.1
Identification and registration, min./animal	3	2.5	2.5
Re-identification and registration, min./animal	8	5.5[a] ó 7.5[b]	5.5[a] ó 7.5[b]
Reading and registration of movements, min./animal	3	0.1[c] ó 0.17[d]	0.1[c] ó 0.17[d]
Recovery of devices in abattoir, min./animal	0.6	0.6	0.8

[a] Re-identification of the conventional device.
[b] Re-identification of the electronic device.
[c] Dynamic reading.
[d] Static reading.

Reading and registration of animal movements

The cost analysis includes the movements made among farms (entry and exit), towards the abattoir (exit from the final farm) and entry and exit from the livestock fairs. Likewise, the arrival of the

animal to the abattoir and the readings made at the slaughter line are included. Finally, the reading and registration of the annual declaration of stock established by the SAG Program was considered.

Based on the number of animals auctioned at fairs and the number of animals slaughtered in abattoirs (INE, 2006), the estimated annual total of readings and registrations for the CID is 9,322,623. In the case of EID and BID, a third reading in the slaughter house was added, totalling 10,074,419 annual readings and registrations.

Implementation and maintenance of the national database

According to personal information provided by the SAG, the implementation and maintenance of the database (SIPEC) has an annual cost of US$ 176,283.30, which indicates an annual cost of US$ 0.045 per animal identified.

Necessary equipment

For each strategy evaluated, Table 2 details the necessary amount, price and depreciation periods of the equipment according to production facilities, livestock fairs or slaughter houses.

Table 2. Necessary equipment, prices and depreciation periods.

Equipment	Units per			Price (US$)	Depreciation period (años)
	Farm	Livestock fair	Abattoir		
Ear tag applicator	1	0	0	38	5
Bolus gun[1]	1	0	0	70	5
Dynamic reader[2]	1	0	0	480	5
Static reader[2]	1/30	1	3	2,410	5
Desktop computer	0	1	1	780	3
Laptop computer	1/30	0	0	1,270	3
Printer	1/30	1	1	70	5

[1] Device required only for BID.
[2] Equipment required only for EID and BID.

Results

Table 3 shows that the total cost of the three strategies ranges between US$ 7,940,402 and US$ 29,531,089. The CID is the lowest cost and the BID is the highest cost strategy. The annual costs per animal identified were US$8.10 US$30.12, respectively. The EID had slightly lower costs than BID, at US$ 27.80 per animal identified per year.

As Table 3 shows, the main cost of CID were the components linked to manpower (identification, re-identification and registration, reading and registration of the movements and recovery of the devices in the abattoir) that add up to 41.98% of the total cost, with the cost of the reading and registration of movements being the most important component (34.33%). The initial identification devices were the second most important component (29.24%), followed by the acquisition of the equipment required (15.94%). The lowest cost components were the devices required for the re-identification of animals (10.61%) and the database (2.23%).

In the case of the electronic strategies, the main component was the cost of the equipment, which represented 79.93% and 81.33% for EID and BID, respectively. In these strategies, the cost of the components linked to manpower dropped considerably to 2.22% in EID and 1.84% in BID, due to the automatic reading and registration of the electronic identification which leads to higher speeds and greater precision. The cost of the initial devices was the second most important component for both strategies (12.62% for EID and 12.94% for BID), followed by the re-identification devices (4.58% and 3.29% for EID and BID, respectively) and the database (0.65% for EID and 0.60% for BID).

Table 3. Annual cost of the three identification and registration strategies (CID, EID and BID) of the total bovine population in Chile.

Cost, US$/year	CID	EID	BID
Identification devices	2,321,869.97 (29.24%)	3,439,807.37 (12.62%)	3,822,008.19 (12.94%)
Re-identification devices	842,223.74 (10.61%)	1,247,738.87 (4.58%)	970,463.57 (3.29%)
Manpower for identification, re-identification and registration	563,925.92 (7.10%)	452,608.56 (1.66%)	374,624.88 (1.27%)
Reading and registration of movements	2,725,913.16 (34.33%)	110,374.18 (0.4%)	110,374.18 (0.37%)
Recovery of the devices in the abattoir	43,964.68 (0.55%)	43,964.68 (0.16%)	58,619.57 (0.20%)
Database	177,148.11 (2.23%)	177,148.11 (0.65%)	177,148.1 (0.60%)
Equipment	1,265,356.47 (15.94%)	21,784,792.33 (79.93%)	24,017,850.23 (81.33%)
Total	**7,940,402**	**27,256,434**	**29,531,089**
Total per animal identified	**8.10**	**27.80**	**30.12**

Given that the main component of the electronic strategies was the cost of the equipment, the dynamic reader was proposed as an alternative for every 30 production facilities that substituted the static reader. The results show a reduction of over 60% in the cost of the equipment required for the electronic strategies, bringing total costs down to US$10.00 per animal identified per year in the case of EID and US$12.31 in the case of BID. In this scenario, the cost of manpower is a determinant factor in the total cost of the three strategies. Amounts over US$ 0.17 per minute make the CID equal the costs of EID, while amounts above US$ 0.24 make the CID equal the costs of the BID strategy.

Another determinant cost factor, mainly in electronic strategies, is the number of animals to be identified per farm per year. Table 4 shows the annual costs of the identification of animals in farms with 50 heads of cattle or more.

Table 4. Annual cost of the implementation of the three identification and registration strategies (CID, EID and BID) of bovines in farms with 50 heads of cattle or more in Chile.

Cost, US$/year	CID	EID	BID
Identification devices	1,496,381.45 (33.15%)	2,216,861.40 (39.93%)	2,463,179.34 (42.78%)
Re-identification devices	544,891.58 (12.07%)	807,264.79 (14.54%)	627,858.61 (10.91%)
Manpower for identification, re-identification and registration	364,126.63 (8.07%)	292,227.09 (5.26%)	241,774.17 (4.20%)
Reading and registration of movements	1,760,820.76 (39.01%)	71,246.84 (1.28%)	71,246.84 (1.24%)
Recovery of the devices in the abattoir	28,245.50 (0.63%)	28,245.50 (0.51%)	37,660.66 (0.65%)
Database	174,405.17 (3.86%)	174,405.17 (3.14%)	174,405.17 (3.03%)
Equipment	144,764.07 (3.21%)	1,962,119.41 (35.34%)	2,140,757.91 (37.19%)
Total	**4,513,635.15**	**5,552,352**	**5,756,883**
Total per animal identified	**7.14**	**8.79**	**9.11**

As Table 4 shows, the identification of 50 heads of cattle or more per farm per year reduces the total annual cost of EID and BID by more than 65% (US$8.79 and US$9.11, respectively), thus making these strategies viable options for identifying the livestock population. Furthermore, if in this scenario a dynamic reader is used for every 30 farms substituting a static reader, the cost of the electronic strategies drops below the cost of CID, at US$6.60 for EID and US$6.93 for BID.

Discussion

The results of this study indicate that electronic identification of the bovine population in Chile by means of the ear tag or ceramic bolus does not appear to be a difficult option to implement. The use of reading equipment for every 30 farms, as an implementation alternative, offers highly competitive total annual costs with regard to the conventional strategy, especially when the additional benefits of electronic identification are considered (time savings, minimization of reading and information transfer errors, etc.).

Manpower and the number of animals to be identified per farms per year were identified as factors that determine the cost of implementation of an identification and registration system for bovines in Chile. In the case of the former, the conventional strategy is more sensitive to variations due to greater time requirements. In the case of the latter, it mainly affects electronic strategies, since for these strategies to be competitive, under the conditions considered in the study, they require a dilution of the reading equipment costs among a greater number of animals identified.

References

Ghirardi, J., Caja, G., Conill, C., Hernández-Jover, M. & Garín, D. (2004). Long term comparative trial of ear tags and ceramic boluses for the electronic identification of beef cattle under European rangeland conditions. *J. Anim. Sci., 82 (Suppl. 1): 351 (Abstr.)*.

Hervé, L.P. (2004). Descripción temporal y espacial de ganado bovino, en ferias y plantas faenadoras de carne en Chile. Memoria para optar al Título Profesional de Médico Veterinario. Departamento de Medicina Preventiva Animal, Facultad de Ciencias Veterinarias y pecuarias de la Universidad de Chile. Santiago, Chile.

INE. (2006). Instituto Nacional de Estadísticas. *www.ine.cl*.

Ribó, O., Cuypers, M., Korn, C., Meloni, U., Centioli, G., Cioci, D., Ussorio, A. & Veran, J. (2003). IDEA Project, large scale project on livestock electronic identification. Final Report, version 3.0. *http://idea.jrc.it/pages%20idea/final%20report.htm*.

Saa, C., Milán, M.J., Caja G.& Ghirardi, J.J. (2005). Cost evaluation of the use of conventional and electronic identification and registration systems for the national sheep and goat populations in Spain. *J. Anim. Sci. 83:1215-1225.*

SAG. (2006). Servicio Agrícola y Ganadero, Ministerio de Agricultura de Chile. *www.sag.gob.cl.*