Need to conciliate beef quality, farm efficiency, environment preservation and animal welfare


INRA, VetAgro Sup, Unité Mixte de Recherches sur les Herbivores
Centre de Clermont-Ferrand/Theix
The definition of quality

**Intrinsic quality** refers to the characteristics of the product itself and includes sensory traits (e.g. tenderness, flavor, juiciness, overall liking), safety, healthiness, convenience, etc.

**Extrinsic quality** refers to traits which are associated with the product, namely (i) production system characteristics (from the animal to the processing stages including for example animal welfare, carbon footprint), and (ii) marketing variables (including price, brand name, distribution, origin, packaging, labelling, and traceability).
OVERALL QUALITY resulting from the combination of intrinsic & extrinsic qualities

Environment

Economy of the whole chain

Quality & Image of beef

GHG

Resources

Pollution

Biodiversity

autonomy

resilience

incomes

A global approach
Husbandry, slaughtering, ageing and cooking: combining criteria for a better prediction of sensory quality
## Different beef grading schemes

<table>
<thead>
<tr>
<th>Country Scheme</th>
<th>Europe</th>
<th>S. Africa</th>
<th>Canada</th>
<th>Japan</th>
<th>S. Korea</th>
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<td>Pre slaughter factors</td>
<td>HGP implants &amp; Bos Indicus</td>
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**Slaughterfloor**

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**Chiller**

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**Post chiller**

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</table>

However, consumers do not eat carcasses!
The Meat Standards Australia (MSA) system

MSA moved from a carcass pathways to a cuts based grading scheme

Tenderness

Juiciness

Flavour

Overall liking

Unsatisfactory  Good every day  Better than everyday  Premium

**Meat Quality score (MQ4) (0-100 scale)** = 0.3 tenderness + 0.1 Juiciness + 0.3 Flavor liking + 0.3 Overall liking
# Meat Standards Australia (MSA)

## MSA2000model®

<table>
<thead>
<tr>
<th>Cut Description</th>
<th>Muscle Reference</th>
<th>Days Aged</th>
<th>Grilled Steak</th>
<th>Roast Beef</th>
<th>Stir Fry</th>
<th>Thin Slice</th>
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**Palatability grade**

- **AT**: 8
- **m**: 0
- **0**: 0
- **250**: 140
- **130**: 5
- **5**: 12
- **5.50**: 2
- **2**: n
- **0.86**: Wght/App.Maturity

**AUSMEAT Meat Col.**

- **Saleyard? (Y, N)**
  - **Y**: 2
  - **N**: n

**State**

- **Science & Impact**
- **VetAgro Sup**
Feeding practices: comparison of three contrasting bull-fattening systems used in France
Comparison of three contrasting diets

⇒ Blond d’Aquitaine young bulls

<table>
<thead>
<tr>
<th>% concentrate →</th>
<th>% forages→</th>
<th>35% 65% corn silage</th>
<th>50% 50% hay</th>
<th>86% 14% wheat straw,</th>
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Per kg of body weight gain

greenhouse gas (GHG) emissions in kg eq-CO₂

Including enteric methane  

Energy consumption eq-MJ

Eutrophication potential g eq-PO₄³⁻

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<td>18,6</td>
<td>☹️15,8</td>
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Each diet has different advantages and disadvantages

Doreau et al, 2011; Nguyen et al, 2012
Husbandry practices: win-win relationships between environmental and economic issues
Feeding practices and beef quality

⇒ 59 farms in the Charolais area from 2010 to 2011.

High variability:
- from 7 to 15 for GHG emissions
- from 150 to 550 for gross margin

Win-win relationships:
- Farms are the most efficient on an economic basis.
- Farms are also the most efficient for low GHG emissions.

Win-win relationships:
- Feeding practices and beef quality

Veysset et al., 2013
Husbandry and slaughtering: win-win strategies to optimise both welfare, nutritional value and tenderness

Quality & Image of beef

- Technological
- Sensory
- Nutritional

Welfare
Stress at slaughter and beef quality

Win-win relationship:

- Cows
  - with the lowest stress
  - provide the most tender beef

Terlouw et al., 2012
Feeding practices and beef quality

cows (Normand breed): Linseed supplementation

↑ 18:3 n-3 content in muscles

😊 Higher PUFA content

_except Higher susceptibility to FA oxidation

Negative impact on sensory quality

Win-win relationships:

Simultaneous addition of linseed and antioxidants produce beef of better quality:

→ better stability of PUFA
→ better stability of colour

Gobert et al., 2008; Parafita et al., 2008; Bauchart et al, 2009
How to combine different criteria of quality?

1. Analysis by an expert: done by traditional butchers. Not transparent, not exhaustive and also not consistent across experts.

2. Minimum requirements (= thresholds) easy to understand and implement but rough evaluation (good vs bad).

3. A ranking system from best (rank 1) to worst (rank n), and a summation of the ranks: this is only a 'relative' judgment, comparing alternatives among themselves, and not an 'absolute' assessment.

4. Conversion of quality traits into value-scores (e.g. quantitative information on a common scale) which are then compounded (e.g. the MSA system for sensory analysis based on a weighted sum).

Etc.
Conclusions about multicriteria approaches

- **Consumer satisfaction** when eating beef involves a complex response based on **objective** and **emotional** assessments of the product.

- **Scientific research** must provide **methods** to predict, in a reliable manner, intrinsic and extrinsic quality traits of beef.

- **Combining intrinsic and extrinsic** quality traits by relevant and new methods is a key driver for the future.
About 80% of feed of herbivores are forages in France.
Biodiversity
Happy cows
Natural feeding
Beautiful landscape
PUFA-rich meat
Carbon sequestration

Photo credit ©: JF Hocquette