

# Working with farmers to make the most of soil nutrients for eco efficiency – The PROSOIL PROJECT

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## Abstract

Working with key industry stakeholders and farmers, the PROSOIL project aims to achieve a better understanding of soil and nutrient management to optimise farm productivity. Linked to IBERS research that is scientifically determining the impact of improving soil health on forage and livestock productivity and quality, farmer participation is a key part of the dissemination. Eight commercial development farmers (CDF), who volunteered during a series of events, are working with IBERS Grassland Development Centre to explore the effects of their farming practices on soil health and productivity by making field-scale measurements. The farms represent different agriculture sectors including three dairy farmers who use a range of systems for recycling animal manures and other soil nutrients. Results from the CDF, including the implications of nutrient management methods, and a survey of Welsh dairy farmers' soil nutrient management practices will be presented. Findings are disseminated through a range of knowledge exchange methods, from indirect factsheets to active learning through participation that encourages farmers to actively adopt and evaluate soil management approaches when they meet, discuss and share results.

**Keywords:** soil health, soil nutrients, slurry, earthworms, management

## Introduction

PROSOIL aims to develop producer-led co-operation across Wales to better understand and improve soil management to optimise farm productivity; to scientifically determine the impact of improving soil health on forage and livestock productivity and quality; and to disseminate key findings. Linking the farmers' activity to the studies at the university is central to the project.

## Materials and methods

To ensure active participation, eight commercial development farmers were selected from a pool of forty-two farmers who volunteered to be part of the project which was promoted at a range of agricultural events in Wales. Selection was based on geographic region, farm type and suitability of both resources and the farmer's enthusiasm and interest in soil management. The three dairy farmers selected management options that focussed on soil nutrient management which included slurry aeration, use of anaerobic digestate and slurry analyses to guide application rates. The farmers also monitored the project fields including counting earthworm numbers as an indicator of soil health. Using data from the dairy farmers questioned in a soil management survey, results were collated on key nutrient questions.

## Results and discussion

On Farm 1, analysis of slurry and manipulating its application was of key importance in cutting fertiliser use and for farming within the Nitrate Vulnerable Zone (NVZ) rules. Its variability (dry matter ranged from 2.6 to 10.7%, and the total value of the nutrients ranged from £22 to £54.59 per 10 m<sup>3</sup>) demonstrated how the standard 'RB209' book values (Defra, 2010) are useful only as a guide. Using a trailing shoe maximized the use of available nitrogen in slurry and contributed to meeting the needs of entry to the Welsh agri-environment scheme 'Glastir'. It also reduced slurry damage to the leys and reduced slurry odour in an urban area. On Farm 2, the liquid digestate (feedstock included breadwaste,

Table 1. Financial value of on farm slurries and liquid digestate (£/10 m<sup>3</sup>)<sup>1</sup> on PROSOIL commercial development farms.

Years 1-4	Farm 1	Farm 2	Farm 3	Farm 3
£/10 m <sup>3</sup>	Dairy slurry	Liquid digestate	Aerated slurry	Non-aerated slurry
Highest	54	107	63	50
Lowest	22	47	33	6
Mean	40	73	44	31
RB209	44	44	44	44

<sup>1</sup>Calculated as the fertiliser value based on N, P and K content at 80, 66 and 47 pence kg<sup>-1</sup> respectively, and based on current UK prices.

slurry and apple pomace) was consistently higher, averaging £73 per 10 m<sup>3</sup> with a range of £43-107 per 10 m<sup>3</sup>. (The 'RB209' standard value for slurry is £44 per 10 m<sup>3</sup>). On Farm 3 the mean increase in the value of aerated slurry pre-application was £13 m<sup>-3</sup> rising to a difference of £27 m<sup>-3</sup> at the lowest estimated values.

The results of a survey of 66 dairy farmers in Wales showed that 79% did not obtain analyses of their slurries or manures to guide application rates of manures and fertilisers. However, 63% did change their fertiliser applications to follow a whole-farm nutrient management plan.

Earthworms are essential to healthy soils including soil formation and for the NPK value of their casts. On the 3 dairy farms the economic value of soil formation by earthworms was estimated from earthworm counts at key times of the year (Sandhu *et al.*, 2008), at between £2.63 and £3.39 ha<sup>-1</sup> year<sup>-1</sup>. Using the average biomass per earthworm from IBERS plot data of 0.37 g and that 1000 kg of earthworms can turnover 1000 kg soil ha<sup>-1</sup> (Sandhu, 2008) the value was estimated from the current price of topsoil at £78 Mg<sup>-1</sup>. On farm 2, under different management methods the value of soil formation by earthworms was estimated as £3.67 under ryegrass and no digestate and £4.51 ha<sup>-1</sup> year under red clover receiving digestate application. The PROSOIL commercial development farmers regularly counted earthworms and an economic value was calculated; however, from the survey just 30% of the farmers questioned counted earthworms in their soils.

## Conclusions

Dairy farmers in the PROSOIL project were able to understand the value of slurry and digestate by routinely analysing its nutrient content and adjusting their fertiliser applications to meet grassland needs. The variation from the standard RB209 figures highlights the importance of slurry/digestate analyses in soil nutrient management from both an economic and environmental perspective. Participation in the PROSOIL project enabled farmers to share these experiences with other farmers. The survey highlighted that although more than half the farmers followed a whole-farm nutrient management plan, only 31% had their slurries and manures analysed. There is potential to improve economic and eco efficiency of dairy farmers in Wales by improving the understanding of the value of manure analyses and slurry treatments through further participative learning.

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## References

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