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Note from the field

Economic value as a functional unit for environmental labelling of food and other consumer products

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ABSTRACT

The objective of this paper is to contribute to the debate on environmental labelling by exploring the potential of economic value as a functional unit (FU) for the environmental labelling of food and other consumer products. We used life cycle inventory (LCI) data for organic and conventional pigs and broiler chickens from the public French AGRIBALYSE LCI database and the CML 2001 method to calculate impacts per ton of animal live weight at the farm gate, per hectare (ha) of land occupied and per 1000 Euro of animal live weight. We also examined the relationship between carbon footprint (CF) and price for 24 food product groups representative of French food consumption. When using the FU live weight, organic animals had larger impacts than conventional animals. Per ha of land occupied, organic animals had smaller impacts than conventional animals, but production was lower. Per 1000 Euro of value, organic animals had similar or lower values for eutrophication, lower values for climate change and higher or similar values for land occupation. These results illustrate that the choice of FU is crucial when comparing products from highly efficient conventional systems to products from less intensive organic systems. For the 24 food product groups CF per product mass was positively correlated with product price; CF per product economic value was not correlated with product price. This suggests that a rebound effect may occur: consumers that choose foods with lower CFs per mass will tend to spend less money on food, leaving them with more money to buy other products which may compensate the reduced food CF. This type of correlation has not been observed for non-food sectors of the economy. Nevertheless, the FU economic value is attractive, as it considers product quality through the product's price. An economic-value-based FU will be more favourable to systems producing products of superior quality. More generally, an economic-value-based FU is well suited for environmental labelling of consumer products. A consumer has a certain budget to spend; an economic-value-based FU may guide the consumer towards reduced impacts per Euro spent. We recommend the use of an FU based on economic value for the environmental labelling of food and other consumer products. This FU will be a complement to currently used FUs. It will guide consumers towards lower impacts for a given expenditure.

1. Introduction

In 2009 the French government passed a law declaring the right of French consumers to “sincere, objective and comprehensive environmental information” through the *affichage environnemental*, i.e. environmental labelling, of mass marketed products (Vergez, 2012). This information should be based on a product's entire life cycle and consider several environmental impacts, including a carbon footprint (CF). To implement this law, sector and product category rules have been developed, and a voluntary one-year (2011–2012) trial was conducted, involving 168 companies, 70 of which were agrifood companies. This trial has been a full-scale test, on a variety of market segments, on how information is passed on throughout the entire production and distribution chain, to the end consumer.

In November 2013 a commission of the French parliament produced a report, based on this trial, on the interest of environmental labelling in France (Errante and Saddier, 2013). The report judges that the proposed Life Cycle Assessment (LCA) methodology produces results that are insufficiently reliable, as “the

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environmental impact displayed is an average value, which is in reality a *potential impact* rather than a *scientific impact*". It notes that the impact data result from "conventional choices, lacking a scientific basis", "these methodological choices – functional unit, criteria considered, calculation methods, etc. - markedly affect the variability of the displayed results". Regarding food, the report criticizes the chosen functional units (FU), relative to which impacts are to be expressed: 100 g, 100 ml or a portion, as they do not reflect the functions of food. According to the report, these FUs will favour efficient high-input intensive systems and result in higher impact values for products from low-input and organic systems aiming to produce quality products. The report further argues that for food the FU should be based on nutritional value.

This parliamentary report may well be the first instance of a commission of a national legislature pronouncing itself on the implementation of LCA to support policy. The point of view expressed in the report echoes Freidberg's (2013) observations that, for companies, LCA "seems too complicated" as a tool, while as a field "it seems too fraught with conflict and dispute". Freidberg further points out that "in LCA, methodological debates date back nearly as far as the field itself. They defy resolution partly because LCA's models, like those in fields such as climate science and environmental technology, are inherently unverifiable".

The International Organisation for Standardisation (ISO) 14044 standard (ISO, 2006) for LCA defines the term functional unit as: the quantified performance of a product system for use as a reference unit. In this paper we focus on the choice of the FU for the environmental labelling of food, and, as an extension of that, of consumer products generally. The most common FU used for food is mass or volume (Schau and Fet, 2008; Roy et al., 2009), so the proposed FU for environmental labelling in France corresponds to usual LCA practice. Other FUs that have been proposed for food products are nutritional value, area of land occupied, serving and economic value (Schau and Fet, 2008; Ingwersen, 2012; Tyszler et al., 2014). The use of nutritional value as an FU is complicated, since food products supply a range of macro and micro nutrients, which is hard to capture. The FU area of land occupied is quite frequently used; it reflects the function of agricultural systems as modes of land use. A serving represents a normalized unit of food intake for a diet that is composed of a recommended number of servings of foods from food groups (Ingwersen, 2012). Economic value has been proposed as an FU to capture "emotional value" of food (Dutilh and Kramer, 2000). A relationship between product quality and price of products exists in all sectors of the economy, in the food sector this is exemplified for instance for products bearing origin-based labels yielding a price premium (Deselnicu et al., 2013). Surprisingly, so far, consideration of food quality in the definition of an FU has been limited to nutritional quality aspects. This ignores important constituents of food quality such as taste and aesthetics (Heller et al., 2013), and the perceived animal welfare quality associated with a food product. These aspects however are hard to capture.

The objective of this paper is to contribute to the debate raised by the French parliamentary commission on the most appropriate FU for environmental labelling of food products. We will explore the effect of the choice of FU on the ranking of agricultural products from production systems of contrasting intensification level (i.e. conventional versus organic agriculture), and we will examine the relationship between CF and price for a wide range of food products to assess potential effects of the use of a mass-based versus economic-value-based FU for environmental labelling. We want to contribute to the debate on environmental labelling by exploring in particular the potential of economic value as an attractive FU for the environmental labelling of food and other consumer products.

2. Materials and methods

2.1. Organic and conventional pig and broiler chicken

The AGRIBALYSE public life cycle inventory (LCI) database (Colomb et al., 2014) contains 139 LCIs of French agricultural products at the farm gate. The database has two aims: i) provide data to support environmental labelling of food products, and ii) share knowledge about environmental assessment to support eco-friendly practices and reduce environmental impacts of the French agri-food sector. To ensure database consistency, a common methodology was defined in line with the International Organisation for Standardisation (ISO) and the International Reference Life Cycle Data System (ILCD) standards (Koch and Salou, 2014). We used AGRIBALYSE LCI data for organic and conventional pig and broiler chicken production and the CML 2001 method to calculate impacts per ton of animal live weight at the farm gate, per hectare (ha) of land occupied and per 1000 Euro of animal live weight. For broilers live weight prices at the farm gate used were 0.85 and 2.70 Euro/kg for conventional and organic (Gallot et al., 2009), respectively. For pigs we used a dressing percentage of 78% and carcass prices: 1.30 and 2.95 Euro/kg for conventional and organic (GAB/FRAB, 2009), respectively, to calculate life weight prices at the farm gate.

2.2. Commonly consumed foods

Masset et al. (2014) supplied CFs (kg CO_2-equivalent/kg) and mean prices ($/kg) for 24 food groups representative of food consumption patterns of French adults. The 24 food groups were: ruminant meat; pork, poultry, eggs; deli meats; fish and fish products; cheese; yogurt; milk; mixed dishes of animal origin; vegetarian mixed dishes; breakfast cereals; salty snacks; desserts, sweets, pastries; soft drinks; butter, cream; oils, margarine; condiments; grains; potatoes; legumes; dried fruit and nuts; cooked vegetables; processed fruit and juices; fresh fruit; raw vegetables. Food consumption data were based on a survey conducted during 2006–2007 on a representative sample of 2624 adults. CFs at consumer of these products were calculated using an LCA approach combining French trade and production data and standard LCI data. Food prices at consumer were obtained from a French household consumer panel of 12 000 households. These data were used to analyse the relationship between CF and price of these foods.

3. Results

3.1. Organic and conventional pig and broiler chicken

When using the FU live weight, organic animals had larger impacts than their conventional counterparts (Table 1). Although these are data for live animals at the farm gate rather than for transformed products, they illustrate that a mass-based FU finds lower impact values for intensive, highly efficient conventional systems than for less intensive organic systems that produce less product of higher quality and value.

Per ha of land occupied, organic animals had smaller impacts than their conventional counterparts for both eutrophication and climate change, but production in kg live weight per ha was lower. Organic agriculture thus constituted a less impacting mode of land use for a given territory. When the FU economic value was used, organic animals had similar or lower values for eutrophication, lower values for climate change and higher or similar values for land occupation.

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