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Sculpture by Fritz Røed, Sverd i fjell, 1983 - © Fritz Røed / BONO 2010

Lamb traceability evaluation by visual ear tags, electronic boluses and retinal imaging

(Abstr. #10950)

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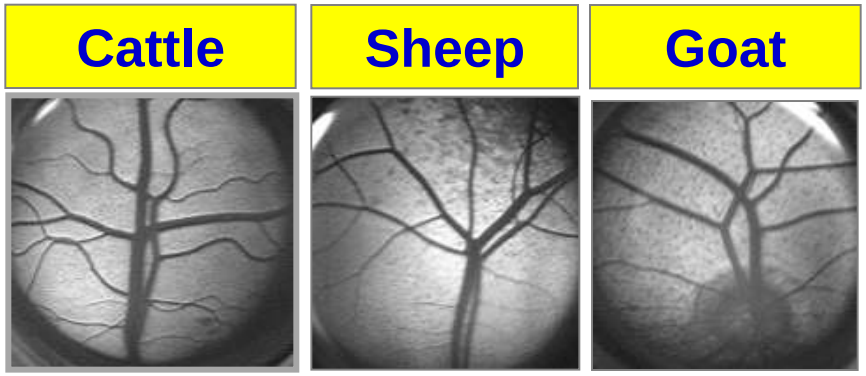
Introduction

Meat traceability: ‘a hot topic’

- Key element for the agrifood global market
- Tracking animal from birth to slaughter: **‘From farm to fork’ and ‘From fork to farm’**
- A credible **traceability schema** requires: identification (**ID**) system; and auditing system for verification.
- For auditing. a secondary ID-based on tamper-proof artificial or natural marks may be used. like retinal imaging (**RI**).

Introduction

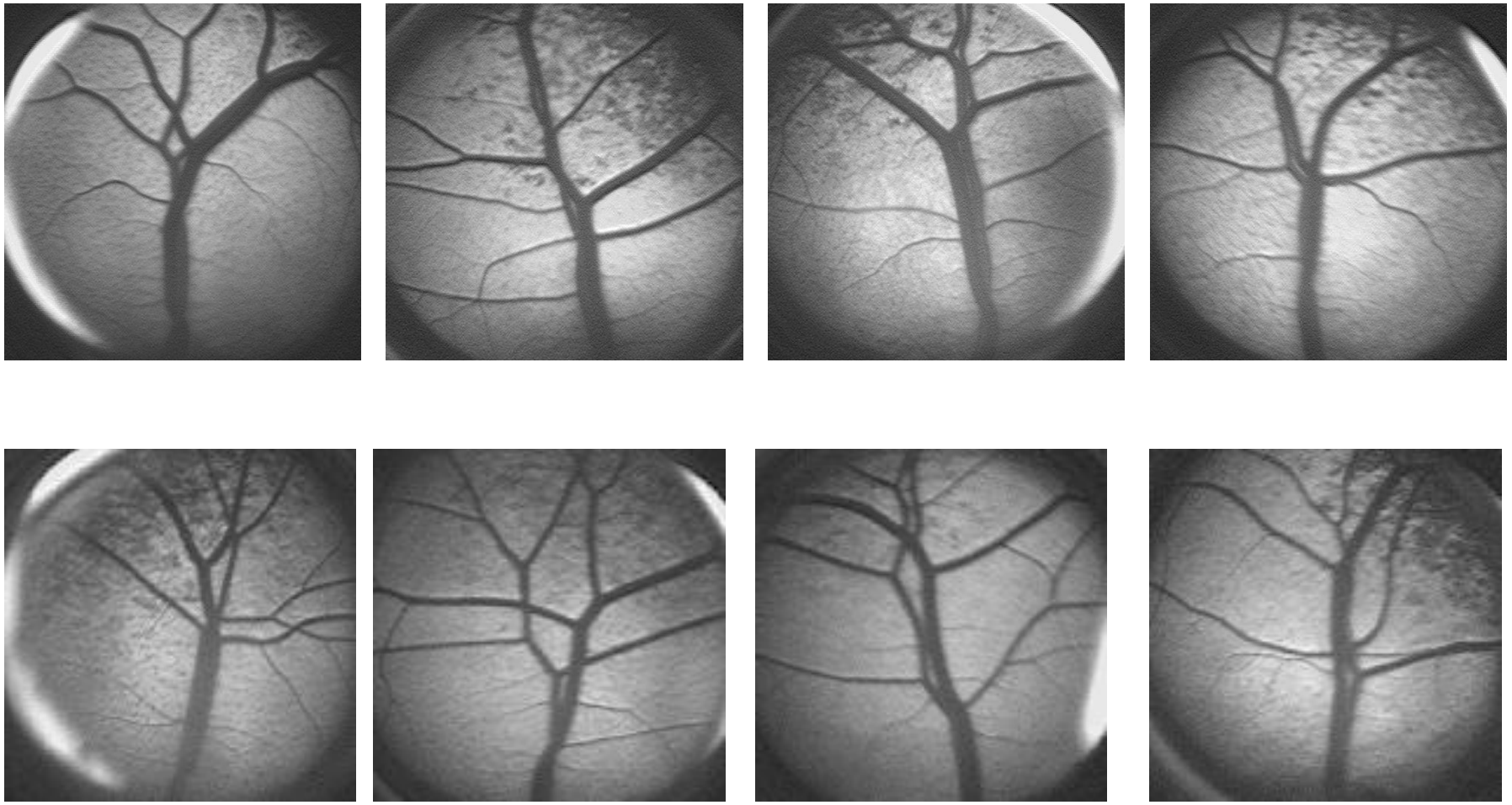
- **Uniqueness** of retinal vascular pattern of each eye during **the animal life-span**.
- **Differences** between:
  - Eyes (left vs. right)
  - Species
  - Twins, clones...



- **Previous research** on retinal identification of **cattle** (Allen et al., 2008; Rusk et al., 2008) and **sheep** (Barry et al., 2008; Rojas et al., 2011).
- There is no information on **using RI** for **verifying animal ID** throughout the meat chain

Introduction

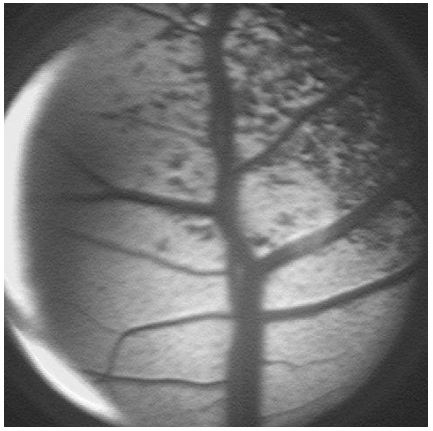
- **Retinal Image of 8 individuals lambs, showing the unique retinal vascular patterns**



Introduction

- **Retinal Image of the same lamb at different age**

Day 1



Day 8

Day 30

Day 90

Day 180

Day 360

Objectives

1) To evaluate the efficiency of different ID systems: **visual ear tags and electronic devices**

2) To assess the **use of RI method to verify** the identity of **live** and **harvested** lambs.

Materials & methods

Animals & management

- **241** intensively fattened lambs from 3 breeds (**Lacaune**, n = 74; **Manchega**, n = 109; **Ripollesa**, n = 58).
- **213** were harvested as fattened light lambs for the Spanish market (so called '**Recental**', <13 kg carcass) at approximately 3 mo of age and <25 kg BW.
- Lambs were processed in a **medium size commercial slaughterhouse** ('Excorxador Sabadell'): **~ 200 lambs/h.**

Materials & methods

Lamb identification devices

- **Official ear tags**:
  - ✓**Temporary at birth** (2.8 g; 40 × 14.5 mm; Allflex-Azasa. Madrid. España; **left ear**). **V1, n = 241**
  - ✓**Permanent at weaning** (5.2 g; 38 × 39 mm; Allflex-Azasa; **right ear**). **V2, n = 104**

- **Electronic**:
  - ✓**Mini-boluses at weaning** (19 g; 56.2 × 11.9 mm; Allflex-Azasa). **MB, n = 104**

Materials & methods

Materials & methods

Transponder readings

- **Farm:** MB and IT after administration and day before lambs were harvested.
- **Slaughterhouse:** MB and IT at the start and end of slaughtering process.

Lamb order in the line was **linked** to **transponder code**

Materials & methods

- **Retinal images**

✓**OptirReader portable device** (*Optibrand*. Fort Collins. CO).

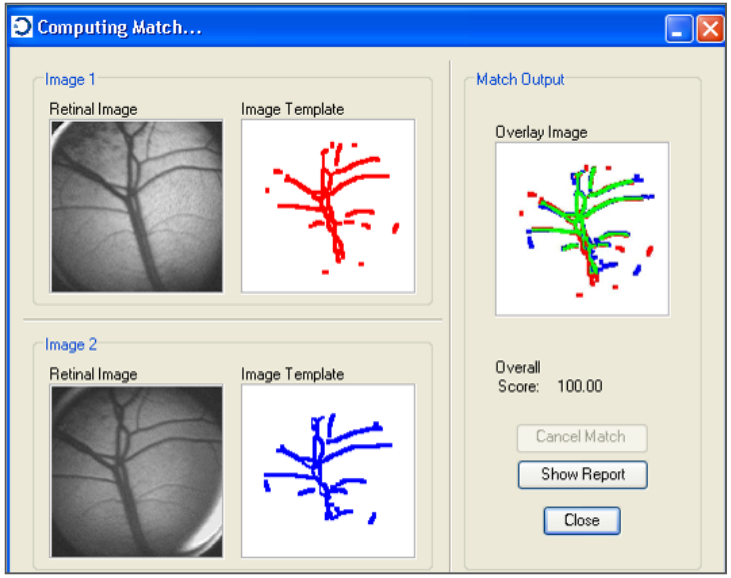
✓**98** live and slaughtered lambs. From both eyes and in duplicate (196 images).

✓Effect of **head standing position** (**normal**, n = 67; **reversed**, n = 31) was compared in slaughtered lambs

Materials & methods

Matching score (MS)

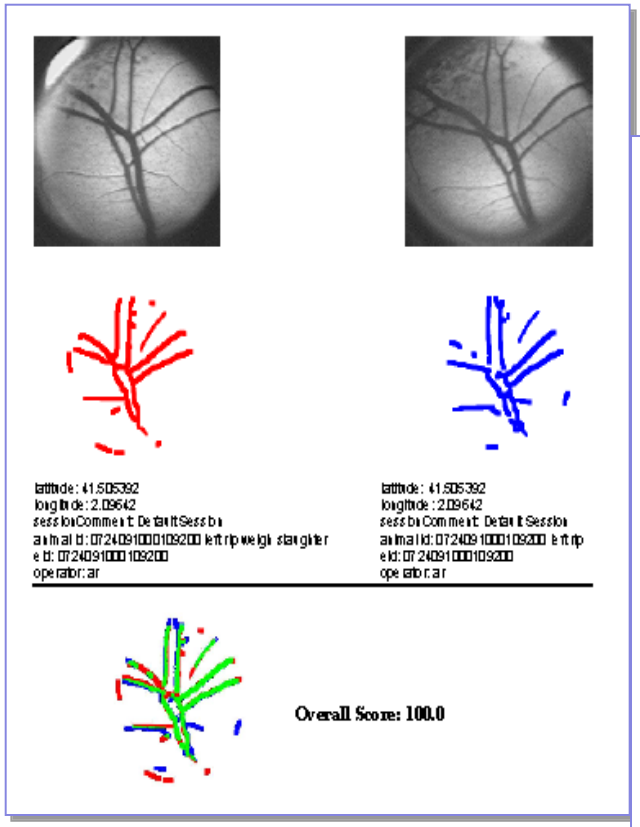
➔ **Optibrand Data Management Software** (v. 4.1.3) for comparisons of pairs of images using MS < 70 as exclusion criteria (sensitivity, 98.9%; specificity, 99.5%).



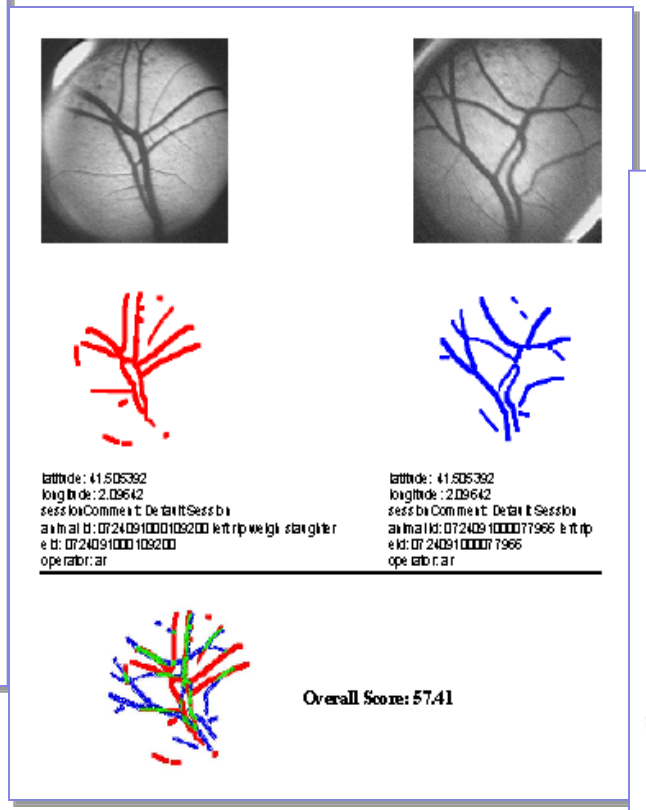
➔ Initial RI from live lamb were compared to the respective eyes in the fattened lambs and in the heads of the slaughtered lambs.

Materials & methods

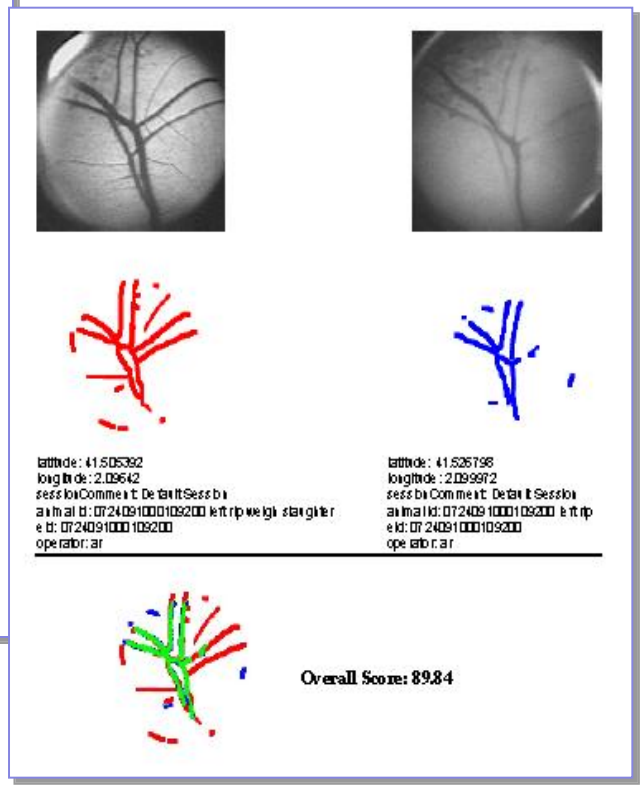
Live correct match



Live correct non-match



Live vs. Slaughtered correct match



Materials & methods

Statistical Analyses

The PROC CATMOD of SAS (v. 9.2). Model was based on the “one-inflated bivariate ß distribution” by using R software (www.r-project.org) and the Likelihood ratio test was used for separation of means at $P < 0.05$.

Results & discussion

On farm

Item	Visual ear tags		Electronic devices		Retinal images
	V1	V2	MB	IT	
Lambs, n	**241**	**104**	**104**	**81**	**98**
Mortality, n (%)	28 (11.6)	3 (2.9)	3 (2.9)	0 (0)	0 (0)
ID devices					
Read at start, n	**213**	**101**	**101**	**81**	**195**
Lost, n (%)	1 (0.5)	0 (0)	1 (1.0)	1 (1.2)	0 (0)
Not readable, n (%)	2 (0.9)	0 (0)	0 (0)	0 (0)	0 (0)
Read at end, n	210	101	100	80	195
Traceability, %	**98.6**	**100.0**	**99.0**	**98.8**	**100.0**

Differences not significant ($P > 0.05$).

All devices showing traceability > 98%; Only V2 and MB > 99 required by ICAR (2009) in trials < 6 mo

Results & discussion

Slaughterhouse

Item	Visual ear tags		Electronic devices		Retinal images
	V1	V2	MB	IT	
Lambs harvested, n	**210**	**101**	**100**	**80**	**98**
ID devices					
Read at the start, n	**210**	**101**	**100**	**80**	**195**
Reading site	Ear	Ear	Rumen	Carcass	Eyes
Reading method	Visual	Visual	Reader	Reader	Camera
Lost, n (%)	–	–	0 (0)	16 (20.0)	0 (0)
Not readable, n (%)	–	–	0 (0)	1 (1.2)	49 (25.0)
Read at the end, n	–	–	100	63	146
Recovered, n (%)	–	–	**100 (100.0)**	**70 (87.5)**	–
Traceability, %	–	–	**100.0**	**78.8**	**75.0**
Auditing					
Lamb individual	No	Yes	Yes	Yes	Yes
Carcass auditing	No	No	No	Yes	No
Carcass order matching, %	–	–	–	**68.3**	–

Results & discussion

Retinal Image (L= Live; S= Slaughterhouse)

Item	Matching comparison	Lamb head position		Overall
		Normal	Reversed	
MS	L vs. L	95.3 ± 0.5^{x}	96.9 ± 0.7^{x}	95.8 ± 0.4^{x}
	S vs. S	80.0 ± 1.4^{y}	80.7 ± 1.9^{y}	80.2 ± 1.1^{y}
	L vs. S	69.9 ± 1.1^{az}	76.2 ± 1.7^{bz}	71.8 ± 1.0^{z}
MS ≥70, %	L vs. L	100	100	100
	S vs. S	70.1^{x}	72.1^{x}	70.8^{x}
	L vs. S	56.4^{ay}	75.0^{bx}	62.2^{x}

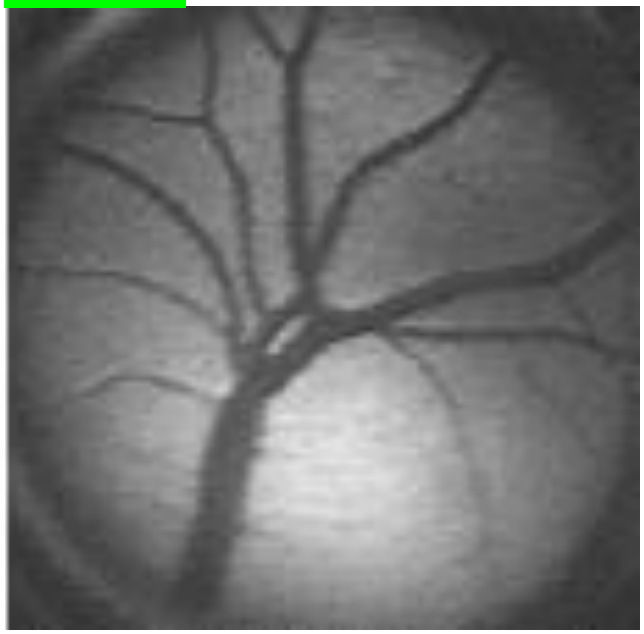
a-b Within rows, values with different superscript differ ($P < 0.05$).

x-z Within columns and for same variable, values with different superscript differ ($P < 0.05$).

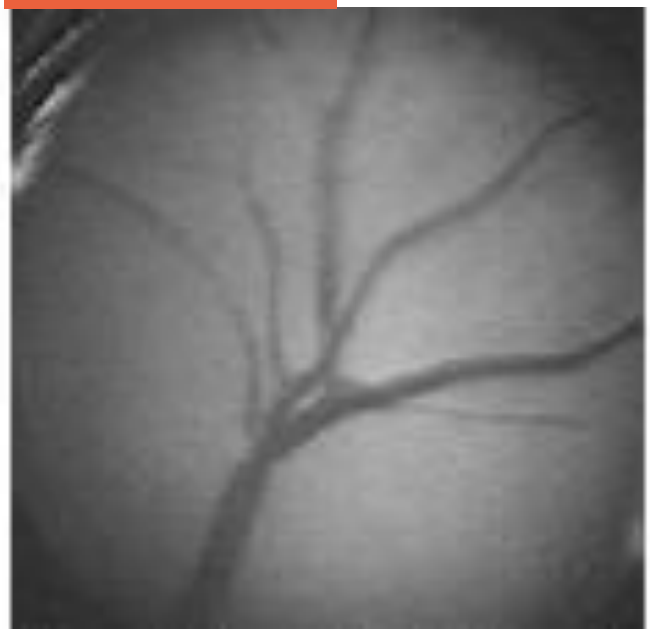
Results & discussion

Retinal Image

Live



Slaughter



In practice, 3 of every 4 lambs can be efficiently audited after slaughter by retinal imaging of their heads.

Conclusions

- **V1, V2, MB** and **IT** were **efficient** devices for individually tracing **live lambs** but all of them **failed** for tracing **carcasses** efficiently.
- Individual tracing from farm to carcass by using **radiofrequency ID devices** would be **possible** if carcass **order is maintained** during processing.
- **Retinal images** are a **valid tool for auditing** live lamb ID and, in most of them (2/3), also after slaughter.

Thank you!