Comparison of the environmental impacts of the goose's fattened liver produced using overfeeding or spontaneous fattening

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COMPARISON OF THE ENVIRONMENTAL IMPACTS OF THE GOOSE FATTY LIVER PRODUCED USING OVERFEEDING OR SPONTANEOUS FATTENING

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Context : It is possible to trigger a spontaneous hepatic steatosis in geese using a dietary restriction period followed by a maize distribution *ad libitum*, concomitant with a reduced photoperiod (Guy *et al.*, 2013). This system could provide answers to societal issues concerning overfeeding. But what are its environmental performances ?

Objective : Compare the potential environmental impacts related to the production of goose fatty liver in two production systems: the Alternative System, in which a fattened liver is obtained spontaneously without overfeeding and the Conventional system, in which fatty liver is produced using overfeeding.

Studied systems

- The test was conducted in an experimental unit in France, and involved 280 male grey geese (*Anser anser*) divided into 2 groups according to two production systems: Alternative and Conventional described respectively by Guy *et al.* (2013) and Arroyo *et al.* (2012).
- Differences concerning rearing practices in both systems are described in Table 1.

Table 1 - Animal performance in both production systems

	Conventional	Alternative
FCR starting-rearing period	4.28	5.73
MCI Overfeeding / Fattening	17.55	54.37
Feed use (kg/geese) [period lenght, days]		
Starting period	9.3 [1-41d]	8.9 [1-41d]
Rearing period	19.0 [42-97d]	27.2 [42-140d]
Overfeeding/fattening period	14.3 [98-114d]	28.0 [141-224d]
Age at slaughter (days)	115	224
Weight at slaughter (g)	9 280	8 242
Liver weight (g)	815	515
Mortality (%) during starting + growing periods	5	7
during overfeeding / fattening period	1	4

FCR : food conversion rate ; MCI : Maize conversion rate into fatty liver

LCA methodology

- **System studied**: from the production of egg until the slaughterhouse gate
- **Functional unit**: 1 kg of liver
- **Primary data**: experimental data and surveys
- **Secondary data**: INRA and Ecoinvent database
- **Calculation method**: CML2
- **Software**: SIMAPRO
- Seven potential **environmental impacts** estimated

LCA results

Table 2 – Potential environmental impacts for production of 1 kg of liver in Conventional and Alternative systems

Potential environmental impact	Conventional	Alternative
Climate change (kg CO_2-eq.)	53.02	140.55
Eutrophication potential (kg PO_4-eq.)	0.37	0.84
Acidification potential (kg SO_2-eq.)	0.75	1.74
Trrestrial toxicity (kg 1,4-DB-éq)	0.15	0.32
Cumulative energy demand (MJ-eq)	406.66	905.62
Water use (m^3)	3.44	8.16
Land occupation (m^2.an)	66.74	142.68

- The impacts are more important in **the Alternative system** than in the Conventional System from **+ 114% to + 165%** depending on impacts, mainly due to a longer lifespan and a greater food consumption of animals for a lower liver production.
- The **contributions of category of inputs or production steps to potential impacts are similar for both systems** studied: Food and emissions from animal manure explain together more than 90% of impacts and the two production steps that contribute mostly to impacts are the rearing and the overfeeding / fattening periods (80 to 98% of impacts).

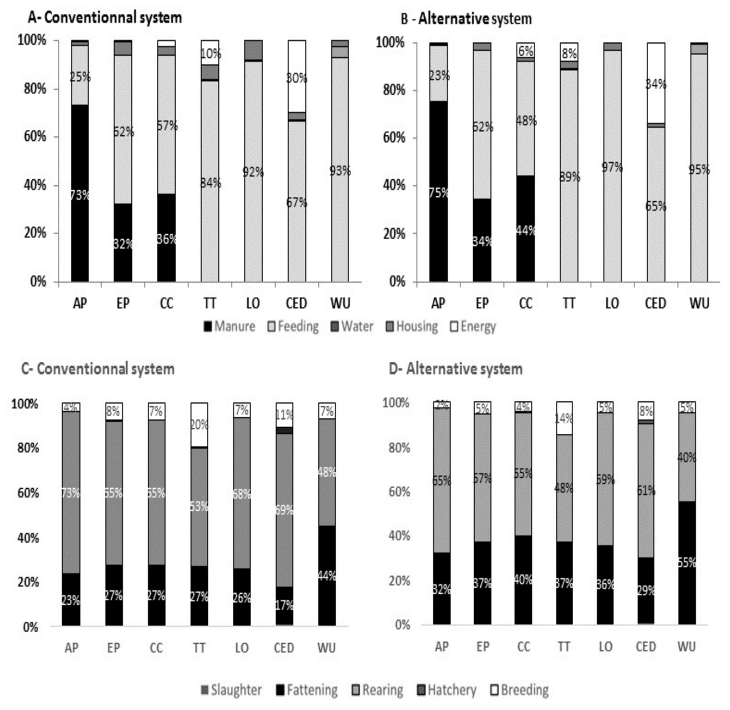

Figure 1 - Contribution (%) of different categories of inputs (A and B) and of the various stages of production (C and D) to the environmental impacts of production of 1 kg of fatty liver obtained using Conventional system (A and C) or 1 kg of fattened liver obtained using the Alternative system (B and D)

AP : Acidification Potential, PE : Eutrophication Potential, CC : Climate Change, TT : Terrestrial Toxicity, LO: Land Occupation, CUD : Cumulative Energy Demand, WU : Water Use

Conclusion : The Alternative production system, which provides a fattened liver without overfeeding, can answer some societal demands concerning the insertion of the feeding-tube into the esophagus. However, in the present state of our knowledge, to produce 1 kg of liver, such a system generates greater potential environmental impacts than the Conventional system especially due to its low productivity and its longer rearing period.

Reference : Arroyo J., Fortun-Lamothe L., Dubois J.P., Lavigne, F., Bijja M., Auvergne A. 2012. INRA Prod. Anim., 25, 419-430.
Guy G., Fortun-Lamothe L., Bénard G., Fernandez X., 2013. J. of Animal Science, (91), 455-464

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