

Supplementary Information for

Complementary measures of soil texture, organic nitrogen accessibility and rhizosphere dynamics improve nitrogen supply prediction for short-cycle leafy vegetables.

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Table S1 Sample location, rotation of crops and N fertiliser strategy for each field where soil samples were taken. Composite samples taken for each field, later split between three pots for incubation.

Sample name	Code	Location	Crop rotation	N fertility strategy
Straight	Straight	University of Reading Farm, Sonning	Arable rotation	FYM*+ Nitram
Skew	Skew			FYM*+ Nitram
Gravel	Gravel			Nitram
Broad	Broad			Cover crops
Joe	Joe	The Watercress company, Dorset	Baby leaf salad crops: either lettuce or spinach	Calcium ammonium nitrate (CAN)+ 10% S
Brake	Brake			
KNAP	KNAP			
P3	P3			
Garden	Garden	Reading	Grass	Miracle Grow
Mush Cl	M+Cl	RHS Wisley, Surrey	Ornamental flowers	Mushroom compost†+ cover crop
Mush Co	M+Co			Mushroom compost+ cover sheet
Bark Cl	B+Cl			Bark compost+ cover crop
Bark	Bark			Bark compost†
Clumps	Clumps	CEDAR farm, Reading	Grass	Slurry+ Nitram
Groves	Groves		Maize	FYM

*Farmyard Manure

†Nutrient analysis of compost can be found in Table S2

Table S2 Nutrient analysis of both organic amendments added to the trial plots at RHS Wisley. Data supplied by Marc Redmile-Gordon.

Amendment	pH	EC (uS/cm)	TN (% w/w)	TC (% w/w)	C:N ratio	NH ₄ ⁺ (mg/L)	TSN (mg/L)	P (mg/L)	K (mg/L)
Mushroom compost	7.6	5246.7	2.29	31.20	13.6	280.2	280.2	54.13	4602.1
Composted bark	6.5	129.0	0.79	47.73	61.27	6.7	7.03	33.93	138.6

Table S3 Simple linear regression analysis with measured plant N uptake (mg N/kg dry soil) as the dependant variable and different reservoirs of potentially available soil N as predictors. Log₁₀ transformed data used.

	<i>Reservoirs (see Figure 2)</i>					
x	1M KCl	Anaerobic mineralisable	Hydrolysable	FLOLF-N	Total soil N	PRS®
Coefficient	-0.047	0.357*	0.423**	0.139*	0.346*	0.487**
SE	(0.315)	(0.185)	(0.179)	(0.0545)	(0.171)	(0.193)
Constant	1.136***	0.512	-0.140	0.812***	-0.109	-0.403
SE	(0.370)	(0.299)	(0.519)	(0.114)	(0.592)	(0.590)
Observations	15	15	15	15	15	15
R ²	0.002	0.223	0.301	0.334	0.239	0.329
Adjusted R ²	-0.075	0.163	0.247	0.283	0.180	0.277
Std. Error [†]	0.210	0.185	0.176	0.171	0.183	0.172
F Statistic [‡]	0.022	3.734*	5.591**	6.52*	4.082*	6.372**

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$ [†](df = 13) [‡](df = 1; 13)

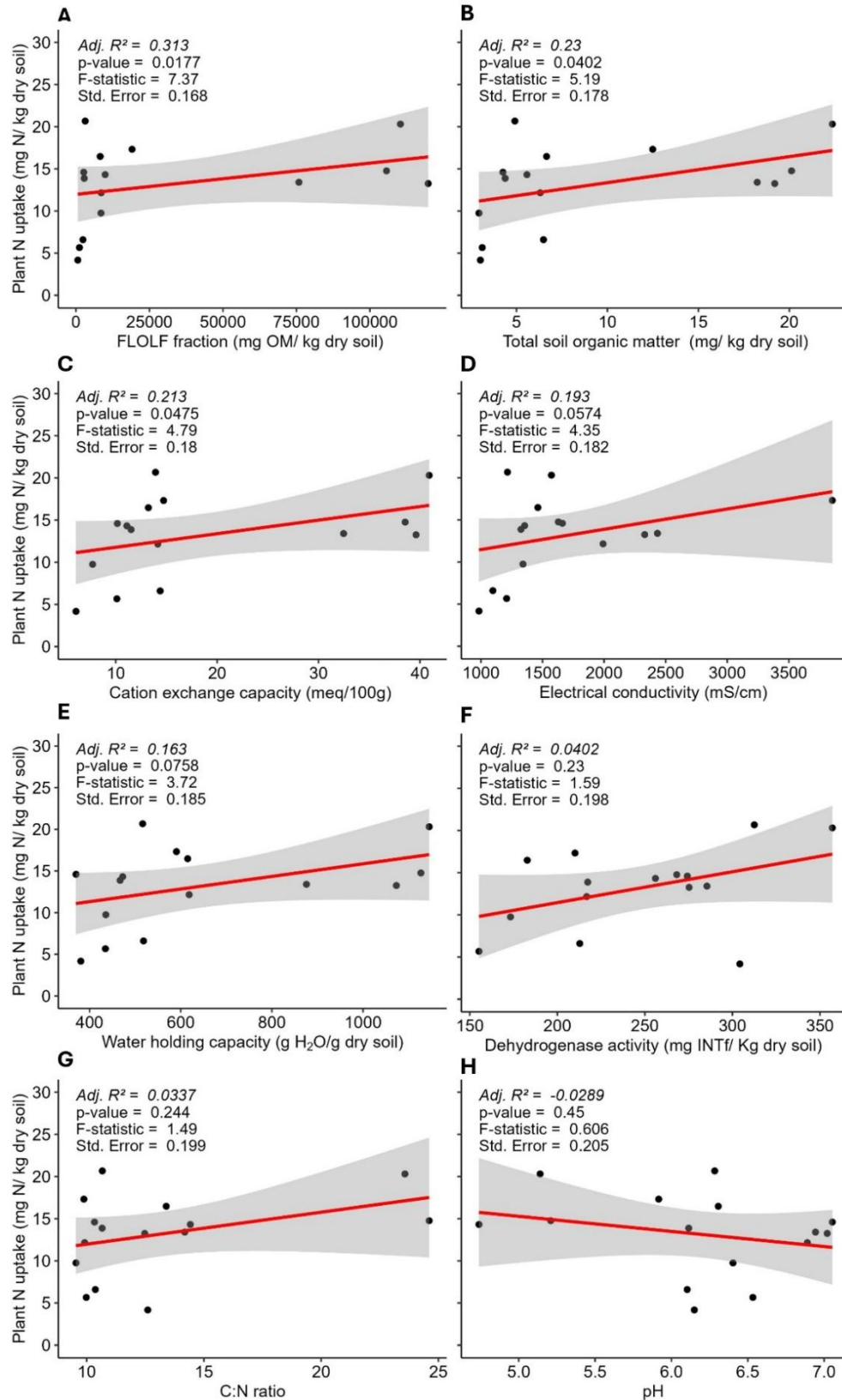


Figure S1 Linear regression analysis plant N uptake (mg/ kg dry soil) on moderators of plant N uptake. Linear regression line shown in red, confidence intervals (95%) shown in grey. Mean ($n = 3$) value for each of the fifteen soils shown. Regressions results shown are based on Log_{10} transformed data.

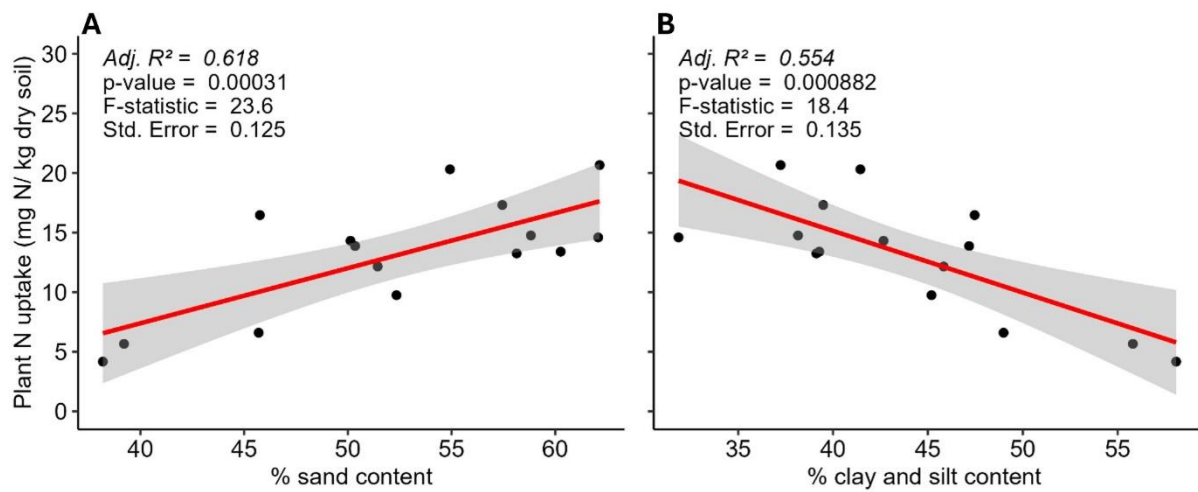


Figure S2 Linear regression analysis plant N uptake (mg/ kg dry soil) on soil particles **A** sand (%) **B** clay and silt (%) content of soils. Linear regression line shown in red, confidence intervals (95%) shown in grey. Mean ($n = 3$) value for each of the fifteen soils shown. Regressions results shown are based on Log_{10} transformed data.

Table S4 Simple linear regression analysis with measured Plant N uptake (mg N/kg dry soil) as dependant variable and mediators of soil N availability as predictors. Log₁₀ transformed data used.

	See Figure S1								See Figure S2	
x	FLOLF fraction	Total SOM	Cation exchange capacity	Electrical Conductivity	Water Holding Capacity	Dehydrogenase activity	C:N ratio	pH	sand (%)	clay+ silt (%)
Coefficient	0.164*	0.340**	0.398**	0.655*	0.567*	0.647	0.498	-0.824	2.42***	-2.255***
SE	(0.0604)	(0.149)	(0.182)	(0.314)	(0.294)	(0.514)	(0.409)	(1.058)	(0.497)	(0.526)
Constant	0.429	0.790***	0.609**	-1.015	-0.491	-0.459	0.535	1.732*	-3.06**	4.774***
SE	(0.244)	(0.136)	(0.221)	(1.007)	(0.817)	(1.225)	(0.451)	(0.837)	(0.853)	(0.862)
Observations	15	15	15	15	15	15	15	15	15	15
R ²	0.362	0.285	0.269	0.251	0.223	0.109	0.103	0.045	0.645	0.586
Adjusted R ²	0.313	0.230	0.213	0.193	0.163	0.040	0.034	-0.029	0.618	0.554
Std. Error [†]	0.168	0.178	0.180	0.182	0.185	0.198	0.199	0.205	0.125	0.135
F Statistic [‡]	7.37*	5.191**	4.787**	4.347*	3.723*	1.587	1.488	0.606	23.6***	18.390***

* = p < 0.05, ** = p < 0.01, *** = p < 0.001 [†](df = 13) [‡](df = 1; 13)

Table S5 Combined model of anaerobic incubation assay for potentially mineralisable N with KCl extractable SMN linear regression analysis.

Term	Estimate	SE	T-value	p- value
Intercept	0.613	0.437	1.403	0.186
Anaerobic min.	0.362	0.192	1.887	0.0836
KCl	-0.0952	0.289	-0.329	0.748

Observations	Residual SE	R²	Adj. R²	F-statistic
15	0.1918 (df = 12)	0.23	0.102	1.793 (p = 0.208)

Table S6 Model averages posterior summary of coefficients for multiple Bayesian linear regression analysis, coefficients sorted by $BF_{inclusion}$.

Coefficient	P(incl)	P(excl)	P (incl data)	P (excl data)	$BF_{inclusion}$	Mean	SD	Lower 95% CI	Upper 95% CI
Intercept	1	0	1	0	1	13.155	0.888	11.302	15.104
texture	0.5	0.5	0.868	0.132	6.567	-0.3	0.17	-0.578	3.483×10^{-5}
PRS	0.5	0.5	0.569	0.431	1.319	0.003	0.004	-0.002	0.011
KCl	0.5	0.5	0.482	0.518	0.931	-0.073	0.135	-0.422	0.131
pH	0.5	0.5	0.436	0.564	0.772	-0.5	1.21	-3.632	1.618
FLOLF-N	0.5	0.5	0.433	0.567	0.763	-0.001	0.01	-0.018	0.013
WHC	0.5	0.5	0.431	0.569	0.759	0.005	0.018	-0.032	0.052
FLOLF	0.5	0.5	0.421	0.579	0.728	-31.48	1.309×10^{-4}	-29.17	1.945×10^{-4}
Dehydro	0.5	0.5	0.414	0.586	0.707	0.006	0.017	-0.023	0.053
CNratio	0.5	0.5	0.401	0.599	0.67	0.073	0.352	-0.655	0.993
CEC	0.5	0.5	0.397	0.603	0.66	-0.034	0.351	-0.914	0.753
SoilN	0.5	0.5	0.388	0.612	0.635	-14.44	0.001	-0.003	0.002
EC	0.5	0.5	0.382	0.618	0.618	3.109×10^{-4}	0.002	-0.002	0.004
Anamin	0.5	0.5	0.382	0.618	0.617	-0.006	0.065	-0.17	0.133
OM	0.5	0.5	0.373	0.627	0.595	-0.036	0.463	-1.062	1.04

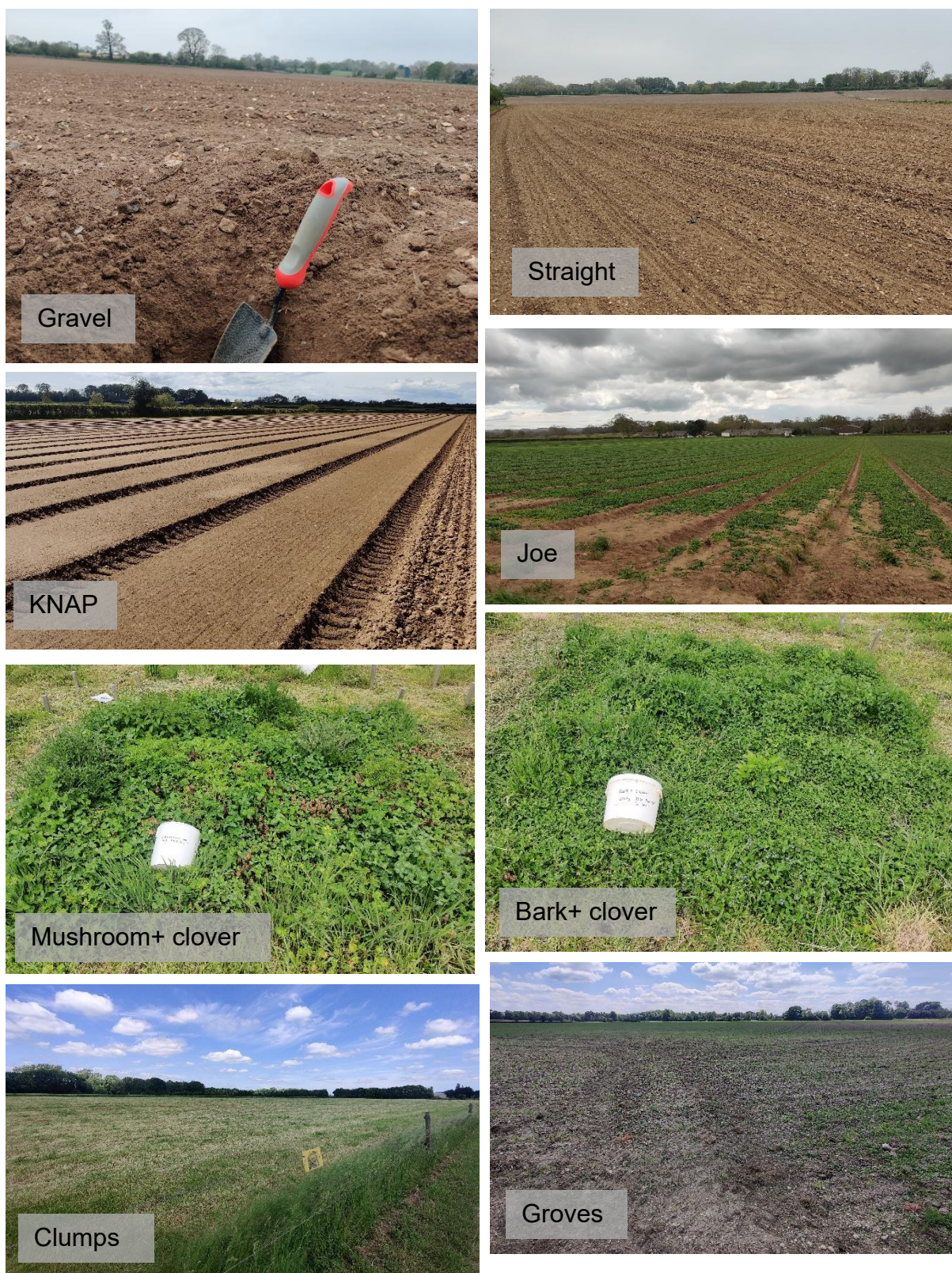


Figure S3 Fields sampled for soil to use in the pot incubation. Field locations and previous management history detailed in Table S1. Further information about the RHS Wisley trial (mushroom and bark +clover) design can be found in Duddigan et al. [1].

References

1. Duddigan, S., Shaw, L. J., Alexander, P. D. & Collins, C. D. Effects of application of horticultural soil amendments on decomposition, quantity, stabilisation and quality of soil carbon. *Scientific Reports* 2022 12:1 **12**, 17631- (2022).