The effect of slurry application technique on Phosphorus loss in overland flow

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Agriculture makes a significant contribution to phosphorus (P) levels in Northern Ireland's waterways, and as such, action is required to reduce P losses from agricultural soils. With livestock manures a significant source of P, there is increasing interest in spreading techniques that minimise P losses following slurry application. To address this, an experiment was conducted to examine the impact of a range of slurry spreading techniques on P loss in overland flow.

Six treatments were investigated in a split-plot design experiment: control (no slurry), splashplate, injection-horizontal to the slope, injection-vertical to the slope, trailing shoe-horizontal to the slope and trailing shoe-vertical to the slope. Treatment plots (0.5 m^2) were set out in four blocks (6 treatments within each block). Treatments were simulated by hand application of slurry. Slurry was applied to silage stubble immediately post harvest. Slurry was applied at a rate of 40 m^3 $ha^{-1.}$ Volumetric soil moisture content was equal to field capacity at application. Overland flow was generated at days 2, 9 and 30 post slurry application using two portable rainfall simulators (Amsterdam design) which simulated rainfall at a rate of 40 mm hr^{-1}. Runoff was generated for a period of 30 minutes, collected and analysed for dissolved reactive P (DRP), particulate P (PP) and total P (TP). Data was analysed using SPSS.

	Treatment							
	Control	Splashplate	Injection Horizontal	Injection Vertical	Trailing Shoe Horizontal	Trailing Shoe Vertical	SIG	SED
DRP (mg/l)	0.54^{a}	1.75^{d}	1.10^{bc}	0.91^{b}	1.06^{bc}	1.30^{c}	***	0.361
PP (mg/l)	0.98^{a}	4.44^{c}	4.14^{bc}	2.87^{b}	3.42^{bc}	4.61^{c}	***	0.675
TP (mg/l)	1.60^{a}	6.76^{c}	5.53^{bc}	3.90^{b}	4.78^{bc}	6.19^{c}	***	0.858

Table 1: Flow weighted mean P concentrations measured in runoff at Day 2 post slurry application

Slurry application technique had no significant treatment effect on P runoff at either day 9 and 30 post application due to dry soil and weather conditions. The flow weighted mean P concentrations exported in overland flow at day 2 post slurry application are presented in Table 1. The splashplate spreading treatment exhibited significantly higher levels of DRP in runoff when compared with the injection and trailing shoe treatments ($p<0.001$). Total P concentrations were again highest from the splashplate treatment however this is only significantly different for the injection vertical and control treatments ($p<0.001$). There was no significant difference between application direction employed in the injection or trailing shoe treatments.

In conclusion trailing shoe and shallow injection apparatus both reduced DRP loss following slurry spreading at day 2 post application to silage stubble. It is hypothesised that this is due to a higher rainfall-slurry contact area available in the splashplate treatment. Longer term reductions in P loss were masked by weather conditions at the time of rainfall simulation.