

## *Supplementary Material*

S1.	Soil and rock characterization.....	2
S2.	Differences of Mg resulting from two irrigation treatments .....	4
S3.	DIC concentrations .....	5
S4.	pH .....	6
S5.	Mg concentrations .....	7
S6.	DSi concentrations .....	8
S7.	Mg/Si ratios .....	9
S8.	Trace element accumulation in the topsoil.....	10
S9.	Cr concentrations .....	12
S10.	Ni concentrations.....	13
S11.	Ni and Cr concentrations corrected for blank values.....	14
S12.	Mg fluxes from the outlet .....	15
S13.	Partial pressure of CO <sub>2</sub> in the soils .....	16
S14.	pH development over time.....	17

## S1. Soil and rock characterization

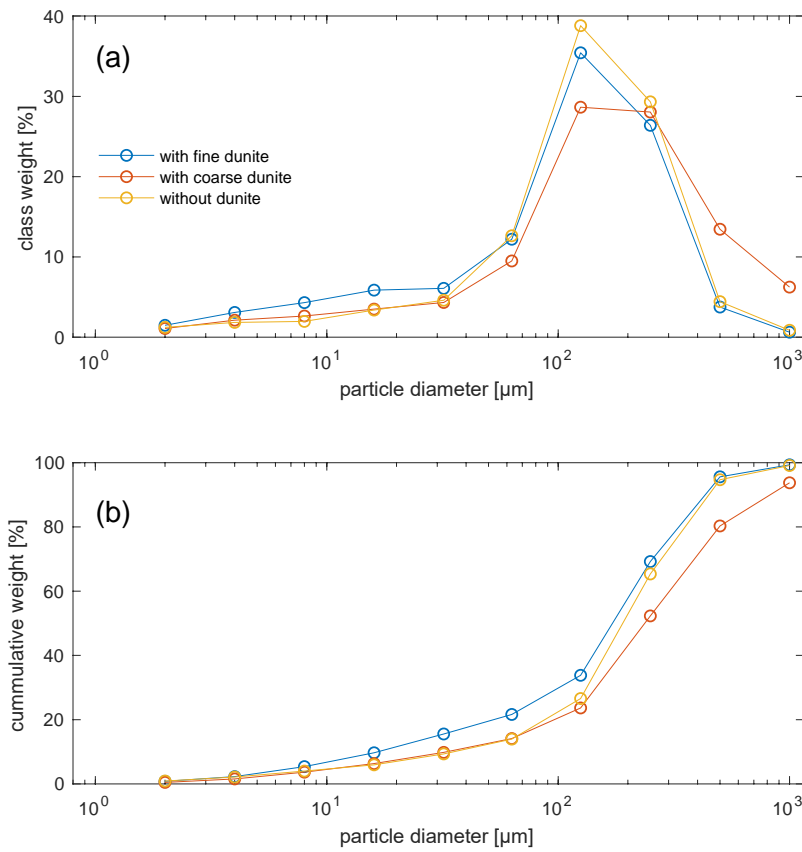
The soil was provided by the *Bodemkundige Dienst van België* in 2013. Initial soil pH was measured as 6.6. The bulk density was 1.15 g cm<sup>-3</sup> (dry mass) at a soil moisture of 16%. More data in Tabs. Tab. S 1-1 and Tab. S 1-2. Basic granulometric data for the soil amended with rock powder and the rock powder alone can be found in Figs. S1 and S2, respectively.

Tab. S 1-1 Basic soil parameters

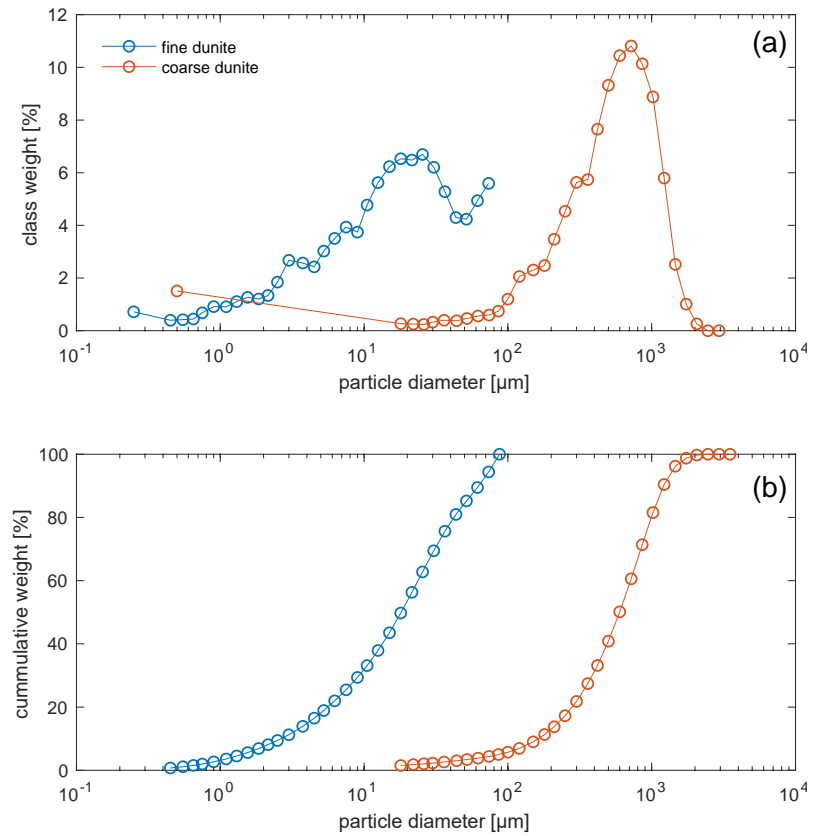
Parameter	Value	Unit	Method
pH-KCl	7.8	-	external (certified) lab from provider of the soil
pH-KCl	6.6 ± 0.1	-	own analysis of delivered soil, based on 3 replicates
Organic carbon	1.22	%	external (certified) lab from provider of the soil
Plant available NH <sub>4</sub>	0.91 ± 0.63	mg NH <sub>4</sub> -N/kg DS	own analysis, KCL-extraction (1:2,5), based on 3 replicates
Plant available NO <sub>3</sub>	24.93 ± 3.37	mg NO <sub>3</sub> -N/kg DS	own analysis, KCL-extraction (1:2,5), based on 3 replicates
Plant available PO <sub>4</sub>	83.85 ± 6.90	mg PO <sub>4</sub> -N/kg DS	own analysis, AA-EDTA-extraction (1:5), based on 3 replicates

Tab. S 1-2 Elemental composition of two exemplary blank soils without olivine treatment and plants.

Soil	Ca	K	Mg	Na	Fe	Al	Mn	CEC
	(meq/100 g dry soil)							
Blank 1	6.841	0.361	0.340	0.254	0.009	0.019	0.004	7.83
Blank 2	8.367	0.298	0.373	0.263	0.005	0.012	0.005	9.32

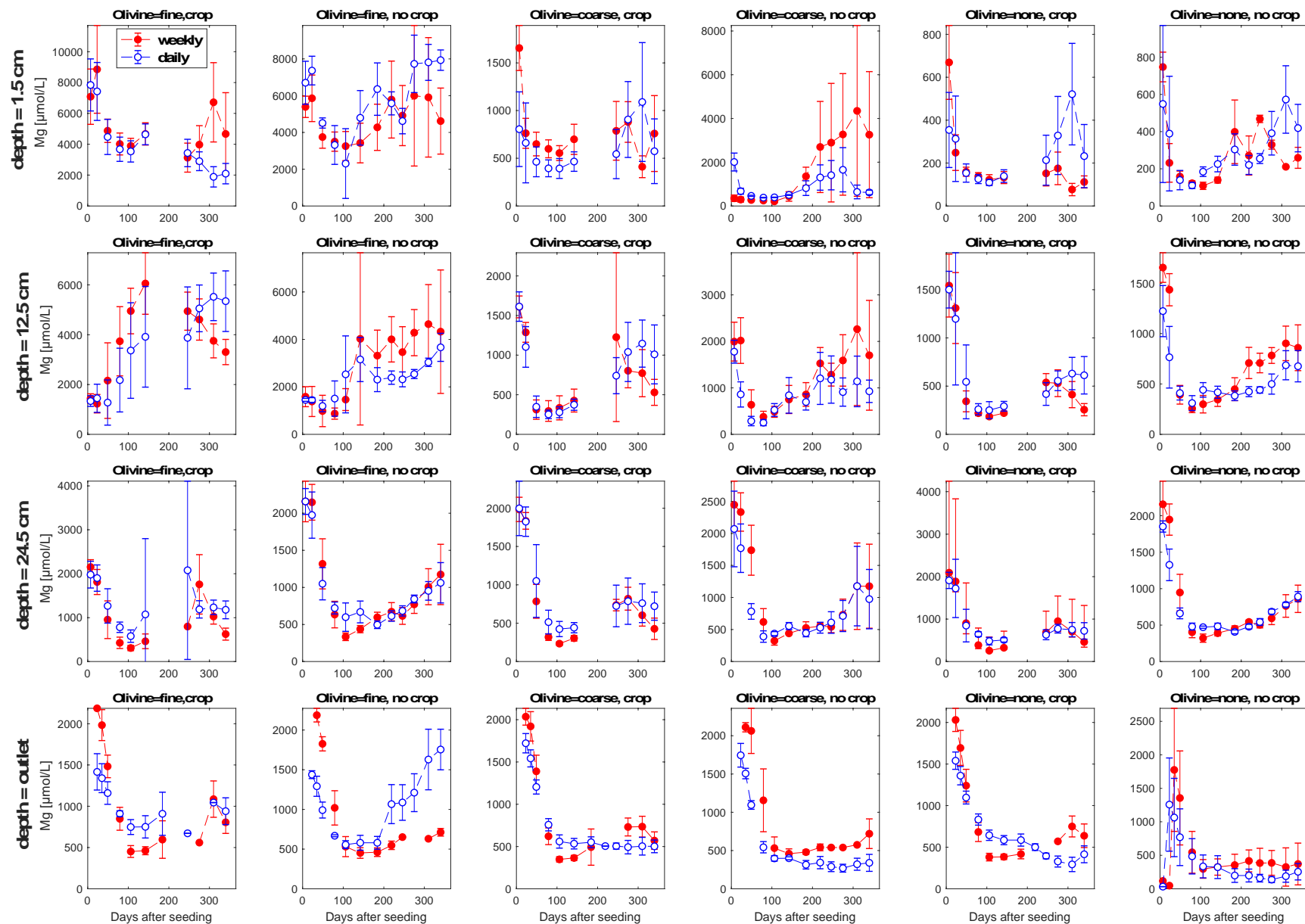


**Fig. S1-1.** Granulometric analyses of the topsoil with and without amended dunite material of fine and coarse grain size.



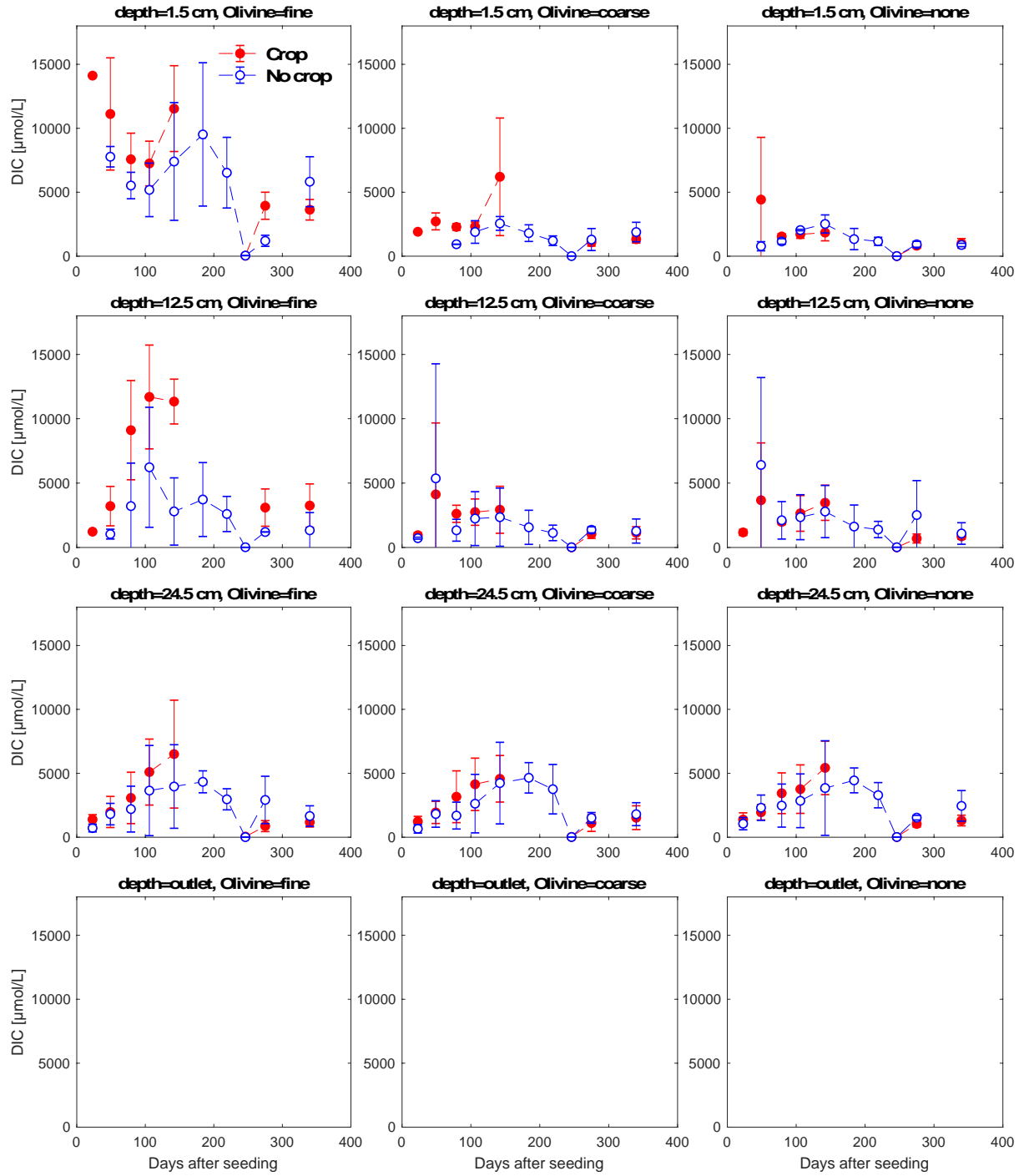
**Fig. S1-2.** Granulometric analyses of the dunite material used. (a) shows the class weight distribution and (b) the cumulative class weight.

## S2. Differences of soil water Mg concentrations resulting from two irrigation treatments



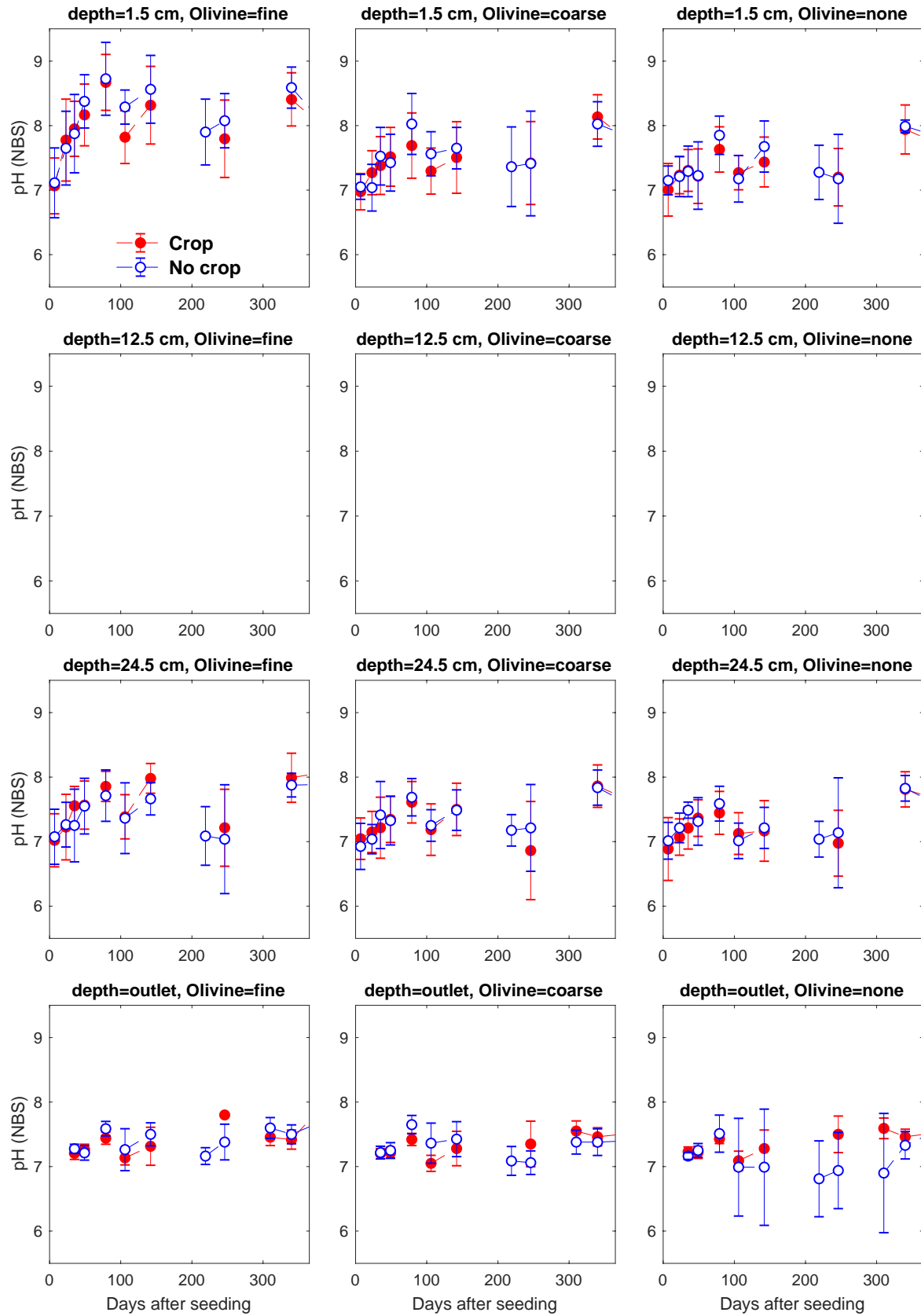
**Fig. S 2-1** Exemplary data for Mg, differentiated by rain treatment (and all other variables), showing that there is no systematic difference between daily (blue, open circles) and weekly (red, filled circles) irrigation treatment. Total rain applied was in both treatment 800 mm/a.

### S3. DIC concentrations in soil water



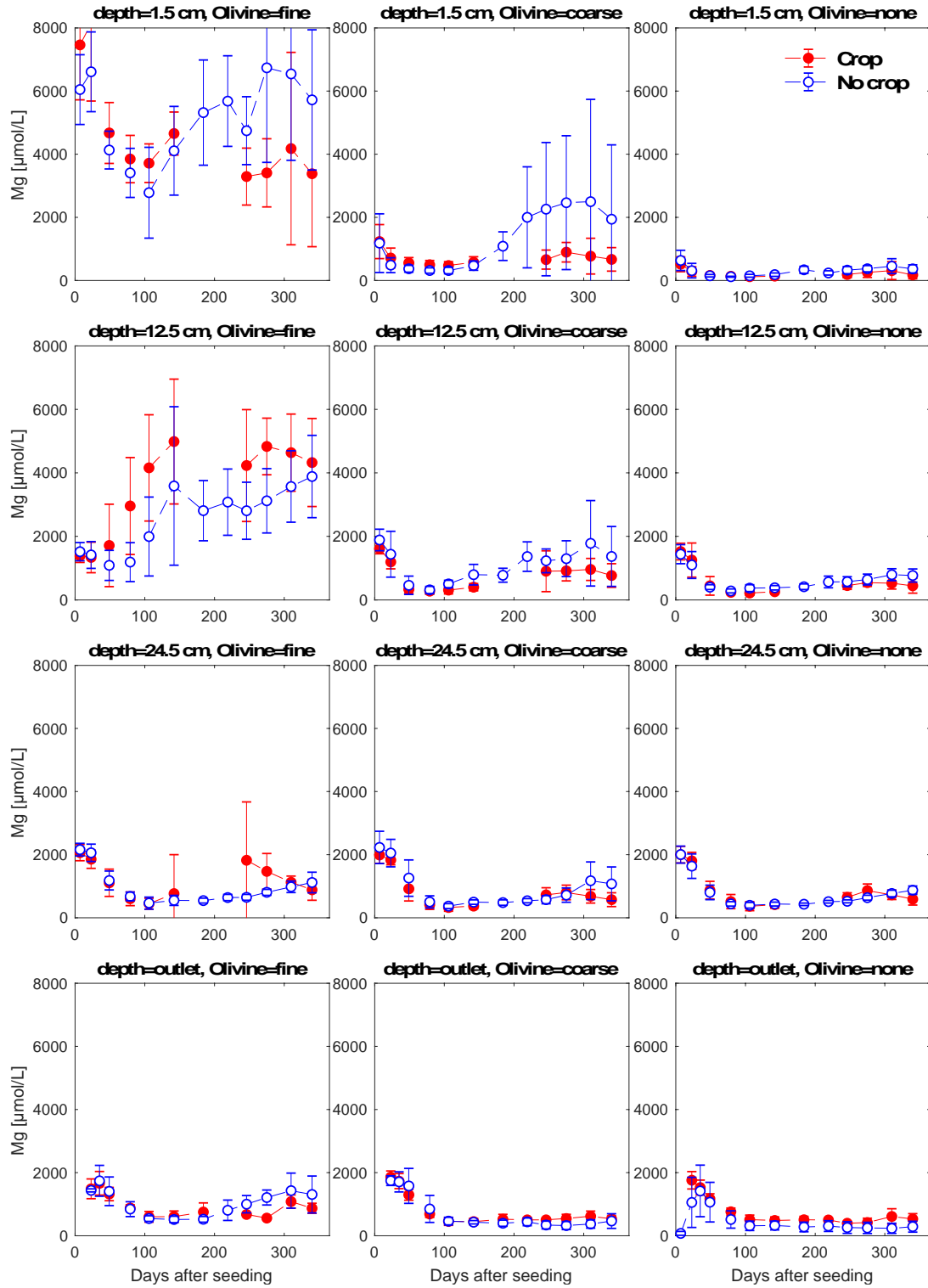
**Fig. S3-1.** Development of DIC concentrations over one year where available, differentiated by olive and crop treatment. Error bars indicate  $\pm 1$  standard deviation.

## S4. pH of soil water



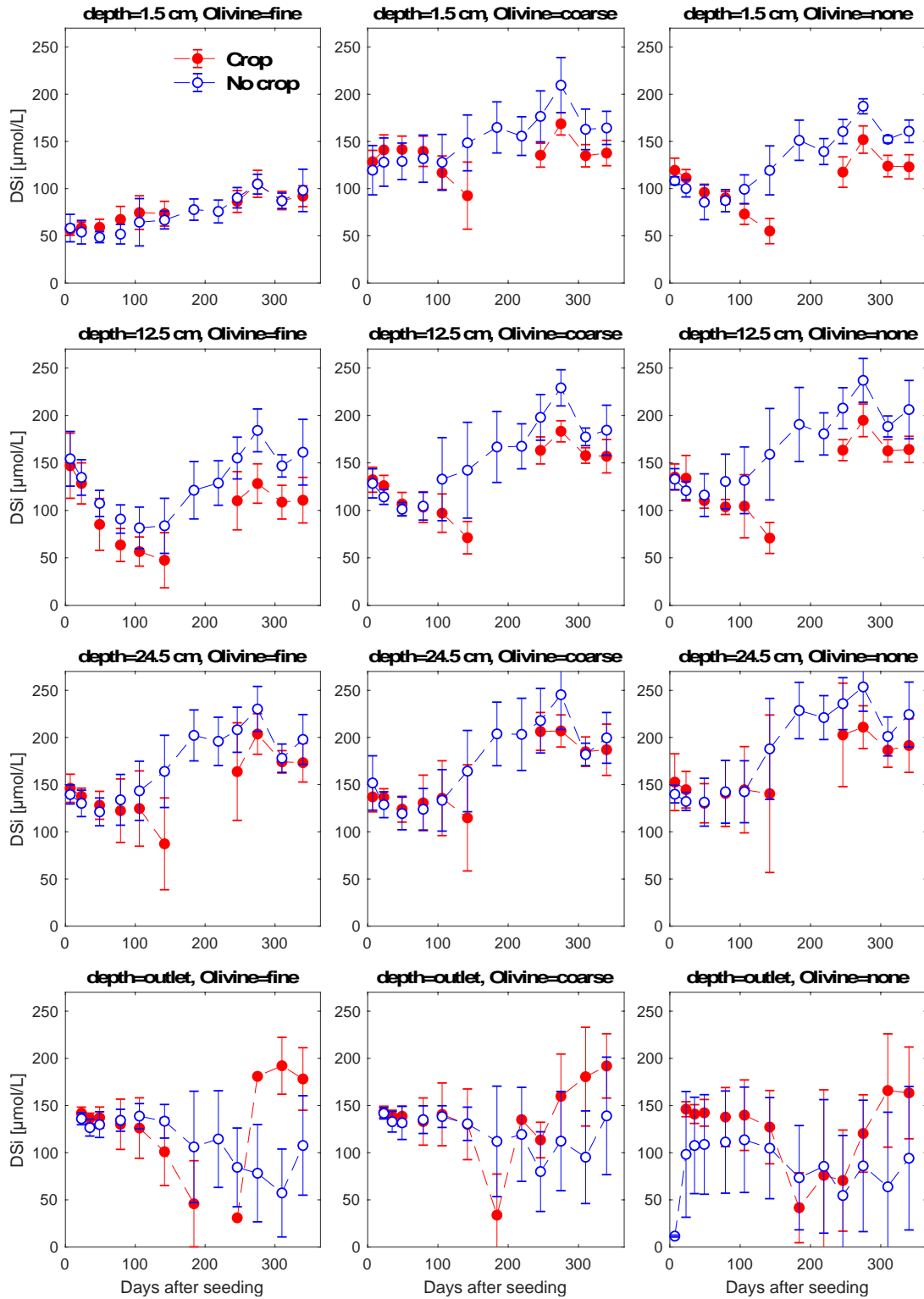
**Fig. S4-1.** Development of pH over the experiment time, differentiated by olivine and crop treatment. Error bars indicate  $\pm 1SD$ .

## S5. Mg concentrations in soil water



**Fig. S5-1.** Development of Mg concentrations in solution over the experiment time, differentiated by olivine and crop treatment. Error bars indicate  $\pm 1\text{SD}$ .

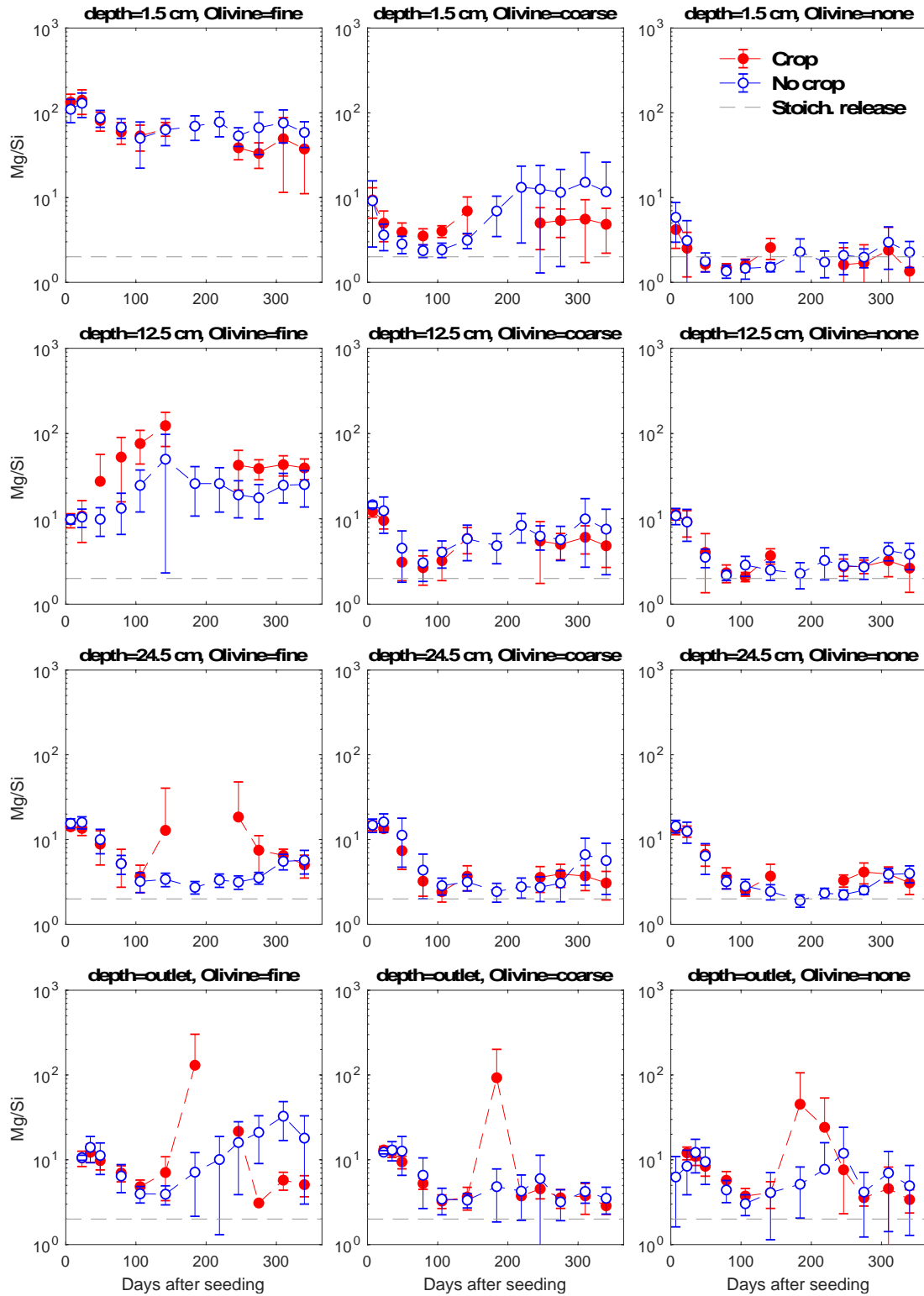
## S6. DSi concentrations in soil water



**Fig. S6-1.** Development of DSi concentrations over the experiment time, differentiated by olive and crop treatment. Error bars indicate  $\pm 1SD$ .

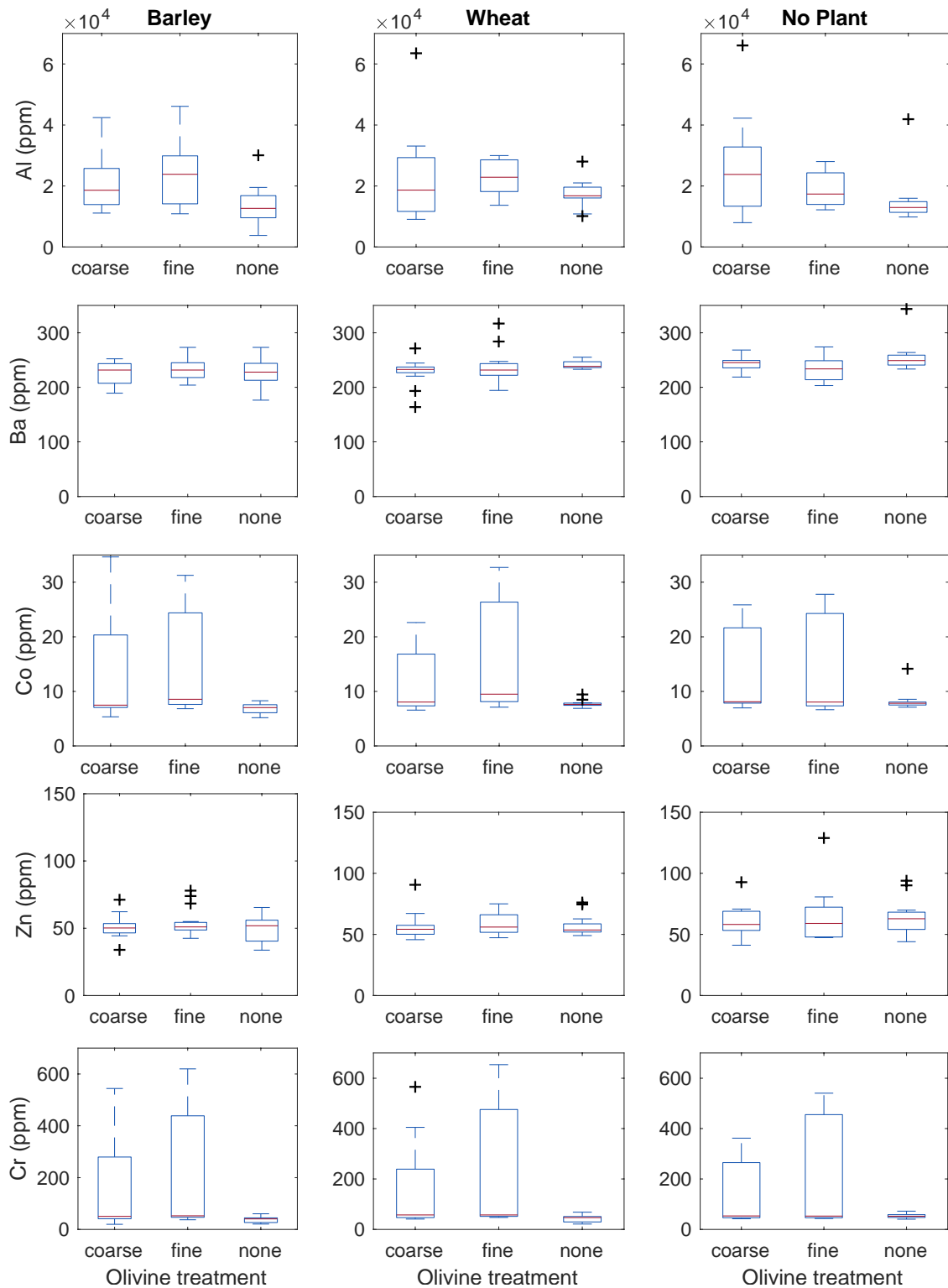


## S7. Mg/Si ratios in soil water

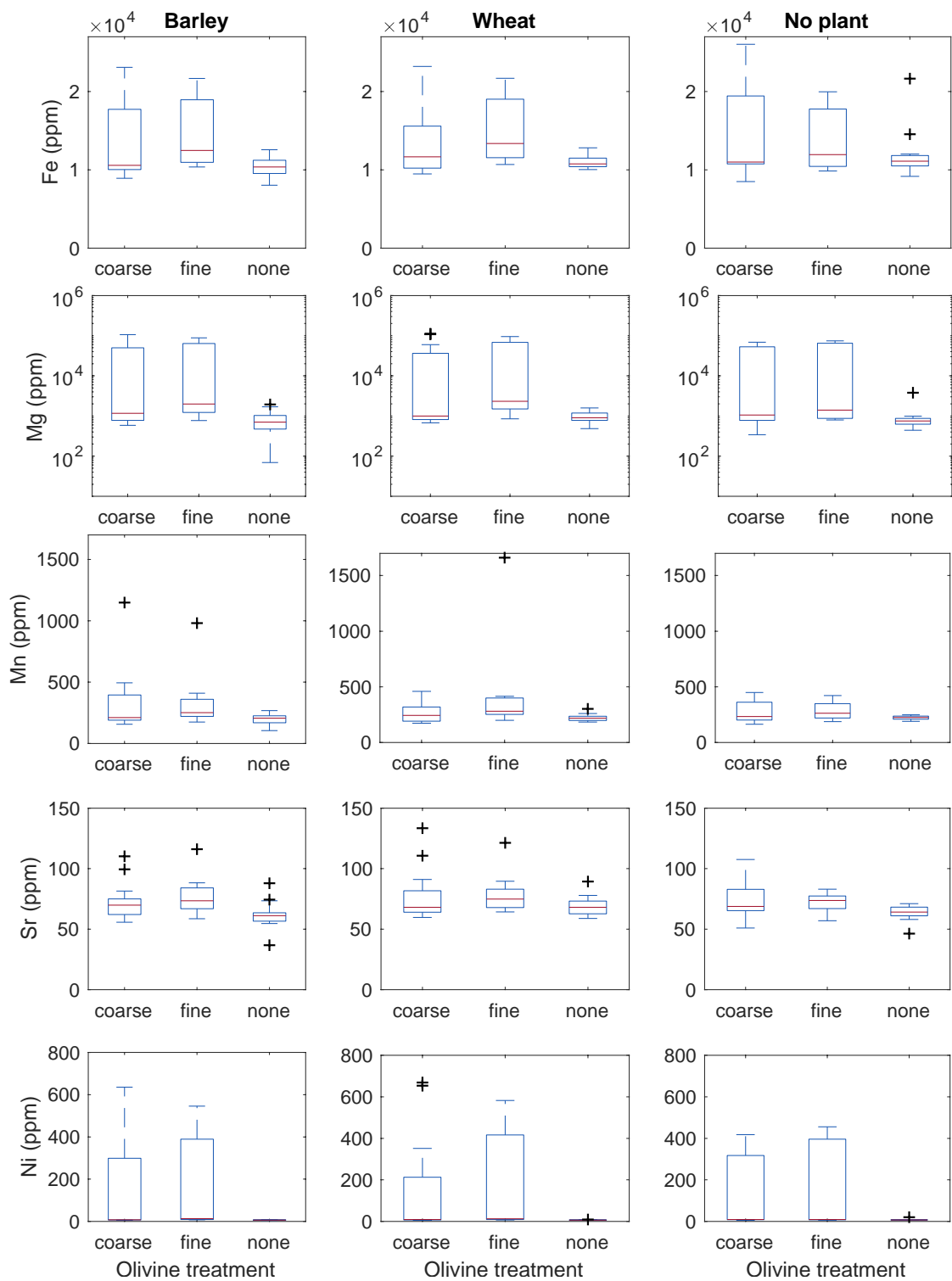


**Fig. S7-1.** Development of Mg/Si ratios in solution over the experiment time, differentiated by olivine and crop treatment. Error bars indicate  $\pm 1SD$ .

## S8. Trace element accumulation in the topsoil

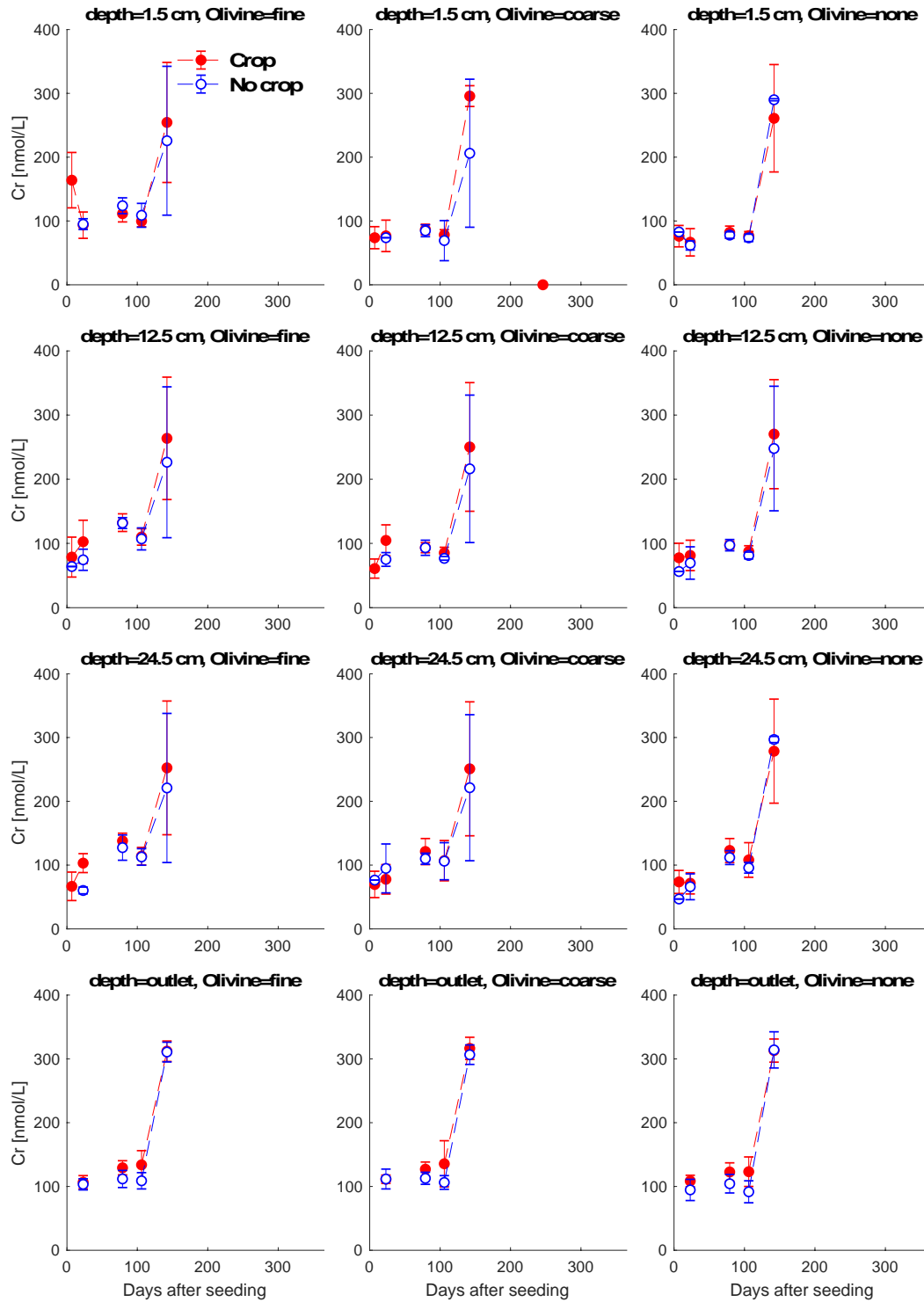


**Fig. S8-1.** Trace metal concentrations in the solid material of the topsoil. Part 1. Boxes indicate the 25th and 75th percentiles, the red bar shows the median, the whiskers extend to the most extreme data points, not considered outliers.



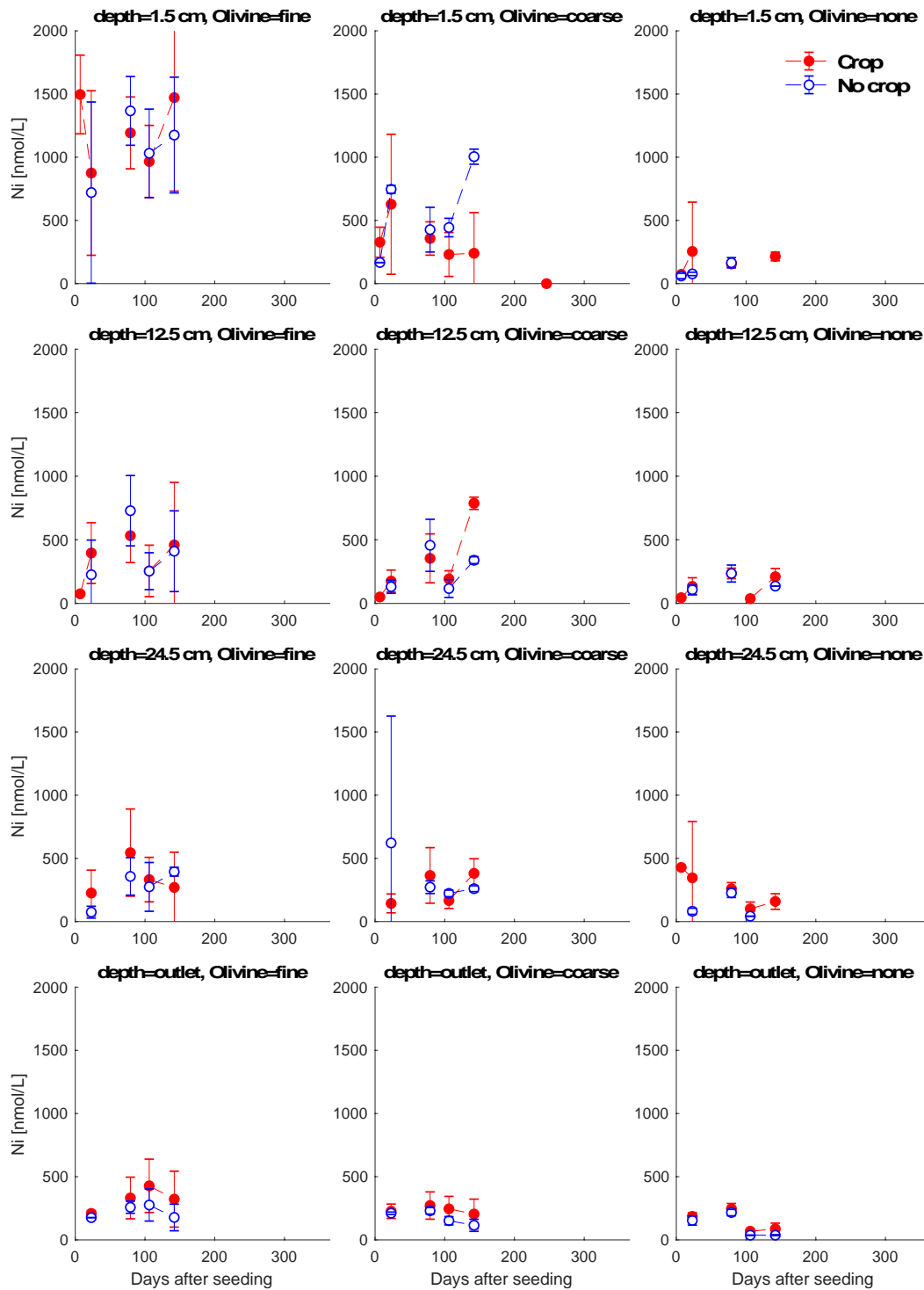
**Fig. S8-2.** Trace metal concentrations in the solid material of the topsoil. Part 2. Boxes indicate the 25th and 75th percentiles, the red bar shows the median, the whiskers extend to the most extreme data points, not considered outliers.

## S9. Cr concentrations in soil water



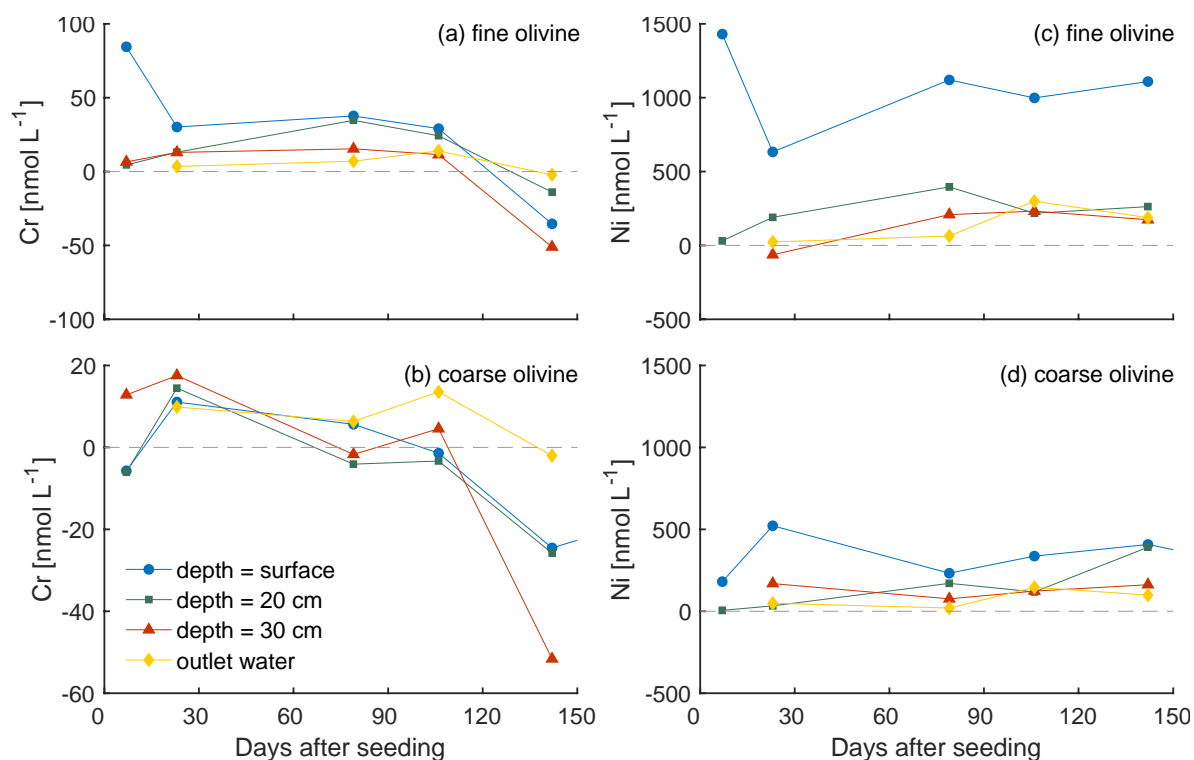
**Fig. S9-1.** Development of Cr concentrations in solution over the experiment time, differentiated by olivine and crop treatment. Error bars indicate  $\pm 1SD$ .

## S10. Ni concentrations in soil water



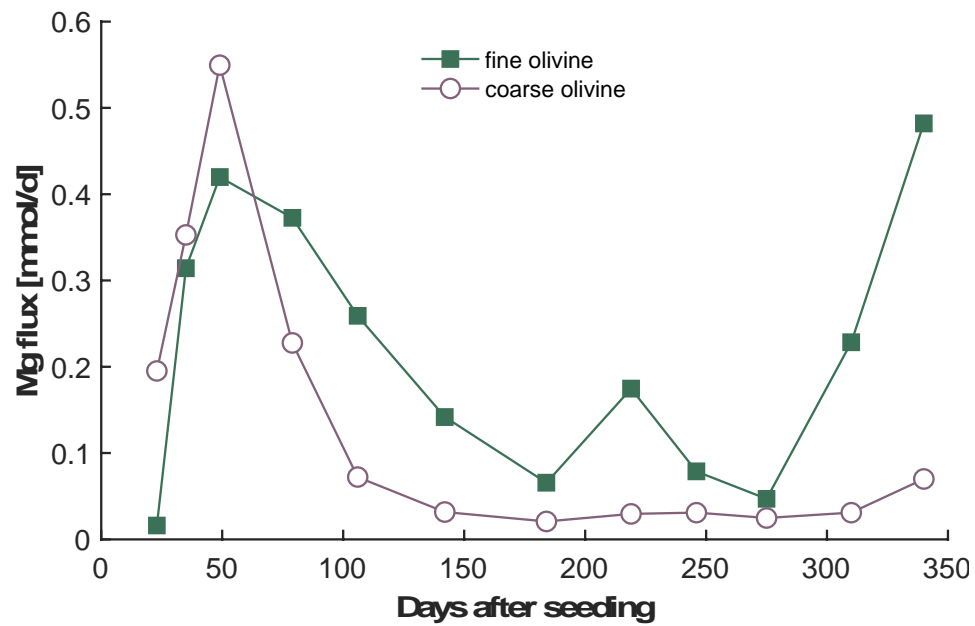
**Fig. S10-1.** Development of Ni concentrations in solution over the experiment time, differentiated by olivine and crop treatment. Error bars indicate  $\pm 1SD$ .

# S11. Ni and Cr concentrations in soil water, corrected for blank values



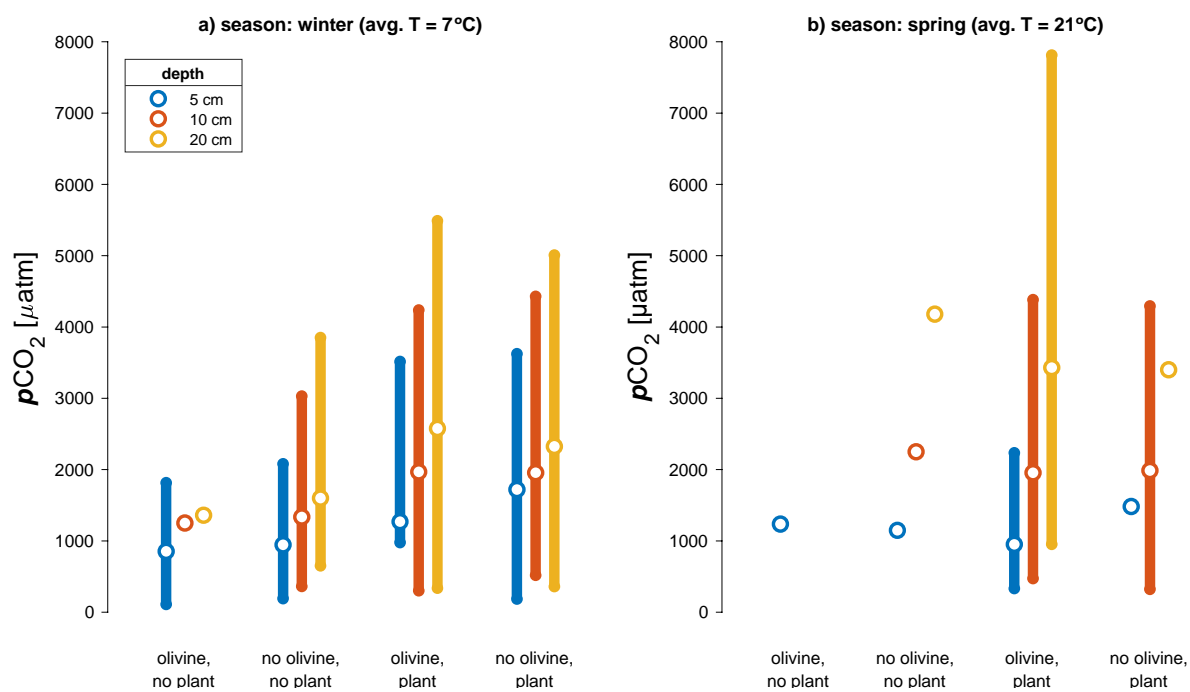
**Fig. S11-1.** Average concentrations of Cr (a) and Ni (b) relative to the control (pore water w/o olivine treatment) in the soil pore water of olivine treated mesocosms over the first 5 months, relative to the control (pore water w/o olivine treatment).

## S12. Mg fluxes from the outlet



**Fig. S12-1.** Fluxes of Mg from the outlet, corrected for background Mg release (no treatment values). Values refer to the daily-normalised flux of the interval preceding the sampling day.

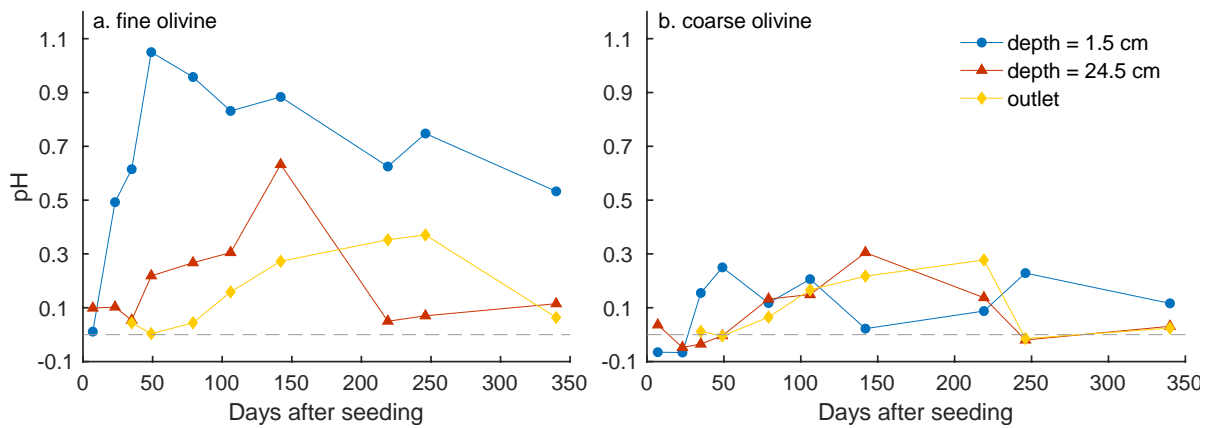
## S13. Partial pressure of CO<sub>2</sub> in the soils



**Fig. S13-1.** Partial pressure of CO<sub>2</sub> ( $p\text{CO}_2$ ) measured in selected mesocosms at different depth in winter (a) and spring (b). Bars indicate  $\pm 1$  SD.



## S14. Soil water pH development over time



**Fig. S14-1.** Mean pH anomaly in the soil pore water of olivine treated mesocosms (with increasing depths) throughout the experiment time, relative to the control (pore water w/o olivine treatment, and irrigation water, dashed line: blank). Differences in pH were calculated with pH values and do thereby not directly represent proton concentration differences.