

Supporting Information Figs S1–S5

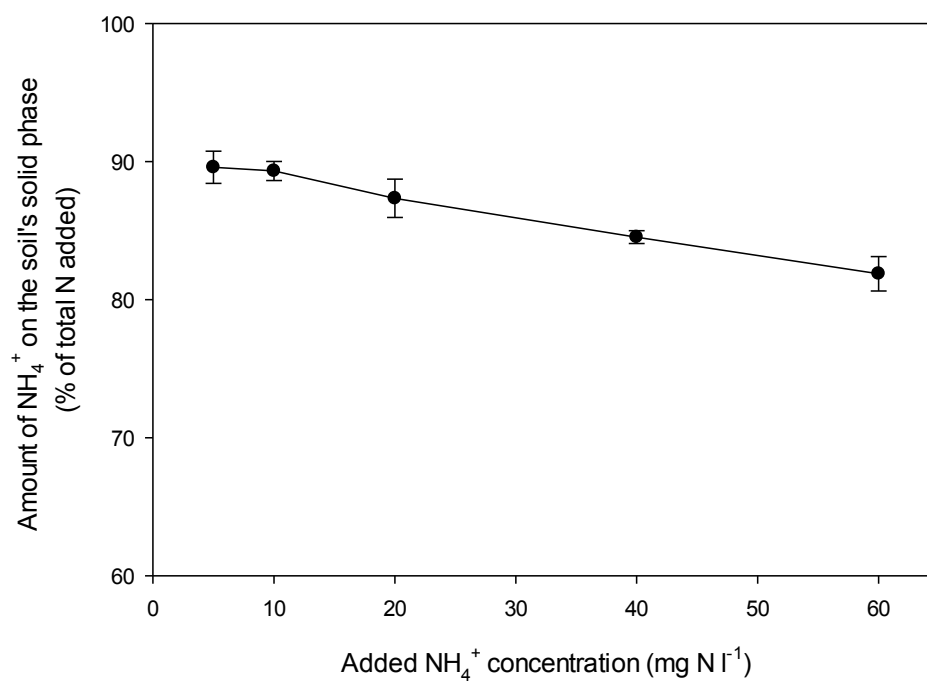


Fig. S1 Amount of NH₄⁺ held on the soil's solid phase as a function of solution NH₄⁺ concentration. Values represent means \pm SEM ($n = 3$).

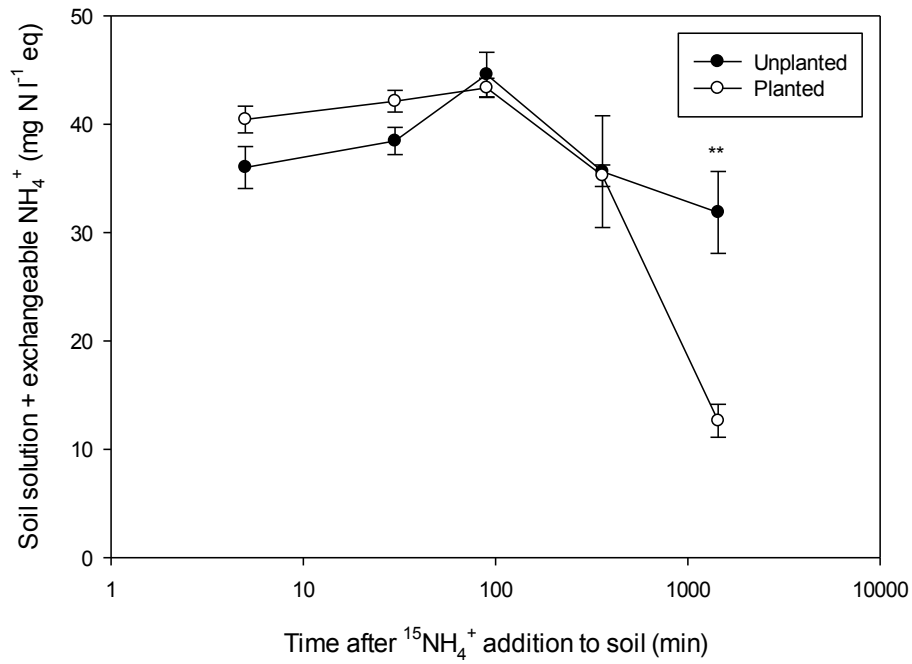


Fig. S2 Total amount of $^{15}\text{NH}_4^+$ present in soil solution and held on the soil's cation exchange phase in planted and unplanted microcosms to which $^{15}\text{NH}_4$ was injected. Values represent means \pm SEM ($n = 4$). ** indicate significant differences between the planted and unplanted treatments at the $P < 0.01$ level.

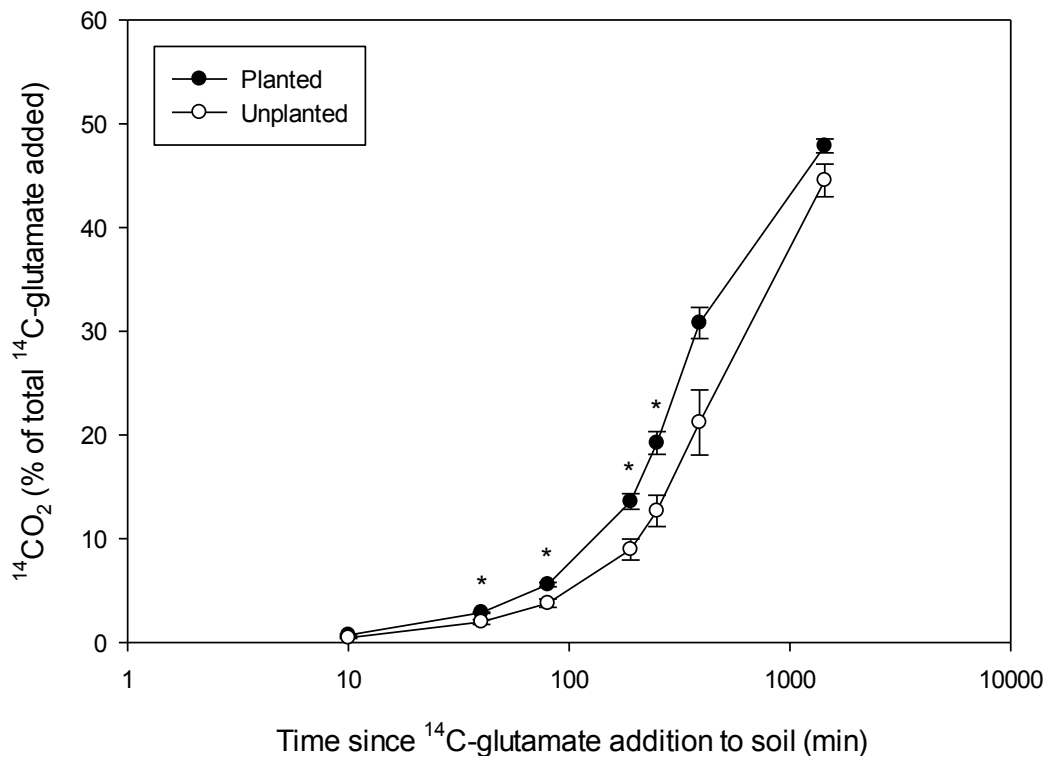


Fig. S3 Time dependent mineralization of ¹⁴C-labelled glutamate in soil in the presence and absence of wheat roots. Values represent means ± SEM (*n* = 4). * indicate significant differences between the planted and unplanted treatments at the *P* < 0.05 level.

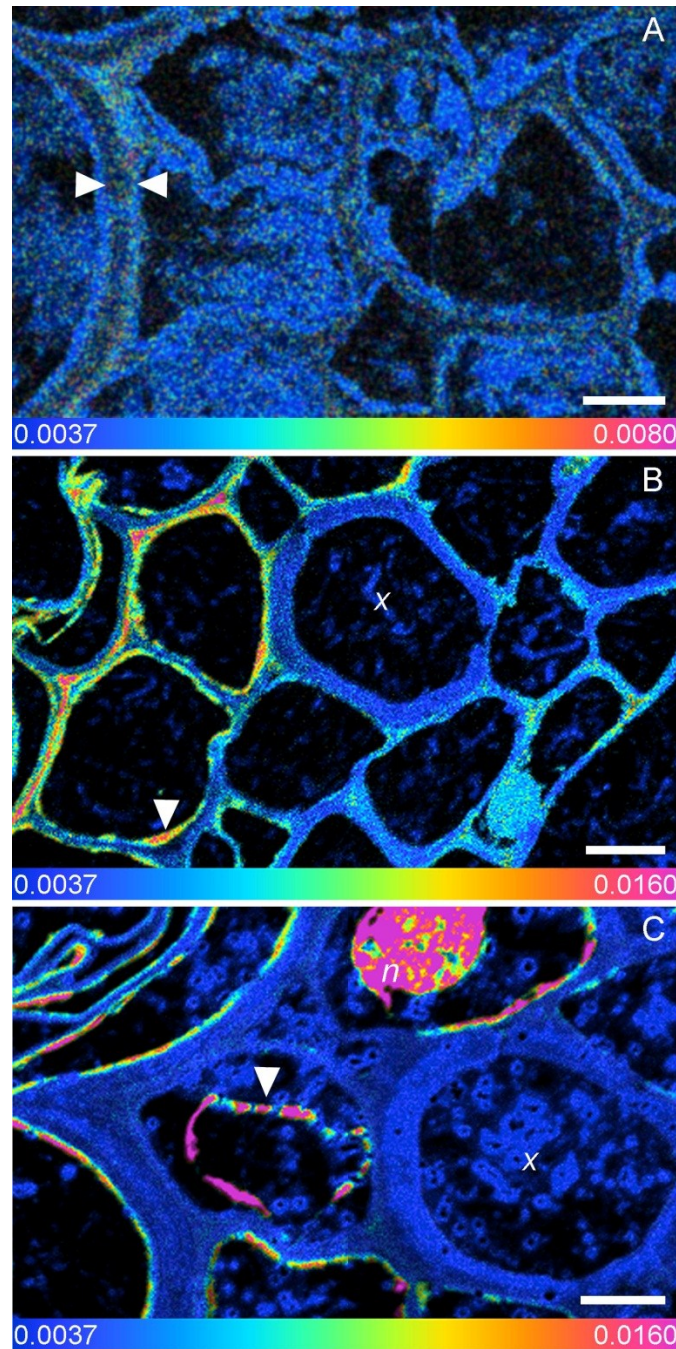


Fig. S4 NanoSIMS imaging and analysis of plant roots *in situ* within the embedded soil core after exposure to ^{15}N -labelled glutamate uptake. A) 5 min where the plant has a small amount of ^{15}N enrichment in between cell walls (between arrows), B) 30 min where the ^{15}N can be seen moving between the cell walls and in the cell cytoplasm (arrow) and C) 24 h where the ^{15}N is mainly in the cell cytoplasm (arrow) and the nucleus (n) having largely passed through the root. The xylem cells (x) remain unenriched at all times. Enrichment levels of ^{15}N are shown as $^{15}\text{N}/^{14}\text{N}$ Hue Saturation Intensity (HSI) images. The HSI color scale is optimised to show ^{15}N uptake in each image. Scale bar = 5 μm for all images.

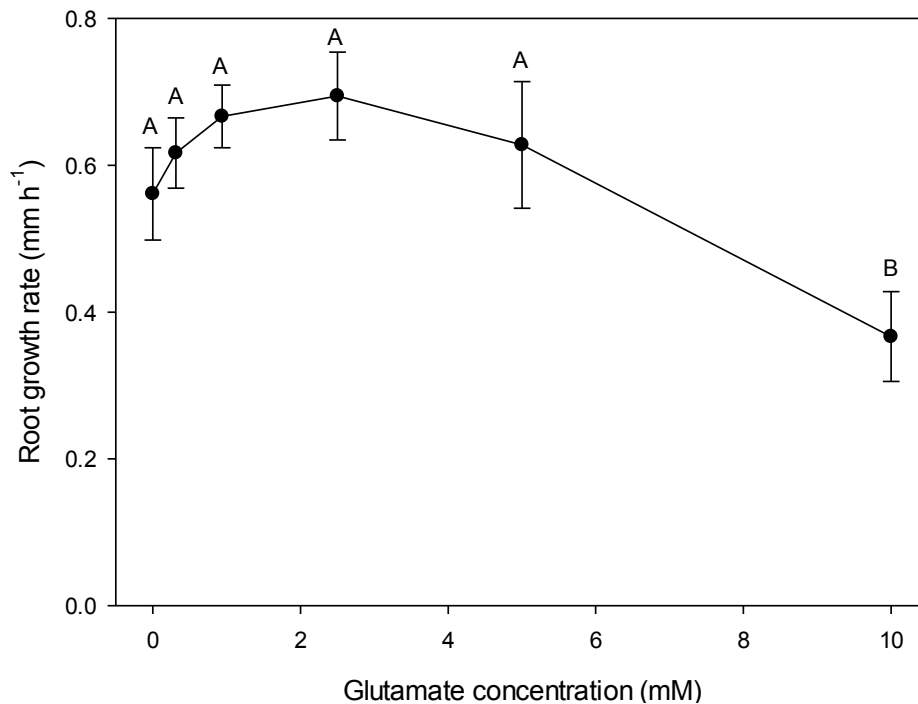


Fig. S5 Influence of external solution glutamate concentration on the growth rate of wheat roots exposed to various concentrations of glutamate for 24 h. Plants (7 d old) were grown in hydroponic culture at 20°C with a 16 h photoperiod. Alongside various concentrations of K-glutamate, the root bathing solution contained CaCl₂ (1 mM), KCl (1 mM) and the initial pH was adjusted to pH 6.0 with HCl. Values represent means ± SEM (*n* = 9). Different capital letters above the symbols represent significant differences between the concentrations at the *P* < 0.05 level. ANOVA result, *P* = 0.007. We conclude from this experiment that exogenously applied glutamate at concentrations <5 mM are not toxic to root growth over short time periods. It is therefore unlikely that the pulse addition of ¹⁵N-glutamate used in our experiment (3 mM) caused any major impact on root growth.