The double dividend from efficient nutrient management of phosphorous inputs on intensively farmed agricultural land

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Within the constraints of the EU Nitrates and Water Framework Directives, controlling and managing nutrient transfers to water from excessive fertiliser use on agricultural land is a significant environmental policy challenge. This paper assesses whether there is room for land managers to reduce phosphorus inputs by exploring the extent of its' over application using data envelopment analysis methodology.

Data envelopment analysis (DEA) is a deterministic approach to efficiency measurement. It measures the relative efficiency of a decision making unit (DMU) by comparing relative inputs to outputs. DEA establishes the most efficient DMU's (farms) and compares all others to the most efficient. The method uses linear programming to place a non-parametric frontier over the data. This frontier consists of the most efficient DMUs and all other DMUs are measured by their relative distance to this frontier as a measure of their level of efficiency (Coelli et al., 1998).

The main data source employed in this analysis is the Teagasc National Farm Survey (NFS) 2008. The NFS is collected annually as part of the Farm Accountancy Data Network requirements of the European Union. A farm accounts book is recorded on a random representative sample of farms throughout the Republic of Ireland (Connolly et al., 2009). This paper concentrates on specialist dairy and tillage farms. These agricultural systems are the most intensive and may pose the greatest risk in terms of managing nutrient transfer from agricultural land to water courses. The analysis was undertaken and stratified by soil type.

Results demonstrate considerable inefficiency in the utilisation of phosphorus fertilisers across these systems. Average over application compared to efficient benchmark farms ranged from 3.0 to 3.3 kg P ha^{-1}. Average excess application of P through imported feedstuffs of between 0.95 to 1.58 kilogrammes / livestock unit was indicated on dairy farms. Potential cost savings on chemical fertilisers across all systems on average ranged from €36 ha^{-1} to €50 ha^{-1} of which approximately €11 ha^{-1} was attributable to phosphorous. While potential cost savings on imported feeds of €68 to €113 per livestock units were indicated on dairy farms. Such reductions have the potential to deliver a double dividend by reducing the risk of nutrient leaching and diffuse pollution from agricultural land while improving economic margins at farm level.

Coelli, T.J., Prasada Rao, D.S., O'Donnell C.J. and Battese G.E., 1998. An introduction to efficiency and productivity analysis, 2nd edition, Springer.

Connolly, L., Kinsella, A., Quinlan, G. and Moran, B., 2009. National Farm Survey 2008.