

**Table 1**

Background properties of the agricultural grassland Eutric Cambisol used in the study.

Values represent means  $\pm$  SEM ( $n = 4$ ). All values are expressed on a dry weight soil basis.

Soil property	Mean $\pm$ SEM
pH	6.57 $\pm$ 0.05
EC ( $\mu\text{S cm}^{-1}$ )	26.5 $\pm$ 1.0
Basal soil respiration ( $\text{mg CO}_2 \text{ kg}^{-1} \text{ h}^{-1}$ )	12.61 $\pm$ 1.04
Total soil C ( $\text{g C kg}^{-1}$ )	25.35 $\pm$ 1.47
Total soil N ( $\text{g N kg}^{-1}$ )	2.95 $\pm$ 0.06
Soil C:N	8.62 $\pm$ 0.64
DOC ( $\text{mg C kg}^{-1}$ )	70.08 $\pm$ 2.57
DON ( $\text{mg N kg}^{-1}$ )	10.48 $\pm$ 1.07
Mineralisable N ( $\text{mg N d}^{-1} \text{ kg}^{-1}$ )	3.92 $\pm$ 0.54
Microbial C ( $\text{g C kg}^{-1}$ )	1.03 $\pm$ 0.10
Microbial N ( $\text{g N kg}^{-1}$ )	0.16 $\pm$ 0.01
Exchangeable Ca ( $\text{mg Ca kg}^{-1}$ )	501 $\pm$ 122
Exchangeable K ( $\text{mg K kg}^{-1}$ )	46.05 $\pm$ 12.61
Exchangeable Na ( $\text{mg Na kg}^{-1}$ )	25.43 $\pm$ 5.13
Available P ( $\text{mg P kg}^{-1}$ )	7.38 $\pm$ 2.02
Above ground biomass ( $\text{t DM ha}^{-1}$ )	1.56 $\pm$ 0.14

**Table 2**

Summary statistics describing the spatial variability of soluble N derived from the nested sampling of a grassland soil prior to the application of N fertiliser. Alongside the raw data, an estimate of the Box-Cox transformation parameter ( $\lambda$ ) is also provided.

Variable ( $\mu\text{g N g}^{-1}$ )	Mean	Median	Skewness	Minimum	Maximum	$\lambda$
Nitrate-N	1.71	1.10	5.41	0.29	22.51	-0.426
Ammonium-N	1.87	1.27	12.82	0.29	80.49	-0.541
Amino acid-N	1.44	1.39	3.37	0.65	5.20	-0.492

**Table 3**

Variance components for the (Box-Cox transformed) variables and associated Wald tests describing the spatial variability of soluble N derived from the nested sampling of a grassland soil prior to the application of N fertiliser. The Wald statistic and associated p-value describe differences between the two sampling days. Those variance components marked with an asterisk are ones which caused an increase in AIC if they were dropped from the model (finest scale cannot be dropped).

Variable	Variance component						Wald statistic	p-value
	$\sigma_s^2$	$\sigma_m^2$	$\sigma_2^2$	$\sigma_{0.5}^2$	$\sigma_{0.1}^2$	$\sigma_{0.01}^2$		
Nitrate-N	0.0629*	0.0362*	0.0	0.0795*	0.0937*	0.0628	0.001	0.974
Ammonium-N	0.0087	0.0121*	0.0078	0.00008	0.0153	0.0751	6.8	0.009
Amino acid-N	0.0058	0.0035*	0.0	0.0	0.0124*	0.0307	1.89	0.17

**Table 4**

Summary statistics describing the spatial variability of soluble N derived from the nested sampling of a grassland soil after the application of N fertiliser. Alongside the raw data, an estimate of the Box-Cox transformation parameter ( $\lambda$ ) is also provided.

Variable ( $\mu\text{g N g}^{-1}$ )	Mean	Median	Skewness	Minimum	Maximum	$\lambda$
Nitrate-N	1.36	1.25	0.89	0.26	3.45	0.103
Ammonium-N	1.96	1.71	3.28	0.26	9.88	-0.424
Amino acid-N	1.25	1.18	2.58	0.56	4.40	-0.481

**Table 5**

Variance components for the (Box-Cox transformed) variables and associated Wald tests describing the spatial variability of soluble N derived from the nested sampling of a grassland soil after the application of N fertiliser. The Wald statistic and associated p-value describe differences between the two sampling days. Those variance components marked with an asterisk are ones which caused an increase in AIC if they were dropped from the model (finest scale cannot be dropped).

Variable	Variance component							Wald statistic	p-value
	$\sigma_s^2$	$\sigma_m^2$	$\sigma_2^2$	$\sigma_{0.5}^2$	$\sigma_{0.1}^2$	$\sigma_{0.01}^2$	$\sigma_\varepsilon^2$		
Nitrate-N	0.0	0.0575*	0.0	0.0052	0.0472*	0.0263*	0.0121	8.09	0.0045
Ammonium-N	0.0039	0.0069*	0.0	0.0	0.015	0.045*	0.0109	15.43	$8.60 \times 10^{-15}$
Amino acid-N	0.002	0.0241*	0.0025	0.0	0.0086*	0.0199*	0.0103	0.708	0.4

**Table 6**

Summary statistics describing the aggregate-scale variability of soluble N within a grassland soil. An estimate of the Box-Cox transformation parameter ( $\lambda$ ) is also provided.

Variable ( $\mu\text{g N g}^{-1}$ )	Mean	Median	Skewness	Minimum	Maximum	$\lambda$
Nitrate-N	1.20	1.04	0.80	0.19	3.13	0.282
Ammonium-N	2.00	1.78	1.24	0.30	5.85	0.200
Amino acid-N	1.56	1.50	0.49	0.77	2.69	0.508

**Table 7**

Variance components for the (Box-Cox transformed) variables describing the aggregate-scale spatial variability of soluble N in a grassland soil. Those variance components marked with an asterisk are ones which caused an increase in AIC if they were dropped from the model (finest scale cannot be dropped).

Variable	Variance component			
	$\sigma^2_s$	$\sigma^2_p$	$\sigma^2_c$	$\sigma^2_a$
Nitrate-N	0.0	0.0	0.072*	0.289
Ammonium-N	0.0	0.0311	0.005	0.3766
Amino acid-N	0.0	0.0055	0.0167*	0.0499

**Table 8**

Summary statistics for the residuals of the Box-Cox transformed data describing the influence of soil depth on the vertical variability of soluble N within a grassland soil. An estimate of the Box-Cox transformation parameter ( $\lambda$ ) is also provided.

Variable	Mean	Median	Skewness	Minimum	Maximum	$\lambda$
Nitrate-N	0	0.08	-1.29	-1.29	1.27	-0.343
Ammonium-N	0	0.05	-0.11	-0.83	0.84	-0.365
Amino acid-N	0	0.02	-0.04	-0.36	0.36	0.203



**Table 9**

Estimated mean values for all forms of soluble N (Box-Cox transformed units) for each depth increment, and the results of a Wald test of the null hypothesis of equality of the means at all depths.

Variable	Mean (transformed units) by depth interval (cm)					Wald statistic	<i>p</i> -value
	0-5	5-10	10-15	15-20	20-25		
Nitrate-N	0.103	-0.124	-0.397	-0.533	-0.766	45.9	$2.6 \times 10^{-9}$
Ammonium-N	-0.196	-0.364	-0.540	-0.624	-0.776	44.8	$4.2 \times 10^{-9}$
Amino acid-N	0.335	0.294	0.271	0.263	0.230	3.02	0.55