Clustering forage types according to their feed nutritive value

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Mountain pastures and livestock farming facing uncertainty: environmental, technical and socio-economic challenges

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Introduction

• Mountain livestock farms at the Pyrenees have used traditionally **conserved forages** obtained from **permanent grasslands**

• Hays and silages have been commonly **used to feed adults** animals during winter period

• **young animals** were fattened using high **concentrate diets** (90% concentrate), usually at lower lands
Introduction

• Calves fattening at mountain farms:
  - Use of higher % of forages (high cost of concentrate)
  - Promoted by EU organic regulation (60:40)
  - Added value of meat
  - Design of rations balanced:
    - Using on-farm conserved forages
    - Producing the type of carcass demanded by market (light carcass weight)
Objective
The aim of the study was to evaluate the nutritive value of forages produced in the Spanish Pyrenees and whether they may fulfil nutrient requirements of growing and finishing beef calves.
Material and methods

Roughage sampling

- Roughages were sampled in **spring, summer and autumn** from 16 mountain farms from the east-southern Pyrenees
- 95 samples: **grassland** forage (fresh, n=17, hay, n=35, silage, n=29) or other **fibre sources** (n=14)
- The grassland forage was mainly formed of plants belonging to the *Molinio–Arrhenatheretea* phytosociological class.

Chemical analyses

- analysed in for ash, ether extract, crude fibre and protein, neutral-detergent fibre and acid-detergent fibre
- The relative forage value \( (\text{RFV} = \frac{((88.9 - (0.779 \times \text{ADF}(%))) \times (120 / \text{NDF}(%))]}{1.29}) \)

Statistical analyses

- A **cluster analysis** (proc CLUSTER, SAS v9.4, Cary, NC)
- k-means clustering method with three groups has been performed.
- data were analysed with a general linear model
Chemical composition of the roughages according to the different clusters obtained

High quality
- CP: 16%
- Ash: 6%

Medium quality
- CP: 12%
- Ash: 8%

Low quality
- CP: 6%
- Ash: 7%

13.5% CP
Filling and digestibility indexes

% (on DM basis)

NDF  ADF  CF

50% NDF

High quality  Medium quality  Low quality
Maturity stage & Harvesting losses
**Adjustment of rations**

60:40 forage to concentrate ratio

Concentrate used for simulations contained 1.02 UFV and 13.7% of CP.

Growing (250 kg of live-weight)

<table>
<thead>
<tr>
<th>Calf gain expected</th>
<th>HIGH QUALITY</th>
<th>MEDIUM QUALITY</th>
<th>LOW QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy</td>
<td>Protein</td>
<td>Energy</td>
</tr>
<tr>
<td>1 kg/d</td>
<td>110%</td>
<td>100%</td>
<td>74%</td>
</tr>
<tr>
<td>1.4 kg/d</td>
<td>96%</td>
<td>94%</td>
<td>63%</td>
</tr>
</tbody>
</table>

Finishing (450 kg of live-weight)

<table>
<thead>
<tr>
<th>Calf gain expected</th>
<th>HIGH QUALITY</th>
<th>MEDIUM QUALITY</th>
<th>LOW QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy</td>
<td>Protein</td>
<td>Energy</td>
</tr>
<tr>
<td>1 kg/d</td>
<td>107%</td>
<td>118%</td>
<td>72%</td>
</tr>
<tr>
<td>1.4 kg/d</td>
<td>97%</td>
<td>97%</td>
<td>64%</td>
</tr>
</tbody>
</table>

Intake limitation is the main obstacle to balance diets.
Conclusions

• In this Pyrenean area, the best quality roughages sources consisted mainly of on-farm harvested pasture silages.

• Only around one third of the roughages may allow meeting energy and protein requirements of growing-finishing beef calves fed forage-based diets

• Suggesting the need of tailoring certain farming practices to improve the nutritive value of forages.

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