

ABSTRACT

Life Cycle Assessment is a method for analysis and assessment of environmental impact caused by product systems. In this thesis, the application of LCA methodology on animal production at the farm level was studied with focus on discharges of nutrients and land use assessment. Two case studies on animal production systems were conducted: one on milk production assessing conventional and organic farming and the other one on intensive meat production of pork and beef. Land use assessment was studied in a case study of three vegetable oil crops. Different allocation methods for the co-products surplus calves and meat from milk production were investigated.

Production of meat and milk require a complex production system in which animals, plants and soil interact; due to this complexity, LCA cannot be the sole basis for a comprehensive assessment of environmental performance. The strength of LCA seems to lie in its ability to be an excellent tool for learning and for identifying potential environmental issues from a system-based approach. In its current form, LCA methodology cannot adequately assess the environmental effects caused by intensive livestock production concentrated on a small land base. The production of meat and milk must be seen in relation to land available for the recycling of manure; this is not always made obvious in LCAs, most of which have a product-oriented focus. It was suggested that an area-based nutrient balance, including estimations of ammonia and nitrate losses per product unit, as well as per hectare, should be a complementary environmental tool to an LCA of animal products. This would give information on the potential environmental impact on the ecosystems surrounding the production site.

System expansion is a method of handling co-product allocation, which has seldom been used in agricultural LCAs. Milk and beef production are closely interlinked and must be studied in an integrated manner. Therefore, system expansion is the most preferable method for handling the allocation issue of milk production. An assessment method for agricultural land use was outlined. The results show that the information in a land use impact assessment is a combination of quantitative and qualitative data, which makes the assessment of land use more descriptive than what is normally the case in an LCA and brings it a step closer to Environmental Impact Assessment.

The analyses made in this thesis suggest that a close interaction between livestock production and fodder cultivation could lead to a more environmentally-sound form of animal production. The input and output of nutrients are more balanced when a large share of the fodder comes from the land where the manure is recycled. Cultivation methods currently used in the tropics for crops used in feed production make use of pesticides and land that are not always sustainable in terms of preserving soil fertility and protecting biodiversity. Finally, long-distance feed transports require more energy.

Keywords: environmental life cycle assessment; LCA; allocation; system expansion; land use; nutrient balance; milk production; beef, pork, meat production.