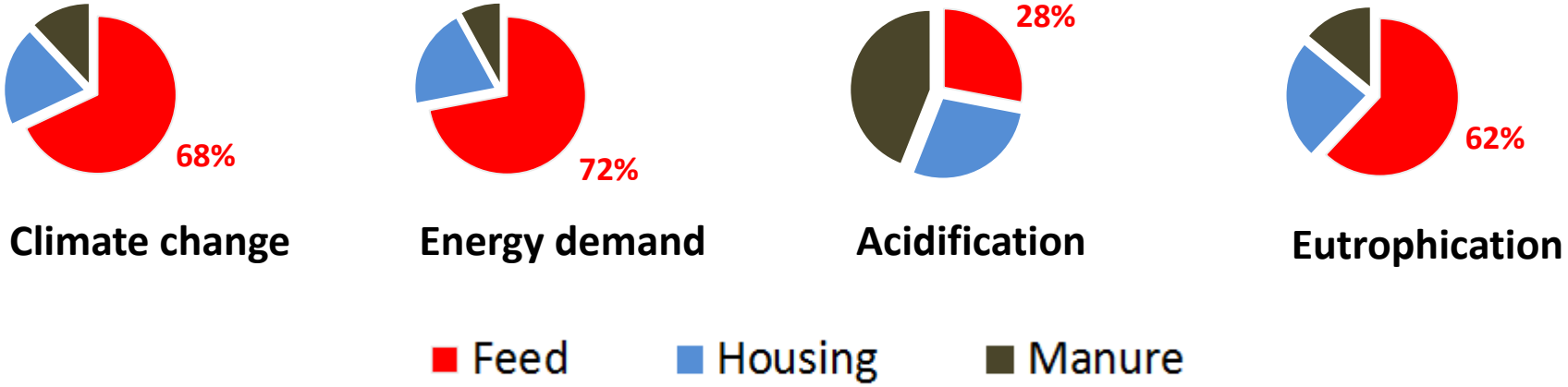
The effect of nutrition on environmental impacts of pig production depends on production context

A.N.T.R. Monteiro, F. Garcia-Launay, L. Brossard, A. Wilfart, J.Y. Dourmad

Production of feed has a major contribution to most environmental impacts of pig farming systems



Dourmad et al., 2014

Effects of feed composition and feeding strategies

✓ **Direct effects : rearing of pigs**

- Nitrogen excretion => emission of N_2O, NH_3, NO_3^-
- Phosphorus excretion => emission of P...
- Fiber content => enteric and manure emissions of CH_4

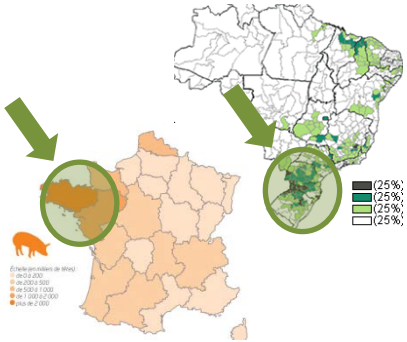
✓ **Indirect effects : production of feeds**

- Use of resources for production of feed ingredients and complete feeds : energy, fertilizers, land...
- emissions from crop production : N_2O, NH_3, NO_3^-, P...

Question : Do the effects of pig feeding strategies on environment depend on the context of production ?

✓ **Evaluate the effects pig feeding strategies in different context of production**

- 2 locations with different climates : France (FR) , Brazil (BR)
- 2 origins of soybean meal from Brazil
  - with recent deforestation (CW)
  - without deforestation (SO)



✓ **Different feeding strategies explored**

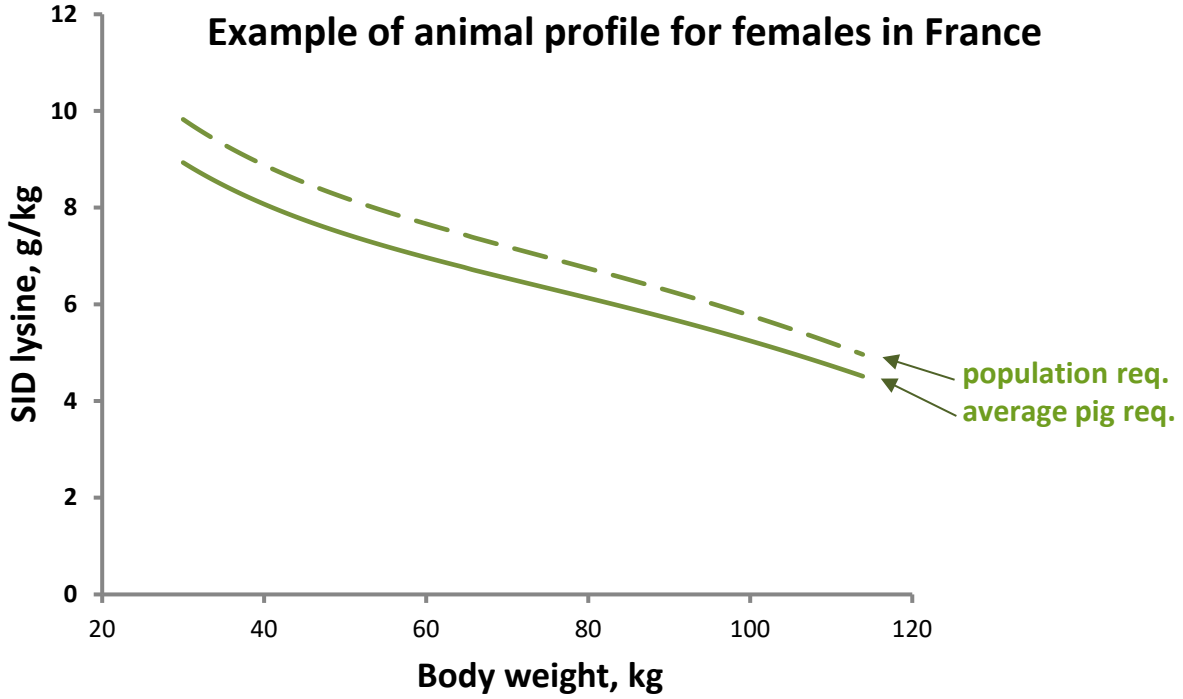
- feed formulation
  - diversity of protein sources (Soy, Mix)
  - use of crytalline AA (noAA, WithAA, Low CP)
- feeding programs
  - phase feeding (2P, 4P, MP)
  - individual precision feeding (PR)

Definition of feeding programs

✓ **Nutrient requirements**

- 2 phenotypes (BR, FR)
- 2 genders (Cast., Fem.)

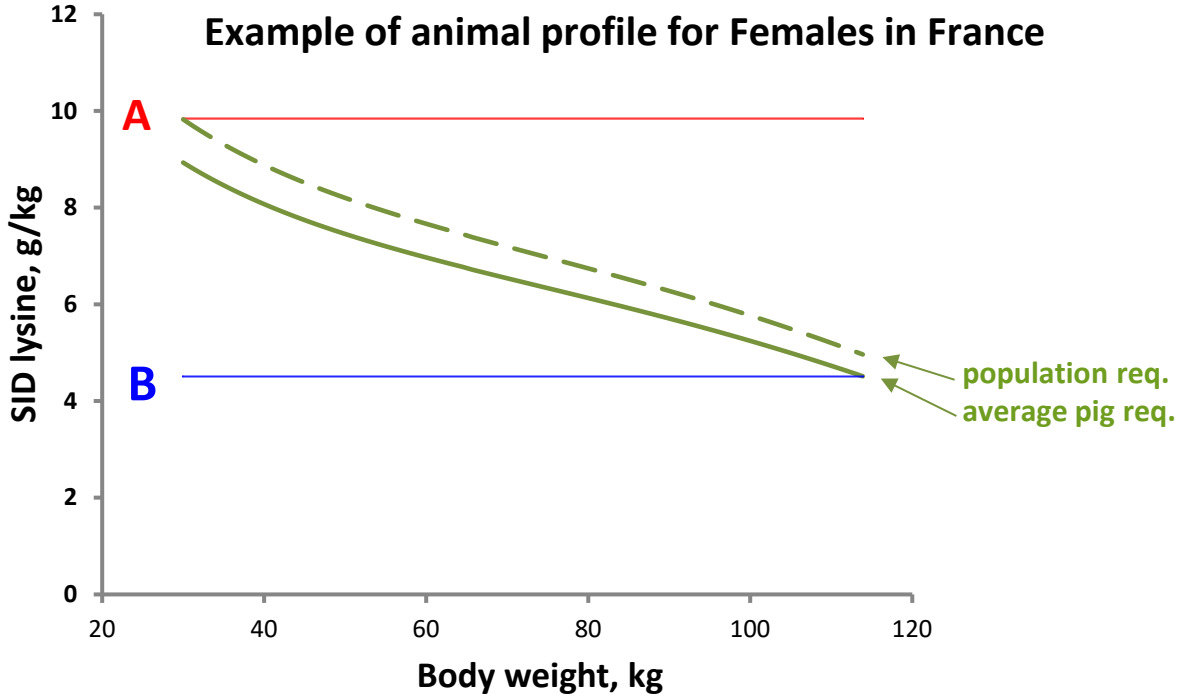
Performed using InraPorc



Definition of feeding programs

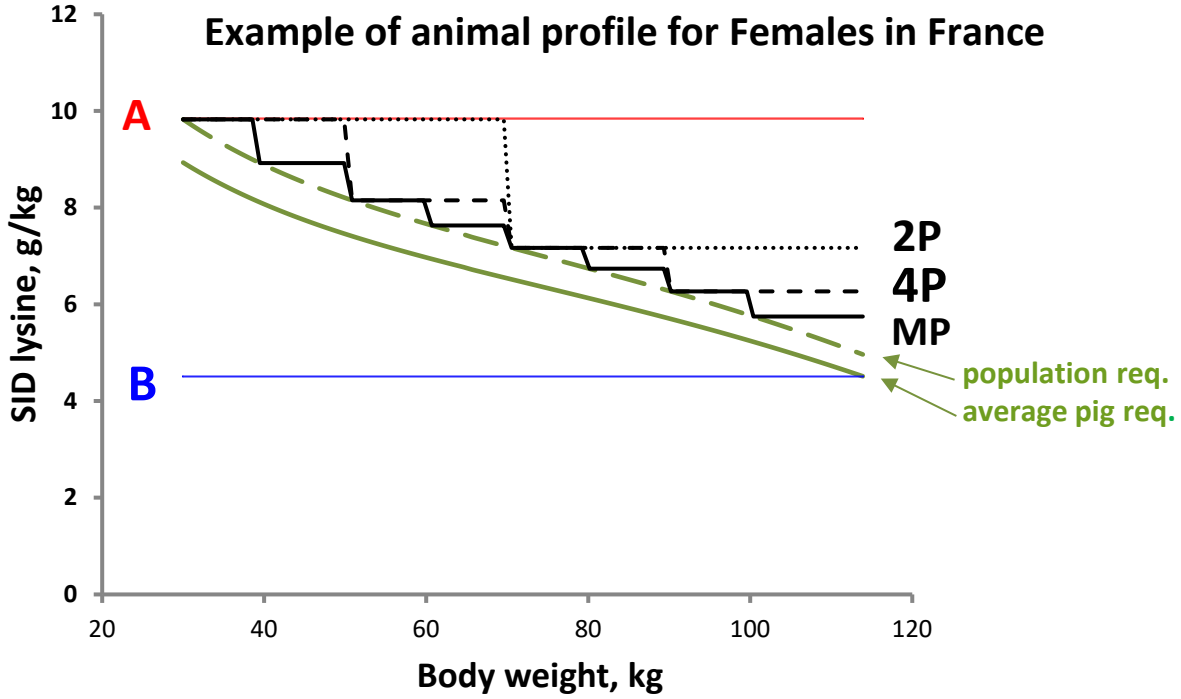
✓ **Nutrient requirements**
- 2 phenotypes (BR, FR)
- 2 genders (Cast., Fem)

✓ **Least cost formulation**
- Two diets (**A**, **B**) per animal profile



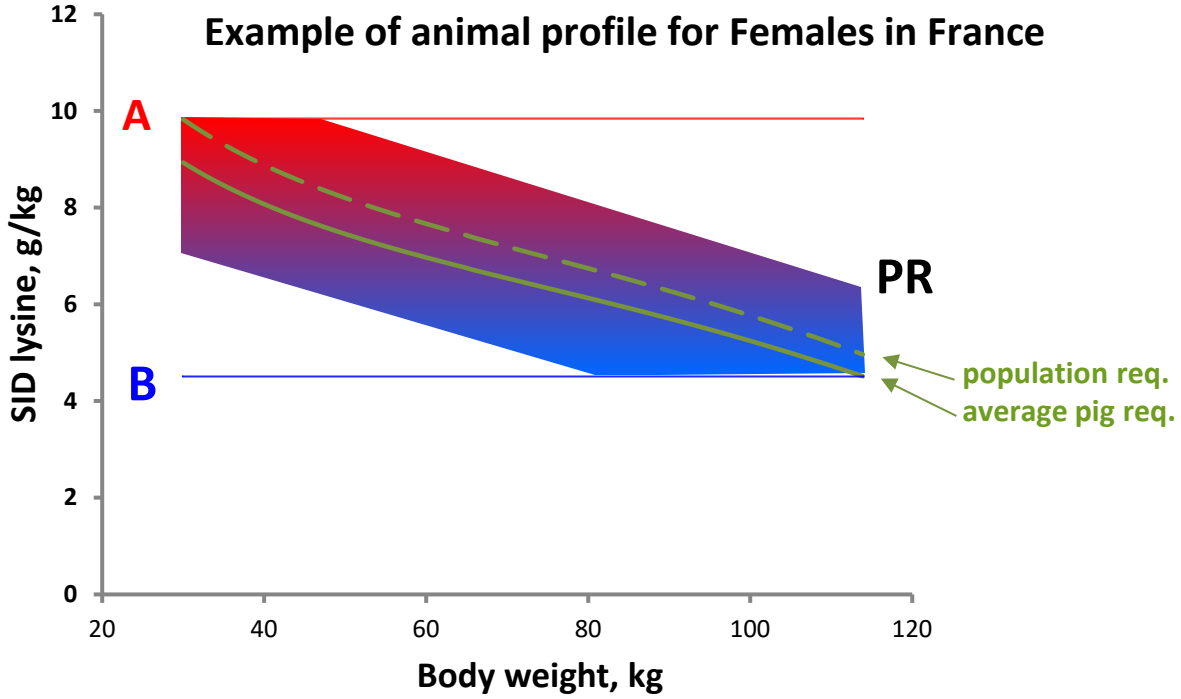
Definition of feeding programs

- ✓ **Nutrient requirements**
  - 2 phenotypes (BR, FR)
  - 2 genders (Cast., Fem)
- ✓ **Least cost formulation**
  - Two diets (**A**, **B**) per animal profile
- ✓ **Feeding sequence**
  - mixing of diets **A** and B



Definition of feeding programs

- ✓ **Nutrient requirements**
  - 2 phenotypes (BR, FR)
  - 2 genders (Cast., Fem)
- ✓ **Least cost formulation**
  - Two diets (**A**, **B**) per animal profile
- ✓ **Feeding sequence**
  - mixing of diets **A** and **B**



Simulations and Life Cycle assessment

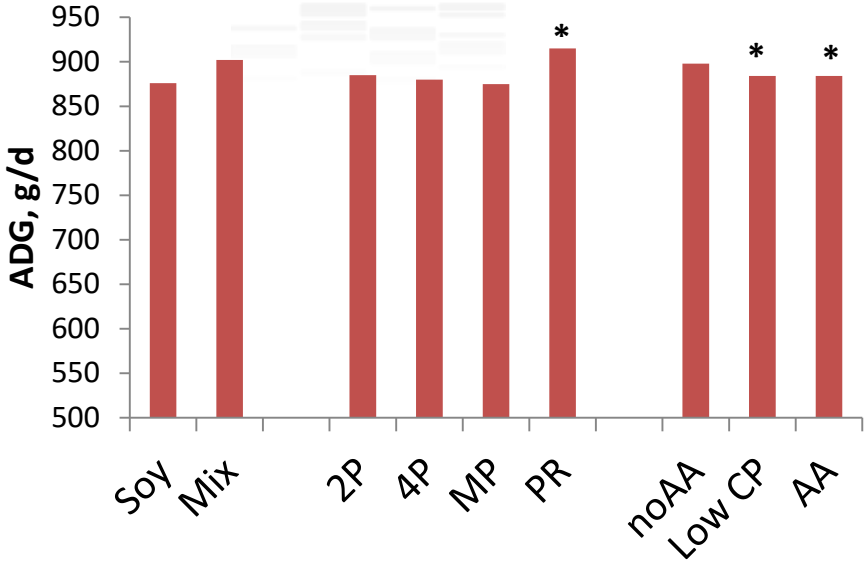
✓ Simulation of performance

- InraPorc population version (Brossard et al., 2014)
- One population of 1000 pigs simulated per scenario (192 scenarios)
- Determination of animal performance and excretion

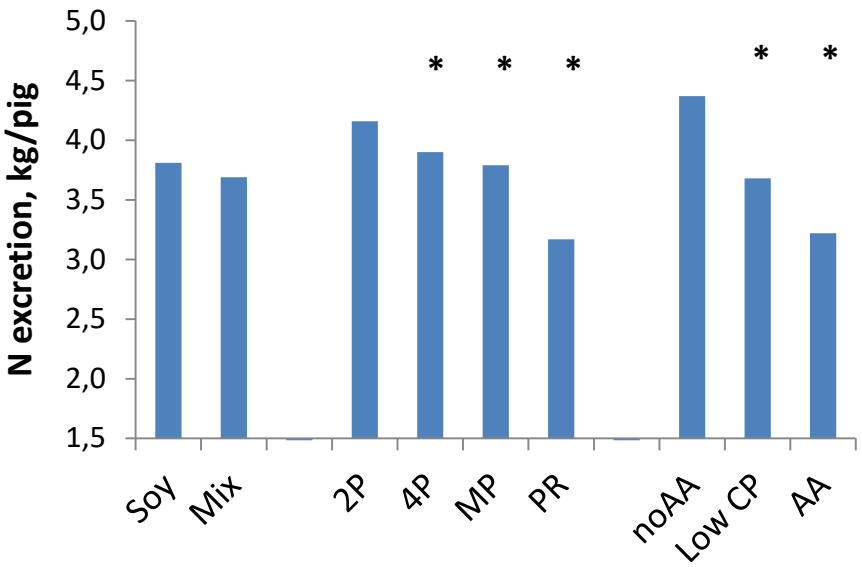
✓ Life cycle assessment

- According to Garcia-Launay et al. (2014)
- Six impact category : climate change (CC), cumulative energy demand (CED), eutrophication (EU), acidification (AC), terrestrial ecotoxicity (TE) and land occupation (LO)
- Functional unit : one kg of body weight gain during fattening

Results – Animal performance



Average daily gain of pigs

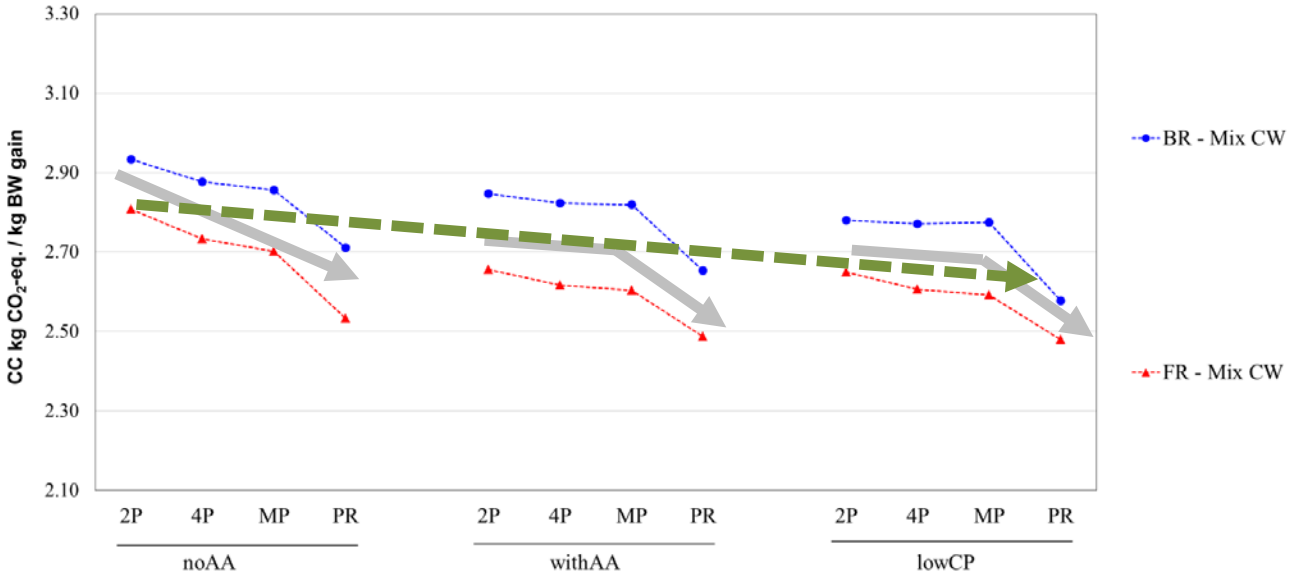


N excretion of pigs

Climate change

"Mixed" protein source – Soybean from Center West

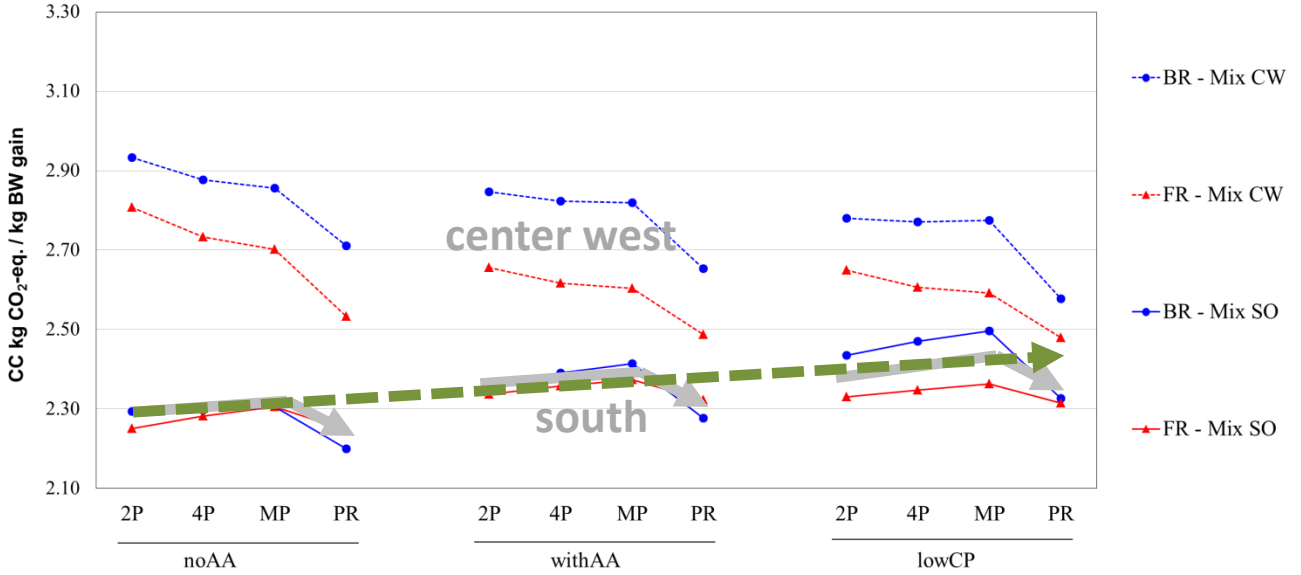
- ✓ **Effect of country** (**BR**, **FR**)
  - CH_4 from manure
- ✓ **Effect of feeding program**
  - less soybean with high CC
- ✓ **Effect of AA inclusion**
  - less soybean with high CC
  - less N_2O emission



Climate change

"Mixed" protein source – Soybean form CW ------- or SO ——

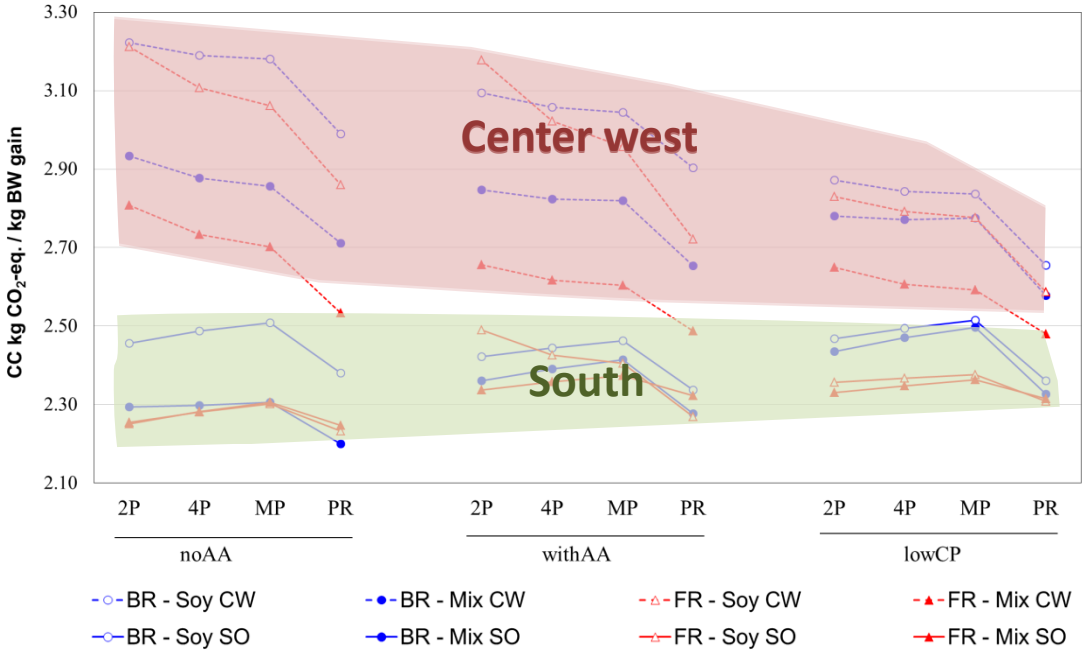
- ✓ **Effect of soybean origin**
  - Deforestation
- ✓ **Limited impact of feeding program**
  - Effect of precision feeding only
- ✓ **Increased CC with AA**
  - Soybean with low CC replaced by cereals and AA



Climate change

“Mixed” or “Soy” source – Soybean from Center West or South

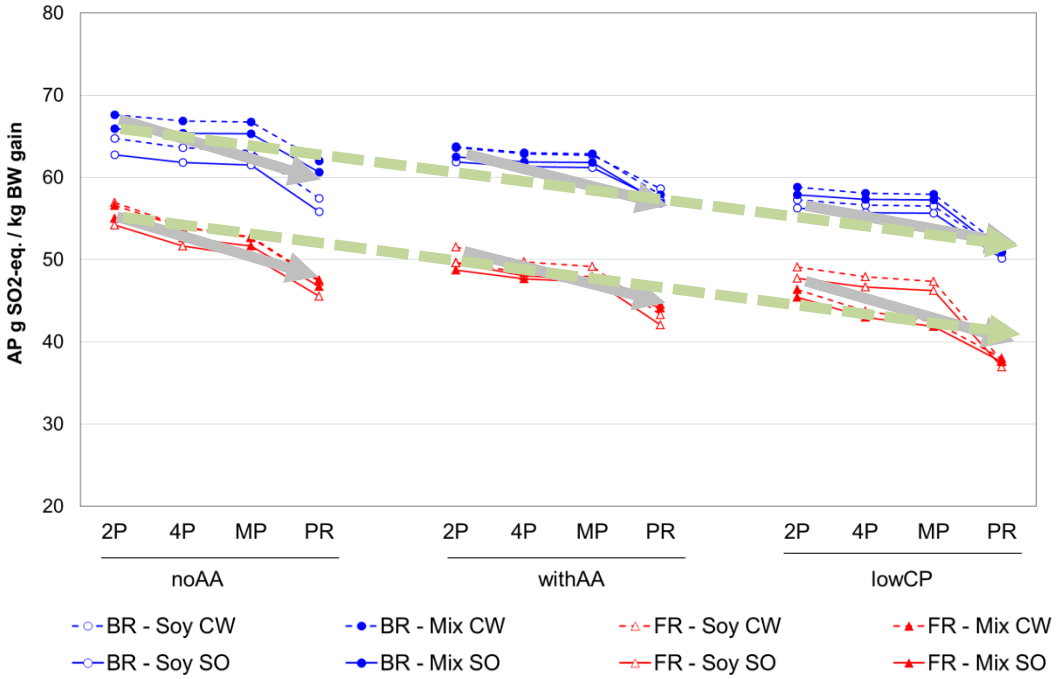
- Significant statistical interactions
- Effects of feeding strategy on CC depends on
  - context of production
  - origin of soybean meal
  - diversity of protein sources



Acidification potential

"Mixed" or "Soy" source – Soybean from CW or SO

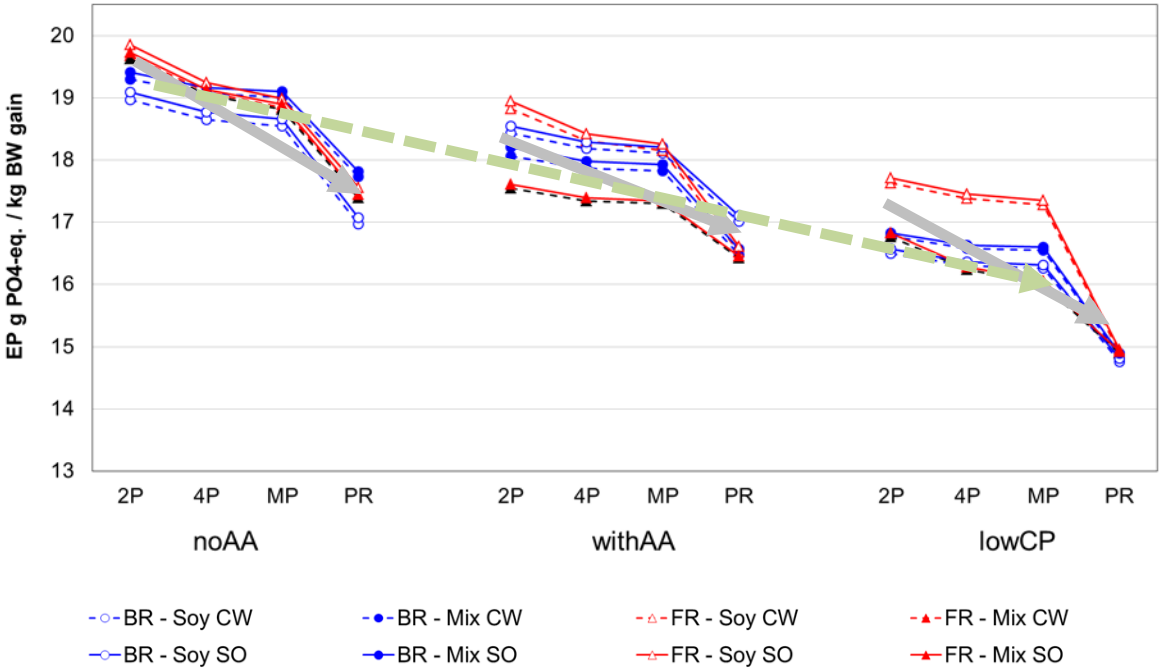
- ✓ **Effect of country** (BR, FR)
  - Crop fertilization (urea vs ammonia)
- ✓ **Effect of feeding program**
  - Reduction of N excretion and ammonia emission
- ✓ **Effect of AA inclusion**
  - Reduction of N excretion and ammonia emission



Eutrophication potential

"Mixed" or "Soy" source – Soybean from CW or SO

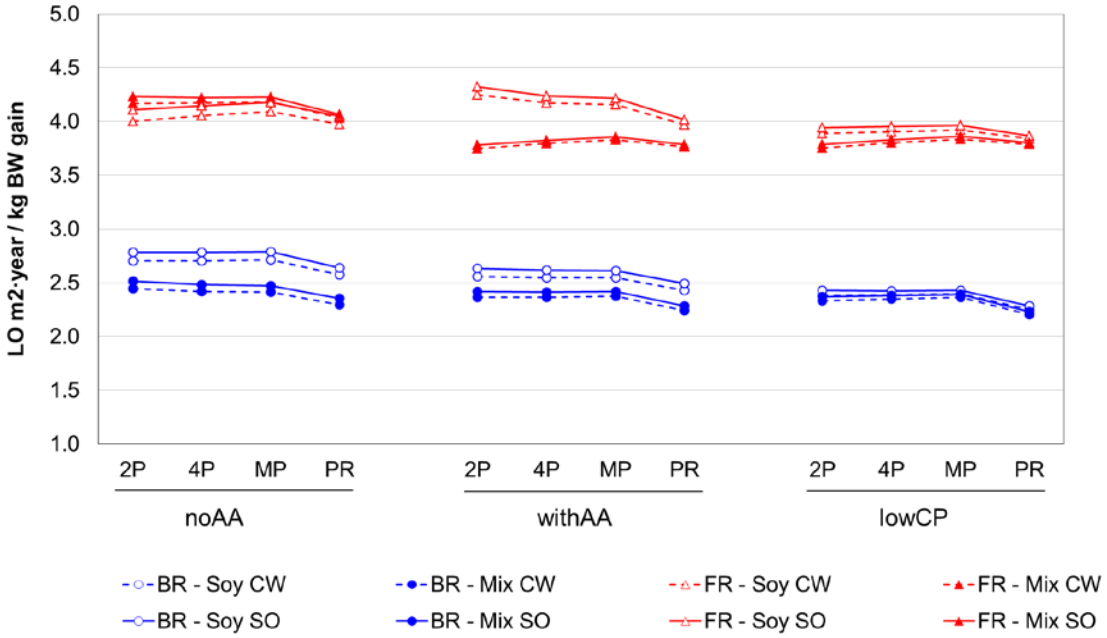
- ✓ **No clear effect of country** (BR, FR)
- ✓ **Effect of feeding program**
  - Reduction of N excretion and ammonia emission
- ✓ **Effect of AA inclusion**
  - Reduction of N excretion and ammonia emission



Land Occupation

"Mixed" or "Soy" source – Soybean from CW or SO

- ✓ **Effect of country** (BR, FR)
  - Crop yield and number of crops/year > in Brazil
- ✓ **Limited effects of feeding strategies**
  - no effect of soybean origin
  - small improvement with PR
  - a tendency to reduce LO with AA inclusion



Conclusions

- **Climate Change and energy use** : a clear interaction
  country **x** soybean origin **x** feeding program **x** AA inclusion
  - ⇒ limited interest of phase feeding and AA with soybean from South Brazil
  - ⇒ but efficient strategies with soybean from CW, especially in Europe
- **Eutrophication and acidification**
  - ⇒ Important additive effect of feeding program and AA inclusion in both countries
- **Land occupation**
  - ⇒ small reduction of LO with precision feeding and AA inclusion

The effect of nutrition on environmental impacts of pig fattening depends on impact category and production context

Universidade Estadual de Maringá

INRA
SCIENCE & IMPACT

Thank you for your attention !

August 31th / 2016