Costs of forage production in disadvantaged mountain areas

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Introduction

- Mountain grassland provides numerous ecosystem services
- Its conservation is best achieved through sustainable site-specific agricultural use
- South Tyrol (N-Italy): mountain region (more than 90% of the area above 800 m a.s.l.), 219,000 ha grassland (about one third of the area)
- Extensive grassland is likely to be found where climate and topography are unfavourable (Niedrist et al. 2009)
Aims

The investigation of the forage production costs in South Tyrol aims at:

- identifying the main factors affecting the production costs and quantifying, as far as possible, these relationships
- providing reliable, local data as a rational decisions basis for public payments
- providing a reliable basis for the consultancy at farm scale
Working group

19 farmers from the Puster Valley
## Investigated fields (n=100)

<table>
<thead>
<tr>
<th>Site factor</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (m a.s.l.)</td>
<td>807</td>
<td>2084</td>
<td>1277 ± 290</td>
</tr>
<tr>
<td>Slope (°)</td>
<td>2.0</td>
<td>41.2</td>
<td>18.5 ± 10.1</td>
</tr>
<tr>
<td>Field area (ha)</td>
<td>0.11</td>
<td>8.26</td>
<td>1.88 ± 1.62</td>
</tr>
</tbody>
</table>
Facts about the investigated farms

- Mean load: 1.8 livestock units ha\(^{-1}\)
- Fertilisation: mainly with farm’s own manure
- Forage conservation: ¾ hay, ¼ silage
- Gross DM-yields: 5.9 to 9.4 Mg ha\(^{-1}\)
Calculation of costs of machinery and labour

- Machinery: buying price, service life and working hours according to data provided by the farmers, calculation according to Gazzarin (2011).

- Labour: opportunity cost approach according to AAEA (2000). Reference to the wages of the collective agreement for agriculture according to agricultural training; minimum wage also for children less than 16 and elderly people more than 65 year old.
Data structure

**Fields**
- Field area
- Altitude
- Slope

**Machineries**
- Costs per hour
- Time for assembling
- Time for dismantling

**Operations**
- Field
- Working time
- Machineries used
- Persons involved

**Persons**
- Costs per hour

**Other costs**
- Proportionally distributed to each fields/operations

**Calculation**

3231 field operations recorded
Ordination of unitary costs (PCA)

Principal Component Analysis with transformed z-scores

Unitary costs (€ ha⁻¹ yr⁻¹)
- <1000
- 1000-1500
- 1500-2000
- 2000-2500
- >2500
Effect of slope and field area on production costs and labour input

- Total costs ($€ \text{ha}^{-1} \text{yr}^{-1}$)
- Labour input ($\text{h} \text{ha}^{-1} \text{yr}^{-1}$)

**Slope (°):**
- $R^2 = 0.27^{**}$
- $R^2 = 0.26^{**}$

**Field area (ha):**
- $R^2 = 0.37^{**}$
- $R^2 = 0.29^{**}$

Initial values:
- 0, 10, 20, 30, 40, 50
- 0, 2, 4, 6, 8, 10

**Total costs:**
- $3000$
- $5000$
- $6000$

**Labour input:**
- $0$
- $10$
- $20$
- $30$
- $40$
- $50$

**Legend:**
- Red: Total costs
- Blue: Labour input
Conclusions

○ These results provide evidence for increasing production costs and labour input as field steepness increases and the field size decreases.

○ These fields in particular are most likely to be managed extensively and in turn to provide non-marketable, environmental and social ecosystem services.

○ The effect of altitude may become evident if costs per forage weight unit and not per area unit would be taken into consideration.

○ As farmers are rational economic agents, public payments for these services are therefore crucial for ensuring them in the long term.
Thank you for your attention