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Pig identification: comparison of results from injected transponders and electronic ear tags

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Summary

The aim of this study was to evaluate the results of two different electronic pig identification methods on various closed-cycle fattening farms in Brescia, Bergamo and Modena provinces and to consider the effect of slaughter procedures on ear tag retention. On-farm tests involved the intraperitoneal injection of a transponder into 527 piglets aged 20-30 days using a 5 cm steel needle, and the use of an electronic ear tag in 114 piglets of the same age range. The percentage of reading controls of intraperitoneal transponders varied from 96.8-100%, with recovery of 70% at the slaughterhouse. Retention of electronic ear tags on arrival at the slaughterhouse was 75.43%. Activities performed during the slaughter process resulted in the loss of 4.65% of the electronic ear tags present at the beginning of the slaughter cycle. To evaluate the effect of procedures conducted in the slaughterhouse on ear tag retention, various tests were conducted in an industrial slaughterhouse in Modena province, using a total of 199 ear tags of three different brands. The percentage of ear tags recovered after the slaughter process varied from 89% to 96%.

Keywords

Ear tags, Electronic identification, Pigs, Transponders.

Introduction

The recent introduction of European Union standards (4), which have targeted food safety as an objective, and consumer demand for reliable information on the origin of purchased products have given impetus to the search for reliable systems able to satisfy these requirements. Animal identification is one of the essential requisites of a system to guarantee traceability along the entire meat production chain. The current official pig identification system in Italy (2) for the 'denomination of protected origin' (DOP) farms involves tattooing the left ear or the outer thigh. The tattoo carries only the farm ID code preceded by the country of origin of the animal. Farms and slaughterhouses that belong to these consortiums (5 386 farms and 139 slaughterhouses recognised) (www.prosciuttodiparma.com) must apply a second permanent tattoo that gives the code of the destination farm when moving animals, before they are sent to the slaughterhouse. The use of electronic pig identification systems is intended to improve the existing traceability system, moving from a batch or lot identification system to individual identification. This system is designed to provide improved management of rapid response systems enabling the immediate identification and withdrawal of products from the cycle if necessary.

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Materials and methods

Farm

A total of 665 pigs were divided into two groups according to the identification type used. Group 1, consisting of 527 commercial hybrids aged between 20 and 30 days and weighing approximately 5-7 kg, from two closed-cycle fattening farms in Bergamo and Brescia provinces, were identified using 148 glass-encapsulated, 23 mm long HDX injectable transponders (TIRIS, Texas Instruments) and 379 HDX injectable transponders of 32 mm in length (TIRIS, Texas Instruments) (Fig. 1). The transponders were supplied in packs of 10, immersed in an iodine solution. They were injected by inserting a 6 cm steel needle into the reference point, on the left between the second and third nipple pairs, lateral to the linea alba (Fig. 2). The needle was disinfected with 5% iodate solution prior to each injection. Animals were held using a wooden support with a central channel in which the animal was placed (Fig. 3). Group 2, consisting of 138 commercial hybrids of the same age and weight as for Group 1, from a farm in Modena province, were identified by FDX-B electronic ear tags (diameter 2.6 cm, weight 5.12 g) (Allflex). The injected transponders were recovered in the two Parma province slaughterhouses with the assistance of five people to avoid hampering the efficiency of the processing line (350-350 pigs/h) and to ensure recovery of the maximum number of identifiers (Fig. 4).

Figure 1
Transponders used

Figure 2
Inoculation of transponder into abdominal cavity

Figure 3
Wooden support used during injection of transponder

Figure 4
Recovery of transponder from the omentum

The recovery procedure involves traction of the omentum near the spleen to enable the transponder to be seen. Two more workers are required for visual checking of the intestines

after their removal from the carcass and another to take the reading. The McNemar test for dependent samples was used to check for any statistically significant difference between readings of the same animals between the farm and the slaughterhouse (1).

Slaughterhouse

A total of 199 electronic ear tags were used during tests conducted at the Italcarni slaughterhouse in Carpi. Three different models (Allflex) were used to evaluate the effect of the slaughter phases on ear tag retention (Fig. 5), as follows:

- Type A: diameter 2.6 cm, weight 5.26 g (long pin), FDX-B transponder
- Type B: diameter 2.6 cm, weight 5.12 g (short pin), FDX-B transponder
- Type C: diameter 3.0 cm, weight 10.2 g (long pin), HDX transponder.

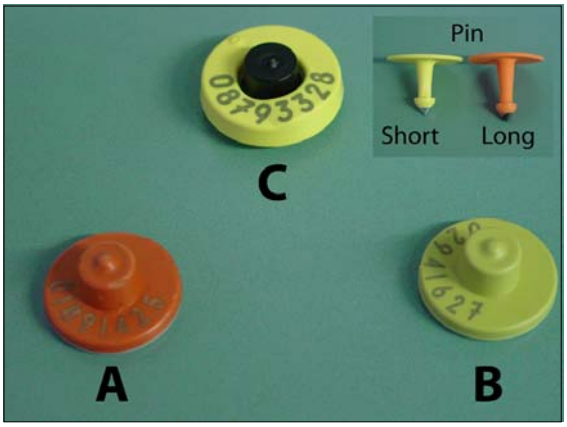

Figure 5
Different models of ear tag used in slaughterhouse tests

Electronic ear tags were applied to animals hung on the processing line immediately after the stunning and bleeding phases and just before scalding (Fig. 6). Two people were required to apply the ear tags due to the high speed of the production line (approximately 360 pigs/h). Readings were taken with a Datamars (model Isomax 3), Innoceramics (model P. 3000) and Allflex (model RS 320) portable reader with a bluetooth wireless system (Fig. 7).

Figure 6
Ear tag (type B)

Figure 7
Readings taken during processing

Results

Results recorded for the intraperitoneal transponder are presented in Tables I and II. Table I provides the transponder reading efficiency for pigs at the Brescia and Bergamo farms, which ranged from 96.8% to 100% of animals identified. Two animals died within 24 h of the injection due to the test itself. Non-identification at the farm or slaughterhouse was not due to transponder malfunction as these were successfully read after recovery at the slaughterhouse. The non-identification at the farm was associated with non-recovery of the transponder at the slaughterhouse (0.56%), while in other cases it was ascribed to environmental interference. The difference between intraperitoneal transponder readings taken on the farm and at the slaughterhouse for the same animals was found to be

Table I
Efficiency of intraperitoneal transponder readings in pigs

Pigs identified	Readings 1 day	7 days	105 days	135 days	210 days
242	241/241* (100%)	234/236 (99.1%)	201/206 (97.5%)	178/181 (98.3%)	166/167 (99.4%)
285	284/284* (100%)	281/284 (98.9%)	260/264 (98.4%)	250/258 (96.8%)	245/251 (97.6%)

* one piglet died 24 h after the injection

Table II
Recovery of intraperitoneal transponders at industrial slaughterhouses in 2003

Date	Pigs slaughtered	Successful readings	Transponders recovered
17 September	51	45 (88.24%)	31 (60.78%)
18 September	36	35 (97.22%)	28[a] (77.78%)
24 September	15	13 (86.67%)	10 (66.67%)
1 October	23	12[b] (52.17%)	11 (47.83%)
9 October	13	12 (92.30%)	10 (76.92%)
15 October	7	7 (100%)	5 (71.43%)
4 November	246	227 (93.03%)	180 (73.77%)
Total	391	351 (90.23%)	275 (70.69%)

a) recovery after intestines were removed from the carcass
b) reader malfunction

statistically significant using the McNemar test (1) for dependent samples (χ^2 =18.22, p<0.01) as reported in Table III. The difference in readings taken in the two slaughterhouses and on the two farms was not statistically significant.

Table III
Distribution of farm and slaughterhouse readings (McNemar test)

χ^2 =18.22 with p<0.01		Read in slaughterhouse Yes	No	Total
Read on farm	Yes	320	34	354
	No	6	8	14
Total		326	42	368

Table II provides the results of readings and intraperitoneal transponder recovery at the slaughterhouses involved in the trial. Readings taken at the slaughterhouses were affected by various environmental factors which interfered with the transponder reading. Technical staff from the European Community Joint Research Centre who were present during the slaughterhouse tests, took electromagnetic measurements to understand the causes of the phenomenon observed (Test Report RE 03/19). After recovery, all transponders were read with success. The percentage of successful readings for injected transponders was high, although the recovery of transponders from the abdominal cavity was low, averaging around 70%.

More than 75% of transponders were found to adhere to the omentum (5) and were recovered by two operators with the intestines still attached to the carcass. Table IV gives the results of electronic ear tag retention in a closed-cycle farm in Modena province. A few days after the commencement of the test, six animals died of unrelated causes. Retention of ear tags in the last three months of the fattening cycle decreased considerably, coinciding with the movement of the animals and the creation of a new group for the last

phase of the farming cycle. Reading efficiency was constant over the entire production cycle.

Table IV
On-farm retention of electronic ear tags

Reading times	Ear tag retention (%)	Reading efficiency
30 days[a]	132/132 (100%)	100%
90 days	121/123 (98.4%)	100%
180 days	112/116 (96.55%)	100%
270 days[b]	86/114 (75.43%)	100%

a) six subjects died after the beginning of the test
b) read on arrival at the slaughterhouse

Table V presents the results from the Modena province slaughterhouse (production line speed: 360 pigs/h). A total of 75.43% of ear tags were retained on arrival at the slaughterhouse, with a reading percentage of 97.01%. After the slaughter cycle, 4.65% of ear tags had been lost within the slaughterhouse (3), while the reading percentage remained unchanged.

The results of slaughterhouse tests on retention at the end of the slaughtering process for the three different ear tag models are given in Table VI. The best results (96% retention) were obtained with type C, which was found to be more resistant to the mechanical and thermal stress (scalding, hair removal and flaming) encountered along the production line (Fig. 8).

Discussion

The use of intraperitoneally injected transponders was found to be compatible with the requirements of farmers, as it is rapid, simple and painless. The operation can be combined with other livestock procedures to avoid unnecessary stress for the animals. However, trained staff must be used to avoid potential problems (5).

On-farm readings, excluding environmental interference, surpass the 98% standard established by the International Committee for Animal Recording (ICAR). Some problems were encountered during both live reading at the farm and transponder reading and recovery at the slaughterhouses. There was no

Figure 8
Flaming technique

Table V
Readings and recovery of ear tags at slaughterhouse

Animals slaughtered	Retention on arrival (%)	Readings cycle start (%)	Recovery cycle end (%)	Readings after recovery (%)	Ear tags lost
89	67/89 (75.28%)	65/67(97.01%)	64/67	62/64	3/67
25	19/25 (76%)	19/19 (100%)	18/19	18/18	1/19
Total: 114	86/114(75.43%)	84/86 (97.67%)	82/86 (95.34%)	80/82 (97.56%)	4/86 (4.65%)

Table VI
Percentage retention of ear tags in slaughterhouse

Ear tag model	Pigs identified	Percentage recovery	Readings after recovery
Type A	99	89/99 (89.9%)	89/89 (100%)
Type B	50	47/50 (94%)	47/47 (100%)
Type C	50	48/50 (96%)	48/48 (100%)
Total	199	184/199 (92.5%)	184/184 (100%)

correlation between the transponder size and its likelihood of recovery during the processing phase. A recovery rate of 100% of identifiers in industrial plants (with high speed production lines requiring experienced staff) must be achieved. This is a critical point for both product traceability and food safety. At the Parma slaughterhouse, electromagnetic measurements conducted by the European Community Joint Research Centre and the previous readings by Datamars technicians revealed the difficulties of taking dynamic readings in such locations, where the environmental factors within the slaughterhouse can significantly reduce the performance of the electronic identifiers. A statistical test of the readings taken at farms and slaughterhouses on the same animals revealed a statistically significant difference between the two sets of data.

A total of 24.56% of ear tags were lost in the farming phase, especially during fattening and in transport to the slaughterhouse, revealing the limits of the ear tag fixing system. However, no problems were found with the electronic component. From the group tagged at the farm, 4.65% of ear tags were lost within the slaughterhouse, while 4%-10% were lost from the group tagged within the slaughterhouse during the performance of the test. This demonstrates that the pig processing procedures and the different materials used during the test have a negative effect on ear tag retention within the slaughterhouse. The equipment used during testing was the same as that used to identify other animal species (cattle, sheep and goats).

Conclusion

As current legislation does not include the use of ear tags for pig identification, no ear tag identification system which takes into account the special requirements for this species has been studied. For the future, it is to be hoped that more suitable identifiers for the requirements of the pork production chain will be examined and tested. The use of electronic identification, such as those tested for other large animal species (e.g. sheep and goats) can provide an alternative or additional system to traditional methods of identification.

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