Is LCA-based eco-labelling reasonable? The issue of tropical food products

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Outline

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- Scientific challenges and perspectives
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Introduction

- Toward more environmental friendly consumption patterns
  => Ecolabelling
- LCA = all production steps, several impacts, FU for comparison

➢ Research work on food LCA & ecolabelling

- Volumes of imported products from the tropics are important:
  (France is the 2nd rice importer in EU, stimulant beverages…)
- Problems: data availability & representativity, adaptation of M&M to the tropics…

Objectives

➢ To analyse the scientific relevance of using LCA for Eco-labelling of food products in Europe in the current state of knowledge

➢ To make recommendations

State of the art

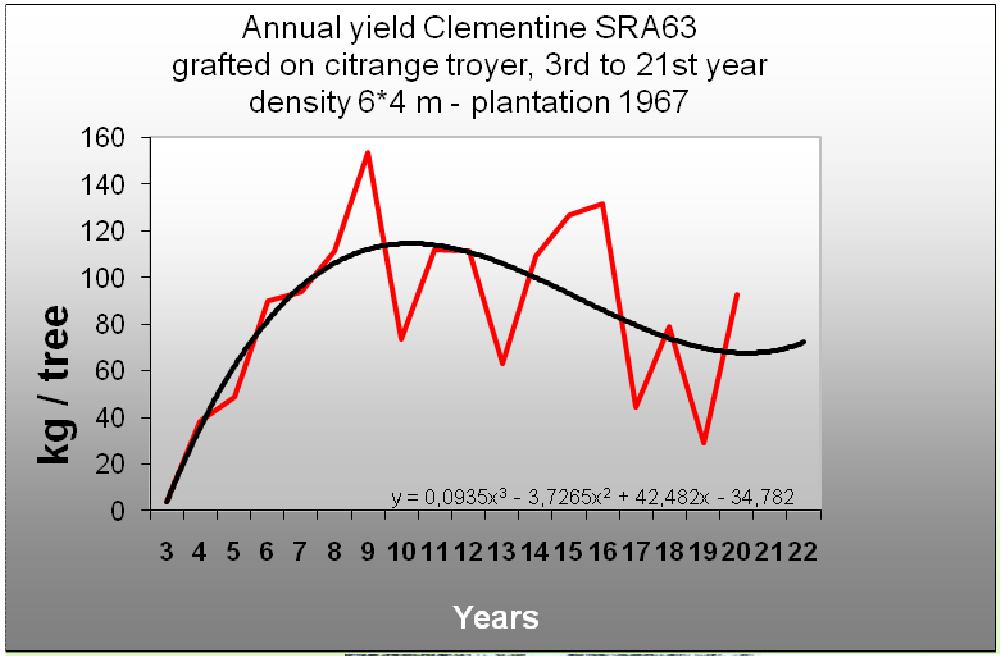
- Review of about 70 papers for 5 major imported product categories:
  - Fruits and vegetables;
  - Rice;
  - Stimulant beverages;
  - Vegetable oils;
  - Animal products
- Review looking at :
  - origin of data for farm and industry systems,
  - methods used for direct field emissions,
  - LCIA indicators selected and results

State of the art for fruits

- No comprehensive LCA studies for fruits in the tropics
- A scarce literature on fruits in temperate and mediterranean regions: apple (Sw, NZ), citrus (Spain, Italy)
- Modelling of perennial cropping systems: most often no inclusion of non-productive, low productives and end-of-life phases but choice of one single year assumed to be representative
- Direct field emissions: not always complete or transparent, and often not specific to orchard context
- Missing indicators: water footprint, biodiversity, toxicity…

Per kg of fruit	Mila i Canals et al., 2006 & Mila i Canals, 2003	Mouron et al., 2006	Sanjuan et al., 2005	Beccali et al., 2009
Country	New Zealand	Switzerland	Spain	Italy
Product	Apple	Apple	Orange	Orange & Lemon
Studied system	Integrated Fruit Production	Integrated apple-growing	Integrated production of oranges	Citrus-based products (oils, juices)
Farm data origin	Survey of 3 commercial orchards & 2 reference orchards - year 1999-2000	Survey of 12 Swiss farms over 4 years: 1997-2000.	Annual reports from FECOAV - year 2000	Literature data and expertise - year: 2005
Direct field emissions	Exhaustive inventory based on literature data + pesticide fate assessment	Exhaustive inventory - "models with situation dependent parameters" (Nemecek, 2003)	Incomplete - Literature data	Incomplete - Literature data
GWP_{100}	0.04 – 0.095 kg CO2-eq	0.083 kg CO2-eq	0.22 – 0.28 kg CO2-eq	0.155 (lemon) - 0.217 (orange) kg CO2-eq
Eutrophication	Not shown because no difference between systems	0.134 g PO4-eq	1.95 g PO4-eq	0.636 (lemon) – 0.905 (orange) g PO4-eq
Aquatic freshwater ecotoxicity	Chronic: 0.8 – 1.25 m^3 water Acute: 0.08 – 0.125 m^3 water	0.00015 kg Zn-eq	-	-
Terrestrial toxicity	0.0015 – 0.026 m^3 soil	0.000016 kg Zn-eq	0.0043 – 0.0054 kg 1.4 DB-eq	-
Water usage (blue water)	0.018 – 0.126 m^3	0	0.167 – 0.200 m^3	0.168 m^3
Biodiversity	-	-	-	-

State of the art for fruits



State of the art for rice

- Paddy fields are contributors to CH4 and N2O emissions, water resource depletion: few & incomplete LCA on rice
- Research has long focused on field GHG & GWP (Japan)
- Recent attempts in Thailand (1st global exporter), Japan, Italy, assessing other categories (eutrophication, acidification)

  => 1 comprehensive LCA on rice (Blengini & Busto, 2009), yet not under tropical conditions
- Many gaps and issues: discrepancies in system boundaries, FU, lack of clarity and definition on cropping system (season, representativeness), no taking account of diversity of cropping systems

  => striking discrepancies in results
- Missing: water use, biodiversity, toxicity, energy use

Per kg of rice	Blengini & Busto, 2009	Hokazono et al., 2009	Yossapol & Nadsataporn, 2008	Kasmaprapruet et al., 2009
Country	Italy	Japan	Thailand	Thailand
Product	Delivered packed milled rice (1kg)	Unmilled rice at farm gate (1kg)	Unmilled rice at farm gate (1kg)	Delivered milled rice, unpacked (1kg)
Studied system	Alternative farming and processing systems	Alternative farming systems, and alternative FUs (mass-area-value)	Alternative processing (energy sources)	Unclear from paper
Farm data origin	A farm model of 50ha based upon regional references and farmers' interviews	One farm of 55ha, and regional references	Averages from farmer and miller surveys, secondary data	Average situation from existing database – unclear from paper
Direct field emissions	Secondary and primary data, Ecoinvent	Incomplete – unclear from paper	Ecoinvent	National references (2004)
GWP_{100}	2.76 – 2.88 kg CO_2-eq	4.4 – 6.0 kg CO_2-eq	0.96 – 1.01 kg CO_2-eq	2.93 kg CO_2-eq
Eutrophication	328.3 – 334.7 g O_2-eq	25.5 – 34.5 g PO_3^--eq	56.5 – 56.7 g PO_4-eq	1.29 g NO_3^--eq
Aquatic freshwater ecotoxicity	-	-	-	-
Terrestrial toxicity	-	-	-	-
Water usage (blue water)	8 – 8.2 m^3	-	-	-
Biodiversity	-	-	-	-

State of the art for rice

Synthesis: among 70 papers reviewed

- Very scarce LCA studies on tropical products : palm oil, coffee, cocoa and some partial LCA studies
- Most often driven by North countries interests and teams; Studied function = producing for North market

➔ Selection of reference studies giving some first proxies for a range of products (see paper)

- Lack of transparency in materials and methods
- Failure to consider farming systems diversity
- Lack of specific methods and data for their inventory
- Absence of several crucial indicators (biodiversity, toxicity and water use)

➔ A state of the art too immature to enable a fair assessment of these products in an eco-labelling program

Specificities of tropical systems

- Extreme diversity of farming situations with many low input and manual systems
- Often interact with still pristine environment:
  - ➔ competition for land and water poses the challenge of biodiversity conservation
- Specific conditions of soil and climate
- A more dispersed and scarce knowledge of the interactions between farming systems in the Tropics and their environment

Specificities of tropical systems

- High diversity of farming situations and practices

Diversity of coffee plantation systems

Shaded

Sun-grown

Mixed crops

- Interaction / competition with an environment with a more acute vulnerability and of high biodiversity value

Deforestation in Amazonia to establish grasslands for beef production

Photo courtesy Bruno Rapidel, Jonathan Vayssières (CIRAD)

Scientific challenges and perspectives

- *Mid-term*
  - Development of more reliable LCI data: definition of typical systems, tropic-specific databases for background processes, specific estimates on direct field emissions
  - Inclusion of human and animal labour into LCA: environmental, social & ethical issues
  - Water use indicator
  - Allocation for mixed crops ? What functions?

- *Long-term*
  - Development of adapted characterisation models
  - Biodiversity assessment

Cécile Bessou (CIRAD)

Manual harvest of oil palm fruit bunches on 1 out of 9 palm trees every week.

Conclusions and perspectives

- The state of knowledge in LCA applied to tropical food and farming systems is insufficient to allow for their inclusion in an Eco-Labelling scheme
- Great scientific challenges are in front of us
- The need for working in close partnerships with our colleagues in South countries
- CIRAD is developing a team and a research program in the LCA of tropical food and farming systems

➔ Ambition to develop a dedicated LCA database

- This presentation was for us a first collective synthesis on this challenging task : thank you for this opportunity!