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Implementing electronic identification for performance recording in sheep: II. Cost-benefit analysis in meat and dairy farms

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ABSTRACT

Costs and secondary benefits of implementing electronic identification (e-ID) for performance recording (i.e., lambing, body weight, inventory, and milk yield) in dairy and meat ewes were assessed by using the results from a previous study in which manual (M), semiautomatic (SA), and automatic (AU) data collection systems were compared. Ewes were identified with visual ear tags and electronic rumen boluses. The M system used visual identification, on-paper data recording, and manual data uploading to a computer. The SA system used e-ID with a handheld reader in which performances were typed and automatic uploaded to a computer. The use of a personal digital assistant (PDA) for recording and automatic data uploading, which transformed M in a SA system, was also considered. The AU system was only used for BW recording and consisted of e-ID, automatic data recording in an electronic scale, and uploading to a computer. The cost-benefit study was applied to 2 reference sheep farms of 700 meat ewes, under extensive or intensive production systems, and of 400 dairy ewes, practicing once- or twice-a-day machine milkings. Sensitivity analyses under voluntary and mandatory e-ID scenarios were also included. Benefits of using e-ID for SA or AU performance recording mainly depended on sheep farm purpose, number of test days per year, handheld reader and PDA prices, and flock size. Implementing e-ID for SA and AU performance recording saved approximately 50% of the time required by the M system, and increased the reliability of the data collected. Use of e-ID increased the cost of performance recording in a voluntary e-ID scenario, paying only partially the investment made (15 to 70%). For the mandatory e-ID scenario, in which the cost of e-ID devices was not included, savings paid 100% of the extra costs needed for using e-ID in all farm types and conditions. In both scenarios, the reader price was the most important extra cost (40 to 90%) for implementing e-ID in sheep farms. Calculated extra costs of using the PDA covered more than 100% of the implementation costs in all type of sheep farms, indicating that this device was cost-effective for sheep-performance recording.

Key words: transponder, performance recording, cost-benefit, sheep

INTRODUCTION

Electronic identification (**e-ID**) by using passive radio frequency transponders is currently mandatory for small ruminants in the European Union (Regulation EC 21/2004, amended by EC 933/2008 and EC 759/2009; European Commission, 2004, 2008), jointly with visual identification (**v-ID**) by official ear tags. Cost of v-ID and e-ID have been calculated for the identification and registration of sheep and goats at national level in Spain (Saa et al., 2005), the United Kingdom (ADAS, 2006), the United States (APHIS, 2009), and the Netherlands (Velthuis et al., 2009). Despite producing primary benefits at national and international level (e.g., food safety, public health), a concern exists about the secondary benefits of e-ID at the farm level, where the main costs are currently supported.

The e-ID devices can be a key tool for the management and data collection of farm animals at individual level (e.g., livestock precision systems). The current technological advances and the decreasing prices of electronic devices have increased the probability that computerized performance data acquisition will become cost-effective and be adopted by farmers. In this sense, the use of e-ID combined with monitoring platforms (Trevarthen and Michael, 2007) or of shared databases (Voulodimos et al., 2010) have been proposed as complete systems of farm management.

Previous research proved that e-ID reduced the working time and implementation costs of milk recording in dairy goats (Caja et al., 1999; Ait-Saidi et al., 2008), but no information on the evaluation of implementation benefits in sheep farms has been reported. As a follow up of a previous research (Ait-Saidi et al., 2014) on the implementation of e-ID for performance record-

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Table 1. Uses of devices according to the type of performance recording conducted in sheep farms

	Performance recording			
Device	Lambing	BW	Inventory	Milk
Handheld reader[1]	Yes	—	—	Yes
Personal digital assistant	Yes	Yes	Yes	Yes
Stationary reader[1]	—	Yes	Yes	—

[1]Radio frequency transceivers for capturing the electronic identification data.

ing in dairy and meat sheep farms, the current study aimed to evaluate and to compare the cost and benefit of performance recording when v-ID or e-ID are used in reference dairy and meat sheep farms using manual (**M**), semiautomatic (**SA**) and automatic (**AU**) systems under different scenarios. A sensitivity analysis was also included.

MATERIALS AND METHODS

Performance Recording Data

Data used in the current study were obtained in 3 consecutive experiments on performance recording of dairy and meat sheep carried out in the experimental farm of the Servei de Granges i Camps Experimentals of the Universitat Autònoma de Barcelona (Barcelona, Spain) and published by Ait-Saidi et al. (2014).

Cost-Benefit Study

Costs and savings of implementing e-ID for performance recording for meat ewes (lambing data, BW, and inventory) and dairy ewes (lambing data, BW, inventory, and milk recording) using the SA and AU systems were calculated in relation to the costs of the M system. Results were expressed in the European Union common currency (euros; €) with a conversion rate of €1.0 = US$1.3 (European Central Bank, 2013).

Overall data from Ait-Saidi et al. (2014) were combined to perform a cost-benefit study under different scenarios: (1) meat sheep farms under extensive or intensive production systems (1 or 1.5 lambing/yr, respectively) and (2) dairy sheep farms (1 lambing/yr) performing once- (**×1**) or twice-daily (**×2**) milk recordings. Additionally, according to European legislation (CE 21/2004 updated by CE 933/2008 and CE 759/2009), an annual inventory of adult sheep, which has been compulsory for European Union sheep farms since 2011, was also included. These scenarios covered the most typical meat and dairy sheep farms in many countries.

The cost-benefit study consisted of a model done using Microsoft Excel 2007 spreadsheet (Microsoft Corp., Redmond, WA) similar to the models used by Saa et al. (2005), APHIS (2009), and Velthuis et al. (2009). In our case, the model calculated the total annual costs and savings of using e-ID bolus and readers (handheld reader and personal digital assistant) under 2 e-ID scenarios (voluntary and mandatory) for dairy (×1 and ×2) and meat (extensive and intensive) sheep farms with regard to the M system. Variables used for the cost-benefit study of implementing the e-ID for performance recording are shown in Tables 1 and 2.

Unitary costs of a personal digital assistant (**PDA**) for improving the throughput and efficiency of the M system and of a handheld reader (**HHR**) for automatically identifying the ewes were calculated, taking into account the depreciation period, flock size, lambing frequency, and test-days per year (Table 2). We considered the possibilities that the HHR readers (for lambing and milk recording) and the PDA (for lambing, BW, inventory, and milk recording) were owned by the farmers or by the milk-recording technicians, in the case of dairy farms (working time = 200 d/yr). Moreover, electronic scales and stationary reading units (for BW and inventory recording) were considered as shared by groups of 30 farms.

Rate of return (**ROR**), calculated as the difference between saving and costs with regard to the costs, and the break-even point (**BEP**) were also calculated for comparing the different performance-recording options considered. The same spreadsheet was used to calculate the ROR and BEP values of the sensitivity analyses in all cases considered.

RESULTS AND DISCUSSION

Data Recording at Lambing

HHR. Calculation of extra costs resulting from the implementation of e-ID for lambing recording was based on using 1 HHR reader per farm (owned by the farmer) for ewe e-ID according to the key parameters described in Tables 1 and 2. As a result, the calculated unitary extra cost (i.e., e-ID bolus and HHR), with regard to M, for a meat flock of 700 ewes under extensive (1 lambing/yr) was €0.371/ewe and year (bolus