Towards sustainable dairy sheep farms based on self-sufficiency: patterns and environmental issues

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Towards sustainable dairy sheep farms based on self-sufficiency: patterns and environmental issues

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Abstract. Agroecology can provide a framework to ensure the sustainability of farming systems in regard to environmental issues of agriculture. In the case of livestock productions, the improvement of feeding systems is one way to limit their environmental impacts. In southern France, development of dairy sheep production under the Roquefort label has led to most of farms to using a high level of input. But over the past few years, groups of farmers have shared perspectives and ideas to test innovative sustainable practices to improve their farms adaptability, mainly increasing farms’ self-sufficiency. We developed a research project on self-sufficiency patterns and their environmental impacts assessment. Based on a participatory approach, we organised focus-groups on self-sufficiency definition and agro-environmental performances. We carried on 20 farmers’ interview to collect data about practices and environmental features. Four self-sufficiency patterns were identified and a set of 20 indicators which addressed agronomical and environmental features was built. Feed self-sufficiency is different for each pattern. The main differences of environmental impacts (based on input use) are linked to the Organic pattern. The use of wide diversity of meadows and species increases the concentrate sufficiency. This study is an important milestone to implement agroecological practices in dairy sheep production.

Keywords. Agroecology – Livestock farming system – Feed self-sufficiency – Diversity – Milk ewe.

Développer l’autonomie pour des systèmes ovin lait durable : modèles et problèmes environnementaux


I – Introduction

Mainly in less favoured areas, the model of development based on agriculture intensification weakens the sustainability of farms and jeopardises their adaptation to global change (Darnohfer et al., 2010). As an alternative way, agroecology is a theoretical and conceptual framework suggested to address the challenges of global change adaptation of agricultural systems: on one hand to increase and on the other hand to secure feed production (Altieri, 2002). Within this framework, five principles were suggested by Dumont et al. (2013) to design agroecological livestock systems. Thénard et al. (2014) proposed a method to translate these agroecological principles into levers for action to design and to assess new farming systems based on agroecological properties. In some cases, the feed self-sufficiency of animals is a favoured stake to design agroecological livestock systems. In southern France, the development of dairy sheep production under the Roquefort label has led most farms to use a high level of input. We developed a participative project with a farmers’ group who wants to improve the feed self-sufficiency of their farms. We examined how farmers develop different patterns for self-sufficiency and we proposed to assess these patterns using some agronomical and environmental indicators. We present different patterns of self-sufficiency identified and some indicators to assess the agroecological value of these farms.

II – Methodology

1. A participatory research with a group of dairy sheep farmers

The study site is the PDO Roquefort cheese made with raw ewe’s milk. Traditionally, sheep grazed local grassland regarded as less-favoured pastures. To overcome the constraints of the area milk production has increased the feed purchases and inputs in farms. Until the 2000s, intensification increased forages harvesting to the detriment of grazing. A wide gradient of resources are used by farmers. Since 2000, the PDO specifications have included new requirements: ewes should be fed with forage coming for 75% from the PDO area and ewes should graze two or three months during the grazing period.

Since 2012, we have carried out a research project with a group of ten farmers supported by a farm adviser. The farmers called themselves “Economical and Locally grown Farms” (ELF): they seek to use the local forage resources and to reduce farm input requirements. The main stake of this participatory research is to test innovative sustainable practices to improve farms adaptability. To limit the dependence on fluctuating input prices and climate variability farmers want to improve the feed self-sufficiency of farms. In the first study, we exposed practices diversity and identified four contrasting farming systems (Thénard et al., 2014). While all farmers want to limit inputs, we observed that the level of self-sufficiency achieved could be different. We then conducted a second study on how self-sufficiency was built by farmers and proposed some indicators to assess the different patterns.

2. Methods to analyse and assess different patterns of self-sufficiency

Within the agroecological framework, we used a participatory approach in order to favour exchanges between farmers, advisers and researchers. In a first step, we carried out work sessions to share the different views on the practices linked to self-sufficiency; and to explain the consequences of self-sufficiency on the farms, their agronomical properties and their impact on the environment. The sessions gave us which main stakes were identified by farmers to assess the impact of their practices on environmental issues. The exchanged knowledge highlighted the influence of practices on four main environmental stakes (soil preservation, no renewable resources use, wild and cultivated biodiversity). Also a set of 20 indicators were identified with farmers to assess the agronomical and environmental impacts of self-sufficient practices. In a second step, we surveyed farmers to describe
the diversity of self-sufficiency practices and to collect data used to calculate the indicators. During spring 2014, 3-hours semi-directive interviews were carried out among 20 farmers from the “ELF” group and others selected by experts as pursuing self-sufficiency. Farms were described in relation to different practices: concentrates purchase, fertilisation, diversity of meadows and crops, pure legume stands, tillage and the pesticides used. Data was analysed with a comprehensive method (Girard, 2006) to define patterns of self-sufficiency practices. Kruskal-Wallis test and Nonparametric Multiple Comparisons were performed to identify significant differences between patterns. Statistical analyses were computed with R software (R Core team, 2012).

III – Results and discussion

Four self-sufficient patterns were identified based on the practices (Fig. 1): a Standard pattern limiting input, while most of the farms use input, this pattern limits them increasing diversity of forages; a Diversity pattern limiting input while increasing diversity of species in crops and forages; a Sufficiency pattern with no ewe-feed purchase; and an Organic pattern without N-mineral and pesticides input but with concentrates purchase. The farms with Standard or Diversity patterns produce milk mainly during the winter period, with harvested forages. These farms ought to produce more milk per ewe (although there were not significative differences – Table 1) and they were not sufficient for concentrates. On the other side, farms which developed Self-sufficient and Organic patterns produce milk mainly during spring. Only the Sufficiency pattern purchased no forage and no concentrate. The use of fuel to produce forages and crops is common and non-discriminating.

The set of indicators is presented in the Table 1, and all significant differences are detailed. Standard pattern was developed in farms with few intensive meadows mainly harvested and based on simple covers like alfalfa and orchard-grass. Farmers had difficulties to achieve self-sufficiency because the ewe requirements were important mainly during winter and farmers needed to buy protein concentrates. Sufficiency pattern was developed in farms with large parts of natural grassland combined to a wide diversity of sown meadows. Self-sufficiency was built with association of poor grassland used during summer and intensive meadows (pure stands and simple mixtures) harvested and grazed. Diversity pattern was developed in farms with a wide diversity of meadows mainly based on mixtures species, and crops mixtures for animal fed. Although farmers have engaged soil conservation practices, the related indicators were not significantly different in this group. Self-sufficiency was based on the wide diversity of forages included during summer period with specific meadows or original mixtures (alfalfa, sainfoin, grass). Organic pattern was developed mainly in farms producing milk for organic label. Because of organic label requirements, the con-
trast with the others groups was important for all indicators related to fertilisation and pesticides used. We observed that the duration of the meadows was longer and the parts of the mixtures in the meadows and crops were similar to the Diversity pattern.

### Table 1. Set of indicators to assess agronomical and environmental impacts of the four different self-sufficiency patterns in dairy sheep farms

<table>
<thead>
<tr>
<th></th>
<th>Standard pattern</th>
<th>Diversity pattern</th>
<th>Sufficiency pattern</th>
<th>Organic pattern</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of farms</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Milk per ewe (l)</td>
<td>270</td>
<td>276</td>
<td>231</td>
<td>217</td>
<td>0.129</td>
</tr>
<tr>
<td>Forage sufficiency</td>
<td>97%</td>
<td>99%</td>
<td>100%</td>
<td>88%</td>
<td>0.168</td>
</tr>
<tr>
<td>Concentrate sufficiency</td>
<td>80% a</td>
<td>77% a</td>
<td>100% b</td>
<td>77% a</td>
<td>0.043</td>
</tr>
<tr>
<td>Area of grassland/AA</td>
<td>29% ab</td>
<td>36% a</td>
<td>69% b</td>
<td>63% ab</td>
<td>0.080</td>
</tr>
<tr>
<td>Area with legumes/AA</td>
<td>64% ab</td>
<td>62% a</td>
<td>54% a</td>
<td>71% b</td>
<td>0.095</td>
</tr>
<tr>
<td>Annual crops/AA</td>
<td>36%</td>
<td>28%</td>
<td>34%</td>
<td>32%</td>
<td>ns</td>
</tr>
<tr>
<td>Meadows and crops mixtures /AA</td>
<td>29% ab</td>
<td>69% ac</td>
<td>27% b</td>
<td>84% c</td>
<td>0.006</td>
</tr>
<tr>
<td>Diversity of meadows (nb of meadows)</td>
<td>3 ab</td>
<td>5 b</td>
<td>5 b</td>
<td>3 ab</td>
<td>0.028</td>
</tr>
<tr>
<td>Duration of meadows (years)</td>
<td>4 a</td>
<td>5 ab</td>
<td>4.6 a</td>
<td>5 b</td>
<td>0.025</td>
</tr>
<tr>
<td>Species on meadows (nb)</td>
<td>2</td>
<td>2.7</td>
<td>2.9</td>
<td>2.75</td>
<td>ns</td>
</tr>
<tr>
<td>Hill Index†</td>
<td>1.03</td>
<td>1.21</td>
<td>1.38</td>
<td>1.40</td>
<td>ns</td>
</tr>
<tr>
<td>Area with manure/AA fertilised</td>
<td>50% a</td>
<td>35% a</td>
<td>59% a</td>
<td>100% b</td>
<td>0.000</td>
</tr>
<tr>
<td>N-mineral/Total Nitrogen used</td>
<td>49% a</td>
<td>45% a</td>
<td>49% a</td>
<td>4% b</td>
<td>0.000</td>
</tr>
<tr>
<td>N-mineral unit per ha</td>
<td>29 a</td>
<td>39 a</td>
<td>48 a</td>
<td>0 b</td>
<td>0.000</td>
</tr>
<tr>
<td>Nitrogen loses per ha AA</td>
<td>16.1 a</td>
<td>32.1 ab</td>
<td>20.5 ab</td>
<td>3.3 b</td>
<td>0.001</td>
</tr>
<tr>
<td>Nitrogen efficiency††</td>
<td>2.5</td>
<td>2.0</td>
<td>2.7</td>
<td>3.3</td>
<td>ns</td>
</tr>
<tr>
<td>Treatment frequency index (TFI)†††</td>
<td>2.5 a</td>
<td>5.3 a</td>
<td>2.4 a</td>
<td>0.0 b</td>
<td>0.000</td>
</tr>
<tr>
<td>Soil working index††††</td>
<td>2.7</td>
<td>2.2</td>
<td>3.9</td>
<td>2.3</td>
<td>ns</td>
</tr>
<tr>
<td>Fuel consumption (litre per cultivated ha)</td>
<td>37.0</td>
<td>36.1</td>
<td>42.8</td>
<td>41.6</td>
<td>ns</td>
</tr>
<tr>
<td>Cultural operations per field (nb)</td>
<td>5.7</td>
<td>5.8</td>
<td>6.9</td>
<td>6.0</td>
<td>ns</td>
</tr>
</tbody>
</table>

Medians for each group and P value for Kruskal-Wallis test. Within an indicator, medians with different letters differ at P<0.05 for Nonparametric Multiple Comparisons.

† Hill Index assess the proportional abundance of cultivated species based on Shannon and Simpson index:

\[
\text{Hill} = \frac{1}{D} \text{e}^{\text{H}'}
\]

(with 1 / D: the inverse of Simpson index and \( \text{e}^{\text{H}'} \): the exponential of Shannon index).

†† Nitrogen efficiency 2 (kg protein produced/ kg N introduced in farm).

††† TFI is based on the calculation of frequency and dose for each pesticides used for crops at farm level.

†††† Soil working index is based on the depth soil working with 1 point for no-tillage, 2 for superficial soil working, 3 for no-deep tillage and 4 for deep tillage. Calculation is a weighted average by ha for each crop.

### IV – Conclusion

Animal feed self-sufficiency is often defined as a way to increase sustainability of the farms, mainly in the less-favoured areas. Nevertheless this study showed that farmers could develop different patterns to improve self-sufficiency. The level of this feed sufficiency is linked to a trade-off between production, purchases and local resources use. Farms without purchases are probably very rare, and each self-sufficiency pattern should be assessed in relation to environmental issues. Agroeccological transition needs to improve knowledge about agronomical practices and their environmental impacts. This study is an important milestone to improve the agroeological practices in dairy sheep production.
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References


