

European Nitrogen Assessment

Chapter 10: Nitrogen flows in farming systems across Europe

Supplementary material: Documentation of farm N budgets

Author: Hutchings, N.

Farm N budgets were calculated for typical Danish conventional dairy, organic dairy, beef (suckler), pig and arable farms. The method adopted was based on that used in the Farm-N budgetary model, the details of which can be found at http://www.fasset.dk/Upload/Fasset/Document/FARM-N_scientific_description.pdf. In brief, a farm N balance or surplus is first calculated, by using, largely, measured data. The exceptions are the inputs of N from the atmosphere by deposition and biological N fixation. The former is obtained from the Danish N deposition model whereas the latter is obtained by multiplying the area of N fixing crops with crop-specific N fixing rates. Gaseous emissions of N from animal housing, manure storage and field-applied manure are calculated using emission factors. Gaseous emissions of N from denitrification in the soil are calculated by using a simple empirical model. Changes in N storage in the soil are calculated with a simple process-based dynamic model. The sum of the N losses and changes in soil N storage will invariably differ from the farm N balance. Since the latter is considered to be estimated with greater certainty than the former, an adjustment algorithm is used to remove the discrepancy. Details of this algorithm can be found in the Farm-N documentation indicated above.

1. For all farm types

Atmospheric deposition is set at a typical Danish value of $15 \text{ kg ha}^{-1} \text{ year}^{-1}$, N. The minor input of N in seed is calculated using typical seeding rates and concentrations of N in seed.

2. Cattle farms

The data used for the cattle farm budgets reflect the situation in 2002. Full details can be found at: http://lcafood.dk/processes/agriculture/N_balance_dairyfarms_2002.htm. Note that the method of partitioning of the N surplus in the latter document differs from that used here. The emission factors used on the cattle farms are shown in Table 10.S1 below.

Table 10.S1 Emission factors used for cattle farms

	Gaseous emission factors (% of total N)		
	NH ₃ emission housing		
Cubical housing/slatted floor	8.2%		
Deep litter	6%		

	NH ₃ emission storage	N ₂ emission storage	NH ₃ emission field
Slurry	2%	0%	10% (trailing hose)
FYM	30%	5%	4% (incorporated)
Grazing			7%
Fertiliser			2%

3. Pig and arable farms

For the pig and arable farms, the same crop rotation is used. The data used are shown in Table 10.S2 below.

Table 10.S2 Pigs and arable

Soil			
Soil type	Clayey-sandy		
Previous use	pig farming		
Irrigation	no		
Crop rotation			
spring barley		30 ha	
spring barley	Grass cover crop	10 ha	
winter wheat		40 ha	
winter rape		10 ha	
Livestock			
	Livestock present	Production	Housing
Sows	140	23.2 piglets year ⁻¹ , weaned at 7.2 kg	Housing; partially slatted floor (pregnant), fully-slatted crates (lactating)
Weaners	3200 yr ⁻¹	7.2 to 30 kg	Housing; fully-slatted floor
Finishers	3150 yr ⁻¹	30 to 100 kg	Housing; fully-slatted floor
Gaseous emission factors (% of total N)			
	NH ₃ emission housing		
Slatted floor	15%		
	NH ₃ emission storage	N ₂ emission storage	NH ₃ emission field
Slurry	3%	0%	9%
Fertiliser			2%