



## PAPER 13

### Water quality requirements limit the use of manure in Dutch dairy farming systems

Schröder, J.J., Aarts, H.F.M., Verloop, J.

Wageningen University and Research Centre, P.O. Box 16, 6700 AA Wageningen, The Netherlands

EU member states define permitted manure application rates in Action Programs (AP's). These AP's are scrutinized by the EU Commission and hence need an underpinning. Numerous factors among which weather, soil type, manure composition and management, crop type, harvest regime, and environmental targets, determine which combinations of manure and mineral fertilizer are justifiable. The model that we developed to handle this complexity is based on field experiments and data collected on commercial farms. It includes the relationship between N and P inputs and surpluses and between the N surplus and the N concentration in upper groundwater (sandy and loam soils) or neighboring surface water (clay and peat soils).

When targeting at a N concentration of at most 11.3 mg N per liter and a P surplus of 0 kg per ha, model runs show that permissible annual manure rates (including dung and urine excreted during grazing) range from 300 kg manure-N (48 kg P) per ha (good growing conditions, clay soil, cut grass only) to 190 kg manure-N (30 kg P) per ha (suboptimal growing conditions, dry sandy soil, 70% grassland with mixed use of cutting and grazing and 30% silage maize). Judicious supplements of either mineral fertilizer N or biologically fixed N are needed to exploit the manure P, thus avoiding P accumulation, whilst limiting risks of N leaching. The simulated mineral fertilizer rates corresponding to the above manure rates and conditions, are 270 and 110 kg N per ha, respectively.

The permitted manure rates stipulated in the current Dutch AP, 42-44 kg P and 250 kg N per ha for most dairy farms, have strongly reduced the room for manure application on these farms. Hence, intensive dairy farms in particular are confronted with costs to export manure and to purchase additional mineral fertilizer N to compensate for this export. This stimulates further measures to reduce the excretion of N and P per unit milk (e.g. via low protein diets, or by limiting the number of followers), to increase the amount of available N per unit applied manure P (by limiting N losses from storage, land spreading and soil), or to decrease the amount of P per unit manure N. The latter can be achieved by slurry separation. The solid fraction, rich in P, is less bulky and can be exported at lower costs to arable farmers. The widened N (largely ammonia-N) to P ratio of the remaining liquid fraction matches better with the requirements of forage crops. Mineral fertilizer N could thus be partly or largely substituted with treated manure, depending on the quality of the separation process.

EU Directives are as yet unclear about the extent to which the compliance with environmental targets may be evaluated after averaging in space and time or not. For individual farms it makes a difference in terms of permissible rates, however, whether compliance is needed in every year under each field or whether a multi year regional compliance suffices.

In summary, our calculations show that the inputs of manure and fertilizers must be regulated. There is little justification, however, for uniform rules that ignore the many factors determining water quality, unless one does not mind that regulations are too mild in one situation and unnecessarily strict in another situation.