Nitrogen conversion efficiency in French livestock production from 1938 to 2010

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- Setting the scene
- Methodology
- Results on N indicators
  - Nitrogen conversion efficiency
  - Human-edible protein
  - Protein self-sufficiency
- Conclusion

Setting the scene

- Multiple contribution of Livestock production (Cooper et al. 2009)
  - Food security
  - Multiple services
- Environmental pollution
- Competition issue
  - Natural resources and land

Setting the scene

- Current situation
  - growing demand of livestock products
  - resource scarcity
- Close the efficiency gap
- Research focus on nitrogen
  - Protein in human diet (Billen et al. 2014)
  - Misusage associated with detrimental environmental impacts (Bowman et al. 2011)

Objective

to assess nitrogen accounts with multiple indicators to improve understanding of nitrogen use in the French livestock sector

Approach :

Nitrogen conversion efficiency

Change over time in the use of feed resources and provision of livestock products

Human-edible protein balance

Competition with human nutrition

Protein self-sufficiency

Livestock feeding and feed imports

Methodology

- Data sources
  - national agricultural census (Cavailhes et al. 1987)
    - 1938 - 1980
  - national agricultural census
    - 1988 - 2010
- Period
  - years 1938 and 2010
- N coefficients
  - FAO food balance sheets

Nitrogen conversion efficiency

$$NCE = \frac{N\ in\ \text{livestock}\ products}{N\ in\ feed\ resources} = \frac{}{} =$$

NCE

1938 → 2010

$$14.6\% \rightarrow 17.3\%$$

Nitrogen conversion efficiency

$$NCE = \frac{N\ in\ \text{livestock}\ products}{N\ in\ feed\ resources} = \frac{\text{Livestock products}}{\text{Feed resources}} = \frac{\text{1938} \rightarrow \text{2010}}{}$$

0.14 Tg → 0.28 Tg

0.96 Tg → 1.62 Tg

Nitrogen conversion efficiency

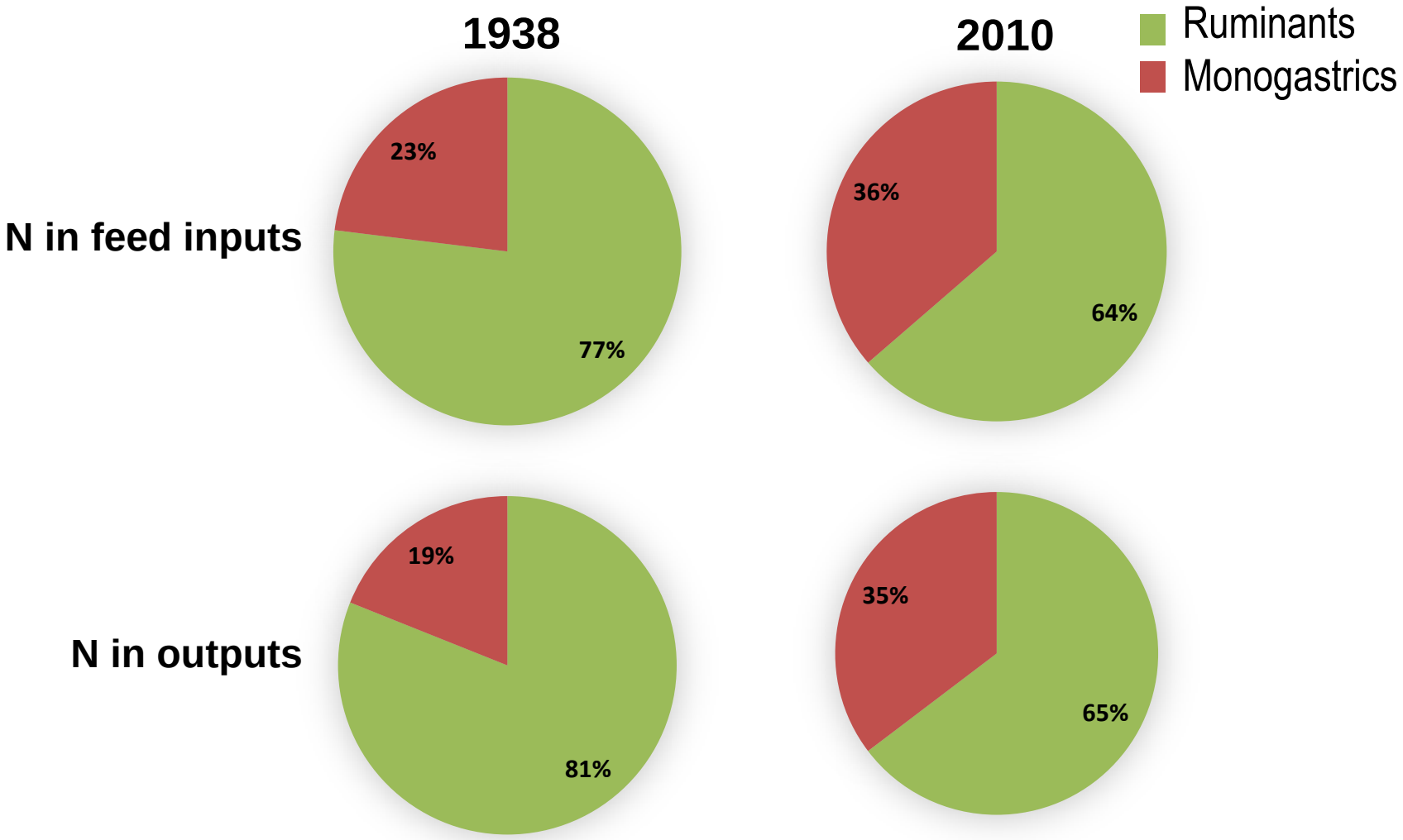
$$NCE = \frac{N\ in\ \text{livestock}\ products}{N\ in\ feed\ resources} = \frac{\text{——————}}{\text{——————}} =$$

1938 → 2010

71% → 42%
Forage

29% → 58%
Concentrate

N in feed inputs and outputs per livestock type

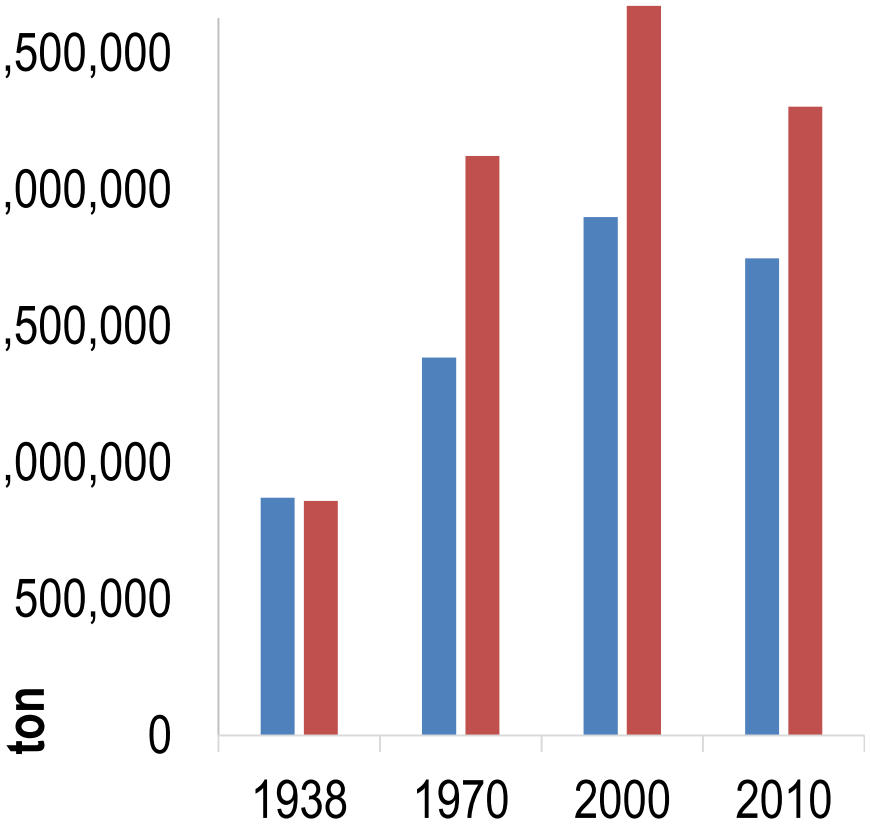


Human-edible protein

$$\text{Ratio} = \frac{\textit{Edible protein output}}{\textit{Edible protein input}}$$

1.01 0.65 0.71 0.76

$$\text{Balance} = \textit{Edible protein output} - \textit{Edible protein input}$$



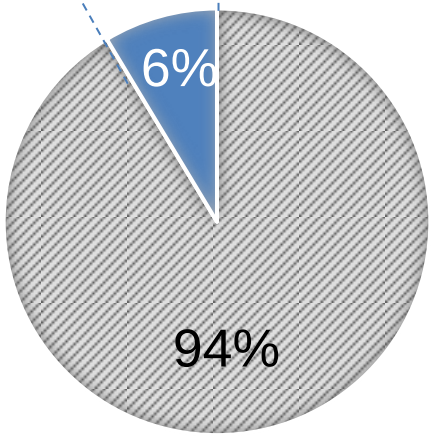
Protein self-sufficiency

Local Global

~ 7 fold increase protein imports

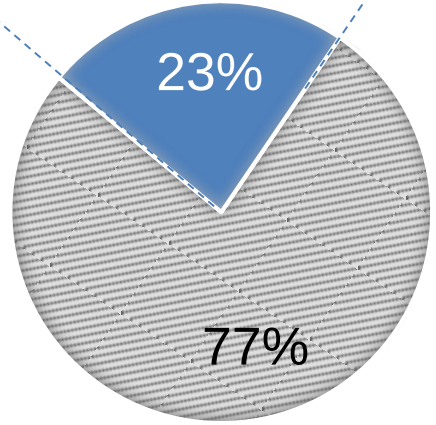
Imports of 0.35 Tg tons of protein

1938



2010

Imports of 2.38 Tg of protein
~ 63% soybean meal



Results summary

- NCE has increased
  - higher share of concentrates is fed to livestock
  - higher share of monogastrics

- At the expense of
  - increased use of human edible protein
  - increased dependence on globally sourced protein

Conclusion

- Even if NCE in the livestock sector has generally increased, we need to keep in mind that feeding inputs and livestock products are just a part of the system

- Research on nitrogen use with a broader perspective to account to the overall use efficiency in the agro-ecosystem

THANKS FOR YOUR ATTENTION!

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