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Evaluation of outputs from a 'Sustainable Nutrient Management Decision Support System' (SNM-DSS) compared to farmer opinion

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Eutrophication of both fresh and coastal water bodies is one of the greatest threats to water quality in Europe and other developed countries. Sources of pollution are multiple but agriculture is known to be a large contributor, due to farm nutrient management such as land spreading of fertilisers and their subsequent loss via overland flow to surface waters. The stringent targets set for compliance with the Water Framework Directive by 2015 have led to action by the Irish regulatory authorities to reduce risk and prevent further deterioration of water status. One step was to prohibit the spreading of fertilisers over the winter period, with closed periods in 3 zones based on annual rainfall statistics. While this calendar approach is supported by scientific evidence, its justification has been debated by the farming community. A consequence of the regulation has been the concentration of hazard on dates directly preceding and following the closed period when soils can be heavily loaded with organic slurries and manures. An alternative lies in a Sustainable Nutrient Management Decision Support System (SNM-DSS), which has been developed to predict optimum conditions for fertiliser application depending on real-time observations of soil and weather conditions. The Hybrid Soil Moisture Deficit (HSMD) model forms the basis of this system and is essential for defining the thresholds for optimum management. The model outputs were tested against field water content data (θ) and evaluated by comparison with farmer opinion over a 3-year period. Daily Soil Moisture Deficit (SMD) was calculated from weather data collected on 5 sites and θ was estimated using time domain Reflectometry probes on 10 fields (2×5 sites). The question "Can slurry be spread today?" was also answered on a daily basis by 6 farmers located at the instrumented sites and the responses were related to calculated SMD values. A significant relationship between SMD and θ for all test sites showed that the HSMD model acceptably captured temporal variations in θ, suggesting that it should be able to predict when risk of nutrient transport by gravity moveable water is high. It was also found that the decision whether to spread the nutrients was determined by soil moisture conditions relative to field capacity. According to farmer opinion, slurry should not be spread when the soil is at or wetter than field capacity but conditions would be suitable when drier. The HSMD model showed great potential and could therefore be used as a core component in a decision support tool for daily farm management practices such as slurry spreading. Although the SNM-DSS has been designed to work at the farm scale, such tools should be able to devise sustainable nutrient management plans for agricultural catchments.