Supplementary Information File

Co-benefits of wollastonite weathering in agriculture: CO_2 sequestration and promoted plant growth

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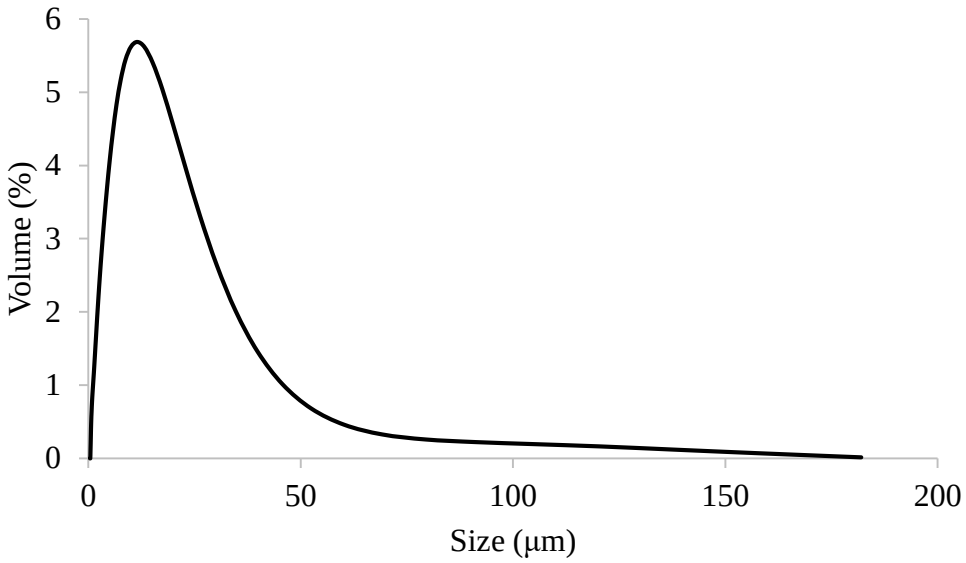

Figure S1: Particle size distribution of Canadian wollastonite, determined by wet laser diffraction.

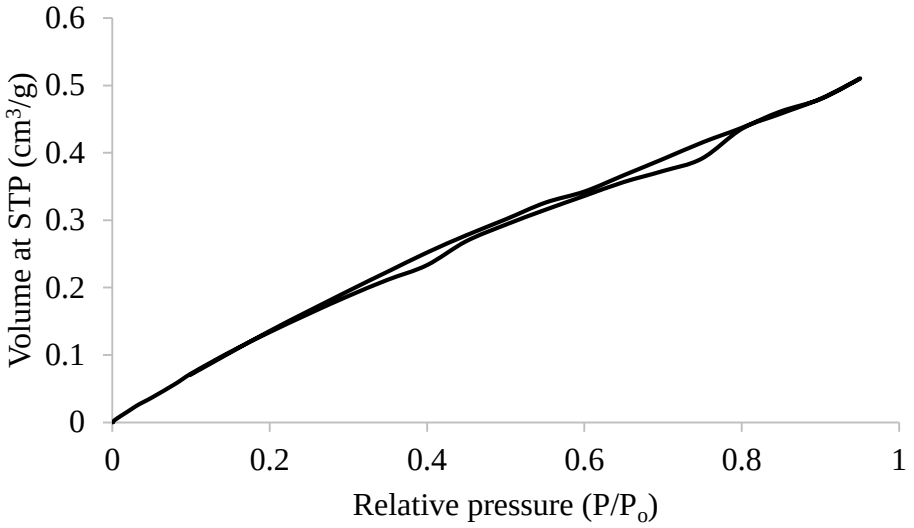

Figure S2: Nitrogen adsorption/desorption isotherm of Canadian wollastonite, determined for specific surface area and pore size analyses.

Wollastonite-to-soil ratio selection

Figure S3 shows the variation of pH versus time for various wollastonite-amended soils. Change in pH was monitored over a period of 72 h. The initial pH of the soil (as-received) was 4.81 ± 0.01. For 0.5 h shaking time, 10 g and 20 g wollastonite addition (to 8 kg soil) showed the same pH increase to 4.94, and final pH (72 h shaking) of 5.41 ± 0.01 and 5.53 ± 0.02, respectively. Addition of higher amounts, 200 g, and 600 g, resulted in a final pH of 6.67 ± 0.01 and 7.17 ± 0.01. Geochemical modelling, using Visual Minteq v3.1, showed that at pH 7.23 ± 0.02 the saturation index becomes positive, which is required for the precipitation of solid mineral phases, especially calcite in the case of wollastonite.

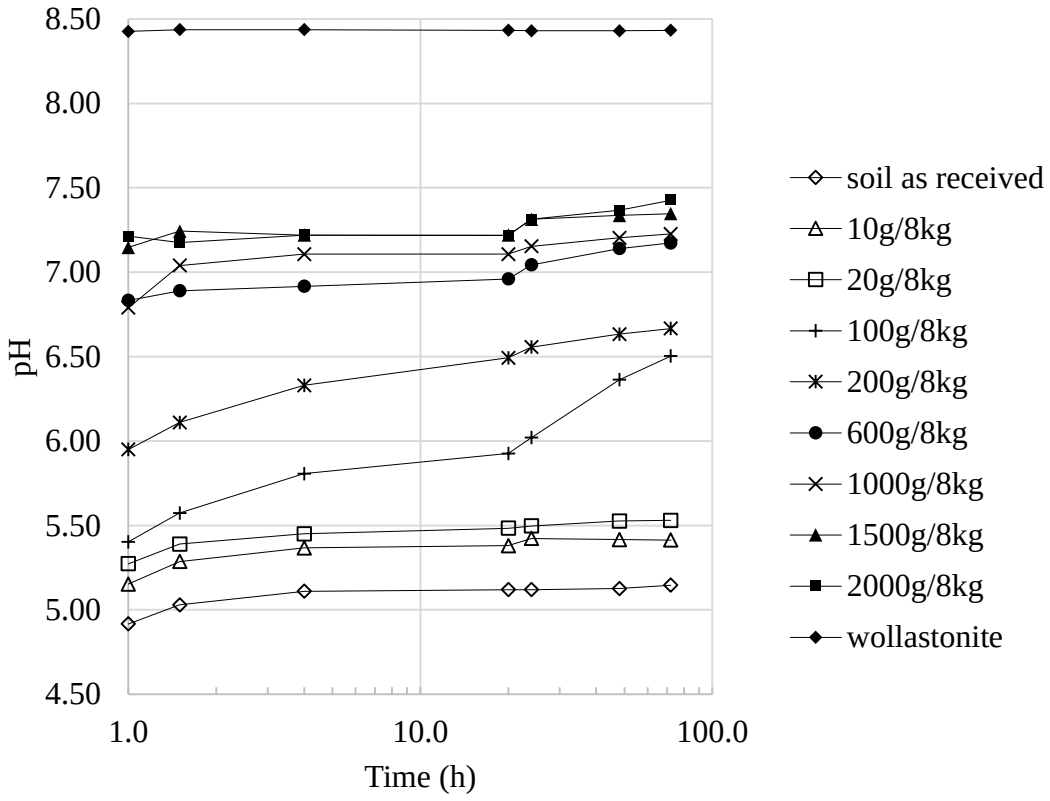

Figure S3: Variation of pH with time of various wollastonite-amended soils, including as-received soil and as-received wollastonite.

Table S1: Development stages of beans and corn plants in wollastonite-amended and non-amended soils, in cumulative days from start of growth period.

	V1	**V2**	**V3**	**V4**	**R1**	**R2**	**R3**	**R4**
"Soil+Bean" and "MSA+Bean" (days)	15	21	26	32	36	40	45	49
	V1	**V2**	**V4**	**V6**	**V10**	**VT**		
"Soil+Corn" and "MSA+Corn" (days)	17	26	20	25	33	52		

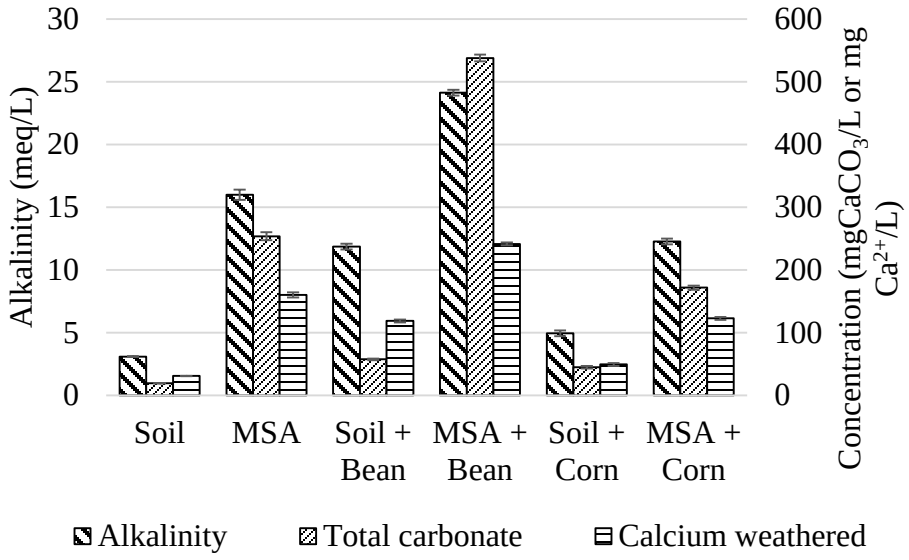

Figure S4: Alkalinity and total carbonate of all potting experiments at the end of the growth period (55 days).

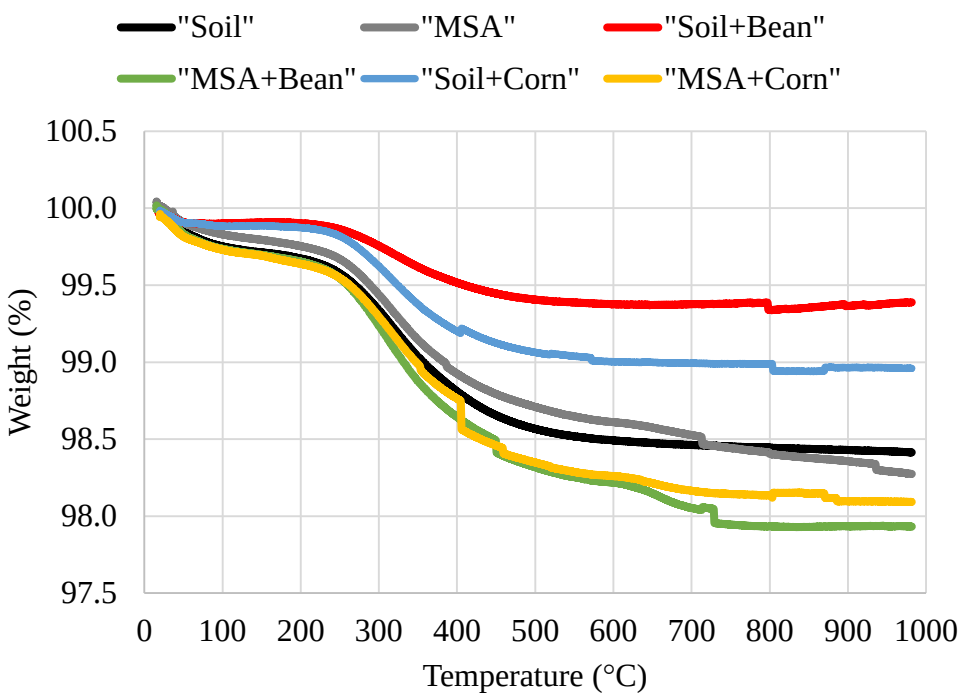

Figure S5: Thermogravimetric analysis of all potting samples at the end of the growth period (55 days).

Geochemical Modelling using The Geochemist's Workbench

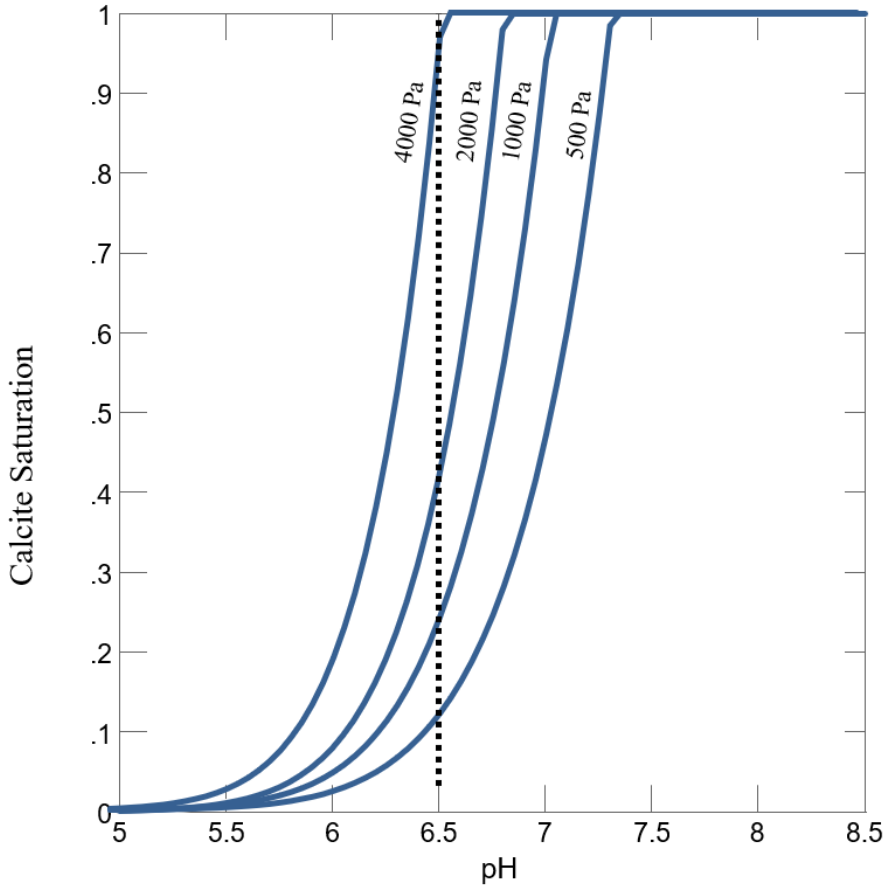

Figure S6: Calcite saturation versus pH at different CO_2 partial pressures (pCO_2, 500-4000 Pa), generated using The Geochemist's Workbench.

The soil pCO_2 is higher than the atmospheric pCO_2 because of the soil root respiration and plant matter decay.[1] For a pCO_2 range of 500 Pa to 4000 Pa, Figure S6 shows that calcite precipitation is favored at a pH above 6.5.

[1] Railsback BL. *Some Fundamentals of Mineralogy and Geochemistry*; Department of Geology, University of Georgia: Athens, Georgia, U.S.A, 2006. Weblink: http://www.gly.uga.edu/railsback/FundamentalsIndex.html (accessed 2018/10/19)

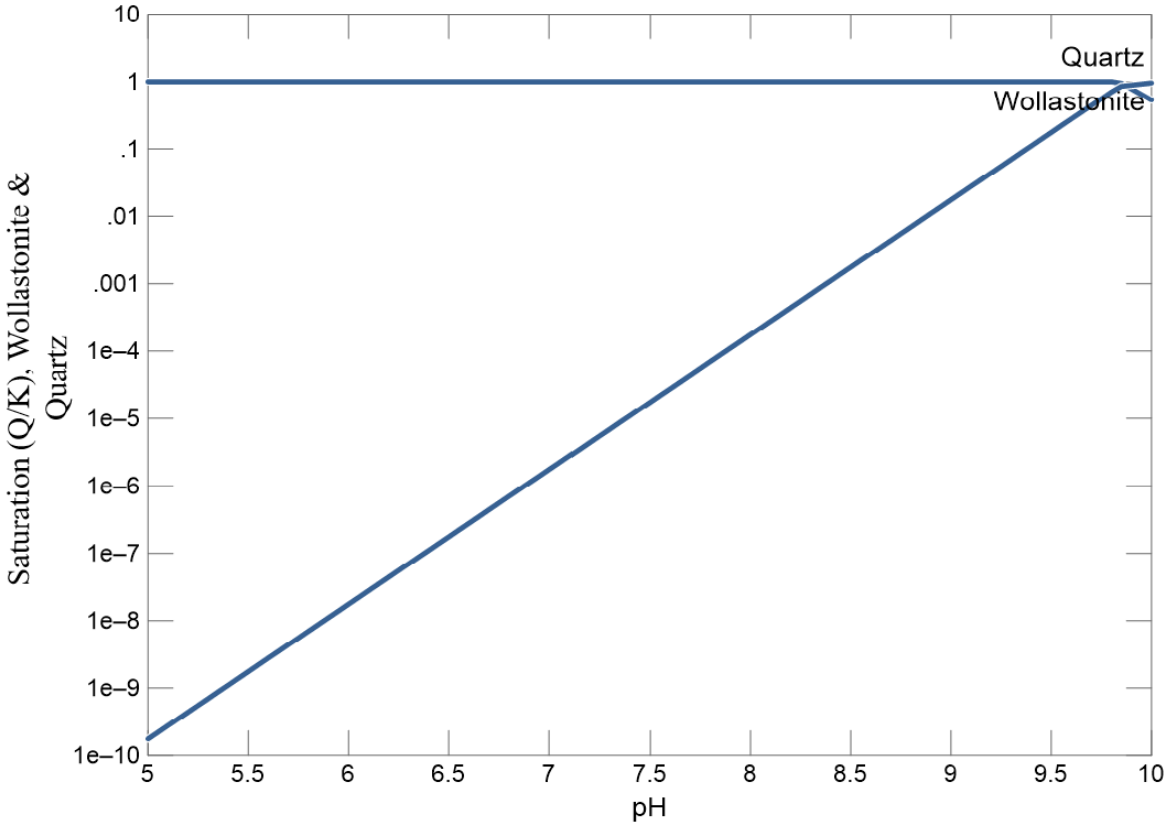

Figure S7: Wollastonite and quartz saturation as a function of pH, generated using The Geochemist's Workbench.

The saturation (Q/K, Q is the reaction quotient, and K is the equilibrium constant) of wollastonite is less than 1 and it decreases further with decreasing pH. This implies that solubility product (K) is higher at lower pH, hence wollastonite is more prone to dissolution as pH lowers. In the pH range of 5-10 (Figure S7), wollastonite is soluble (i.e. $Q/K < 1$).