How could livestock farming maximize organic production at a global scale?

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Bertrand Dumont, Piétro Barbieri, Sylvain Pellerin, Thomas Nesme
Services provided by livestock

Food  Soil fertility  Housing  Energy  Work

Feeding the world  Feed/Food competition  Agroecology - Diversification
Mix - livestock  Crop - Livestock

Gastronomy  Culture  Landscape
What (multi) performance expected when implementing OF principles?

1- Many studies show that OF provides many benefits for society:
   Environment, Global health including Human health, Biodiversity, employment etc.
   (but the advantages are less clear on some aspects, as climate change)

2- However, OF’s productivity is globally significantly lower compared to conventional’s one
   (Seufert et al 2012, Ponisio et al 2014) → this is the « black point »
   Searchinger et al 2018, Kirschman 2019, ...

→ A dilemma: How to produce “clean” with the same agricultural area while feeding everybody at world scale?
Producing « clean » ( /synthetic inputs) …while satisfying human feeding requirement ? (productivity)

HOW?

6 major levers

1/ Demographic management (Long term)
2/ Reducing losses and waste
3/ Limit other uses of agricultural land
   Energy, Housing/building (land use), Mobility → Global issue - What policies?
4/ Increase cultivated areas (deforestation; northern latitudes)
5/ Ensure sufficient productivity of agricultural land
6/ Adapting human diets
Diets:
Less animal products in order to feed more people
Why is the consumption of animal products "sub-optimal" compared to the human consumption of plant products?

Energy loss along the trophic chain

Fate of energy consumed (cattle):

- 85% losses → small efficiency
- Avoiding human-animal competition for resources edible by humans

World crops for livestock = 500 million ha = 1/3 of crops
Consequence: Effects of the diet (animal products share) on the agricultural area needed for a consumer. Comparison OF / CA

Consumer Cohorts Q5 vs. Q1

Big vs small consumers of organic products: Q5 vs Q1

Land use

Despite 18-20% lower yields on OF, and thanks to a diet that relies less on animal proteins, the French organic consumer uses 18% less UAA than a conventional consumer.

➢ ... Suppressing livestock to produce "sustainable" and feed the entire population?
Agronomic optimization: «husbandry wisely»
Chemical nitrogen
→ Climate change, fossil energy

Pesticides (diseases, pests, weeds)
→ Loss of biodiversity, water pollution, human health

Simplified rotation in specialized agriculture:
increase complexity and include fodder in the rotation to limit/remove synthetic inputs

Fixing atmospheric nitrogen
Break the cycles
Diseases - Pests - Weeds
Structure the soil and explore deep horizons
Maximization of the agricultural production for humans, avoiding feed-food competition

<table>
<thead>
<tr>
<th>Cereal and protein crops</th>
<th>Edible part (70%)</th>
<th>Inedible part (30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass</td>
<td>100% inedible</td>
<td></td>
</tr>
</tbody>
</table>

- 70% edible part of cereal and protein crops
- 30% inedible part of cereal and protein crops
- Grass is 100% inedible
Overall:
What share of agriculture production should come from livestock ...
to maximize the population fed?
Maximization of the population to be fed: an optimum of livestock in the UAA

Example: Netherlands  
*H. Van Kernebeek et al 2014*

Land and resources are optimally used if 12% of proteins are of animal origin

*No Human/Animal competition*

**The level of this optimum fluctuates according to**
- The perimeter taken into account (country, territory...)
- The pedoclimatic context
- The technologies used

In France: around 25%
What consequences, for what future?
France as an example
An implementation of agroecology or OF at a large scale: Towards a large-scale restructuring of French agriculture

Prospective studies to be undertaken
- Global agricultural production? (*crops, livestock etc.*)
- Environmental and social impacts (*jobs, income, health*)
- International trade
- Food sovereignty
Conclusion

• From **global** issues ... to **local** solutions

• Sustainable food system: \( \downarrow \) livestock share and revisit its functions/types/locations.

• Many challenges:
  - Available skills? (new productions, new systems, new services ...)
  - The traditional industries: how to integrate them into this process?
  - How to manage diversification and heterogeneity of the products?
  - What future for territories that have relied on a concentration economy?

• **The territory:** crucial scale for understanding and implementing the transition lead by agriculture, with major stakes as food security, added-value, resilience, social issues
Thank you!

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