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Short Communication

Electronic and visual identification devices for adult goats reared in semi-intensive system[1]

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ABSTRACT - This study intended to evaluate three identification devices for adult goats reared in semi-intensive system. They were (1) the ruminal bolus, electronic identification device composed of non-toxic ceramic and weighing 74.4 g; (2) small ear tag on left ear, visual identification device with dimensions of 50 × 15mm; and (3) big ear tag on right ear, also a visual identification device with dimensions of 42 × 48 mm. Twenty-two crossbred Boer female goats with mean age of 4 years and mean body weight (BW) of 52.6 kg were used. The identification devices were applied on all animals. Time spent for administration/application, readability and retention rate of devices were assessed. Problems during and after the application of devices, as well as device losses were recorded. Evaluations were performed one day and one week after application, then, monthly, for six months. The time spent for administration/application of the devices showed mean of 21 s and was similar between the evaluated devices. One big ear tag was lost, which decreased the retention rate of this device to 95.5%. The other devices showed retention rate of 100%. The readability was 100% for all studied devices. Small ear tags and ruminal boluses used in this study are recommended for adult goats. Production systems, environment, and ear tags with large dimensions may affect the retention rates of these visual identification devices.

Key Words: ear tags, electronic ruminal bolus, retention rate, time for application

Introduction

Recently, animal traceability has been intensively discussed (McGrann and Wiseman, 2001) in the European Union (EU) due to the increased spread potential of infectious diseases (e.g. foot and mouth disease and classical swine fever). Aiming to improve the identification systems and allow traceability, the EU published the Regulation CE 21/2004 (recently amended by SANCO/1427/2008) which establishes a double-identification system for small ruminants in the member states with populations greater than 600,000 animals. In this system, a visual device (e.g. plastic ear tags) and a second identification device with radio frequency (e.g. electronic rumen boluses) should be used (Carné et al., 2009a; Saa et al., 2009).

In Brazil, the use of electronic devices to identify small ruminants is not required and there is no specific legislation for this type of identification. Hence, the traceability of sheep and goat production is flawed, and the electronic identification is practically absent on herds. Under these circumstances, a meeting between Brazilian researchers (EMBRAPA, EMEPA and SEBRAE) and agents of Spanish government occurred in 2011 with the purpose of implementing this technology on Brazilian herds. Nevertheless, before the implementation of electronic identification system, research and professional training are necessary. For this reason, a partnership between the Brazilian and Spanish governments was established to allow the implementation of this technology on sheep and goat production (Nóbrega, 2011).

Conventional identification systems of small ruminants like plastic ear tags, necklaces and tattoos are not reliable due to possibility of violation and loss of devices (Pinna et al., 2006). Ear tags are visual devices widely used but show high device loss rates. In addition, difficulty in readability of ear tags is observed, and this is considered identification failure (Machado and Nantes, 2004; Pinna et al., 2006; Ghirardi et al., 2007).

On the other hand, the use of electronic systems for animal identification may facilitate the traceability process.

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Systems of identification with electronic ruminal boluses are considered inviolable and promote an efficient tracing of animals and farmers, allowing for better control of animal transportation among different regions and countries (Fallon, 2001).

The International Committee on Animal Recording (ICAR) is responsible for establishing rules and standards for animal identification. The material used for device manufacturing, the activation frequency for electronic devices and the biocompatibility are some characteristics assessed by ICAR (2007).

Electronic ruminal boluses comply with the requirements established by ICAR (2007) and, therefore, are considered safe and effective means of identification of cattle and sheep (Caja et al., 1999; Ghirardi et al., 2006). However, high variability has been observed for retention rate of electronic rumen boluses in goats (Pinna et al., 2006; Carné et al., 2009a; Carné et al., 2009b). The objective of this study was to evaluate three identification devices for adult goats reared in semi-intensive system. The identification devices were two plastic ear tags of different sizes and one electronic ruminal bolus.

Material and Methods

The experiment was carried out at the Laboratory of Production and Research on Sheep and Goats (LAPOC), Universidade Federal do Paraná (UFPR), located in Pinhais-PR, Brazil (25º 25' South, 49º 8' West, altitude of 915 m). The trial period was between August/2010 and March/2011, totaling six months.

Twenty-two crossbred Boer female goats with mean age of 4 years and 52.6 kg of mean body weight (BW) were used. The animals remained on pasture daily (from 08.00 h to 16.00 h) and were kept in an elevated pen at night, where they were supplemented with corn silage and energy concentrate. Between August and November/2010, the goats remained on pasture of annual ryegrass (*Lolium multiflorum* Lam.), and from December/2010 to March/2011, the animals remained on pasture of limpograss (*Hemarthria altissima* cv. Florida) during the grazing period.

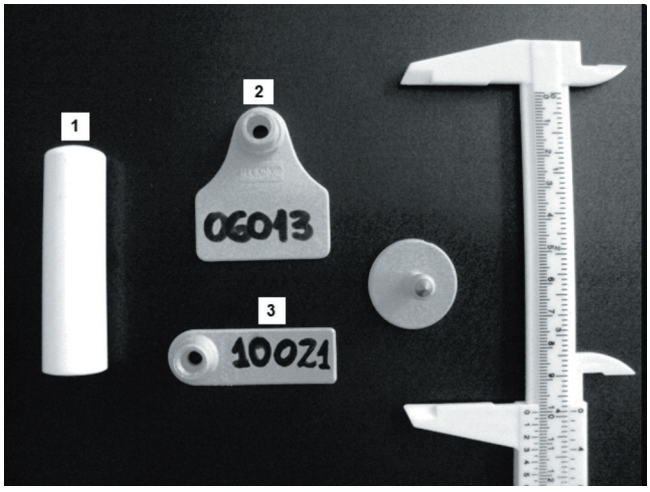
Two types of plastic ear tags and one electronic ruminal bolus were the identification devices evaluated. The ruminal bolus was composed of a non-toxic ceramic capsule and produced by enterprise Saint Gobain (Certag, Brazil). A Half-Duplex (HDX) transponder was implanted in the interior of ceramic capsule. This transponder shows a non-simultaneous communication system between transponder and reading equipment, and operates with activation frequency of 134.2 kHz in accordance with standards 11784 and 11785 of the International Standards Organization (ISO, 1996a,b). The transponder code that identifies each animal was characterized by the first three digits, which identify the enterprise (400 is the number of Certag assigned by ICAR), and the last 12 digits correspond to serial number and identifiy the animal.

The ruminal bolus showed mean weight of 74.4 g, 19.3 mm external diameter, 68.65 mm length, 3.37 g/cm³ density and 22 mL volume. This device was developed for animals with BW equal or superior to 25 kg. Two types of plastic ear tags were used: small ear tag, measuring 50 mm × 15 mm (width × height), applied on the left ear; and big ear tag, measuring 42 × 48 mm (width × height), applied on the right ear. All animals received the three devices (Figure 1).

A metallic balling gun (Gesimpex Comercial, Barcelona, Spain) was used for bolus administration. The goat was restrained and the bolus was applied at the end of its tongue. The mouth of the animal was closed to stimulate involuntary deglutition, as described by Caja et al. (1999). After deglutition, the bolus was retained in the reticulum or rumen. Ear tags were applied with appropriate applicator after asepsis of both ears with iodine solution (10%).

The time spent for bolus administration was measured from restraining the animal until the deglutition of bolus. The time spent on the application of ear tags was measured by restraining the animal until the removal of the applicator. The boluses were administered and the ear tags were applied by the same operator to reduce their influence on the study.

Readings of ruminal bolus were taken immediately before and after administration to identify precocious losses, as recommended by Ghirardi et al. (2006). During



1- ruminal bolus; 2 - big ear tag; 3 - small ear tag.

Figure 1 - Identification devices used in the study.

weighing, a non-portable transceiver detected the bolus and recognized the identification number of each animal.

The readability (Re, %) and the retention rate (RR, %) of the devices were assessed one day and one week after application, then, monthly. The readings were made by the same operator during six months as recommended by ICAR (2007). Readability (Re) and RR were calculated as described by Caja et al. (1999), using the formulae:

Re (%) = n read devices / n applied devices × 100

RR (%) = n retained devices / n applied devices × 100

The experimental design was completely randomized and the animals were the experimental units (n = 22). Data relating to time for administration/application of devices were analyzed by ANOVA using the general linear model (GLM), considering the randomized effect associated with the animal. The model fitted for this variable was:

$$Y_{ij} = \mu + \alpha_i + \alpha_j + e_{ij}$$

in which Y_{ij} = time for administration/application of devices on the j-th animal related to the i-th treatment. Data relating to retention rate of devices were subjected to survival analysis by the Chi-square test. Problems during and after application, devices losses, read failures and readability were presented in descriptive form. Statistical analyses were performed using the statistical software R Project for Statistical Computing version 2.10.1 (R PROJECT).

Results and Discussion

All 22 goats were monitored in the trial period (100% of the experimental units). The time spent for administration/application of devices was 21 s on average (Table 1) and was not affected by the evaluated animal effect (P = 0.2921) or types of devices (P = 0.7084). This result was not expected due to the higher difficulty of ruminal bolus administration compared with the application of ear tags. As such, ruminal boluses for identification of adult goats have an advantage as they are a safer identification device and more effective than ear tags.

Carné et al. (2010), using ruminal bolus with weight similar to this study, reported mean time for administration of 22±1 s, which was 2.4 s greater than the time observed in this study (19.6 s; Table 1). This difference is probably related to the fact that the animals of the present study were frequently handled. In this case, the low stress condition and low reactivity of the animals during the administration of boluses resulted in decrease in time for application.

Problems during application of the big ear tag were recorded (Table 1) and corresponded to bleeding, observed in one goat. Edwards et al. (2001) and Carné et al. (2009a) also reported problems as bleeding, inflammation and tissue reaction after the application of ear tags in sheep and goats. Except for bleeding in one goat, none of these problems was recorded during the application of the ear tags.

No early losses of devices were observed (after one week of application), but after a month of evaluation the loss of one big ear tag was recorded (Table 1), which decreased the retention rate of this device to 95.5%. Carné et al. (2010, 2011) also observed mean retention rate of 95% for big ear tags in goats, but this result was obtained after one year of evaluation.

Small ear tag and ruminal bolus showed similar retention rates, which corresponded to 100%, which is above the value reported in the literature. Pinna et al. (2006) evaluated the retention rate of the ruminal bolus in adult goats and reported mean value of 99.6% after eight months of evaluation. Carné et al. (2011) observed mean retention rate of 99.5% for ruminal bolus in goats after one year of evaluation. However, retention rates reported for ruminal boluses in goats showed high variability, ranging from 71.4 to 100% (Pinna et al., 2006; Carné et al., 2009a; Carné et al., 2011). This variability can be related to the characteristics of boluses used in these studies, which showed differences in diameter (9 to 22 mm), length (37 to 84 mm) and weight (5 to 111 g). These characteristics affect retention rate and few studies have been conducted with the objective to determine the adequate dimensions and weight of ruminal boluses for goats. However, better results with adult goats have been observed with ruminal boluses weighing 70 g or more (Pinna et al., 2006; Carné et al., 2009a; Carné et al., 2009b; Carné et al., 2011).

Although the retention rate of big ear tag was lower than the other devices, there was no statistical difference (P = 0.3170) for retention rate among the evaluated devices. With a retention rate of 95.5% after six months of evaluation, the big ear tag is not recommended as it did not meet the requirements of ICAR (2007). According to this committee, an identification device is approved when

Table 1 - Measures performed during application and estimated readability of identification devices applied in adult goats and monitored for six months

Measures	Devices		
	Big ear tag	Small ear tag	Ruminal bolus
Applied devices (n)	22	22	22
Time for application (s)	21.4	22.0	19.6
Problems during application (n)	0	1	0
Problems after application (n)	0	0	0
Devices losses (n)	1	0	0
Read failures (n)	0	0	0
Readability (%)	100	100	100

the retention rate is equal to or higher than 99% after six months of evaluation, or 98% after one year of evaluation.

The single loss of identification devices (big ear tag) occurred due to intense habit of scratching observed in goats. Probably, in the period that animals were confined overnight, one animal scratched itself on the fence and stuck the big ear tag in the wire, resulting in ear laceration and loss of this identification device. Thus, the production environment and the ear tag dimensions can directly affect the retention rate.

No reading failures or problems in identification of the devices were recorded, which resulted in 100% of readability (Table 1). This result for readability was also reported in other studies (Pinna et al., 2006; Carné et al., 2009a).

Costs of implantation and utilization of electronic identification system are higher than visual identification system. The implantation of electronic system depends on acquisition of the transceiver and boluses, which have an average cost per unit of R$ (Brazilian Reais) 3,500.00 and R$ 9.00, respectively. The implantation of visual system requires an ear tag applicator and ear tags, which have an average cost per unit of R$ 80.00 and R$ 1.00, respectively.

Despite the high cost, the electronic system has advantages over the visual system due to the possibility to establish traceability, which has been required by farmers to export animal products abroad. Moreover, boluses can be reused after slaughter, which reduces the costs with identification. The visual devices (ear tags) can be used only one time and have low retention rates compared with boluses. In the electronic system, the risks of readability failures and confusing data among animals is lower than in the visual system. In the latter, flaws in the visualization of numbers may incur errors on the herd database. Another advantage of electronic identification with boluses is the possibility to connect this system to the herd management software, which allows for better management of the data obtained on the farm.

However, the main problem related to the use of visual identification as a single method is the high risk of losing devices in several animals, which also results in loss of individual data of these animals. This risk is low in the electronic identification with boluses because the device loss is low and hardly occurs in more than one animal simultaneously.

Conclusions

Small ear tags and ruminal boluses with same characteristics and dimensions as used in this study meet the readability requirements of ICAR (2007) and thus are recommended for adult goats. Production system and environment and the dimensions of ear tags may affect the retention rates of these visual identification devices. Despite the high implantation cost, goat identification with electronic system is recommended due to the advantages over the visual system, such as the possibility to establish the traceability; reutilize the devices after slaughter; low risks of readability failures, losing devices and confusing data between animals; and the possibility to connect this system to herd management softwares.

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