

Supplementary Material

Nitrogen and phosphorus leaching losses under cropping and zone-specific variable-rate irrigation

John J. Drewry^{A,}, Carolyn B. Hedley^B, Stephen J. McNeill^C, Ahmed G. El-Naggar^E, Kishor K. Karakkattu^A, and David J. Horne^D*

^ASoils and Landscapes, Manaaki Whenua – Landcare Research, Private Bag 11052, Palmerston North, New Zealand.

^BLand Use and Ecosystems, Manaaki Whenua – Landcare Research, Private Bag 11052, Palmerston North, New Zealand.

^CInformatics, Manaaki Whenua – Landcare Research, PO Box 69040, Lincoln, New Zealand.

^DSchool of Agriculture and Environment, Massey University, Private Bag 11222, Palmerston North, New Zealand.

^EPresent address: Land and Water Management Department, IHE Delft Institute for Water Education, Delft 2611AX, The Netherlands.

*Correspondence to: John J. Drewry Soils and Landscapes, Manaaki Whenua – Landcare Research, Private Bag 11052, Palmerston North, New Zealand Email: drewryj@landcareresearch.co.nz

Supplementary data

Table S1. Absolute difference in the median load for each hydrological year (kg/ha) for all nutrients and zones.

Nutrient	Zone	2016	2017	2018	2019	2020
Ammonia-N	Zone 1 sandy	-0.03	0.055	-0.163	2.098	-0.081
Ammonia-N	Zone 2 silt	-3.4	0.28	-0.288	-0.305	-0.028
NO _x -N	Zone 1 sandy	-9.0	-1.9	-14	7.9	-2.0
NO _x -N	Zone 2 silt	3.0	-2.0	-14	-3.5	3.7
Reactive P	Zone 1 sandy	0.0007	-0.0018	-0.0105	-0.0003	0.0044
Reactive P	Zone 2 silt	0.008	0.0081	-0.045	-0.0051	-0.0151

Table S2. Median values of soil air permeability, total porosity, pH, exchangeable K, Mg, Ca and sulphate for the zones by depth.

Zone	Depth (cm)	Air permeability (m ²)	Total porosity (%)	pH	K (meq/100 g)	Ca (meq/100 g)	Mg (meq/100 g)	SO ₄ (µg S/g)
Zone 1 sandy	0-20	1.10E-11	50.5	5.4	0.40	5.11	0.86	4.12
	20-40	1.60E-11	46.1	5.4	0.23	2.47	0.41	3.01
	40-60	2.88E-11	46.6	5.8	0.13	2.13	0.32	1.78
	60-80	2.88E-11	47.4	6.0	0.07	2.19	0.34	1.00
	80-100	3.92E-11	47.3	5.9	0.08	1.99	0.30	1.00
Zone 2 silt	0-20	6.10E-12	48.6	5.4	0.24	6.93	1.21	4.86
	20-40	6.70E-12	48.2	5.5	0.13	6.36	0.93	4.24
	40-60	6.41E-12	48.9	5.8	0.10	4.62	0.68	3.25
	60-80	6.18E-12	50.4	5.7	0.10	3.79	0.62	4.60
	80-100	5.76E-12	48.4	5.9	0.08	4.03	0.70	5.76

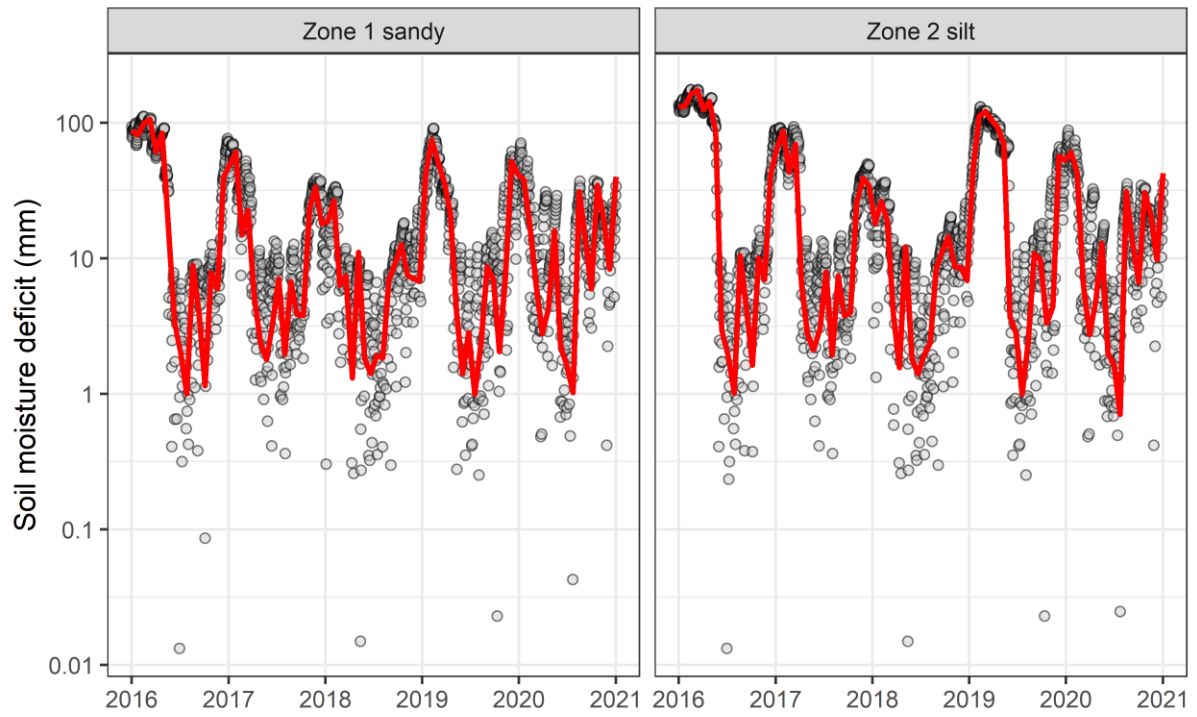


Fig. S1. Soil moisture deficit over time, from the soil water balance, with a smooth loess fit of the data (red lines).

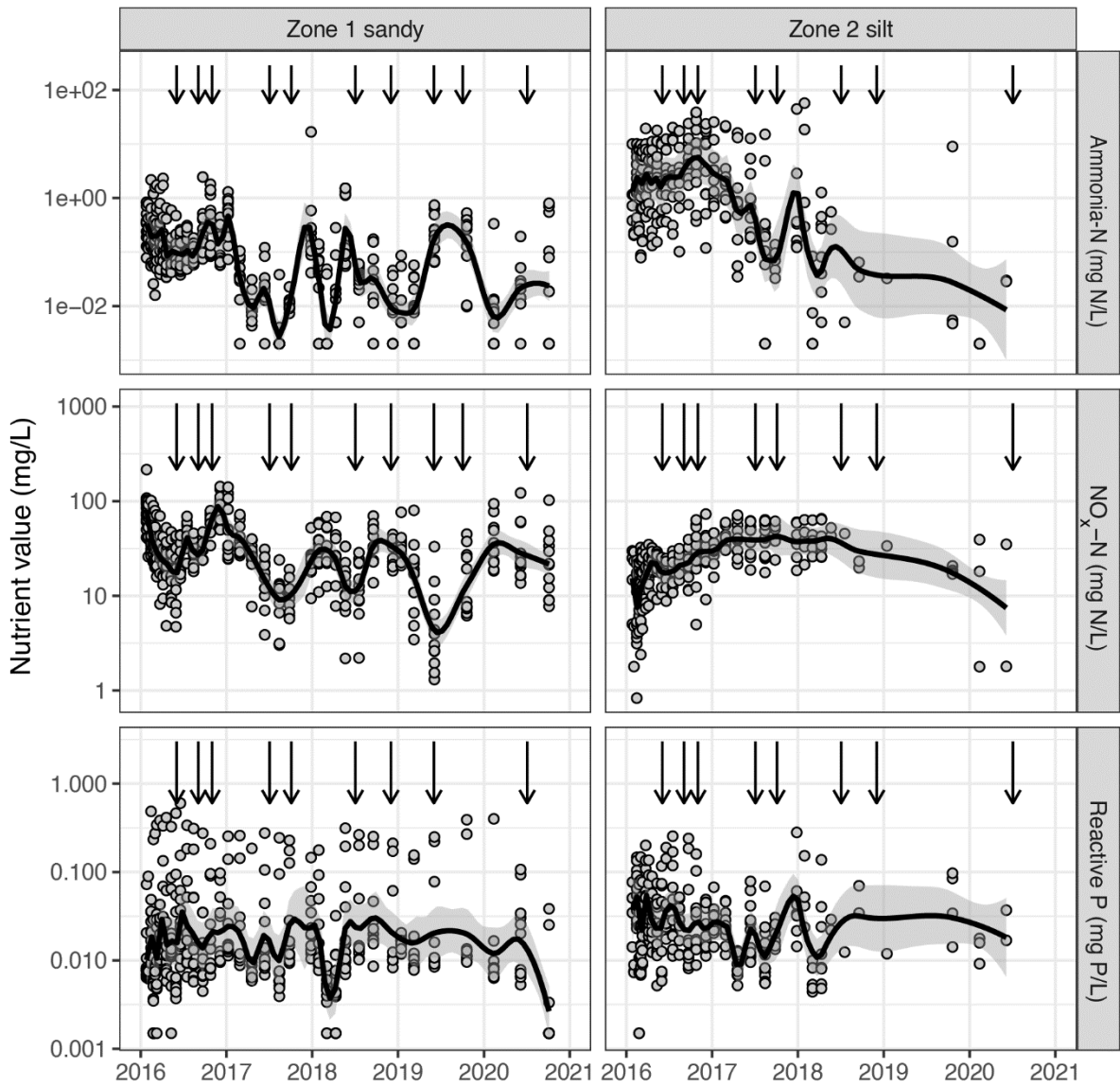


Fig. S2. Drainage nutrient sample data over time, per zone. Each point corresponds to a measurement at a DFM. The solid black line is a smooth loess line fitted to the pooled data from all DFMs within a zone, while the shaded region shows plus-and-minus one standard error from the mean smoothed estimate. Arrows correspond to dates when fertiliser were added in each zone. Note the scale is logarithmic.