Does integration promote sustainability in organic multi-species livestock farm?


INRAE UMR-Herbivores, Clermont-Ferrand, France
Background and challenges

• Agrobiodiversity is a core principle of agro-ecology and organic farming

• Not only crop-livestock integration but also between livestock species integration (or type of production)

• Mix-Enable: a Core-Organic project
  – Assessing the benefits of combining several animal species
  – 3 approaches: Farm monitoring, experimental devices, participatory research
  – All farms are in organic production
Mix-enable

9 partners from 7 different countries

WP2 (monitoring)

WP3 (indicators and analysis) based on 102 farms
Material and method

• Data monitored
  – Farm structure (area, workers, type of animals and number etc.)
  – Production (kg, Protein, MJ, €, type of marketing)
  – Inputs (Feed and fertilization)
  – Work organization (Who, how, when?)

• Global analysis with both
  – Agronomical approach (i.e. technical organisation and performance)
  – Type of marketing
  – Work organization and farmers satisfaction
  – Efficiency of the production

• 2 steps
  – Data analysis → Main types of farms, their characteristic and performance
  – Search for enterprise combinations (types and thresholds) → Farm Efficiency

Multi-species organic livestock farms - Benoit et al
Methodological challenges
Multi-species and productions (meat, milk...)

- **Share of each species** → How? New proposal for LU calculation (with net energy from IPCC, for herbivores. See session 67)

- **What efficiency?** → Output/input
  - → Concentrate / Output (from animals)

**But, productivity (output/LU) depends on species and production**

→ Centered-reduced per enterprise: Eff_CR
→ Then global indicator

\[ \text{Eff}_{\text{farm}} = \sum_{\text{entr}=1}^{n} \text{Eff}_{\text{CRentr}} \cdot \%\text{LU}_{\text{entr}} \]
Principal Component Analysis and Agglomerative Hierarchical Clustering

PCA – AHC

96 farms
- 6 countries
- 2 or more animal enterprises per farm
- Ruminants in all farms
- Beef cattle and dairy cattle are the more represented

38 variables
- n= 14  Farm structure (area, size, production types & importance)
- n= 3  Sales type and other activities
- n=6  Performance (productivity and efficiency)
- n=15  Social aspects (satisfaction, knowledge, farmers origin etc.)
AHC

4 groups of farms

Number of farms:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td></td>
<td>27</td>
<td>54</td>
<td>7</td>
<td>8</td>
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PCA + Clustering
(Factors 1 & 2 = 20%)

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## Main features of the farms (4 groups)

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<tbody>
<tr>
<td><strong>Main (second)</strong></td>
<td>Dairy Cattle (+pig)</td>
<td>Beef Cattle (+poultry)</td>
<td>Dairy Sheep (+ goat)</td>
<td>Beef Cattle (+ Meat sh)</td>
</tr>
<tr>
<td>LU</td>
<td>64</td>
<td>101</td>
<td>112</td>
<td>44</td>
</tr>
<tr>
<td>LU/AWU</td>
<td>14</td>
<td>47</td>
<td>18</td>
<td>34</td>
</tr>
<tr>
<td>AWU</td>
<td>4.4</td>
<td>2.2</td>
<td>6.1</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Worker Paid/Unpaid</strong></td>
<td>36% - 7%</td>
<td>18% - 12%</td>
<td>46% - 31%</td>
<td>14% - 0%</td>
</tr>
<tr>
<td><strong>Process/Short ch (€)</strong></td>
<td>82% - 64%</td>
<td>39% - 44%</td>
<td>71% - 82%</td>
<td>0% - 53%</td>
</tr>
<tr>
<td>% farm fodder in R.feed</td>
<td>81%</td>
<td>84%</td>
<td>46%</td>
<td>98%</td>
</tr>
<tr>
<td>Conversion to OF</td>
<td>1995</td>
<td>2001</td>
<td>2011</td>
<td>2004</td>
</tr>
<tr>
<td>farmer_1_off_root</td>
<td>56%</td>
<td>17%</td>
<td>0%</td>
<td>12%</td>
</tr>
<tr>
<td><strong>Eff: CC / Prod (CR)</strong></td>
<td>- 0.14</td>
<td>+ 0.04</td>
<td>+ 0.49</td>
<td>- 0.62</td>
</tr>
</tbody>
</table>

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What combination for a good efficiency?

- CC/Prot (CR): seen as non-efficiency indic.  
  → Negative is good

- Beef cattle and Sheep (meat):  -0.62  
  See poster no 36.21 from Vazeille et al

- Role of monogastrics?  
  → The more monogastric, the best global efficiency  
  → Why / How?
Relation between share of LU-Monogastric and animal efficiency

Hyp:
Significant and positive impact of feed importation (monogastric) on pasture fertility and on ruminants feed self-suffic.

Hyp:
More importance on short channel marketing? €: marketing > tech.efficiency

Hyp:
Large enterprises are more rationalised /efficient
Take-home messages

• Big-Small ruminants association (beef cattle / meat sheep)
  – Interesting complementarity? (feeding, parasitism management)
  – Low added value on meat (compared to conventional F) → profitability depends to a large extent on technical performance

• Ruminants-monogastrics association
  – Global efficiency ↑ when share of monogastrics ↑
  – Hypothesis
    • Significant fertility transfer (Steinmetz et al 2021)
    • When lower share of Monogastrics → Technical management is less important for farmers and more investment is made on processing / marketing (to be checked)

• Dairy sheep and goat
  – Very frequent in Italy, with
    • Low agronomic potential (rangelands)
    • 82% short channel marketing

  Low Animal Efficiency (output/input)
Conclusion

• **A wide range of data** (technical, marketing, work), on 100 farms, 6 countries, 6 types of production. Huge data verification work. Lack of overall economic results

• Studying complex (diversified) farming systems leads to several methodological issues (calculation of LUs, comparison of performance, input allocation,...)

• Interesting first results

• Additional analyses should be carried out, e.g. effects of the level of integration between enterprises and the role of work organization on farm efficiency and farmers’ satisfaction

• There is a huge diversity in the sample (farm size, type of sales, type of combinations etc.) → for more refined analyses, it would be necessary to re-sample within-combination
Thank you for your attention

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