Environmental assessment of contrasting pig farming systems

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Context

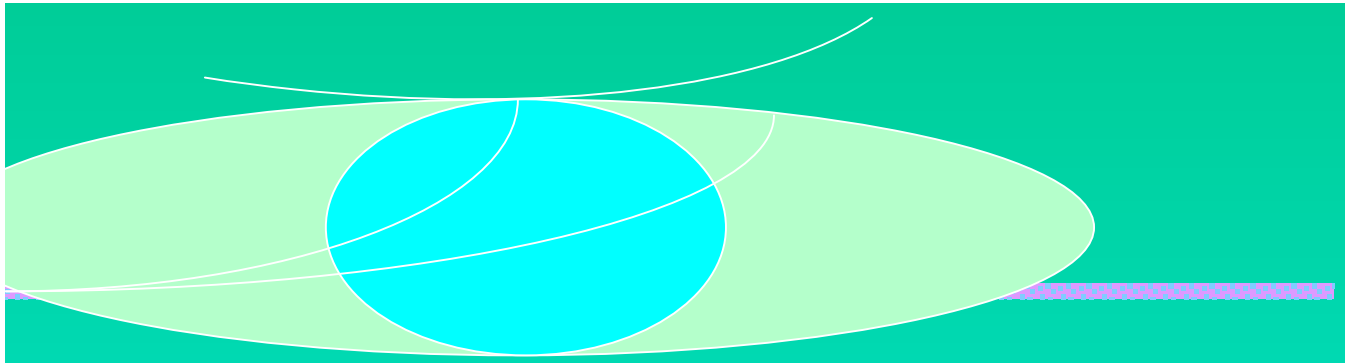
- In Brittany, in forty years : change from a traditional to an intensive industrial production system

  ↳Huge increase in production and animal densities

  ↳ Increased pollution of water, soil and air

The current pig production model is in crisis

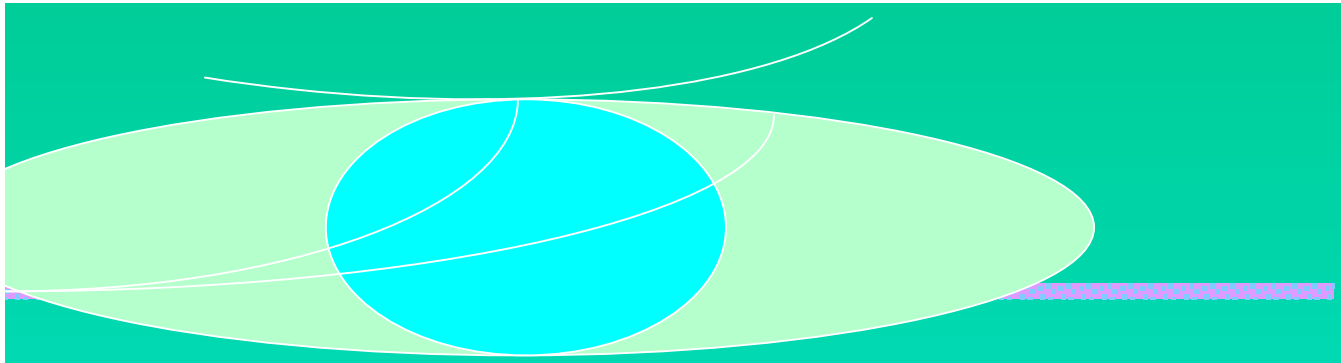
- Pig producers :
  - are facing a social demand for a better respect of the environment
  - and have to cope with a very competitive pig world market



Very few global assessments of the environmental performance of both current or more alternative pig production systems

Objectives

- To produce an assessment of the environmental performance of contrasting pig farming systems
- To identify « hot-spots » for each system
- To propose an evaluation of the robustness of the main results

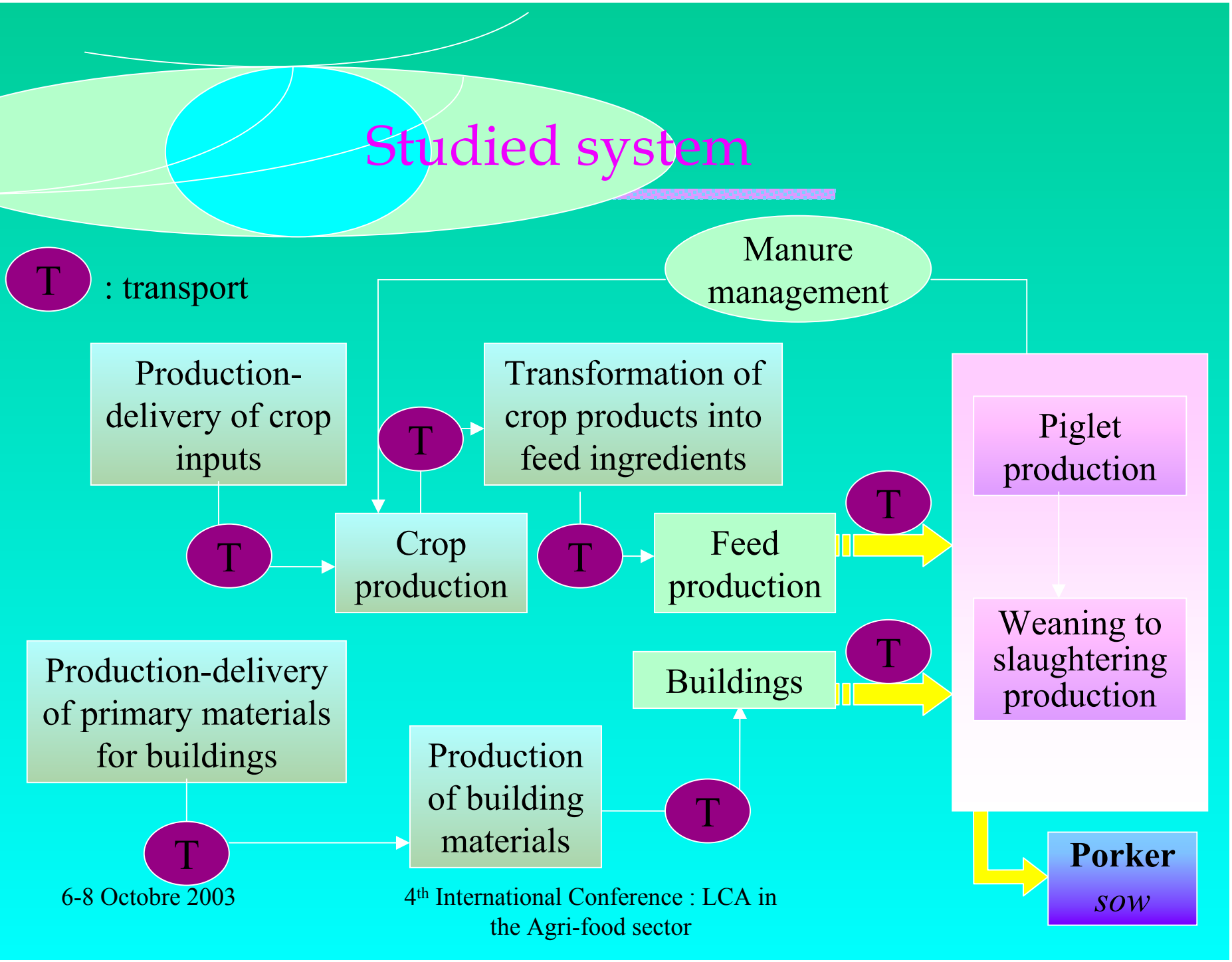


Materials and methods

Evaluation methodology

- Life Cycle Assessment
- 7 impact categories : eutrophication, climate change, acidification, energy use, terrestrial toxicity, land use, pesticide use
- referenced to two functional units :
  - one kg of pig live weight at slaughter
  - one hectare of land used
- applied to three contrasting scenarios of pig production

Studied system



Farming system scenarios

- 1. Good Agricultural Practice (GAP) (conventional)
- 2. Agriculture Biologique (AB) (organic)
- 3. Label Rouge (LR) (« Porc fermier Label Rouge » quality label)

Characteristics of GAP, LR and AB pig farming systems

	GAP	LR	AB
Piglet production			
Housing	Slatted floor	Outdoor	Outdoor
Weaned piglet/productive sow/year	25.5	22.6	20.3
Weaning age, days	25.7	28	42
Surface per sow, m^2	<4	1000	1000
Feed per sow (boar included), kg/year	1313	1490	1695
Weaning to slaughtering			
Housing	Slatted floor	Straw litter	Straw litter
Surface per pig, m^2	0.85	2.6	2.3
Feed : gain ratio	2.7	2.9	3.2
Slaughter age, days	174	190	195
Slaughter weight, kg	110	115	120

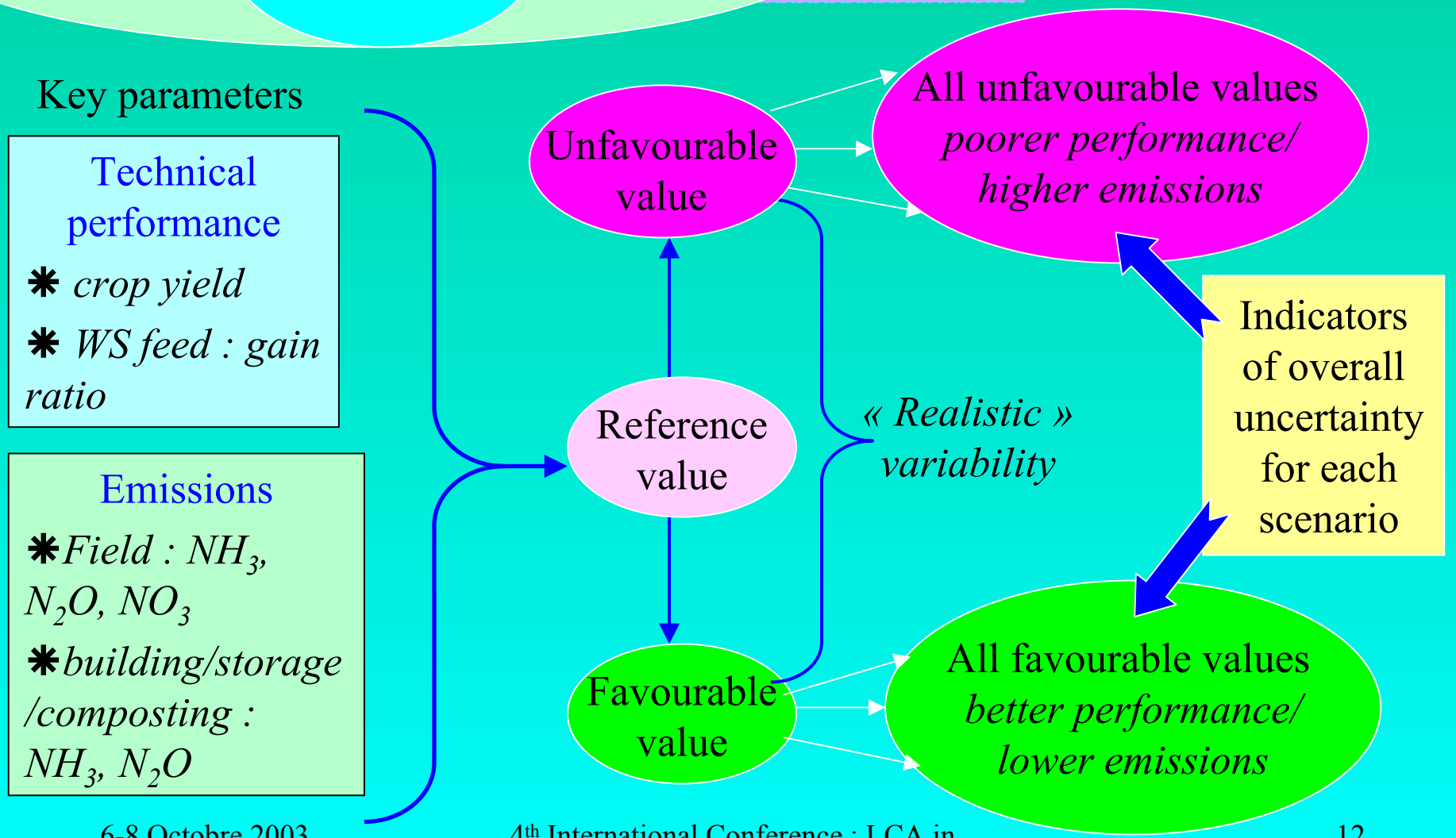
Inventory data

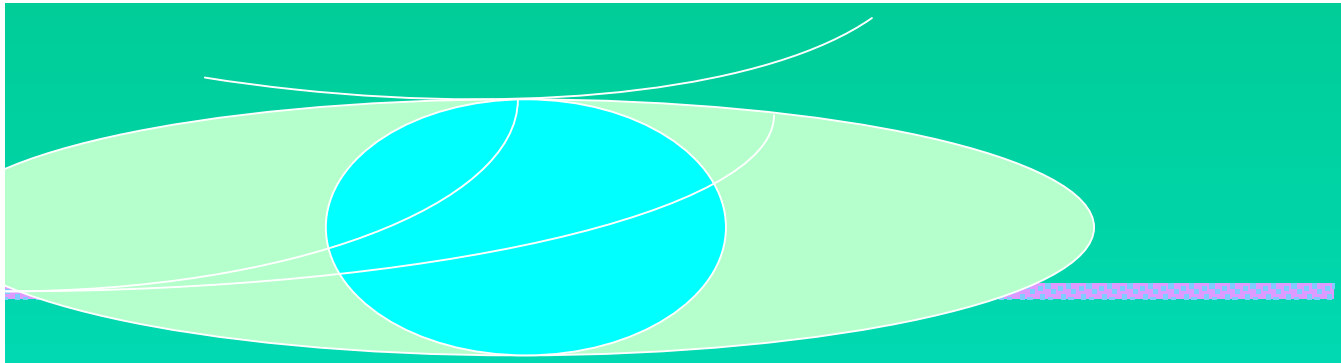
- Objective : to produce specific references for each system
- Currently : use of normative references which do not allow to distinguish different ways of producing the same product
- In this study : support of an expert panel from the INRA which based its expertise on :
  - simulation models
  - experiments
  - interpretation of the available literature.

Some emission calculations….

Emission	Method	Parameters involved
NH_3 after slurry application on field	STAL simulation model (Morvan et Leterme, 2001).	• Slurry composition • climate (application date) • soil surface state • burying degree
NO_3 leaching on field	Experiment, simulation + expertise Morvan	• crop (species) • fertilisation • intercropping duration
NH_3 and N_2O in straw litter housing buildings	Experiments in specialised farms (Robin, 2002)	• type and quantity of substrate • animal density • ventilation
NH_3 and N_2O during compost production	Literature + experiments and modelisation Paillat et al. (2003)	• C/N and pH of substrat • Composting duration

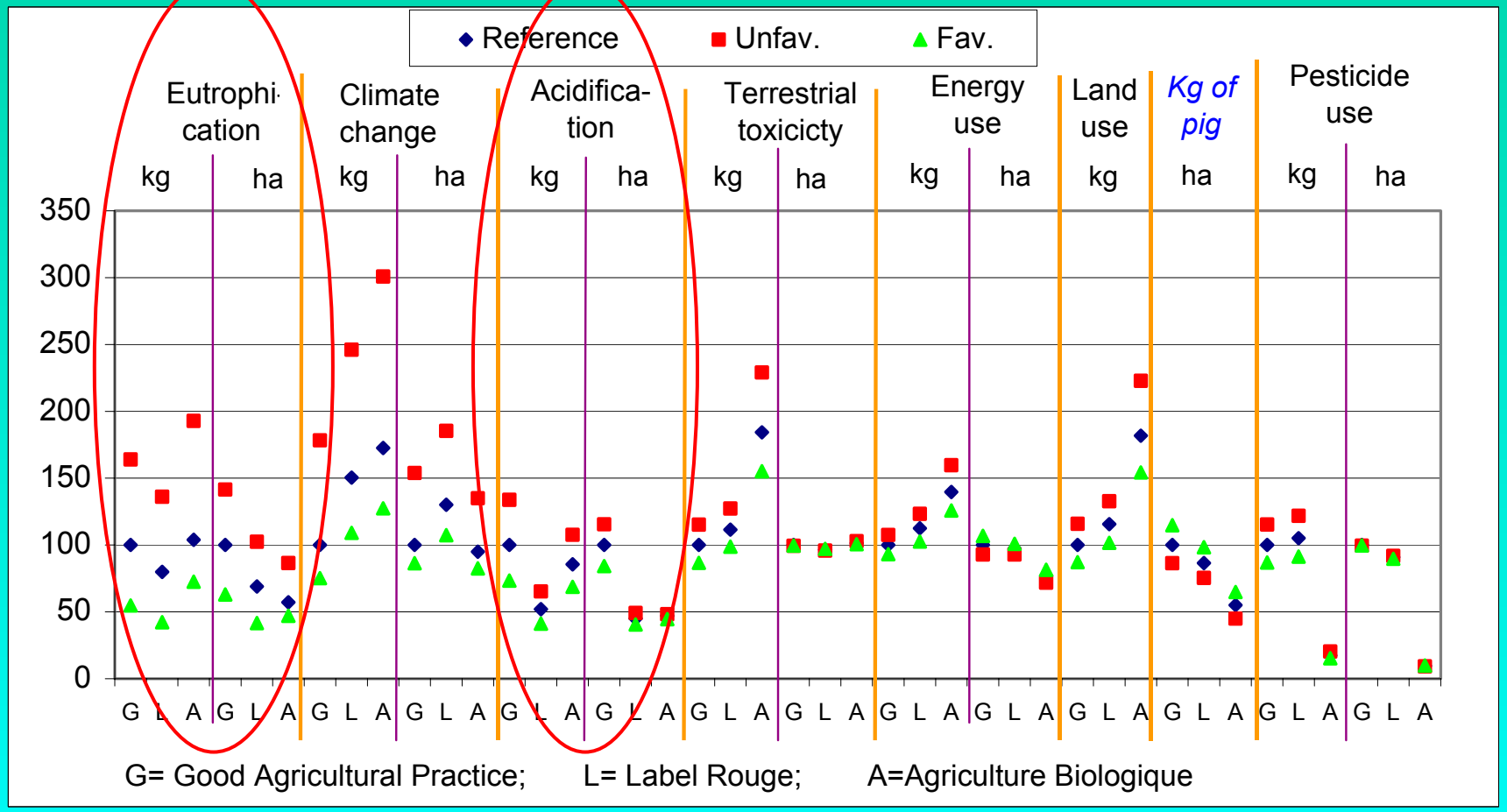
Estimation of the uncertainty of final results





Results

LCA results and estimated uncertainty for three contrasting pig farming systems



LR compared to GAP

- Both per ha and per kg :

↳lower impacts for eutrophication and acidification

↳ a higher impact for climate change

↳ similar other impacts

- pig production per ha : 14% less

AB compared to GAP

Results are very dependent on the FU

- ***Per ha***

↳ Lower impacts : eutrophication, acidification, energy use, pesticide use

↳ Similar : climate change, terrestrial toxicity

↳ Pig production : 45% less

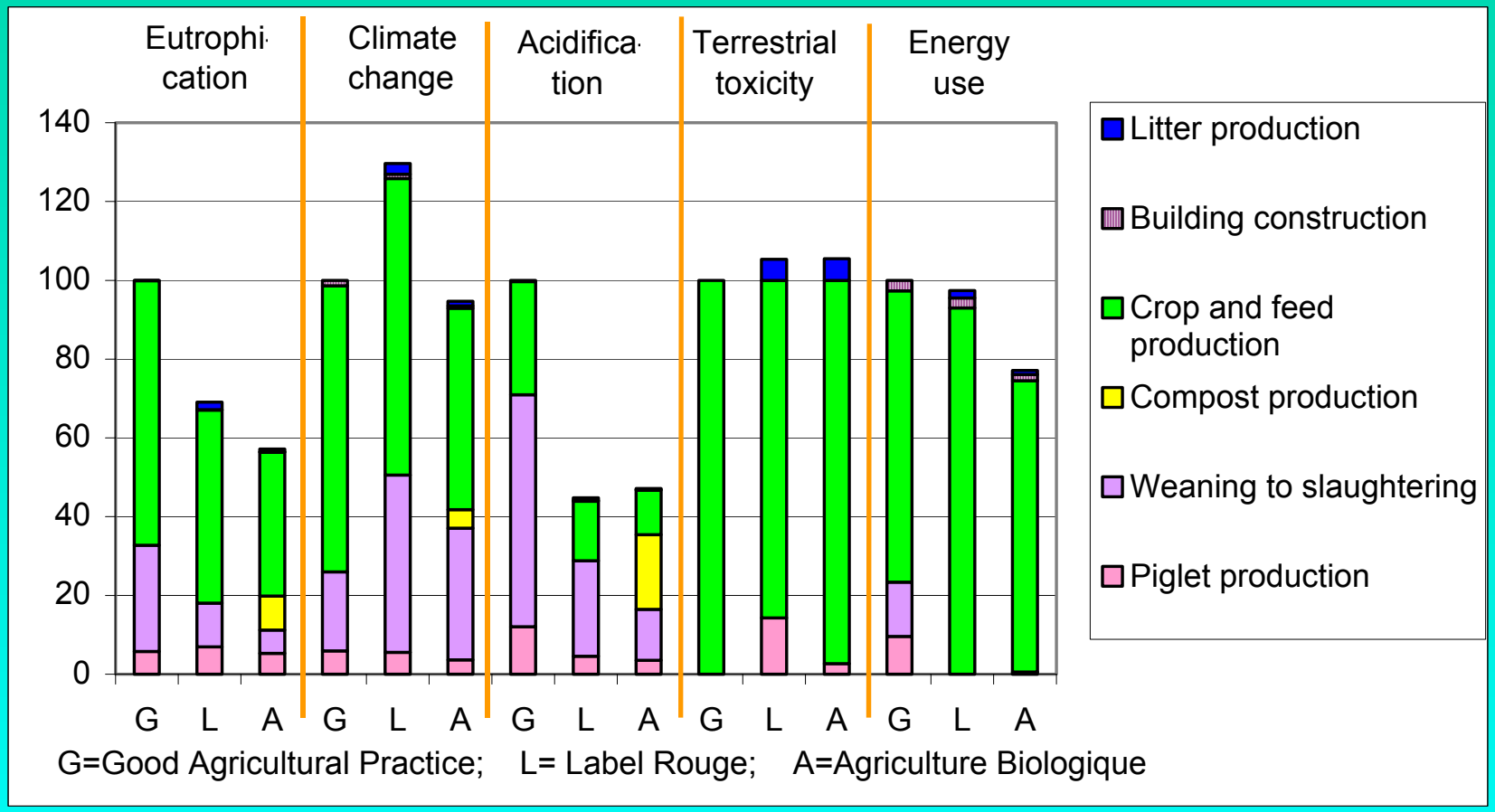
- ***Per kg of pig***

↳ Lower impact : pesticide use

↳ Similar : eutrophication, acidification

↳ Worse : climate change, terrestrial toxicity, energy use, land use

Contribution of life cycle stages to five impact categories, expressed per ha



Hot spots and margins of improvement

- **GAP** : eutrophication and acidification : *crop and feed production; pig production*
- **LR** : climate change : *straw litter system*
- **AB** : acidification : *compost production* climate change : *straw litter system*

- Catch-crops; diet; indoor climate; building design, covered slurry storage; slurry injection
- Nature and quantity of litter; litter management; animal density; diet; indoor climate
- low pH; high C/N; low aeration rate; reduced porosity

In conclusion

- Contribution to eutrophication and acidification :
  - LR : an interesting alternative to GAP provided that its emission of greenhouse gases can be reduced
  - AB : results very dependant on the FU
- Identification of hot spots and margins of improvement for each system
- The use of favourable and unfavourable scenarios allowed an estimation of the uncertainty of the results

Perspectives….

- For the impact category eutrophication : to produce different fate factors of nitrate in reaches relative to the type of reach
- To express the impacts per euro earned
- To produce the assessment of a « current practice » scenario


Thank you for your attention...

Origin of technical data

Type of data	GAP	LR	AB
Crop production and crop succession	Expertise (CETA 35 et CA 35, 56)	Expertise (CETA 35 et CA 35, 56) + farm survey	Expertise (CA 26, 56, 32 ; COOP 41) + farm survey
Crop yield	Statistics 1996 – 2000 (AGRESTE, 2001)	Statistics 1996 – 2000 (AGRESTE, 2001)	Expertise (CA 26, 56, 32 ; COOP 41) + farm survey
Feed composition	Feed industry	Feed industry	Feed industry
Pig produced per sow	Statistics 2001 (ITP, 2002)	Statistics 2001 (ITP, 2002)	Berger, 2000
Feed : gain ratio	Statistics 2001 (ITP, 2002)	Statistics 2001 (ITP, 2002) + growers' association	Expertise (INRA, COOP 44) + farm survey