Outputs and economic assessment of RFID technology and molecular biology (STRs) as innovative tools for traceability and origin protection in "Suinetto di Sardegna"

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• **Limited production within the pork meat chain in Sardinia, known as “Su porcheddu arrustiu o porcheddu a ispidu”**

• **Pork production is represented by a “scattered filiere” (9,17% of national husbandry, ISTAT 2007)**
• Small family run farms (9.264, ANAS 2007) spread all over the Isle, leading to a highly appreciated limited production

Suckling piglets are normally slaughtered around one month of age: whole or half carcasses are the usual ways the product is presented at retailers

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“Suinetto di Sardegna”

• Potentials of such production may lead the suckling piglet meat to achieve “a niche” within the market

• Reinforcement of the “brand” of the pork product, through a sound traceability system

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## Previous trial on deployment of the RFID technology for piglets identification and traceability of animals and RFID + DNA for animal products traceability

<table>
<thead>
<tr>
<th>ON FIELD PERFORMANCE</th>
<th>TECHNICAL CHARACTERISTICS</th>
<th>COSTS OF TRACEABILITY?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ease activities</td>
<td>• Univocable and clear</td>
<td>Fill the blank</td>
</tr>
<tr>
<td>• Reduce errors</td>
<td>• Repeatedly constant</td>
<td></td>
</tr>
<tr>
<td>• Reliable</td>
<td>• Fraud proof</td>
<td></td>
</tr>
<tr>
<td>• Easy to share</td>
<td>• Carrier of information</td>
<td></td>
</tr>
<tr>
<td>• Grant information flow</td>
<td></td>
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</tr>
</tbody>
</table>

### Results
- Grant information flow

### Conclusions
- Outputs and economic assessment of RFID technology and molecular biology (STRs) as innovative tools for traceability and origin protection in "Suinetto di Sardegna"

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ANIMALS:
355 suckling piglets were electronically identified (EID), within the first week of birth in the field, by intraperitoneal injection of a transponder (Caja et al., 2003)

DEVICE:
Passive HDX transponder 32.5 3.8 mm, ISO 11784-11785 Tiris 32 mm

READERS:
RFID handy reader (Gesreader 2S ISO®, static reading)

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Reading of individual transponder code and R%: Controls of transponder code and calculation of readability in farm and at abattoir

DNA analysis: DNA extraction from tissue sample from EID piglet at farm and from correspondent EID carcass for PCR by means of 6 microsatellites for Swine according to FAO panel

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Evaluation of RFID+DNA as an integrated system for Suinetto da latte di Sardegna traceability:

**Global evaluation**

- **Criterion 1** Reliability
- **Criterion 2** Accuracy
- **Criterion 3** Efficiency

**Investigated criteria**

<table>
<thead>
<tr>
<th>Investigated criteria</th>
<th>Averaged score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>0.546</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.571</td>
</tr>
<tr>
<td>Compatibility</td>
<td>0.50</td>
</tr>
</tbody>
</table>

**Score**

1 to 10 according to results from EID+DNA at indicators test

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Parameters evaluated to establish readability, repeatability, univocability of EIC and DNA profile

In vivo traceability

At slaughterhouse

Carcass traceability

DNA matching (auricle and muscular tissue)

Materials and methods

Electric stunning

Jugulation

Scorching

Washing

Materials and methods

In farm controls

Transportation

At abattoir

Evisceration

Recovery

Results

Conclusions

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Costs quantification

The husbandry costs were calculated according to costs of the “Suino Tipico Sardo” in agreement with the Disciplinary of production.

The integrated system EID+DNA costs were evaluated according to costs of electronic devices and tools for 355 EID piglets and DNA analysis on 42 piglets (11.8%).

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Technical performance of the integrated system

**EID + DNA**

**Global evaluation**

**RFID + DNA**

**Criterion 1**

Reliability

- **Indicator 1**
  - Repeatability
  - EID 100%
  - DNA 100%

**Criterion 2**

Accuracy

- **Indicator 2**
  - Univocality
  - EID 100%
  - DNA 100%

**Criterion 3**

Efficiency

- **Indicator 3**
  - Readability
  - EID 99.1%
  - DNA 89.3%

- **Indicator 4**
  - Tool functioning
  - EID 99.1%
  - DNA 89.3%

- **Indicator 5**
  - No. added personnel
  - EID 2
  - DNA 1

**Deaths** 0.56%

**Accidents** 2.54%

Recovery of transponders at abattoir 100%

No cases of DNA matching between 2 different piglets

No cases of non – identity (cross control)

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Global score (%) of the integrated system
EID + DNA

<table>
<thead>
<tr>
<th>Reliability</th>
<th>Accuracy</th>
<th>Efficiency</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>(100%)</td>
<td>(88.8%)</td>
<td>(86.6%)</td>
<td>(94.1%)</td>
</tr>
</tbody>
</table>

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### Costs/piglet with the integrated system EID + DNA and impact on total costs

<table>
<thead>
<tr>
<th>Costs</th>
<th>€</th>
<th>€/kg</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sow feeding</td>
<td>21.3</td>
<td>3.25</td>
<td>55.3</td>
</tr>
<tr>
<td>Farm/abattoir work</td>
<td>4.4</td>
<td>0.67</td>
<td>11.4</td>
</tr>
<tr>
<td>Various costs</td>
<td>2.3</td>
<td>0.35</td>
<td>5.91</td>
</tr>
<tr>
<td>EID+sample+DNA analysis (6 microsatellites)</td>
<td>10.5</td>
<td>1.67</td>
<td>27.2</td>
</tr>
<tr>
<td>Total costs</td>
<td>38.5</td>
<td>5.88</td>
<td>100</td>
</tr>
</tbody>
</table>

### Results

#### Productive information:
- Parturition sow/2 years: 5
- Piglets at abattoir/parturition: 7-8
- Piglet life span: 3-5 weeks
- Averaged carcass weight: 6550 g

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Summary

The integrated system RFID+DNA tested in the limited production of the suckling piglets “Suinetto di Sardegna” for origin protection and brand reinforcement showed to be:

1. Reliable, accurate and efficient at 94.1%

2. Nearly one third of total costs of production per traced carcass produced according to the Disciplinary of production requirements
• At present, **costs to face appear higher than direct benefits**

• Decreasing trend of costs due to massive deployment of RFID, minimum acceptable levels of economic **break-even point can be achieved in a short period**

• If the new technology becomes a standard for the traceability of the suckling piglet, **incremental benefits can arise from the reinforcement of the "brand" of the Suinetto da latte di Sardegna**