GHG emissions and land-use changes from substitution of Brazilian soybean with locally produced protein feed in Scandinavian pig and dairy production

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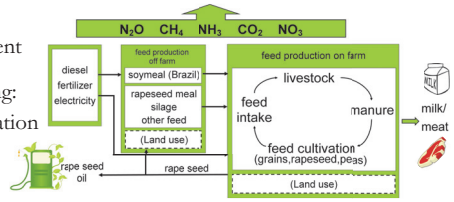
Introduction

- Co-products of liquid biofuel production (eg; rapeseed meal, DDGS) together with other protein feedstuff (eg; peas, forage) produced in Europe could serve as substitutes for soymeal imported from Brazil and used for feeding Scandinavian livestock.
- The protein feed substitution could result in changes in feed production systems, drive changes in land-use in Europe and elsewhere, and subsequently affect the GHG emissions balance.
- **But how would protein feed substitution influence the GHG footprint of Scandinavian livestock production?**

Method

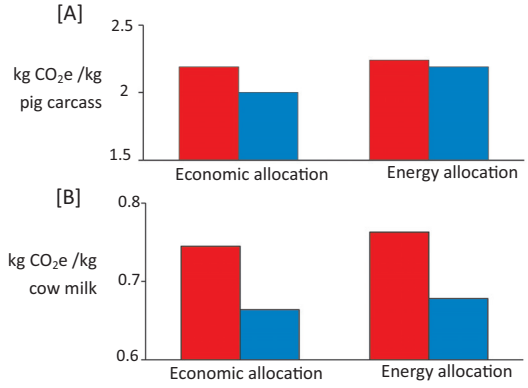
- Two feed scenarios are considered for Scandinavian pig[1] and dairy production[2]
  1. Imported feed scenario: soy meal from Brazil and concertrates are the main protein-feed constituents. Other feed are grown in Europe.
  2. Local feed scenario: rape seed meal, peas, forage produced in Europe are the main protein feed constituents. Other feed are grown in Europe.
- Comparative life cycle assessment of the two feed scenarios to estimate:
  1. GHG emissions
  2. Land use requirement
- Uncertainty analysis using:
  1. Monte Carlo simulation
  2. Sensitivity analysis



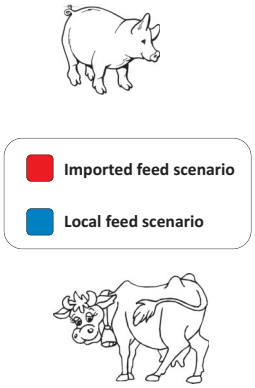
Results

- Local feed scenario compared to imported feed scenario reduces GHG emissions (excluding LUC emissions) by 5% and 11% for pig and dairy production respectively using economic allocation.
- GHG emission reduction is mainly due to higher crop yield from a more diversified crop rotation; reduced N-fertilizer application; and lower fossil CO_2 from feed transport.
- Land use requirement in the local feed scenario is 4% less in pig production but 16 % more in dairy production when compared to the land use requirement in the imported feed scenario using economic allocation.

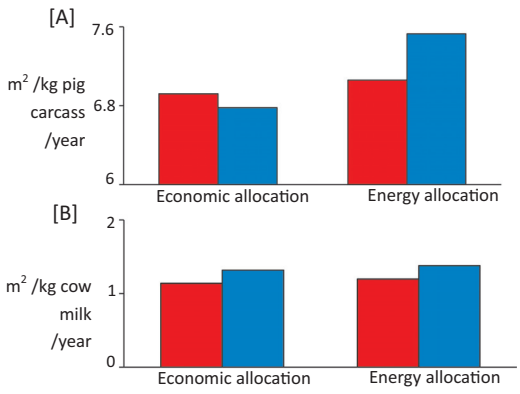
GHG emissions from the feed scenarios



GHG emissions(excluding LUC emissions) for imported feed scenario (red) and local feed scenario (blue) shown for pig (A) and dairy (B) productions. Two allocation methods are used



Land requirement for the feed scenarios



Land-use requirement for imported feed scenario (red) and local feed scenario (blue) shown for pig (A) and dairy (B) productions. Two allocation methods are used.

Conclusions

- Substituting soy meal from Brazil with feed produced locally in Europe can reduce the GHG footprint of Scandinavian livestock farmers.
- Producing feed locally can present a win-win situation for both EU food and bioenergy sectors especially regarding the EU 2020 biofuel directive.
- Feed substitution may drive a chain of land displacements and the resulting indirect land use change emissions. However, the effect on the GHG footprint is not included in this study.

Further work

- Assess the chain land displacements and the resulting indirect LUC emissions of substitution of Brazilian soybean with Northern European protein feedstuffs.
- A partial equilibrium modelling approach paired with a geographically explicit land use description is to be used for the assessment.

Works cited

1. Cederberg C, Flysjö A. Environmental Assessment of Future Pig Farming Systems: Quantifications of Three Scenarios from the FOOD 21 Synthesis Work: SIK; 2004.

2. Wallman M, Strid I, Cederberg C, Florén B. Life cycle assessment of locally produced feed for dairy cows; 2010.

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