

'Walloon action plan for nitrogen sustainable management in agriculture'
Prospective modelling of nutrient transfer in surface water and groundwater

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Walloon Region transposed the nitrate directive (EEC/676/91) into the "Walloon action plan for nitrogen sustainable management in agriculture" (PGDA1) in 2002. In 2007, a second plan was build up to reinforce some topics (PGDA2). The aim of the present study is the hydrological modelling of these plans, on a regional scale, from 2000 to 2015, to forecast their mid term effects concerning nitrogen transfer in surface water and groundwater.

The modelling used EPICgrid-model, developed in Gembloux Agricultural University. This model is a major evolution of EPIC model proposed by Williams (1995), tightly-coupled with a GIS. All the data bases concerning meteorology, pedology, land use,... are distributed using a regular grid of one kilometre cells across all Walloon Region. Agricultural practices are taken into account by agricultural region. Inside each grid cell, homogeneous entities are identified. Hydrology and nutrient transfer are modelled. The relative area of each entity is used to balance the water and nutrient flows for each cell. Available data permit actual daily modelling from 1971 to 2005. Validations of this modelling tool are available concerning water flows, soil moisture, plant growth and nitrate leaching.

The Walloon action plan includes some newly mandatory practices which were modelled aside before law publication. For example, the effects of intercrop's date of ploughing on nitrogen and phosphorus transfer were modelled for three agricultural regions and different crop rotations. The results show that after end of November, date of ploughing does not impact anymore nitrogen losses from root zone.

Pre-normative modelling was also realised to assess sensitivity of nitrogen losses to standards in manure spreading in the Walloon agricultural context. For example, a spreading standard of 120 organic N-unit on a four years rotation (sugar beet-wheat-corn-wheat) leads to 81NO₃ mg/l in leaching water under the root zone. A standard of 80 organic N-unit (using the same mineral amount of nitrogen) leads to 41NO₃ mg/l (annual mean on 30 years of climate modelling).

The Walloon plan includes, among other things, spreading standards about maximum quantities, inter-annual spreading limitations, date of spreading limitations and conditions of spreading limitations. The results of the prospective modelling show that PGDA1 does not induce reduction of nitrogen transfer to groundwater but a reduction is observed after the application of PGDA2. It's also important to notice a major effect of five consecutive years of high rainfall level from 1998 to 2002 which conducted to a nitrogen profile modification in the soil where high amounts of nitrogen were leached down.