Nitrogen self-sufficiency
at the suckler cattle farm scale

session 25 n°8

Veysset P., Lherm M., Bébin D.

Unité Économie de l’Élevage INRA Theix, 63122 Saint Genés Champanelle, France

veysset@clermont.inra.fr
Introduction

• French suckler cattle farms are dependent on N inputs (concentrates and chemical fertilisers) to provide for their requirements

• In 2001, the agricultural nitrogen balance in France showed a 19% surplus
Nitrogen balance

\[ N \text{ balance} = \sum \text{Inputs} - \sum \text{Outputs} \]

Inputs (purchases)
- Fertilisers
- Concentrates
- Forages
- Straw
- Animals

Outputs (sales)
- Animals
- Grain
- Forages
- Straw

Farm
N balance: results

72 Charolais suckler cattle farms 2002

N inputs

total inputs = 57 kg N/ha

N outputs

total output = 16 kg N/ha

Surplus balance = +40 kg N/ha
Objectives

• Can the N self-sufficiency be an objective for the suckler cattle farms?
  – Proportion of cash crop and fodder area?
  – Which cropping plan?
  – Which types of animals produced?
  – Which economic results?
Definitions

- Feed N self-sufficiency %
  \[100 - \left( \frac{\text{N purchased feeds}}{\text{N consumed feeds}} \right) \times 100\]

- Global N self-sufficiency %
  \[100 - \left( \frac{\text{total N purchased}}{\text{total N used}} \right) \times 100\]
Materials and methods

• Search for N self-sufficiency: use of a LP model (Opt ’INRA) for optimising farming systems, by maximising the overall gross margin, under constraints

• Farm studied:
  – Mixed crop-livestock Charolais, 185 ha, 50% cash crop, 70 calvings, store males, fat females
  – Economic situation 2002
Hypothesis

• Substitution purchased cakes / protein-rich plants crop (2.5 t/ha)
• Taking into account legume N
• N balance = +30 kg/ha/year
• With no N input:
  – Herd productivity criteria =
  – Cereal yield: -15 to -25%
  – Pasture yield: -5 to -15%
Results:
Feed N self-sufficiency

- Calvings: - 5 (64 vs 69)
- Fodder area: - 6 ha
- Prot. plants: 11 are/calv.
- Area devoted to the herd =
- Fattening 50% =
- Product : - 2 400 €
- Costs : - 2 400 €
- Gross Margin =
Results:
Global N self-sufficiency

33% legume
- Calvings: +24 (93 vs 69)
- Cash crops: - 64 ha
- Area devoted to the herd: 89% total area
- Fattening: 52%
- Product: - 25 K€
- Costs: - 13 K€
- Gross Margin: - 10%
Results: Global N self-sufficiency

50% legume

- Calvings =
- Cash crops: - 39 ha
- Area devoted to the herd: 75% total area
- Fattening: 100%
- Product: - 19 K€
- Costs: - 10 K€
- Gross Margin: - 7%

EAAP, 56th Annual Meeting, Uppsala, June 5-8 2005
Substitution price of chemical N fertilisers

Market price of chemical N: 0.60 € / Kg
Conclusion (1)

• French suckler cattle farming:
  – High French feed unit self-sufficiency > 90%
  – N self-sufficiency from 50% (mixed crop-livestock farms) to 90% (grassland farms)

But
  – N balance (out of legume) = +40 kg/ha/year
  – low «polluting potential»
Conclusion (2)

- Global N self-sufficiency = technical mastery
  - complementarity crop / livestock farming
  - legume and rich-protein plants cropping
  - long crop rotations
  - renunciation of the maize-soya model
- Promoting the marketing value of this technical mastery?
  - Decrease of the product, low decrease of the costs
  - Gross margin on the best the same (with more labour)
Conclusion (3)

• «Repressive» incentives to the N self-sufficiency:
  – water law, the polluter pays principle
  – nitrate guideline
  – taxation and/or price increase of the inputs

• «Positive» incentives to the N self-sufficiency:
  – Non GMO production and processing network
  – Better sale price of environment-friendly produced agricultural commodities