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METHODOLOGICAL CHOICES FOR AN LCI DATABASE OF FRENCH AGRICULTURAL PRODUCTS

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ABSTRACT

Two laws were passed in 2009 in France on Life Cycle-based environmental labelling. To allow the implementation of such labelling, the Agri-BALYSE programme provides a public database of 114 LCIs of French agricultural products at the farm gate, as well as a comprehensive methodological report. To ensure consistency, a common methodology was defined, consistent with French and international standards. This paper presents an overview of methodological choices regarding: i) definition of the scope and the systems studied, ii) choice and parameterization of models for estimating direct emissions and resource consumption, iii) choice of methods to assign impacts to coproducts. We hope that the methodology will contribute to the harmonisation of methods for agricultural LCAs, both in France and internationally.

INTRODUCTION

Two laws were passed in 2009 in France on the provision of reliable and complete environmental information on “product plus packaging” to consumers. The Life Cycle Assessment method was chosen to assess environmental impacts. ADEME, the French Environment and Energy Management Agency, was mandated to set up an LCI database to support this policy. The Agri-BALYSE programme (2010-2013) aims to provide a public LCI database of agricultural products at the farm gate and a comprehensive report describing the methodology used. Results will be available in October 2013.

To ensure consistency of the database, the partners have agreed on methodological choices. Major methodological choices concerned: i) definition of the scope and the systems studied, ii) choice and parameterization of models for estimating direct emissions and resource consumption, iii) choice of methods to assign impacts to coproducts.

METHODS

Methodology was designed to be consistent with the French BPX30-323 standard (AFNOR, 2011) and the ILCD standards (JRC and IES, 2010).

RESULTS

Definition of the scope and the systems studied

Agricultural systems are a source of variability for product LCIs due to differences in production systems (e.g. open-field versus greenhouse-based production), farmer practices within a given production system, and natural production conditions (climate, soil type).

Considering differences in production systems and farmer practices for a given product, 46 product groups (ex. “pig”, “pea”) were identified. Within a product group one or more production systems with typical farmer practices were defined, e.g. “Pig, French average, conventional production”, “Pig, organic production”, “Pig, rapeseed-meal-based feed, conventional production”. In total 114 LCIs “at the farm gate”, representative of a large fraction of French agricultural production, have been produced. To capture variability due to natural production conditions and prevent artificial differences in the results, 2005-2009 was the reference period for data collection. This period was extended to 2000-2009 for crops subject to biennial bearing (ex: apple).

Considering system boundaries, it was decided to set the cut-off criterion to zero. The inclusion or exclusion of input/output is not determined by quantity considerations, but by explicit enumeration of the processes.

Choice and parameterization of models

The choice of appropriate models for the estimation of direct emissions and resource use was a major challenge: 14 major substances (nitrate, methane, etc.) and 3 resources have been considered. For most of them several options have been considered, based on a review of available models. The choice of the most appropriate models was based on: i) the international scientific recognition of the model; ii) the degree to which the model is directly operational; iii) the consistency of the implementation of the model with the production system data collected and with the time-frame of the programme.

To ensure the consistency of the database, only methods based on emission factors (IPCC 2006, EMEP/EEA 2009) or mechanistic simulation models (Foster, 2005) were retained, thus the use of estimations based on field measurements was avoided. To ensure the accuracy of estimations of direct emissions, when possible, models were parameterised to consider specific French or regional conditions. For instance, emissions of enteric methane were estimated according to an IPCC 2006 Tier 2 method, considering detailed data on type and quantity of feed intake by animals. Similarly, for erosion the Revised Universal Soil Loss Equation (RUSLE; Foster 2005) model was used and parameterised for French regional conditions. When data were not available a standard parameterization of models (e.g. for N_2O, NH_3) was used.

Choice of methods to assign impacts to coproducts

Agricultural systems are often multifunctional, and thus a production system frequently produces two or more co-products. Consequently, the choice of an appropriate method to assign environmental impacts to the co-products is an important issue. Within Agri-BALYSE, this environmental impact attribution concerns: i) co-products of animal and crop production systems (ex: milk/cull cow/calf; grain/straw); ii) shared inputs across a cropping sequence (e.g. P-fertiliser which is consumed by all crops being applied once every 3 years to the crop

with the highest P requirement). A specific method was developed within Agri-BALYSE for such shared inputs.

Choices for the allocation of impacts were made according to international and national standards (ISO 2006, AFNOR 2011) which are: i) avoid allocation; when allocation is unavoidable, allocate the impacts according to ii) a physical criterion that reflects the underlying relationships between the co-products, or iii) the economic value of each co-product.

Considering this, allocation methods retained were based on: i) economic value of grain/straw for cereals/protein crops and Clementine for exportation/Clementine for local consumption; ii) mass of mown grass/grazed grass for grassland. For animal production, a "bio-physical" method consisting of two steps (Figure 1) was developed. In the first step, in accordance with international recommendations, allocation is avoided by dividing the production system in several unit processes. Each of these corresponds to a characteristic physiological stage of the animal. When a stage yields a single product, all impacts are attributed to this product. Thus for several sages, allocation is avoided. For stages yielding several products, allocation is based on the metabolic energy required to produce each co-product. The metabolic functions considered are: maintenance, activity, growth, lactation and gestation.

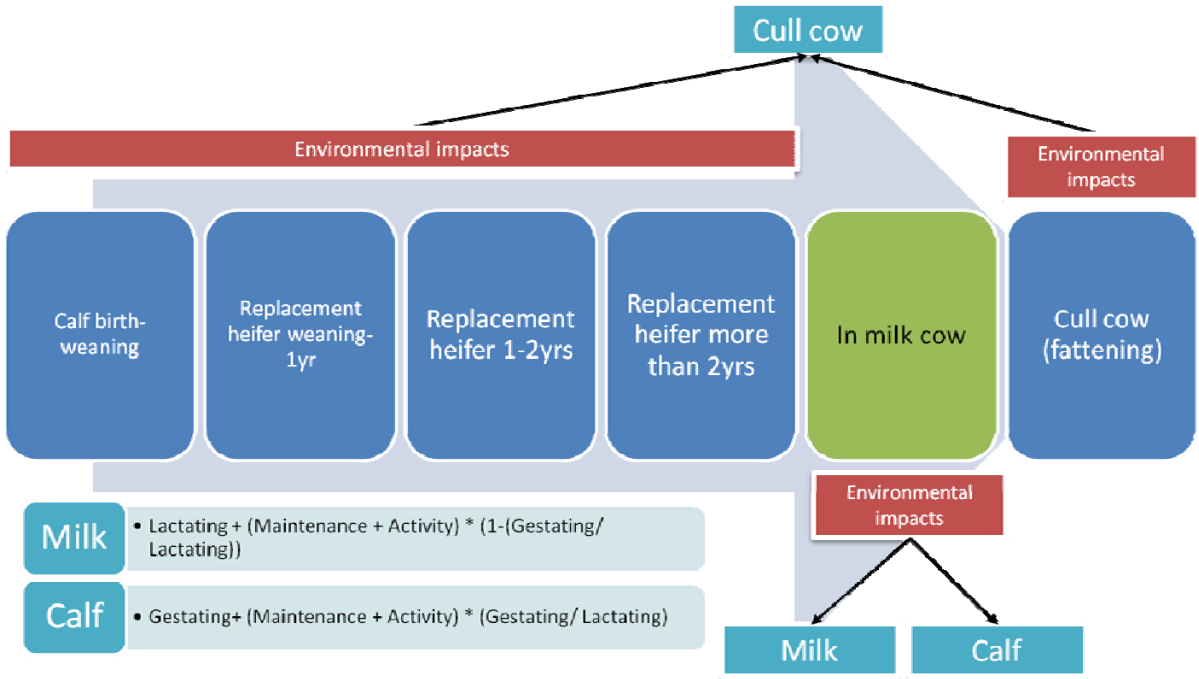

Figure 1: Attribution of environmental impacts for animal production according to the "bio-physical" model; case of dairy cow production. During the "In-milk cow" phase, environmental impacts are allocated according to the energy needed to produce the calf and milk.

DISCUSSION

The aspects presented here show how Agri-BALYSE has ensured the methodological consistency of the LCIs produced thanks to appropriated choices, adaptations of existing models or specific developments. The methods used within the program have been documented in a comprehensive and detailed methodological report (over 300 pages) to be published in October 2013. The aim of this document is to allow the realisation of LCIs of agricultural products, according to the Agri-BALYSE methodology, by different users, to reach various goals. We hope that the methodology developed and described in the programme will contribute to the harmonisation of methods for agriculture LCAs, both in France and internationally.

CONCLUSIONS

Considering the objective of Agri-BALYSE, relatively simple methods were implemented, especially for the estimation of direct emissions. It is expected that there will be a follow-up to the current project, which will allow further methodological developments, based on ongoing developments in the field of LCA, in order the improve the quality of LCIs in the Agri-BALYSE database.

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