

## Size-dependent effects of oxo-degradable plastic contamination on soil quality and the growth of *Zea mays*

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## SUPPLEMENTARY MATERIALS

**Table S1** Results of the 2-way ANOVA showing the effect of increasing amount of oxo-degradable macroplastic and microplastic (ODP) contamination on foliar nutrient concentration ( $n = 5$ )

Element	Size effect ( $p$ -value)	Concentration effect ( $p$ -value)	Interaction effect ( $p$ -value)
K	0.009*	< 0.001***	0.312
Ca	0.031*	< 0.001***	0.002**
P	< 0.001***	0.024*	0.187
S	0.356	< 0.001***	0.768
Cl	0.052	< 0.001***	0.008**
Mn	< 0.001***	0.003**	0.002**
Fe	< 0.001***	< 0.001***	< 0.001***
Ni	0.053	0.089	0.056
Cu	< 0.001***	0.123	0.234
Zn	0.029*	0.004**	0.062
Pb	0.029*	0.052	0.021*

Note: \* refers to  $p < 0.05$ , \*\*refers to  $p < 0.01$ , \*\*\* refers to  $p < 0.001$ .

**Table S2** Effect of increasing amount of oxo-degradable macroplastic and microplastic (ODP) contamination on foliar nutrient concentration

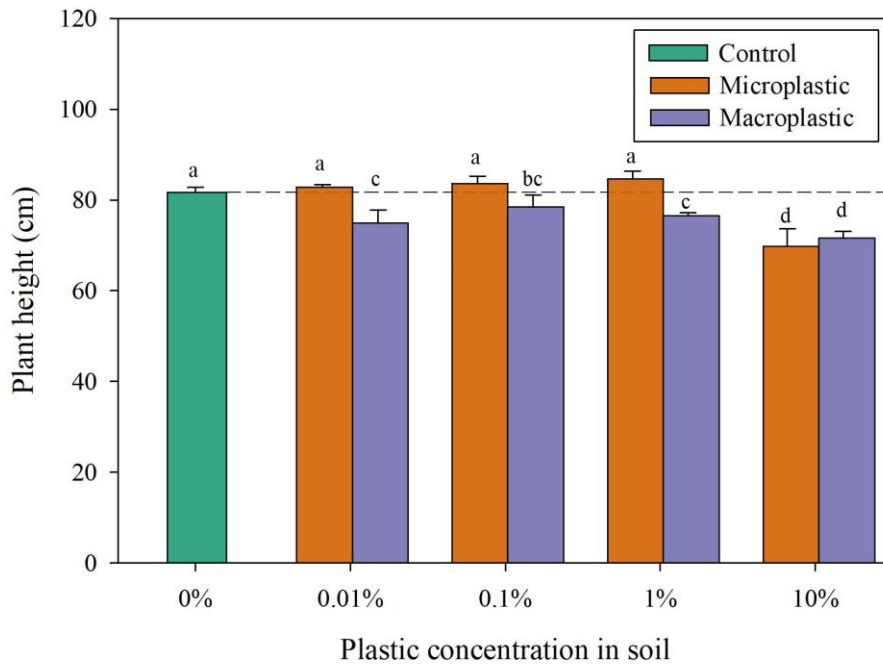
Element	ODP size	ODP concentration (% of soil weight, w/w)				
		0	0.01	0.1	1	10
P	Micro	2415 ± 115 <sup>bc</sup>	1350 ± 146 <sup>d</sup>	1585 ± 136 <sup>cd</sup>	1299 ± 76 <sup>d</sup>	2276 ± 287 <sup>bc</sup>
	Macro		2779 ± 399 <sup>ab</sup>	2564 ± 240 <sup>bc</sup>	2787 ± 146 <sup>ab</sup>	3263 ± 90 <sup>a</sup>
S	Micro	699 ± 44 <sup>c</sup>	776 ± 110 <sup>bc</sup>	1023 ± 89 <sup>a</sup>	958 ± 42 <sup>ab</sup>	795 ± 84 <sup>bc</sup>
	Macro		588 ± 50 <sup>c</sup>	676 ± 27 <sup>c</sup>	741 ± 47 <sup>c</sup>	775 ± 45 <sup>bc</sup>
Cl	Micro	3277 ± 241 <sup>d</sup>	4103 ± 593 <sup>c</sup>	7898 ± 688 <sup>a</sup>	6627 ± 896 <sup>b</sup>	3670 ± 214 <sup>d</sup>
	Macro		5086 ± 526 <sup>c</sup>	3242 ± 672 <sup>d</sup>	3931 ± 959 <sup>cd</sup>	3894 ± 372 <sup>cd</sup>
K	Micro	24412±1187 <sup>a</sup>	14035±1476 <sup>c</sup>	21405±2196 <sup>ab</sup>	18784±1674 <sup>b</sup>	18139±1611 <sup>b</sup>
	Macro		24068±1752 <sup>a</sup>	19764±2239 <sup>b</sup>	21720±2473 <sup>ab</sup>	24309±1634 <sup>a</sup>
Ca	Micro	1664 ± 78 <sup>c</sup>	2106 ± 259 <sup>b</sup>	2794 ± 320 <sup>a</sup>	2917 ± 193 <sup>a</sup>	2813 ± 366 <sup>a</sup>
	Macro		2036 ± 159 <sup>b</sup>	1708 ± 108 <sup>c</sup>	1842 ± 84 <sup>c</sup>	2845 ± 182 <sup>a</sup>
Mn	Micro	35.4 ± 2.1 <sup>b</sup>	19.0 ± 2.7 <sup>d</sup>	23.0 ± 4.0 <sup>cd</sup>	24.6 ± 2.3 <sup>cd</sup>	16.3 ± 2.5 <sup>d</sup>
	Macro		35.6 ± 3.3 <sup>b</sup>	45.7 ± 8.9 <sup>a</sup>	32.5 ± 1.6 <sup>bc</sup>	44.0 ± 5.2 <sup>a</sup>
Fe	Micro	83.6 ± 9.7 <sup>c</sup>	77.8 ± 11.3 <sup>c</sup>	102 ± 28.4 <sup>bc</sup>	94.4 ± 18.5 <sup>c</sup>	48.0 ± 9.4 <sup>d</sup>
	Macro		134.0 ± 6.5 <sup>b</sup>	194 ± 67.8 <sup>a</sup>	124 ± 22.8 <sup>b</sup>	197 ± 45.6 <sup>a</sup>
Ni	Micro	2.71 ± 0.29 <sup>b</sup>	4.23 ± 1.4 <sup>b</sup>	2.93 ± 0.87 <sup>b</sup>	4.01 ± 0.69 <sup>b</sup>	3.67 ± 1.54 <sup>b</sup>
	Macro		2.88 ± 0.65 <sup>b</sup>	6.59 ± 2.94 <sup>ab</sup>	7.03 ± 1.90 <sup>a</sup>	11.4 ± 7.39 <sup>a</sup>
Cu	Micro	2.90 ± 0.18 <sup>b</sup>	2.24 ± 0.29 <sup>c</sup>	2.93 ± 0.15 <sup>b</sup>	2.90 ± 0.12 <sup>b</sup>	2.81 ± 0.25 <sup>b</sup>
	Macro		2.84 ± 0.28 <sup>b</sup>	2.96 ± 0.22 <sup>b</sup>	2.95 ± 0.20 <sup>b</sup>	4.06 ± 0.33 <sup>a</sup>
Zn	Micro	22.3 ± 1.4 <sup>b</sup>	15.9 ± 1.2 <sup>c</sup>	26.4 ± 4.9 <sup>ab</sup>	19.2 ± 2.2 <sup>bc</sup>	19.4 ± 2.5 <sup>bc</sup>
	Macro		22.5 ± 1.8 <sup>b</sup>	22.8 ± 2.2 <sup>b</sup>	20.8 ± 1.2 <sup>bc</sup>	26.4 ± 1.7 <sup>a</sup>
Pb	Micro	0.45 ± 0.09 <sup>c</sup>	0.29 ± 0.06 <sup>c</sup>	0.69 ± 0.31 <sup>b</sup>	0.68 ± 0.04 <sup>b</sup>	0.34 ± 0.12 <sup>c</sup>
	Macro		0.56 ± 0.03 <sup>bc</sup>	1.13 ± 0.20 <sup>a</sup>	0.46 ± 0.13 <sup>bc</sup>	0.95 ± 0.30 <sup>ab</sup>

Note:  $n = 5$  for plastic treatments;  $n = 10$  for control (0%); All values are expressed in  $\text{mg} \cdot \text{kg}^{-1}$  dry weight and presented as mean  $\pm$  SD. Different letters indicate significant differences between treatments at the  $p < 0.05$  level.

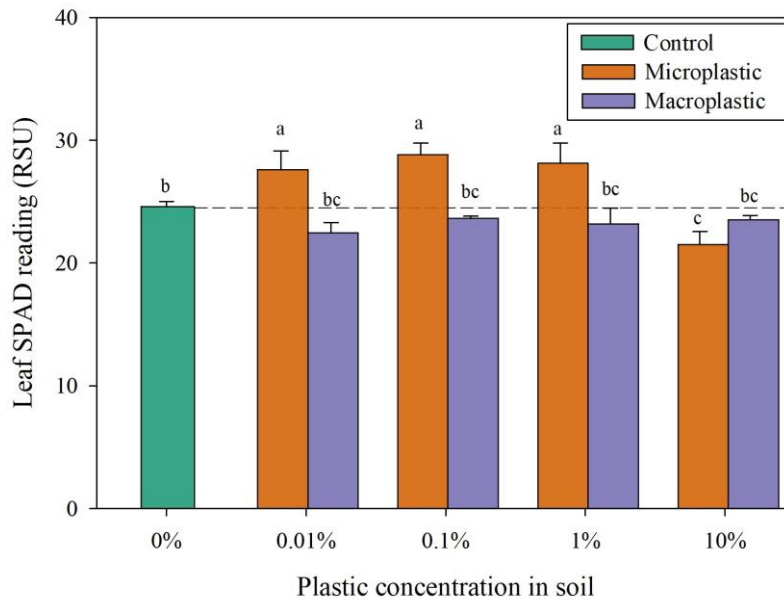
**Table S3** Elemental composition of the oxo-degradable plastic film as measured by digestion and subsequent analysis by ICP-OES

Component	Value
Ash content (%)	8.34 + 0.18
CaCO <sub>3</sub> equivalent (%)	7.14 + 0.20
Ca (g·kg <sup>-1</sup> )	28.6 + 0.79
Ba (g·kg <sup>-1</sup> )	0.44 + 0.01
Na (g·kg <sup>-1</sup> )	0.42 + 0.04
Mg (g·kg <sup>-1</sup> )	0.39 + 0.01
Al (g·kg <sup>-1</sup> )	0.21 + 0.01
Zn (g·kg <sup>-1</sup> )	0.15 + 0.01
Pb (mg·kg <sup>-1</sup> )	59.3 + 0.9
K (mg·kg <sup>-1</sup> )	58.7 + 3.2
Ti (mg·kg <sup>-1</sup> )	57.0 + 4.1
Fe (mg·kg <sup>-1</sup> )	53.1 + 2.3
Cu (mg·kg <sup>-1</sup> )	24.1 + 0.4
Sr (mg·kg <sup>-1</sup> )	18.3 + 0.3
Cr (mg·kg <sup>-1</sup> )	13.5 + 0.3
Mn (mg·kg <sup>-1</sup> )	2.48 + 0.03
Ni (mg·kg <sup>-1</sup> )	0.32 + 0.19
Li (mg·kg <sup>-1</sup> )	0.29 + 0.04
Co (mg·kg <sup>-1</sup> )	0.05 + 0.02

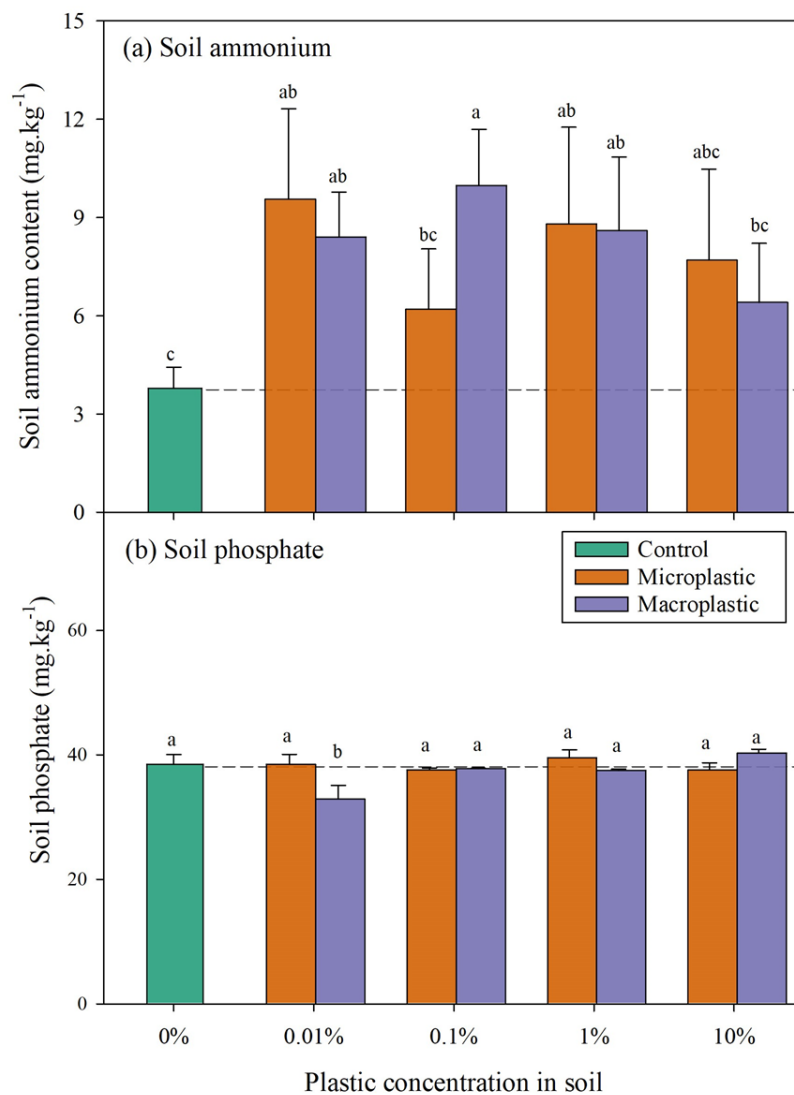
Note: Values are means + SEM ( $n = 4$ ). The elements As and Cd were not detected. The shading indicates the different use of units.



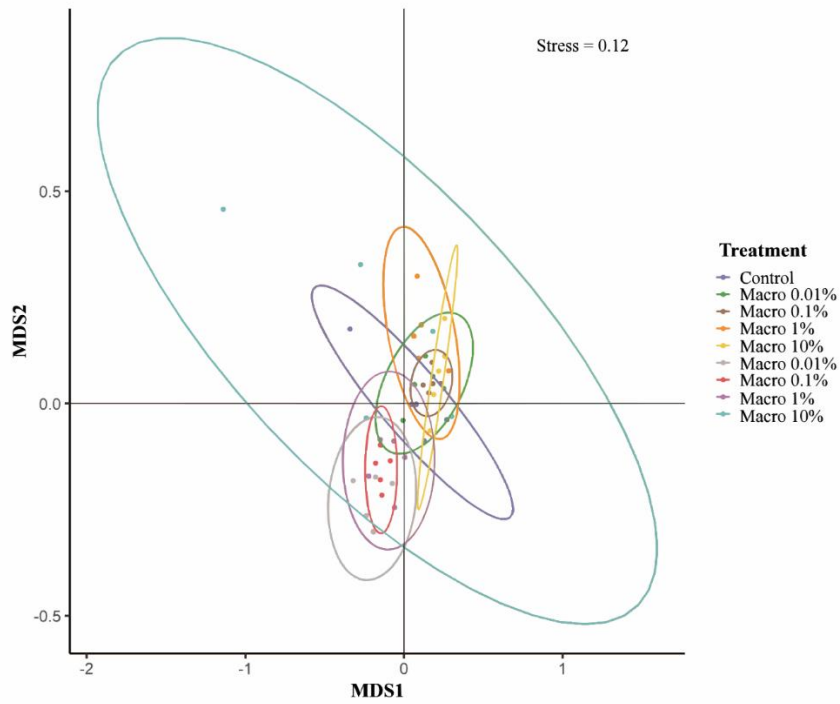
**Fig. S1** Effect of increasing amount of oxo-degradable macroplastic and microplastic (ODP) contamination on maize shoot height. Values are presented as mean  $\pm$  SE ( $n = 5$  for the plastic treatments,  $n = 10$  for control (0%)). Different letters represent significant differences between treatments at the  $p < 0.05$  level. Analysis based on 2-way ANOVA followed by Tukey's HSD test (ODP size  $p < 0.001$ , ODP concentration,  $p < 0.001$ ; Interaction effect: Treatment  $\times$  Concentration,  $p = 0.008$ ). The dashed line represents the average control value for comparison to the other treatments.



**Fig. S2** Effect of increasing amount of oxo-degradable macroplastic and microplastic (ODP) contamination on foliar chlorophyll concentration. Values are presented as mean  $\pm$  SE ( $n = 5$  for the plastic treatments,  $n = 10$  for control (0%)). Different letters represent significant differences between treatments at the  $p < 0.05$  level. Analysis based on 2-way ANOVA followed by Tukey's HSD test (ODP size  $p < 0.001$ , ODP concentration,  $p = 0.008$ ; Interaction effect: Treatment  $\times$  Concentration,  $p = 0.049$ ). The dashed line represents the average control value for comparison to the other treatments. RSU = Relative SPAD Units.



**Fig. S3** Effect of increasing amount of oxo-degradable macroplastic and microplastic (ODP) contamination on (a) soil ammonium and (b) soil phosphate concentration. Values are presented as mean  $\pm$  SE ( $n = 5$  for the plastic treatments,  $n = 10$  for control (0%)). Different letters represent significant differences between treatments at the  $p < 0.05$  level. Analysis based on 2-way ANOVA followed by Tukey's HSD test (ODP size  $p = 0.037$ , ODP concentration,  $p < 0.001$ ; Treatment  $\times$  Concentration,  $p = 0.048$  for soil ammonium, and ODP size  $p = 0.037$ , ODP concentration,  $p < 0.001$ ; Treatment  $\times$  Concentration,  $p = 0.008$  for soil phosphate). The dashed line represents the average control value for comparison to the other treatments.



**Fig. S4** Effect of increasing amount of oxo-degradable macroplastic micro plastic (ODP) contamination on bacterial community composition. Non-metric multidimensional scaling (NMDS) ordination plot of bacterial ASV community composition across microplastic loading rates ( $n = 5$ ). Ellipses represent 95% confidence intervals for each treatment.