

SUPPLEMENTARY LISTS

Table 1A-S. Correlation Matrix plots

	<i>VL4</i>	<i>VL6</i>	<i>VL8</i>	<i>P</i>	<i>N</i>	<i>OC</i>	<i>Ca</i>	<i>K</i>	<i>Mg</i>	<i>Na</i>	<i>pH</i>
VL4	1.00										
VL6	0.72***	1.00									
VL8	0.25	0.34**	1.00								
P	-0.03	0.04	0.04	1.00							
N	0.06	0.11	0.07	0.87***	1.00						
OC	-0.02	0.04	0.01	-0.43**	-0.50***	1.00					
Ca	0.12	0.38**	0.45**	-0.03	0.02	-0.05	1.00				
K	0.03	0.00	-0.09	-0.61***	-0.57***	0.53***	0.10	1.00			
Mg	-0.01	-0.04	-0.10	-0.61***	-0.57***	0.51***	0.07	0.77***	1.00		
Na	0.06	0.13	0.11	0.02	0.08	-0.13	0.15	0.05	0.18	1.00	
pH	0.11	0.19	0.16	-0.59***	-0.69***	0.52***	0.19	0.44	0.45	-0.03	1.00

Table 1B-S. Correlation Matrix plots

	<i>NL4</i>	<i>NL6</i>	<i>NL8</i>	<i>P</i>	<i>N</i>	<i>OC</i>	<i>Ca</i>	<i>K</i>	<i>Mg</i>	<i>Na</i>	<i>pH</i>
NL4	1.00										
NL6	0.79***	1.00									
NL8	0.58***	0.59***	1.00								
P	0.05	0.06	0.02	1.00							
N	0.16	0.11	0.13	0.87***	1.00						
OC	-0.02	0.03	0.00	-0.43**	-0.50***	1.00					
Ca	0.22	0.44**	0.30*	-0.03	0.02	-0.05	1.00				
K	-0.10	-0.01	0.01	-0.61***	-0.57***	0.53***	0.10	1.00			
Mg	-0.06	-0.04	0.05	-0.61***	-0.57***	0.51***	0.07	0.77***	1.00		
Na	0.14	0.16	0.16	0.02	0.08	-0.13	0.15	0.05	0.18	1.00	
pH	0.14	0.22	0.02	-0.59***	-0.69***	0.52***	0.19	0.44***	0.45***	-0.03	1.00

Table 1C-S. Correlation Matrix plots

	<i>LA4</i>	<i>LA6</i>	<i>LA8</i>	<i>P</i>	<i>N</i>	<i>OC</i>	<i>Ca</i>	<i>K</i>	<i>Mg</i>	<i>Na</i>	<i>pH</i>
LA4	1.00										
LA6	0.98***	1.00									
LA8	0.38**	0.45**	1.00								
P	0.03	0.02	0.01	1.00							
N	0.11	0.10	0.10	0.87	1.00						
OC	0.04	0.01	-0.01	-0.43	-0.50***	1.00					
Ca	0.22	0.23	0.40**	-0.03	0.02	-0.05	1.00				
K	0.03	0.07	-0.01	-0.61***	-0.57***	0.53***	0.10	1.00			
Mg	-0.06	-0.04	-0.03	-0.61***	-0.57***	0.51***	0.07	0.77***	1.00		
Na	-0.15	-0.10	0.09	0.02	0.08	-0.13	0.15	0.05	0.18	1.00	
pH	0.09	0.10	0.12	-0.59***	-0.69***	0.52***	0.19	0.44**	0.45**	-0.03	1.00

Table 1D-S. Correlation Matrix plots

	<i>FL</i>	<i>FW</i>	<i>FD</i>	<i>Wplot</i>	<i>P</i>	<i>N</i>	<i>OC</i>	<i>Ca</i>	<i>K</i>	<i>Mg</i>	<i>Na</i>	<i>pH</i>
FL	1.00											
FW	-0.54***	1.00										
FD	0.81***	-0.91***	1.00									
Wplot	0.87***	-0.35*	0.64***	1.00								
P	0.60***	-0.95***	0.92***	0.45**	1.00							
N	0.54***	-0.90***	0.86***	0.44**	0.87***	1.00						
OC	-0.26	0.51***	-0.44**	-0.25	-0.43**	-0.50***	1.00					
Ca	0.14	0.13	-0.03	0.32*	-0.03	0.02	-0.05	1.00				
K	-0.36**	0.61***	-0.57***	-0.26	-0.61***	-0.57***	0.53***	0.10	1.00			
Mg	-0.40**	0.62***	-0.59***	-0.29	-0.61***	-0.57***	0.51***	0.07	0.77***	1.00		
Na	0.04	0.00	0.02	0.03	0.02	0.08	-0.13	0.15	0.05	0.18	1.00	
pH	-0.24	0.74***	-0.60***	-0.11	-0.59***	-0.69***	0.52***	0.19	0.44**	0.45**	-0.03	1.00

Table 2A-S. Structural equation model metrics and outputs

lavaan 0.6.15 ended normally after 4399 iterations		
Estimator		ML
Optimization method		NLMINB
Number of model parameters		119
Number of observations		66
Model Test User Model:		
Test statistic		146.515
Degrees of freedom		76
P-value (Chi-square)		0.000
Model Test Baseline Model:		
Test statistic		1902.892
Degrees of freedom		182
P-value		0.000
User Model versus Baseline Model:		
Comparative Fit Index (CFI)		0.959
Tucker-Lewis Index (TLI)		0.902
Loglikelihood and Information Criteria:		
Loglikelihood user model (H0)		-2192.873
Loglikelihood unrestricted model (H1)		-2119.615
Akaike (AIC)		4623.746
Bayesian (BIC)		4884.314
Sample-size adjusted Bayesian (SABIC)		4509.679
Root Mean Square Error of Approximation:		
RMSEA		0.119
90 Percent confidence interval - lower		0.089
90 Percent confidence interval - upper		0.147
P-value H_0: RMSEA <= 0.050		0.000
P-value H_0: RMSEA >= 0.080		0.983
Standardized Root Mean Square Residual:		
SRMR		0.099
Parameter Estimates:		
Standard errors		Standard
Information		Expected
Information saturated (h1) model		Structured

Table 2B-S. Structural equation model showing the regression and covariance parameters.

Regressions:				
	Estimate	Std.Err	z-value	P(> z)
FL ~				
OC	-0.141	0.310	-0.454	0.650
N	2.568	0.488	5.258	0.000
FW ~				
P	-0.009	0.001	-11.545	0.000
N	-11.379	1.553	-7.329	0.000
FD ~				
P	0.006	0.001	11.466	0.000
N	9.474	1.378	6.877	0.000
wplot ~				
P	-0.000	0.000	-0.195	0.845
OC	-0.079	0.048	-1.629	0.103
N	0.217	0.079	2.758	0.006
VL4 ~				
Ca	-0.031	0.007	-4.565	0.000
K	0.004	0.003	1.283	0.200
N	0.265	1.782	0.149	0.882
VL6 ~				
OC	1.223	2.963	0.413	0.680
N	-0.045	1.148	-0.039	0.969
VL8 ~				
N	2.512	10.848	0.232	0.817
OC	2.771	14.110	0.196	0.844
NL4 ~				
pH	-0.168	0.338	-0.498	0.618
OC	-0.197	0.464	-0.426	0.670
NL6 ~				
Na	0.085	0.039	2.181	0.029
OC	0.146	0.456	0.320	0.749
NL8 ~				
Mg	0.000	0.000	1.819	0.069
OC	-0.538	0.489	-1.101	0.271
LA4 ~				
K	-0.004	0.001	-3.323	0.001
OC	1.706	3.123	0.546	0.585
LA6 ~				
Ca	-0.002	0.001	-1.252	0.210
OC	-0.238	1.657	-0.144	0.886
LA8 ~				
P	-0.000	0.000	-0.902	0.367
OC	-0.144	0.450	-0.320	0.749
Covariances:				
	Estimate	Std.Err	z-value	P(> z)
.FL ~~				
.FW	2.455	2.394	1.025	0.305
.FD	17.903	3.391	5.280	0.000
.wplot	1.153	0.221	5.214	0.000
.VL4	19.013	6.044	3.146	0.002
.VL6	28.459	9.319	3.054	0.002
.VL8	-10.511	24.406	-0.431	0.667
.NL4	2.523	1.099	2.296	0.022
.NL6	3.899	1.372	2.842	0.004
.NL8	2.683	1.043	2.573	0.010
.LA4	16.253	7.090	2.292	0.022
.LA6	11.843	4.096	2.892	0.004
.LA8	4.141	1.198	3.456	0.001
.FW ~~				
.FD	-9.878	4.913	-2.010	0.044
.wplot	0.899	0.332	2.707	0.007
.VL4	30.660	10.963	2.797	0.005

.VL6	75.058	18.433	4.072	0.000
.VL8	111.431	47.059	2.368	0.018
.NL4	9.804	2.291	4.280	0.000
.NL6	11.759	2.780	4.229	0.000
.NL8	7.384	2.041	3.618	0.000
.LA4	49.477	13.962	3.544	0.000
.LA6	28.284	7.880	3.589	0.000
.LA8	6.743	2.168	3.111	0.002
.FD ~~				
.wplot	1.851	0.409	4.526	0.000
.VL4	24.967	11.584	2.155	0.031
.VL6	24.423	17.567	1.390	0.164
.VL8	-49.614	49.227	-1.008	0.314
.NL4	1.015	2.116	0.479	0.632
.NL6	2.419	2.593	0.933	0.351
.NL8	2.554	2.007	1.272	0.203
.LA4	15.013	13.758	1.091	0.275
.LA6	12.700	7.829	1.622	0.105
.LA8	5.002	2.258	2.215	0.027
.wplot ~~				
.VL4	3.788	0.870	4.354	0.000
.VL6	5.314	1.313	4.048	0.000
.VL8	3.356	3.239	1.036	0.300
.NL4	0.438	0.149	2.937	0.003
.NL6	0.755	0.193	3.908	0.000
.NL8	0.442	0.141	3.128	0.002
.LA4	3.032	0.971	3.122	0.002
.LA6	2.032	0.563	3.609	0.000
.LA8	0.740	0.169	4.368	0.000
.VL4 ~~				
.VL6	234.749	47.279	4.965	0.000
.VL8	313.830	112.456	2.791	0.005
.NL4	21.614	5.286	4.089	0.000
.NL6	32.994	6.893	4.786	0.000
.NL8	16.208	4.728	3.428	0.001
.LA4	123.038	33.140	3.713	0.000
.LA6	76.427	19.068	4.008	0.000
.LA8	26.629	5.729	4.648	0.000
.VL6 ~~				
.VL8	445.861	172.617	2.583	0.010
.NL4	46.104	9.073	5.082	0.000
.NL6	66.439	11.890	5.588	0.000
.NL8	37.292	8.075	4.618	0.000
.LA4	292.236	58.141	5.026	0.000
.LA6	173.130	33.387	5.186	0.000
.LA8	39.058	8.725	4.477	0.000
.VL8 ~~				
.NL4	46.712	20.789	2.247	0.025
.NL6	74.890	26.045	2.875	0.004
.NL8	34.206	19.215	1.780	0.075
.LA4	210.741	131.499	1.603	0.109
.LA6	116.434	73.939	1.575	0.115
.LA8	26.721	20.809	1.284	0.199
.NL4 ~~				
.NL6	6.810	1.346	5.058	0.000
.NL8	3.850	0.939	4.099	0.000
.LA4	29.571	6.659	4.441	0.000
.LA6	17.259	3.789	4.555	0.000
.LA8	3.749	1.001	3.744	0.000
.NL6 ~~				
.NL8	4.822	1.153	4.182	0.000
.LA4	44.027	8.694	5.064	0.000
.LA6	25.527	4.950	5.157	0.000
.LA8	5.099	1.252	4.072	0.000
.NL8 ~~				
.LA4	26.482	6.165	4.296	0.000

.LA6	16.015	3.543	4.520	0.000
.LA8	4.524	1.003	4.511	0.000
.LA4 ~~				
.LA6	160.995	28.330	5.683	0.000
.LA8	17.407	6.122	2.843	0.004
.LA6 ~~				
.LA8	12.074	3.553	3.399	0.001
Variances:				
	Estimate	Std.Err	z-value	P(> z)
.FL	10.447	1.819	5.745	0.000
.FW	35.641	6.204	5.745	0.000
.FD	41.966	7.305	5.745	0.000
.wplot	0.181	0.032	5.745	0.000
.VL4	196.185	34.151	5.745	0.000
.VL6	471.100	82.008	5.745	0.000
.VL8	3752.448	653.217	5.745	0.000
.NL4	7.020	1.222	5.745	0.000
.NL6	10.436	1.817	5.745	0.000
.NL8	6.182	1.076	5.745	0.000
.LA4	292.304	50.884	5.745	0.000
.LA6	92.542	16.110	5.745	0.000
.LA8	7.426	1.293	5.745	0.000
R-Square:				
	Estimate			
FL	0.253			
FW	0.919			
FD	0.837			
wplot	0.142			
VL4	0.076			
VL6	0.001			
VL8	0.001			
NL4	0.005			
NL6	0.005			
NL8	0.018			
LA4	0.005			
LA6	0.001			
LA8	0.005			



PLATE 1A. Palm kernel shell biochar



PLATE 1B. Weighing Palm kernel shell biochar for field application



PLATE 1C. Experimental layout with biochar applied



PLATE 1D. Mixing the soil with biochar applied



PLATE 1E. Cucumber plant



PLATE 1F. Cucumber plant at 5WAP



PLATE 1G. Cucumber harvesting



PLATE 1H. Sample cucumber fruits



PLATE 1I. Samples of cucumber fruits to be transported