Crop acreage allocation decisions on intensive mixed crop-livestock farms

Bénédicte ROCHE, Amiotte C., Boussard H., Joannon A., Martel G.

INRA SAD Paysage, Rennes, France

EAAP 2013, Nantes, France
Session 31a: Livestock Farming Systems
Introduction

Organization of crop and grassland areas at the landscape level

Natural resources
Ecological processes

Individual decisions taken at the farm level
Dynamic of a crop mosaic

Plots of 6 different farms

1 km²
Whole territory of each farm
Aims of our research

Why understanding farmers' crop area allocation decisions

> simulate realistic agricultural landscapes
> identify in farmers’ decisions, key factors affecting landscape dynamics
> some may be levers for action

→ Building a farm model for multi-year simulations
Farmers' crop area allocation decisions: available knowledge

- Studied by agronomists, mainly in cash crop farms
  
  **Key parameters:**  
  - Farm territory characteristics  
  - Crop management  

- Models in dairy farms  

- Mixed crop-livestock farms less studied, especially in intensive contexts  

- **How livestock management,**  
  in combination with farm territory characteristics and crop management,  

  **influence crop area decision making?**
**Context:** Brittany, France

- Diverse LFS, more or less intensive
  - Cattle (milk or beef) × Pig × Poultry

- Land mainly dedicated to animal feeding:
  - Temporary grasslands
  - Maize
  - Wheat
Comprehensive survey in 12 farms

4 different combinations of productions

<table>
<thead>
<tr>
<th>(nb of farms)</th>
<th>Total area</th>
<th>Cattle (nb cows)</th>
<th>Granivores</th>
<th>Cash crops</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dairy</td>
<td>Suckling</td>
<td>Poultry</td>
</tr>
<tr>
<td>(n=3)</td>
<td>77-125 ha</td>
<td>55-85</td>
<td>35-85</td>
<td></td>
</tr>
<tr>
<td>(n=2)</td>
<td>45-57 ha</td>
<td>30-60</td>
<td></td>
<td>800-1200 m²</td>
</tr>
<tr>
<td>(n=4)</td>
<td>71-118 ha</td>
<td>35-100</td>
<td></td>
<td>1850-2500 m²</td>
</tr>
<tr>
<td>(n=3)</td>
<td>43-74 ha</td>
<td></td>
<td></td>
<td>4400 m²</td>
</tr>
</tbody>
</table>
Results preview. Farmers’ crop area decision making: livestock management

• Farmers define **priority crops**
  > depends on animal raised

• They define **minimum areas for these crops**
  > diversity
  > depends on feeding strategies of cattle

• **Agronomic decision rules similar among farms**
Results 1/4  Crop grown : priorities

In farms raising cattle
priority = forage production

*Grassland and/or maize*

In farms raising ‘granivores’
priority = secure incomes,

*mainly with wheat, that provides also straw*
Results 2/4. Minimum area defined for

Diversity due to farm size?

Crop - use

Roche B., INRA SAD-Paysage

EAAP 2013, Nantes, France
Results 3/4. More diversity in relatives

Crop - use

- Temporary Grassland
- Maize silage
- Wheat straw
- Wheat grain a.f.
- Wheat incomes
- Rapeseed incomes

Min area / UAA
Min area / LU
Results 4/4. Partly explained by feeding strategies

3 feeding strategies of cattle

Roche B., INRA SAD-Paysage
EAAP 2013, Nantes, France
Perspectives

• Complete analysis => a spatially explicit simulation of landscape
  – Spatial allocation of crops > connectivity of landscape elements
  – Agronomic decision rules > multi-year simulation, landscape dynamics

• Some complementary surveys
Thanks for financial support and most for your attention.
Details Results. Crop grown: priorities

No herbivore

Herbivores

- Temp grld - Maize silage
- Maize silage - Temp grld
- Maize silage - Wheat straw
- Wheat straw - Barley straw
- Wheat cer feed - Maize grain feed
More results. Homogeneity in agronomic decision-making rules

For each crop
• Suitable cultivation area
• Return time
• Acceptable preceding crops
• Maximum number of successive cycles

Perm GL “determinate” on certain plots:
small, wet, distant

On arable land,
  . no constraints for maize,
  . few for cereals (2 farms)
  . distance for grasslands

More frequent sequences M-W-TGL M-W
• If more Wheat
  – W-W or W-TGL possible
• If more Maize
  – M-M or M-TGL possible
More precise perspectives

• Confirm results with other data sets:
  - Specialized dairy farms
  - Pig farms ➔ Martel et al. poster EAAP 2013

• Complete survey
  - Other LFS types
  - Agronomic rules