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Soil Research

Supplementary Material

A simple incubation test for determining soil dispersion and gypsum rates

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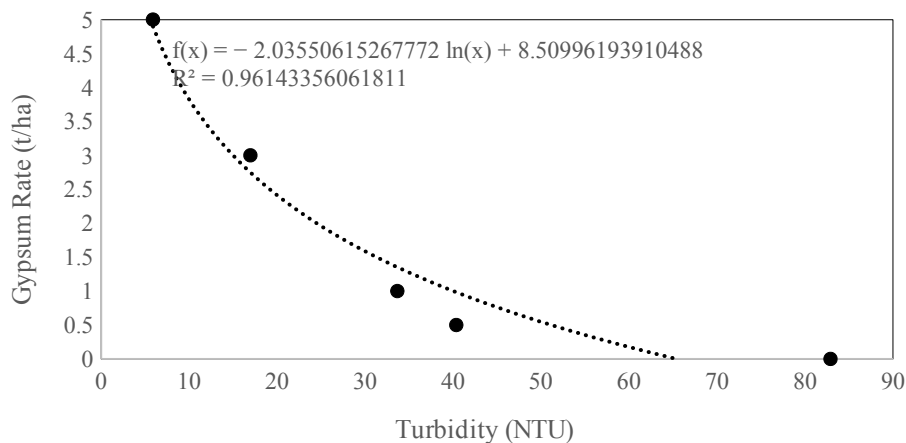
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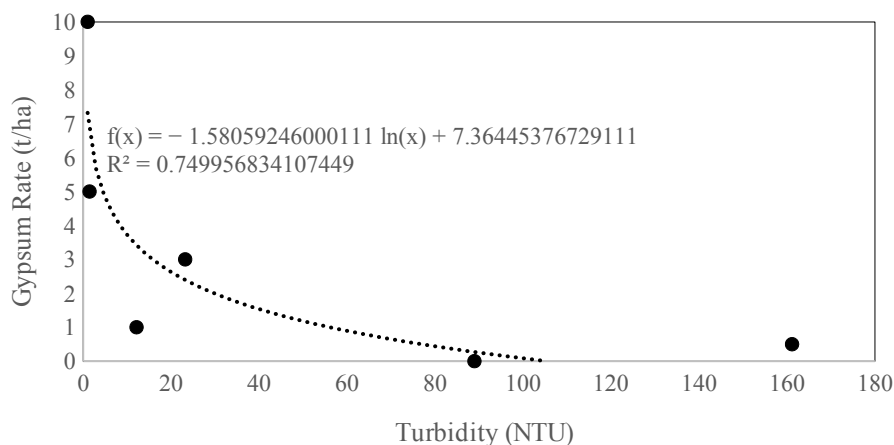
Supplementary Materials – Liang et al.

S1. The relationship between gypsum rates and the mean turbidity values of replicate leachate samples from the soils used in this study. The logarithmic regression formula was used to estimate gypsum requirement: y represents the calculated gypsum requirement (GR) and x represents the target turbidity value (10 NTU used in our case). Note these relationships are shown for soil BIL-2 in the main manuscript.

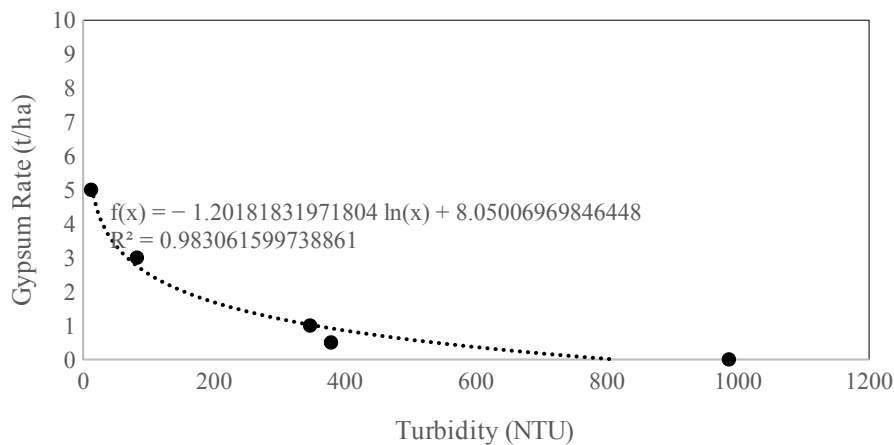
GLV 1 (0-10 cm) - Turbidity (NTU)



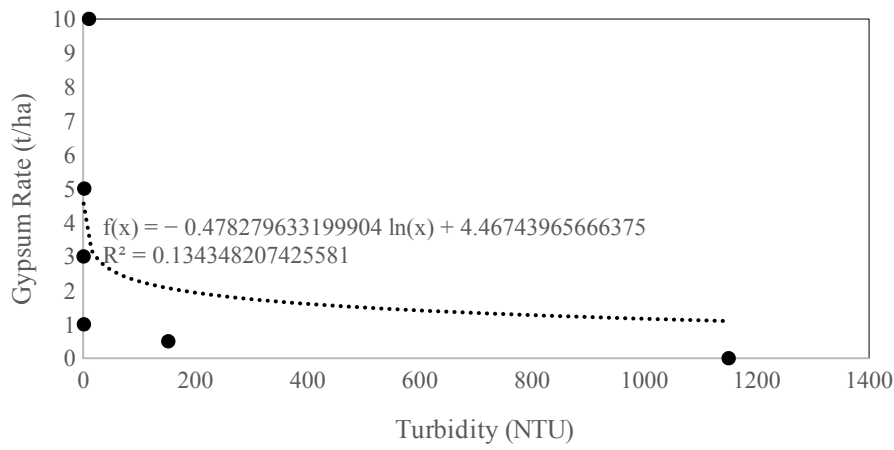
GLV 1 (45 - 80 cm) - Turbidity (NTU)



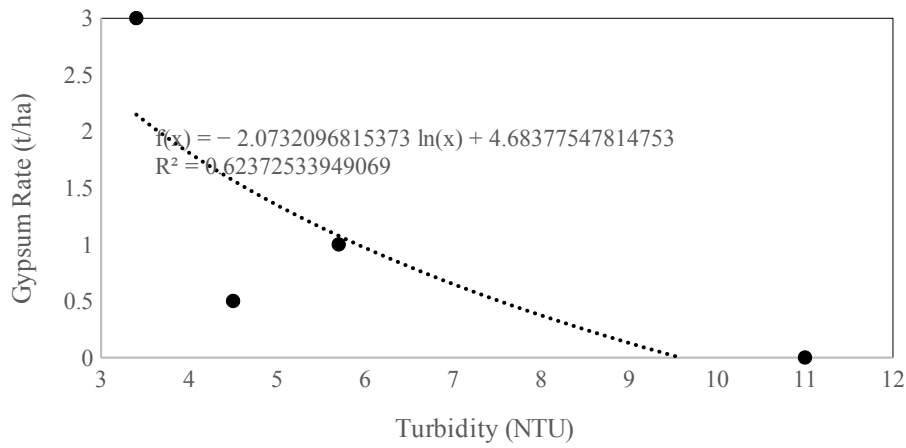
GLV 2 (0-10 cm) - Turbidity (NTU)



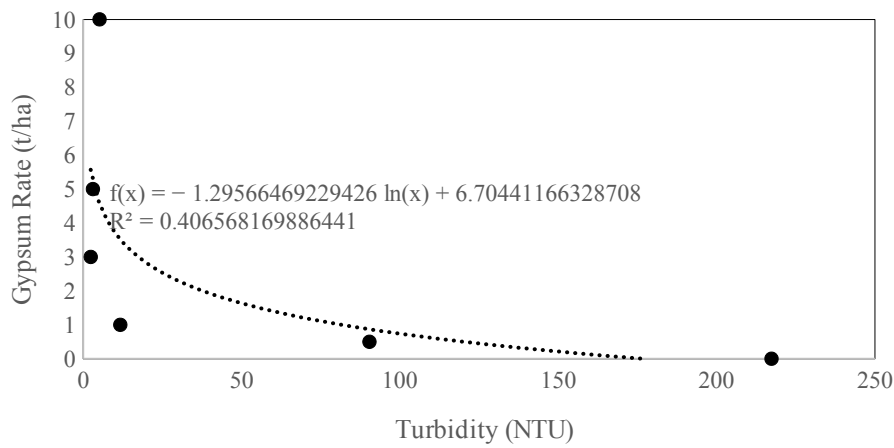
GLV 2 (45-80 cm) - Turbidity (NTU)




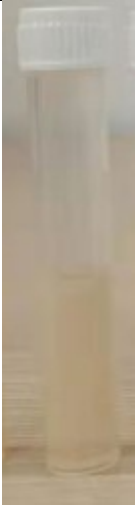

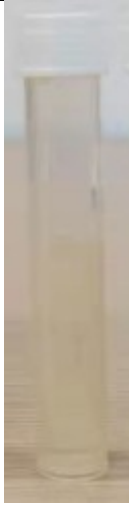

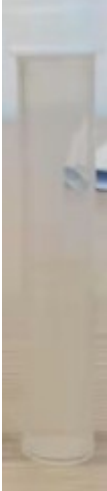


BIL 4 (0-10 cm) - Turbidity (NTU)



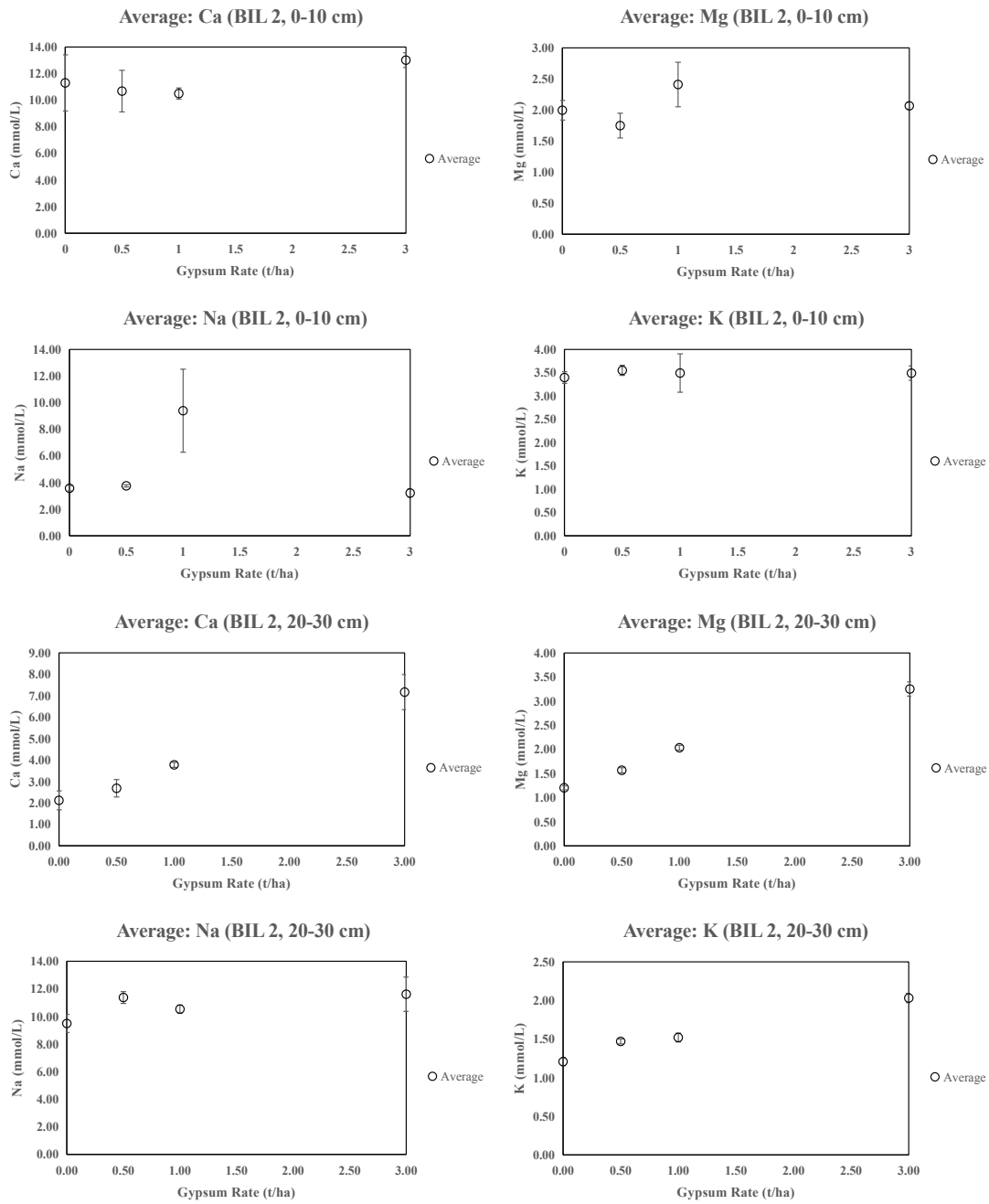
BIL 4 (30 - 50 cm) - Turbidity (NTU)



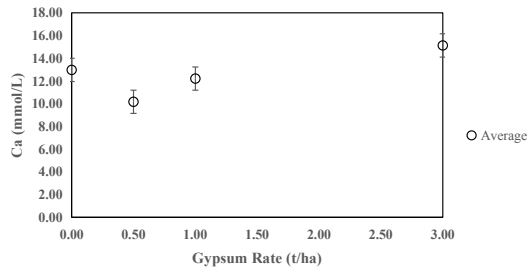
S2: Visual observations of turbidity changes in leachate from BIL 2 (20-30 cm) and BIL 4 (30-50 cm) soil columns with different gypsum amendment rates (GR).

			
BIL 2 (20-30 cm) with GR 0 t ha⁻¹ (control)	BIL 2 (20-30 cm) with GR 0.5 t ha⁻¹	BIL 2 (20-30 cm) with GR 1 t ha⁻¹	BIL 2 (20-30 cm) with GR 1.6 t ha⁻¹
			
BIL 4 (30-50 cm) with GR 0 t ha⁻¹ (control)	BIL 4 (30-50 cm) with GR 0.5 t ha⁻¹	BIL 4 (30-50 cm) with GR 1 t ha⁻¹	BIL 4 (30-50 cm) with GR 1.6 t ha⁻¹

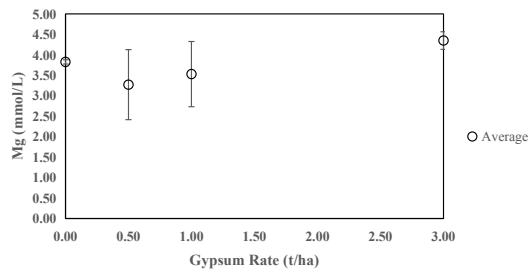
S3. Changes in average concentrations of exchangeable cations (Ca^{2+} , Mg^{2+} , K^+ and Na^+) in the leachate over time during leaching in other seven samples with DI water. Note: GLV 1 (45-80 cm) figures are shown in the main manuscript.



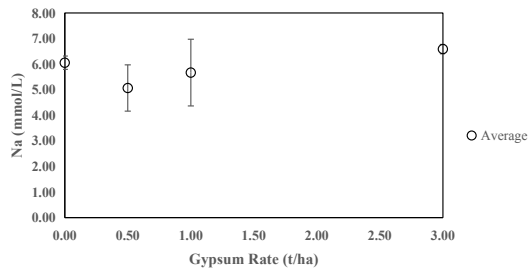
Average: Ca (BIL 4, 0-10 cm)



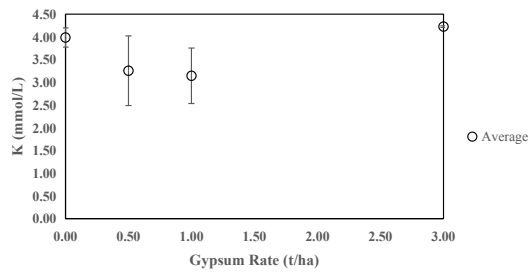
Average: Mg (BIL 4, 0-10 cm)



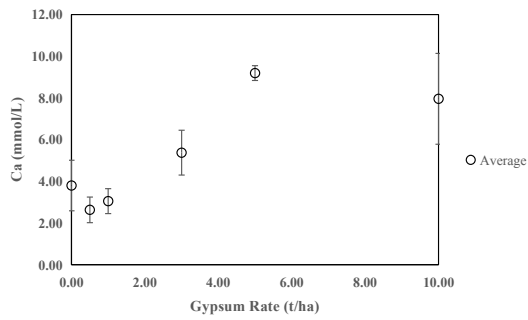
Average: Na (BIL 4, 0-10 cm)



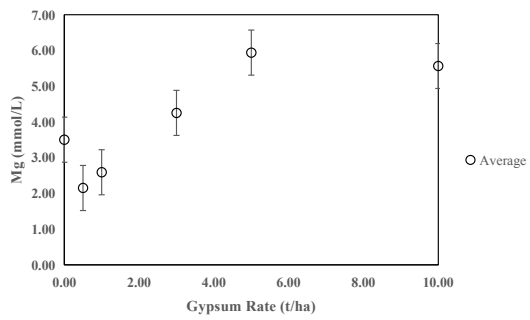
Average: K (BIL 4, 0-10 cm)



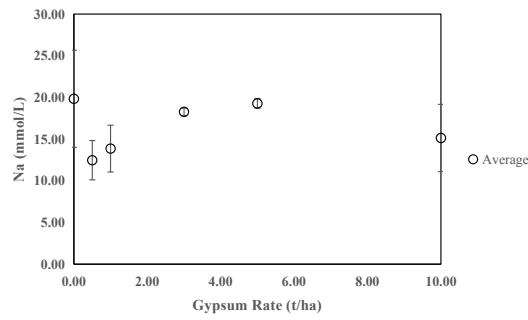
Average: Ca (BIL 4, 30-50 cm)



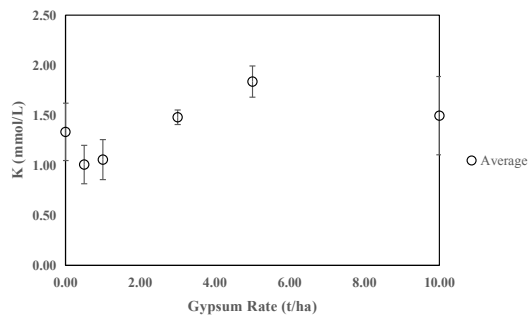
Average: Mg (BIL 4, 30-50 cm)

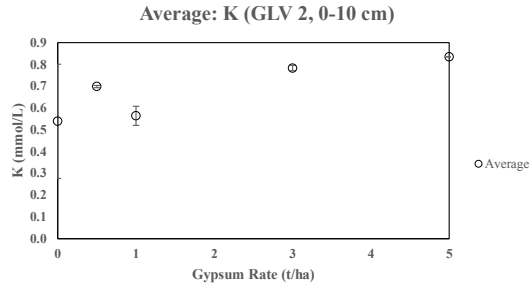
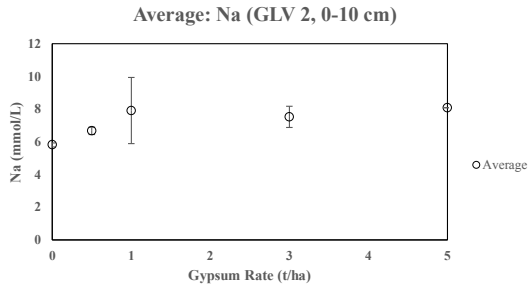
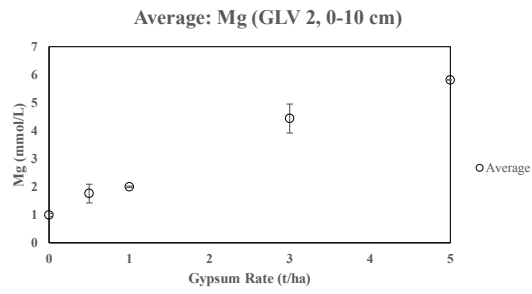
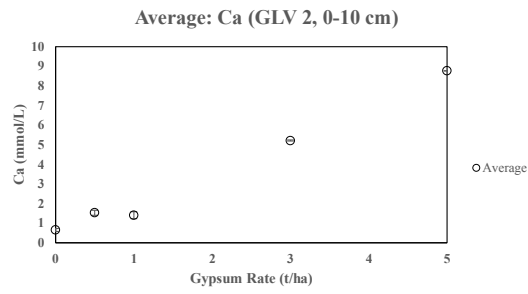
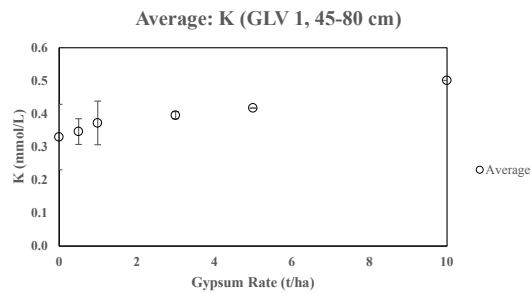
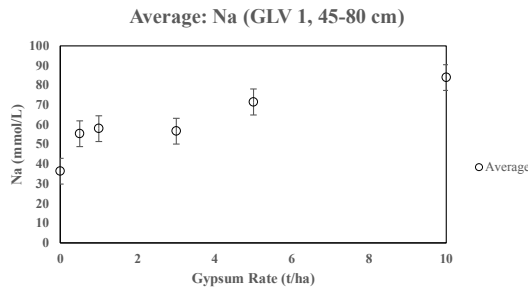
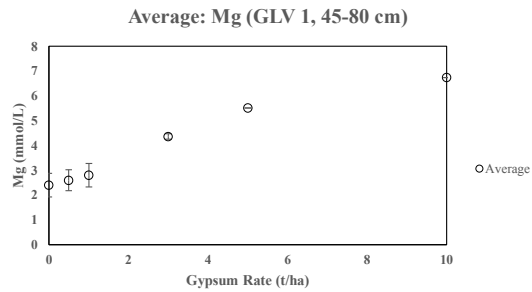
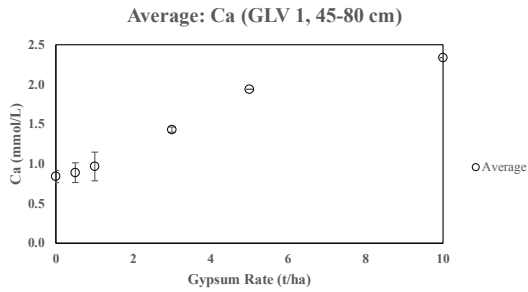
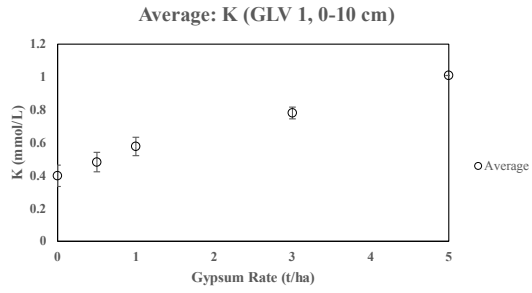
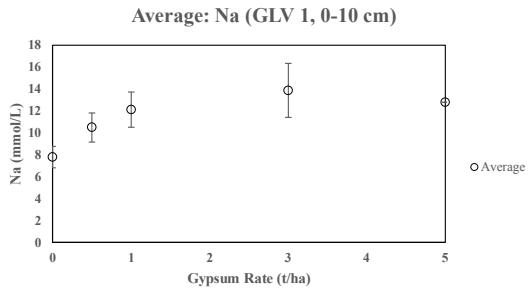
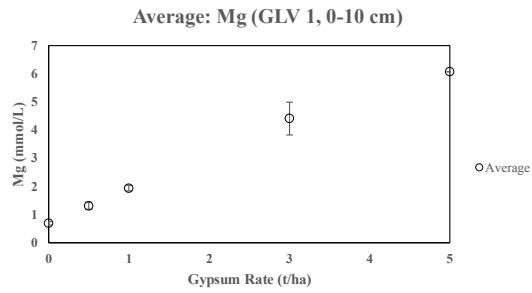
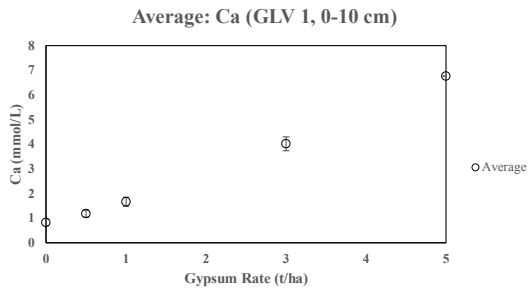


Average: Na (BIL 4, 30-50 cm)



Average: K (BIL 4, 30-50 cm)





S4 The changes of cation concentration (Ca^{2+} , Mg^{2+} , K^+ and Na^+) with 0-10 t ha⁻¹ gypsum rates at in the leachate over time during leaching in other seven samples with DI water.

BIL 2 (0-10 cm) - Mean values of replicates ± Standard Errors				
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹
Ca ²⁺	11.30±2.11	10.68±1.56	10.50±0.42	13.01±0.56
Mg ²⁺	2.00±0.16	1.75±0.20	2.41±0.36	2.07±0.05
K ⁺	3.40±0.12	3.55±0.11	3.49±0.41	3.49±0.15
Na ⁺	3.57±0.20	3.75±0.08	9.39±3.12	3.21±0.33

BIL 2 (20-30 cm) - Mean values of replicates ± Standard Errors				
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹
Ca ²⁺	2.12±0.44	2.68±0.41	3.77±0.12	7.17±0.82
Mg ²⁺	1.20±0.04	1.57±0.05	2.03±0.05	3.25±0.15
K ⁺	1.21±0.05	1.47±0.03	1.52±0.06	2.03±0.06
Na ⁺	9.49±0.65	11.38±0.43	10.53±0.30	11.61±1.24

BIL 4 (0-10 cm) - Mean values of replicates ± Standard Errors				
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹
Ca ²⁺	12.98±1.96	10.17±3.33	12.21±4.01	15.13±0.13
Mg ²⁺	3.83±0.05	3.27±0.85	3.53±0.80	4.35±0.22
K ⁺	3.99±0.21	3.26±0.77	3.14±0.61	4.23±0.02
Na ⁺	6.05±0.26	5.06±0.90	5.67±1.30	6.59±0.18

BIL 4 (30-50 cm) - Mean values of replicates ± Standard Errors						
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹	10 t ha ⁻¹
Ca ²⁺	3.80±1.21	2.63±0.61	3.05±0.60	5.38±1.07	9.19±0.36	7.96±2.18
Mg ²⁺	3.50±1.21	2.15±0.48	2.59±0.48	4.25±0.53	5.94±0.08	5.56±1.58
K ⁺	1.33±0.29	1.01±0.19	1.06±0.20	1.48±0.07	1.84±0.16	1.50±0.39
Na ⁺	19.83±5.83	12.46±2.36	13.86±2.81	18.27±0.45	19.28±0.58	15.13±4.03

GLV 1 (0-10 cm) - Mean values of replicates ± Standard Errors					
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹
Ca ²⁺	0.83±0.13	1.18±0.13	1.67±0.19	4.02±0.29	6.76±0.00
Mg ²⁺	0.69±0.06	1.32±0.12	1.94±0.10	4.41±0.58	6.08±0.00
K ⁺	0.40±0.07	0.48±0.06	0.58±0.06	0.78±0.04	1.01±0.00
Na ⁺	7.80±0.97	10.50±1.32	12.12±1.62	13.88±2.4	12.79±0.00

GLV 1 (45-80 cm) - Mean values of replicates ± Standard Errors						
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹	10 t ha ⁻¹
Ca ²⁺	0.84±0.08	0.89±0.12	0.97±0.18	1.43±0.03	1.94±0.00	2.34±0.00
Mg ²⁺	2.40±0.48	2.60±0.42	2.80±0.47	4.36±0.11	5.52±0.00	6.74±0.00
K ⁺	0.33±0.10	0.35±0.04	0.37±0.07	0.40±0.01	0.42±0.00	0.50±0.00
Na ⁺	36.38±3.97	55.39±5.67	57.97±7.58	56.67±3.66	71.46±0.00	83.92±0.00

GLV 2 (0-10 cm) - Mean values of replicates ± Standard Errors					
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹
Ca ²⁺	0.66±0.31	1.54±0.17	1.41±0.08	5.21±0.11	8.76±0.00
Mg ²⁺	1.00±0.06	1.77±0.33	2.00±0.03	4.44±0.52	5.82±0.00
K ⁺	0.54±0.26	0.70±0.01	0.56±0.04	0.78±0.01	0.83±0.00
Na ⁺	5.81±0.13	6.67±0.22	7.91±2.03	7.53±0.65	8.08±0.00

GLV 2 (45-80 cm) - Mean values of replicates ± Standard Errors						
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹	10 t ha ⁻¹
Ca ²⁺	0.35±0.00	0.32±0.09	0.39±0.12	1.12±0.04	1.71±0.00	2.24±0.00
Mg ²⁺	0.93±0.00	0.87±0.17	1.13±0.38	3.99±0.87	4.86±0.00	6.50±0.00
K ⁺	0.16±0.00	1.35±1.19	0.20±0.00	0.51±0.23	0.28±0.00	0.37±0.00

S5 pH and EC of leachate from soil incubations at different gypsum rates

pH and EC of leachate from BIL 2 (0-10 cm) with 0-3 t ha⁻¹ gypsum rates (Mean values of replicates ± Standard Errors)				
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹
pH	7.22±0.08	7.56±0.29	7.56±0.21	7.82±0.03
EC	1725±48.5	1648±25.0	1895±99.0	1853±49.0

pH and EC of leachate from BIL 2 (20-30 cm) with 0-3t ha⁻¹ gypsum rates (Mean values of replicates ± Standard Errors)				
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹
pH	8.13±0.11	7.86±0.37	8.06±0.22	7.63±0.20
EC	1063±79.0	1182±14.50	1359±15.5	1723±2.50

pH and EC of leachate from BIL 4 (0-10 cm) with 0-3 t ha⁻¹ gypsum rates (Mean values of replicates ± Standard Errors)				
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹
pH	7.94±0.11	7.90±0.06	8.03±0.23	7.99±0.14
EC	2358±184.0	2185±84.50	2265±195	2228±202

pH and EC of leachate from GLV 1 (0-10 cm) with 0-5 t ha⁻¹ gypsum rates (Mean values of replicates ± Standard Errors)					
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹
pH	7.50±0.28	7.16±0.09	7.21±0.11	7.37±0.27	7.43±0.00
EC	538±151.1	941±100.3	1225±125.7	1800±225.8	1962±0.00

pH and EC of leachate from GLV 1 (45-80 cm) with 0-10 t ha⁻¹ gypsum rates (Mean values of replicates ± Standard Errors)						
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹	10 t ha ⁻¹
pH	7.84±0.25	8.17±0.01	7.94±0.11	8.05±0.05	7.65±0.00	7.68±0.00
EC	2249±646.45	3585±575.0	4223±141.9	4780±663.65	5430±0.00	5580±0.00

pH and EC of leachate from GLV 2 (0-10 cm) with 0-5 t ha⁻¹ gypsum rates (Mean values of replicates ± Standard Errors)					
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹
pH	7.74±0.34	7.52±0.33	7.35±0.45	7.57±0.57	6.46±0.00
EC	634.5±76.5	869.5±37.5	1885±24.0	1395±64.0	1818±0.00

pH and EC of leachate from GLV 2 (45-80 cm) with 0-10 t ha⁻¹ gypsum rates (Mean values of replicates ± Standard Errors)						
	0 t ha ⁻¹ (control)	0.5 t ha ⁻¹	1 t ha ⁻¹	3 t ha ⁻¹	5 t ha ⁻¹	10 t ha ⁻¹
pH	7.90±0.00	7.90±0.33	7.76±0.00	8.06±0.28	7.87±0.00	7.81±0.00
EC	1543±0.0	2133±162.5	1654±626.5	3890±660	3580±0.0	4100±0.0