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Global warming potential of Swiss arable and forage production systems

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Organic agriculture and climate change, Clermont-Ferrand 17 April 2008

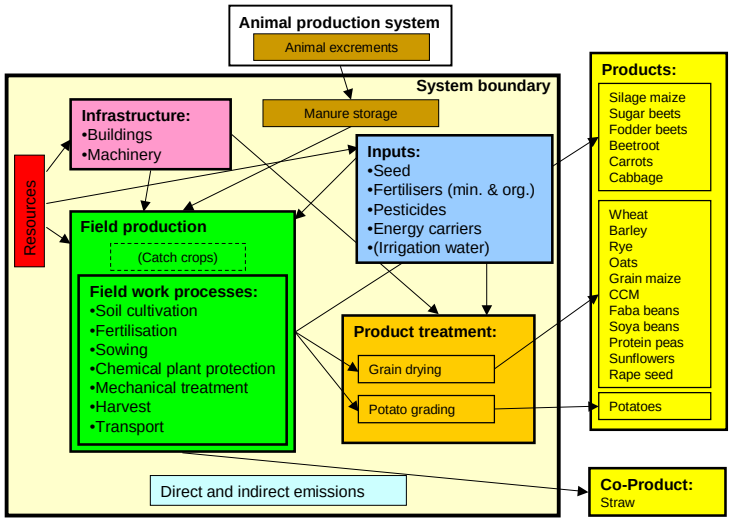
ART Overview

- LCA methodology
- Impacts of organic and integrated farming on global warming:
  - ➢ Farming system experiments
    - DOC
    - Burgrain
  - ➢ Arable crops
  - ➢ Forage production systems
- Conclusions

Life cycle assessment (LCA): characteristics

- Life cycle assessment: „from cradle to grave“ (or farm gate)
- Environmental management tool:
  - Process optimisation („hot spots“)
  - Choice of the best option (comparative LCA)
- Comprehensive assessment of environ. impacts:
  - Energy demand, global warming, ozone formation, eutrophication, acidification, ecotoxicity, human toxicity, *biodiversity, soil quality*
- Potential environmental impacts assessed by models
- Environmental impacts related to functional units:
  - 1 ha*year for *function “land management”*
  - 1 kg dry matter of main products for *productive function*
  - 1 currency unit for the *financial function*

System description



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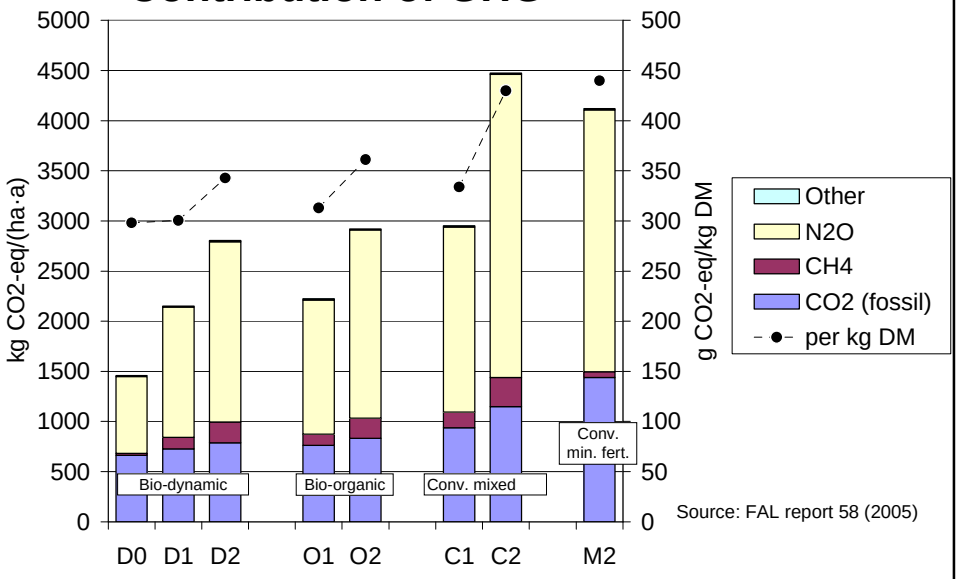
DOC farming systems
Contribution of GHG



Source: FAL report 58 (2005)

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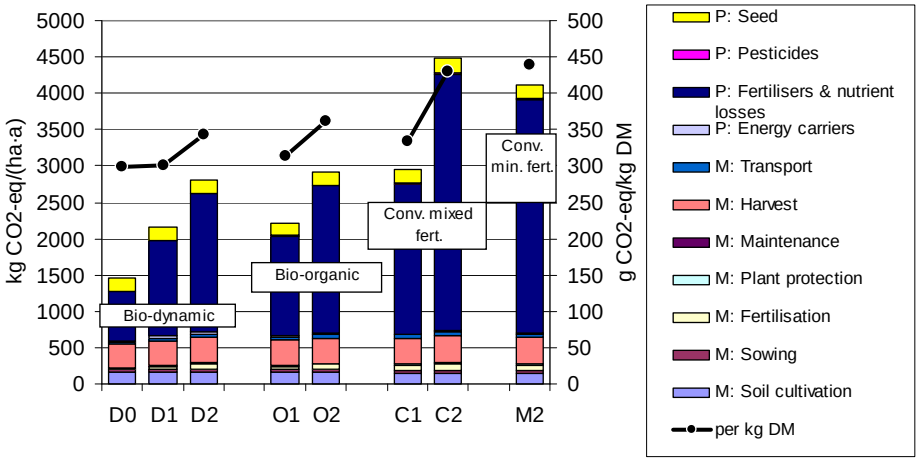
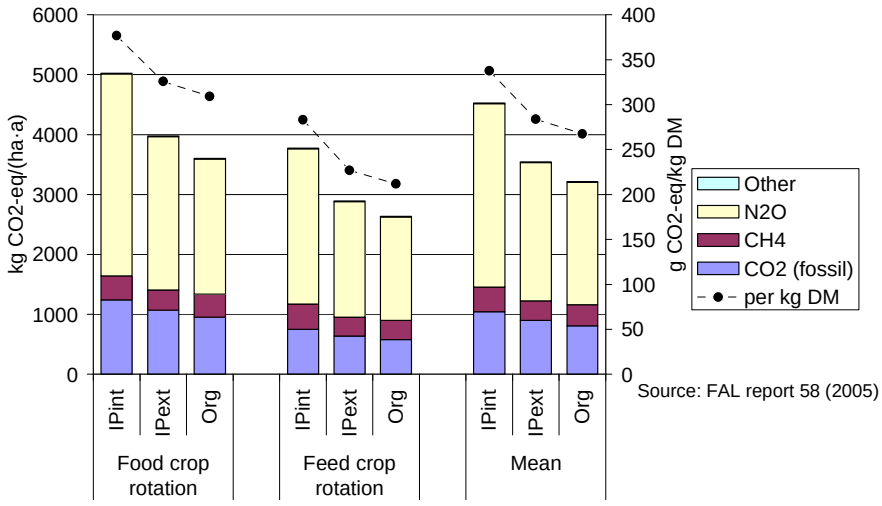
DOC farming systems
Contribution of inputs and processes



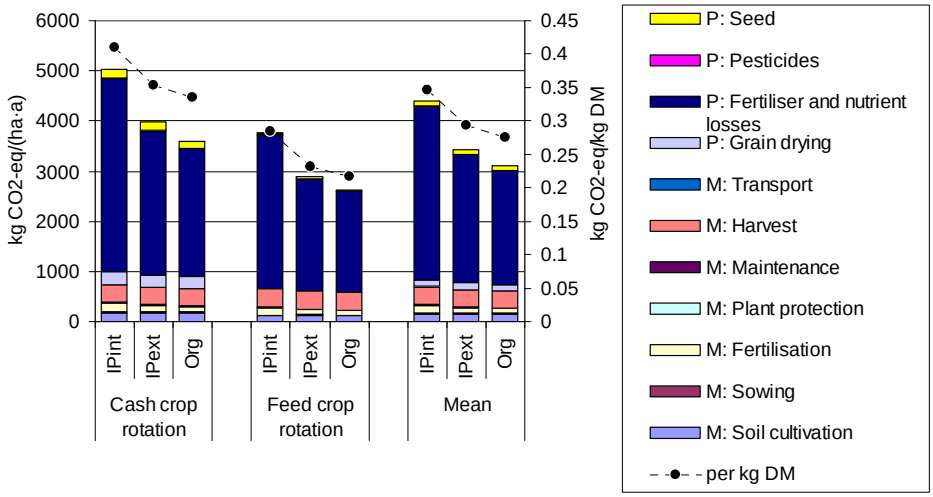
Source: FAL report 58 (2005)

Burgrain farming systems
Contribution of GHG



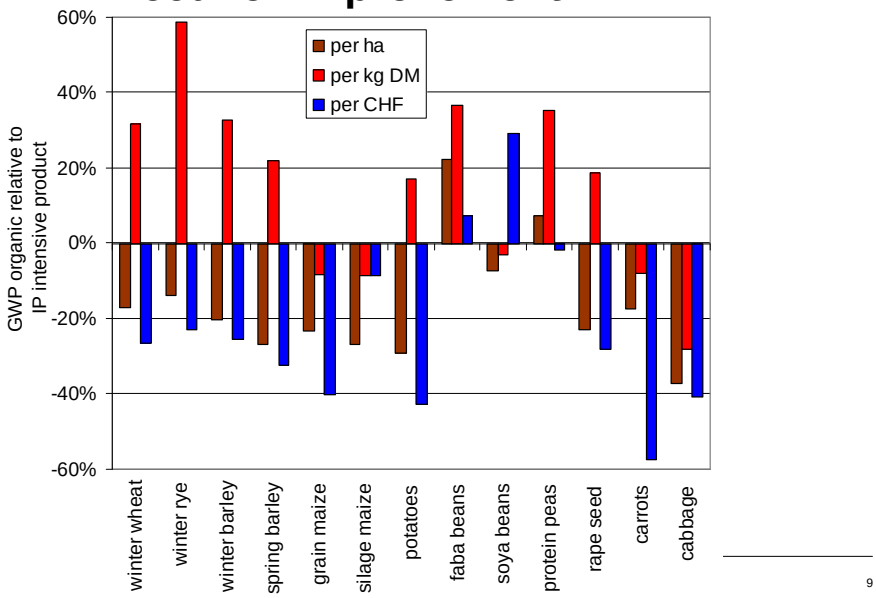
Source: FAL report 58 (2005)

Burgrain farming systems
Contribution of inputs and processes



Source: FAL report 58 (2005)

Organic arable crops: Need for improvement



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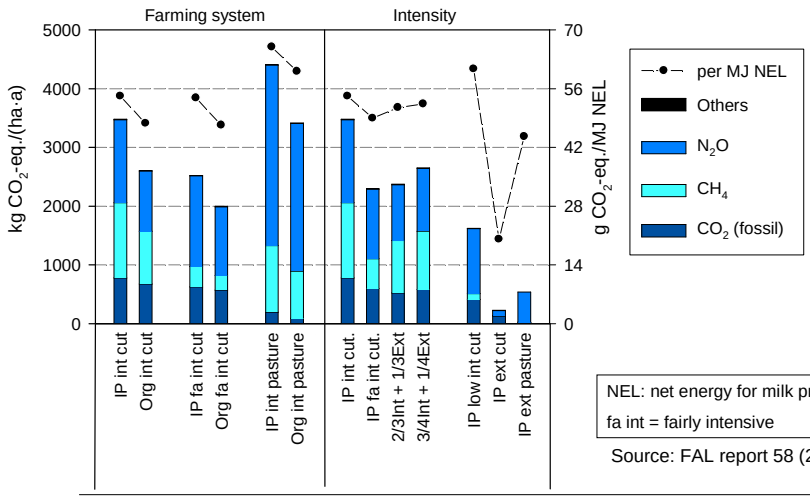
Source: FAL report 58 (2005)

Organic forage production: Slightly lower GWP



NEL: net energy for milk production
fa int = fairly intensive

Source: FAL report 58 (2005)

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Conclusions (1)

- Organic farming system as a whole: lower global warming potential (GWP)
  - Less nitrous oxide (no mineral N fertilisers, lower N inputs)
  - Less carbon dioxide (no mineral N fertilisers)
- Advantages bigger per ha (25-37%) than per kg (6-20%), due to lower organic yields
- Higher GWP for several organic products from arable crops

Conclusions (2)

- Options to reduce GWP in organic farming:
  - Increase yields
  - Use the machinery efficiently
  - Implement minimum tillage techniques
  - Reduce nitrogen losses contributing directly (N_2O) or indirectly (NH_3, NO_3, NO_x) to the GWP
- Methodical aspects:
  - Consider farming systems as a whole
  - Life cycle perspective is crucial
  - Do not focus only on global warming