Operationalising methods for minimising soil compaction and reducing soil erosion and diffuse pollution risk from wheelings in winter cereals

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Recent UK government-funded research has shown that compacted, unvegetated tramlines wheelings can represent an important source and transport pathway, which can account for 80% of surface runoff, sediment and phosphorus losses to edge-of-field from cereals on moderate slopes. For example, recent research found 5.5-15.8% of rainfall lost as runoff, and losses of 0.8-2.9 kg TP/ha and 0.3-4.8 T/ha sediment from tramline wheelings. A new project is now underway investigating the most cost-effective and practical ways of operationalising methods for managing tramline wheelings in autumn-sown cereal systems to reduce the risk of soil compaction from the autumn spray operation and the associated risk of surface runoff and diffuse pollution loss of sediment, phosphorus and nitrogen to edge-of-field. The project is focusing on the over-winter period when soils are close to field capacity and the physical protection of the soil surface granted by the growing crop is limited. The experiment, at three years on four sites with contrasting soils on moderate slopes, is investigating the relative importance of soil compaction, rather than the lack of vegetation cover, in accounting for the much greater losses of surface runoff, sediment and P loss identified down tramline wheelings compared to the uncompacted, cropped area.

This paper outlines methodologies and preliminary results, which include

- hillslope-scale event-based evaluations of the effectiveness of novel mitigation methods on surface runoff and diffuse pollution losses to edge of field,
- cost-effectiveness assessments of the economic and practical viability of mitigation methods,
- modelling the impact on water quality of implementing the most promising techniques at farm and catchment scale.

Initial data on soil physics (e.g. near-surface compaction, bulk density), and surface losses of runoff, phosphorus and sediment, are presented showing the impact of low ground pressure tyres compared to conventional systems, and evaluating the effect of drilling tramline wheelings (and using GPS systems to support autumn crop spraying). Subsequent monitoring is also exploring the cost-effectiveness of techniques to lift the soil compaction caused in the autumn using novel, recently-patented tools developed by machinery manufacturers for attachment to the sprayer unit.

Results from such applied, field scale cost-effectiveness studies provide evidence to support the identification and targeting of practical pollution control measures in the landscape; improve our process understanding of the response of soil systems to land management practices; help inform farm-scale evaluations of diffuse pollution risk; develop practical recommendations to the farming industry; and yield data to parameterise and refine diffuse pollution models at a range of scales.

Silgram, M., Jackson, R.J, Bailey, A.P., Quinton, J.N, 2010. Field-scale runoff, suspended sediment, and nutrient losses from disrupted and untreated tramlines. *Earth Surface Processes and Landforms* (DOI:10.1002/esp.1894).