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Ökologischer Kreislauf Moorbad Harbach: Life Cycle Assessment (LCA) for Agricultural Plant Production and Transportation

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Introduction

In 1992 the community of Moorbad Harbach (Austria), located near the border of the Czech Republic and dominated by extensive agricultural practice on small scale farms, decided to initiate activities for regional devolopment. About 40 farms (27 %) converted to organic farming, a local marketing service as well as regional food processing businesses (slaughterhouse, dairy), operating as linkages between regional agriculture and the local spa hotel were founded. The basic idea for the work presented here was to evaluate the – especially ecological – consequences of such a regional conversion. One part of this attempt of evaluation was carried out as a LCA for the agricultural production in Moorbad Harbach. The emphasis of the study was to compare plant production before and after the regional conversion to organic farming. In another step changes in transportation distances and quantities with special regard to transport of raw milk and milk products were quantified.

Material and methods

To gain detailed information about common regional agricultural practice, 6 farms (comprising about 30 % of the agricultural land and livestock of the 40 converted farms) were analyzed. In addition to the study of Fromm (see also the contribution of Fromm *et al.* at this conference), information was gained by interviews and the review of literature. Production inventories were composed for 11 different crops, reflecting the situation before and after the regional conversion. The environmental inventories - based on the production inventories – include direct agricultural emissions (e.g. from use of pesticides, fertilizers, manure, machines) as well as indirect emissions (caused by production, transport and use of machines, fuel and agricultural buildings). Impact assessment – weighting different emissions depending on the concerned medium (soil, water, air) and aggregating indicators into 14 different categories of environmental impact (like resource use, global warming potential, ozone depletion, acidification, soil toxicity,...) – as well as interpretation were carried out with the help of the ecobalance model of FAT (Forschungsanstalt Tänikon, CH). Information about transportation distances and transported quantities between farms, dairy and other food processing locations as well as the spa hotel were obtained in interviews. Environmental consequences of changes in transportation with regard to 48 different indicators were calculated by using the method of Frischknecht *et al.* (1994).

Results, discussion and conclusions

Generally the LCA-results show a positive change for the different crops over a wide range of environmental impacts which were taken into consideration. In particular the renunciation of mineral fertilizer and pesticides after the conversion process causes positive results for the nutrient balances, the categories groundwater toxicity, soil toxicity, resource use as well as short-term (100 years) and long-term (500 years) global warming potential. Partially critical results in the categories acidification and terrestric eutrophication can be explained by increasing emissions of ammonium caused by redistribution of manure and therefore raising manure use for some crops after conversion. Some cases of increasing potential for ozone depletion and air toxicity for certain crops can be related to higher use of machines after conversion. It has to be mentioned that critical results for some crops are compensated if the full range of inventories resp. the whole agricultural area was taken into consideration. In spite of extensive agricultural activities in 1992, it was possible to realize further environmental improvements by regional conversion to organic farming. Due to the reduction of transportation distances for meat, eggs, flour, milk products and vegetables and the use of smaller trucks, the environmental impact caused

by emitted substances, use of resource and material has been reduced by about 77 % (in the case of raw milk) resp. 83 % (in the case of milk products) since the opening of the local dairy. These results could be improved, if the still existing seperated systems of collecting and distributing organically resp. conventionally produced milk and milk products were avoided. The results of this work show that combining regional conversion to organic agriculture and increasing local orientation of (agricultural) procurement and marketing activities contains the potential to raise regional environmental sustainability.

References

Frischknecht, R. *et al*. (1994): Ökoinventare für Energiesysteme. ETH, Zürich.