Electronic Supplementary Information

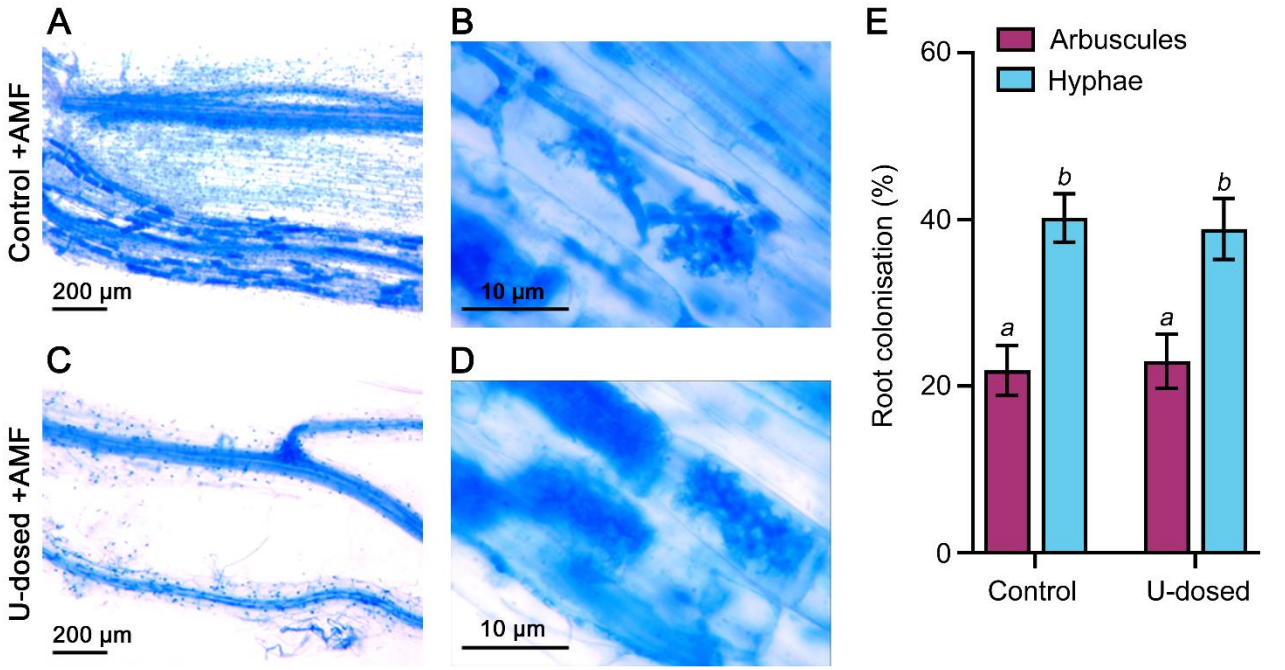

Fig. S1. AM fungal colonisation of *Plantago lanceolata* roots in response to U dosing. (A – D) Representative images at low and high magnification of aniline-blue stained root segments from control (un-dosed) (A and B) and U-dosed (C and D) seedlings colonised by *Rhizophagus irregularis*. The magnified images (B and D) show *R. irregularis* arbuscules connected to filamentous hyphal structures. (E) Arbuscular and hyphal colonisation within control (un-dosed) and U-dosed seedlings. Data are mean values ± SEM, n = 5. Different lowercase letters indicate statistically significant difference ($p < 0.05$) between treatments as determined by 2-way ANOVA and Tukey's post-hoc test. Un-colonised seedlings showed no arbuscular or hyphal presence and so values are not shown.

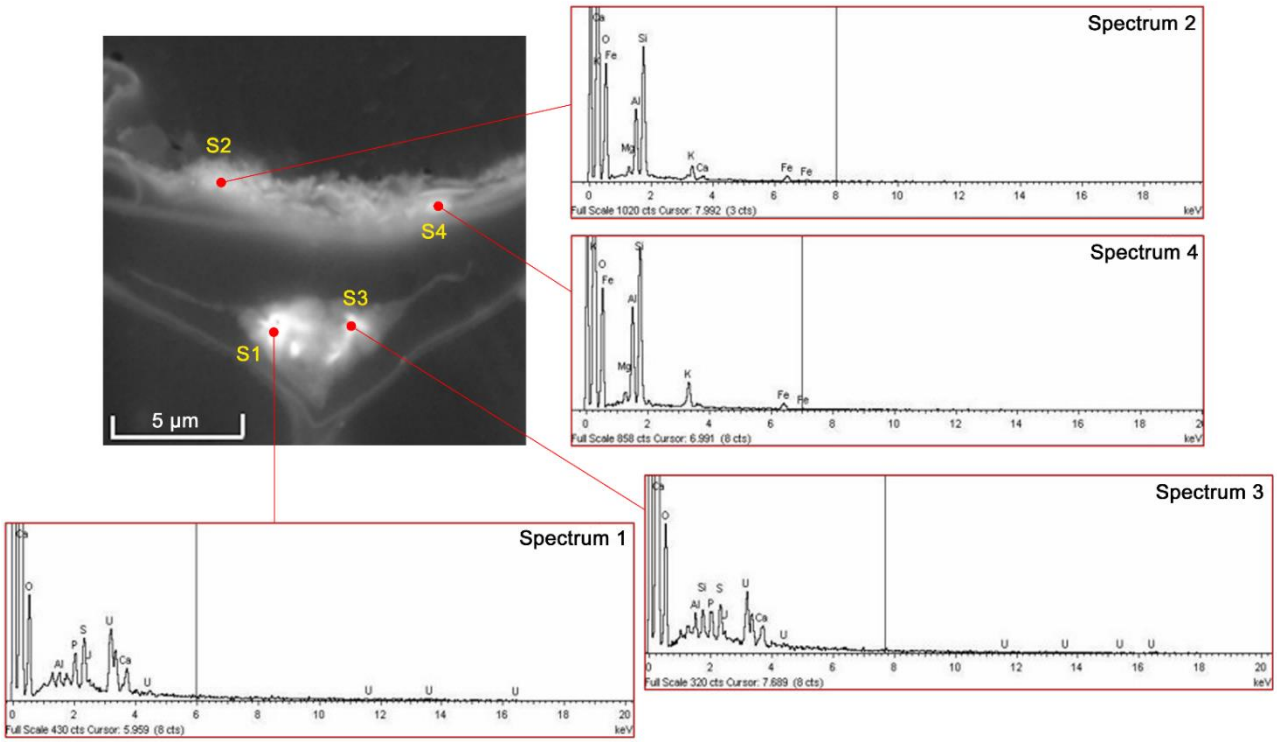

Fig. S2. BSE image of a representative epidermal cell region from a U-dosed non-mycorrhizal root containing U-rich particles. EDS point spectra obtained from four selected regions (S1 – S4) are shown. Spectra 1 and 3 provide evidence of U, P and Ca rich particles while spectra 2 and 4 provide evidence of Fe and Al rich particles. Elemental maps of the same cell region is presented in Fig. 3A.

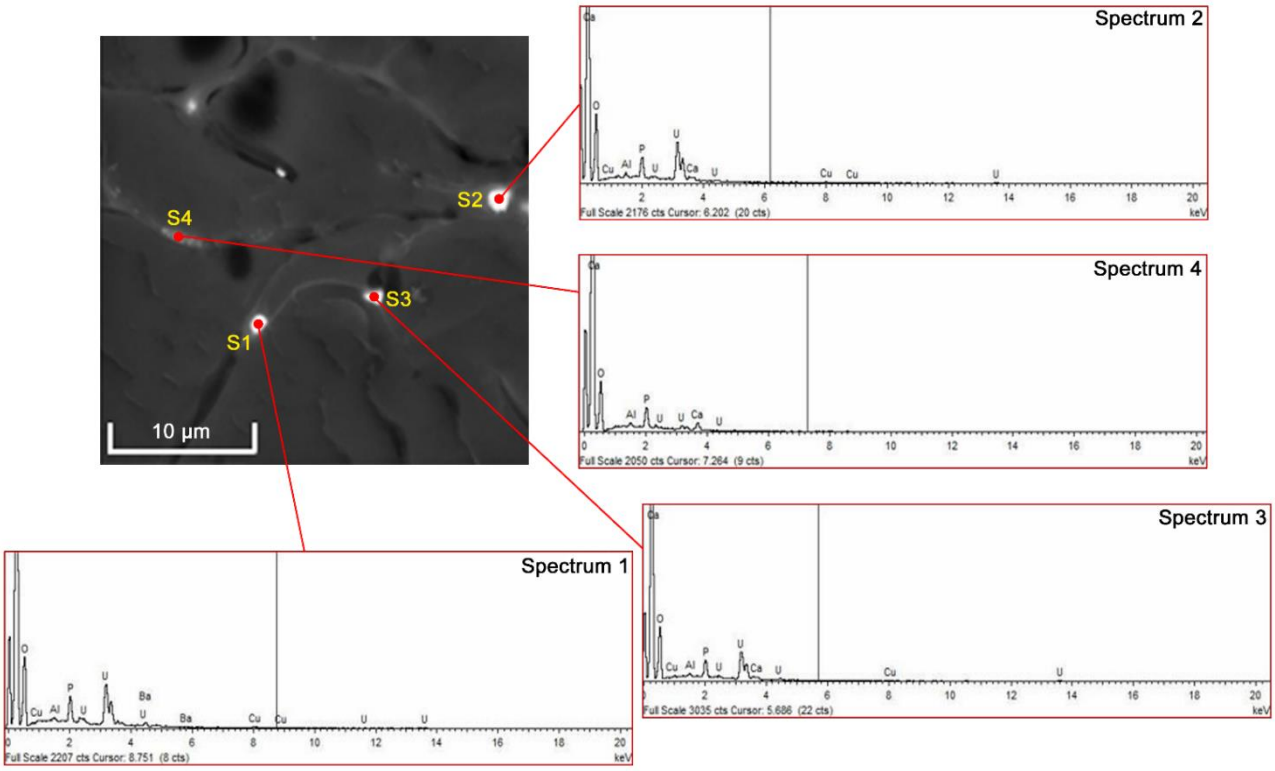

Fig. S3. BSE image of a representative epidermal cell region from a U-dosed mycorrhizal root containing U-rich particles. EDS point spectra obtained from four selected regions (S1 – S4) are shown. All spectra provide evidence of U, P and Ca rich particles. Elemental maps of the same cell region is presented in Fig. 3A.

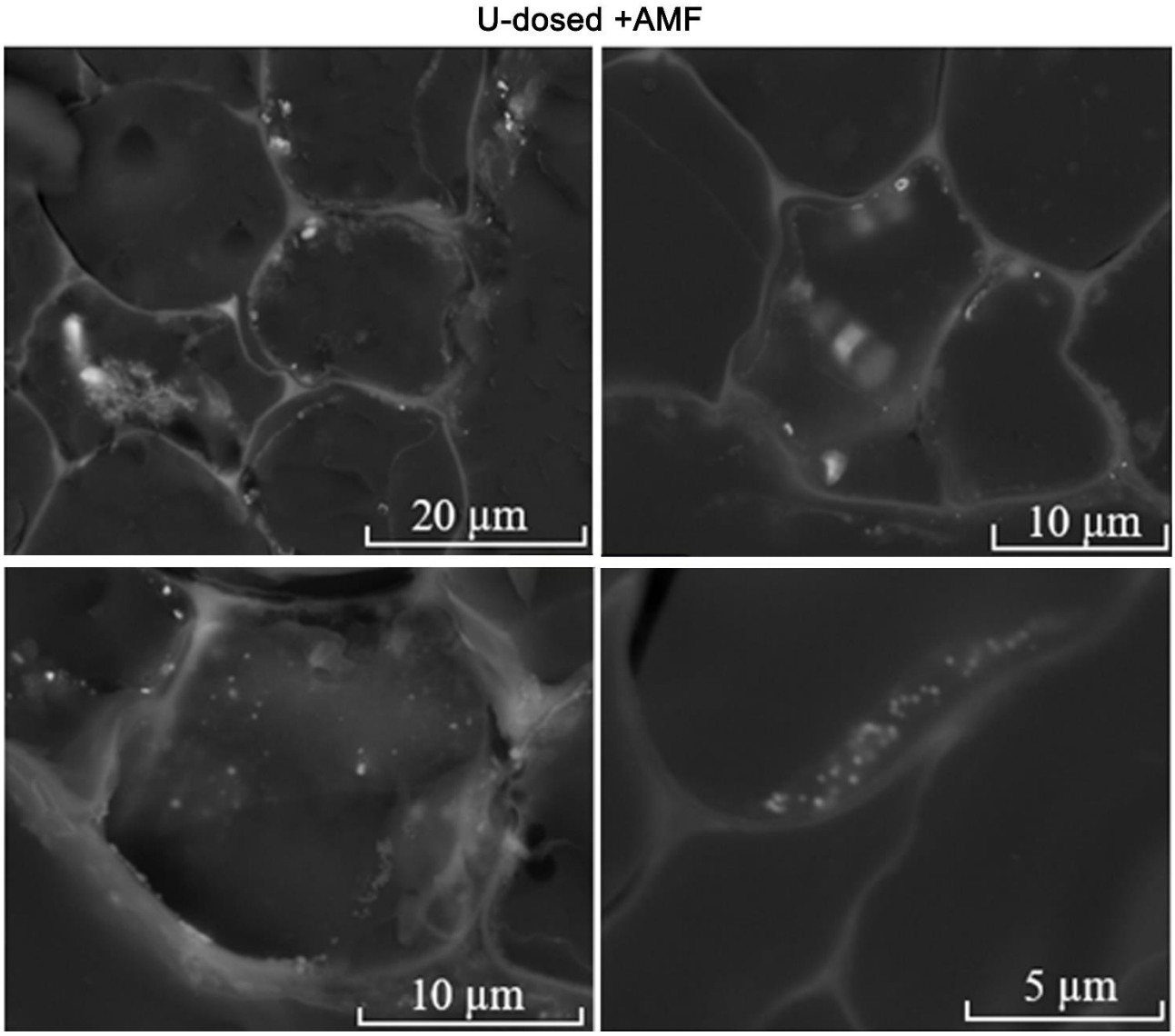

Fig. S4. BSE images for four representative root sections from U-dosed mycorrhizal (+AMF) seedlings. The presence of U-rich particles were detected within and surrounding cortex cells as bright structures.

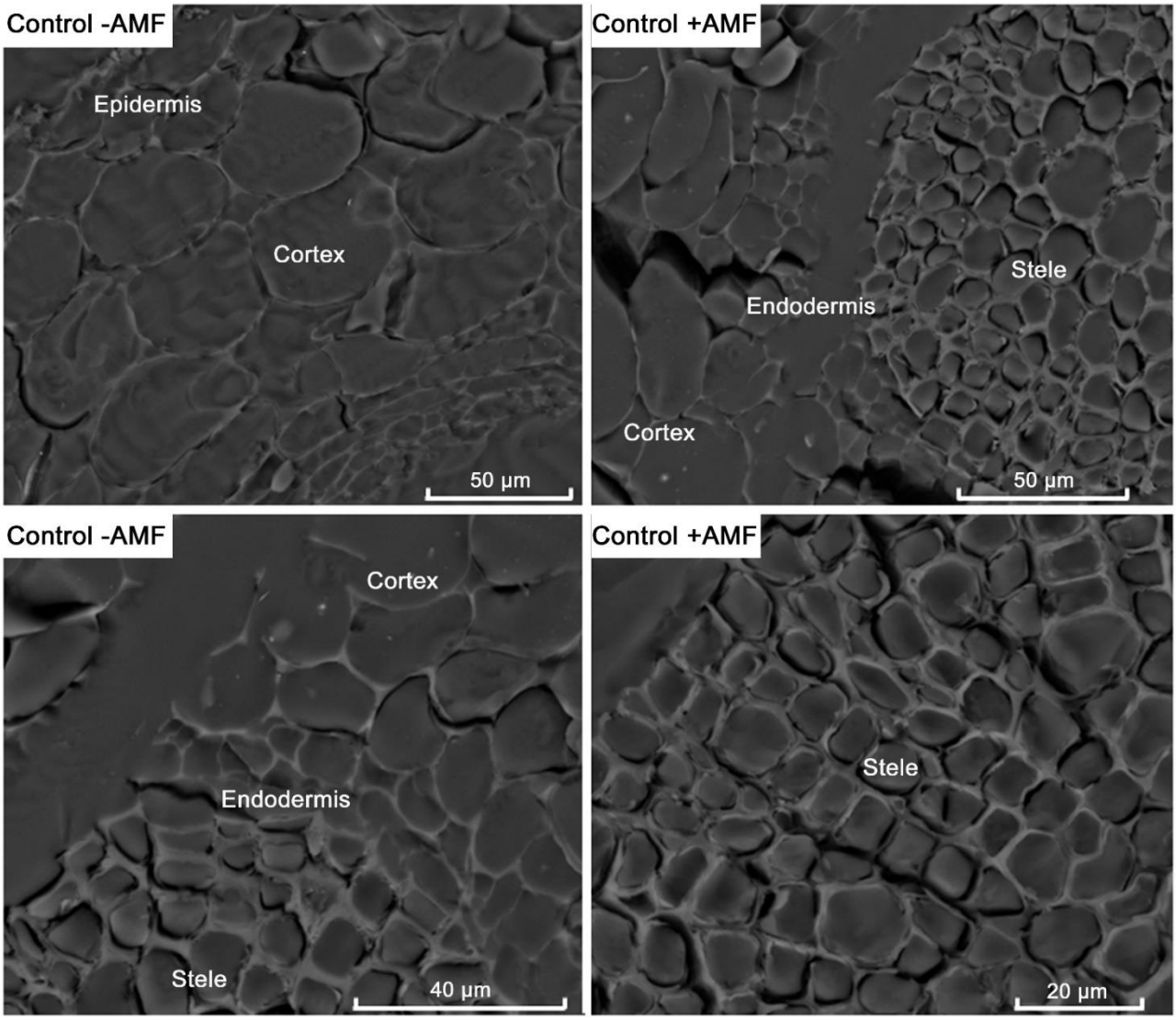

Fig. S5. BSE images for representative root sections from un-dosed (control) non-mycorrhizal (-AMF) and mycorrhizal (+AMF) seedlings. U-rich regions were undetectable in both the -AMF and +AMF un-dosed roots.

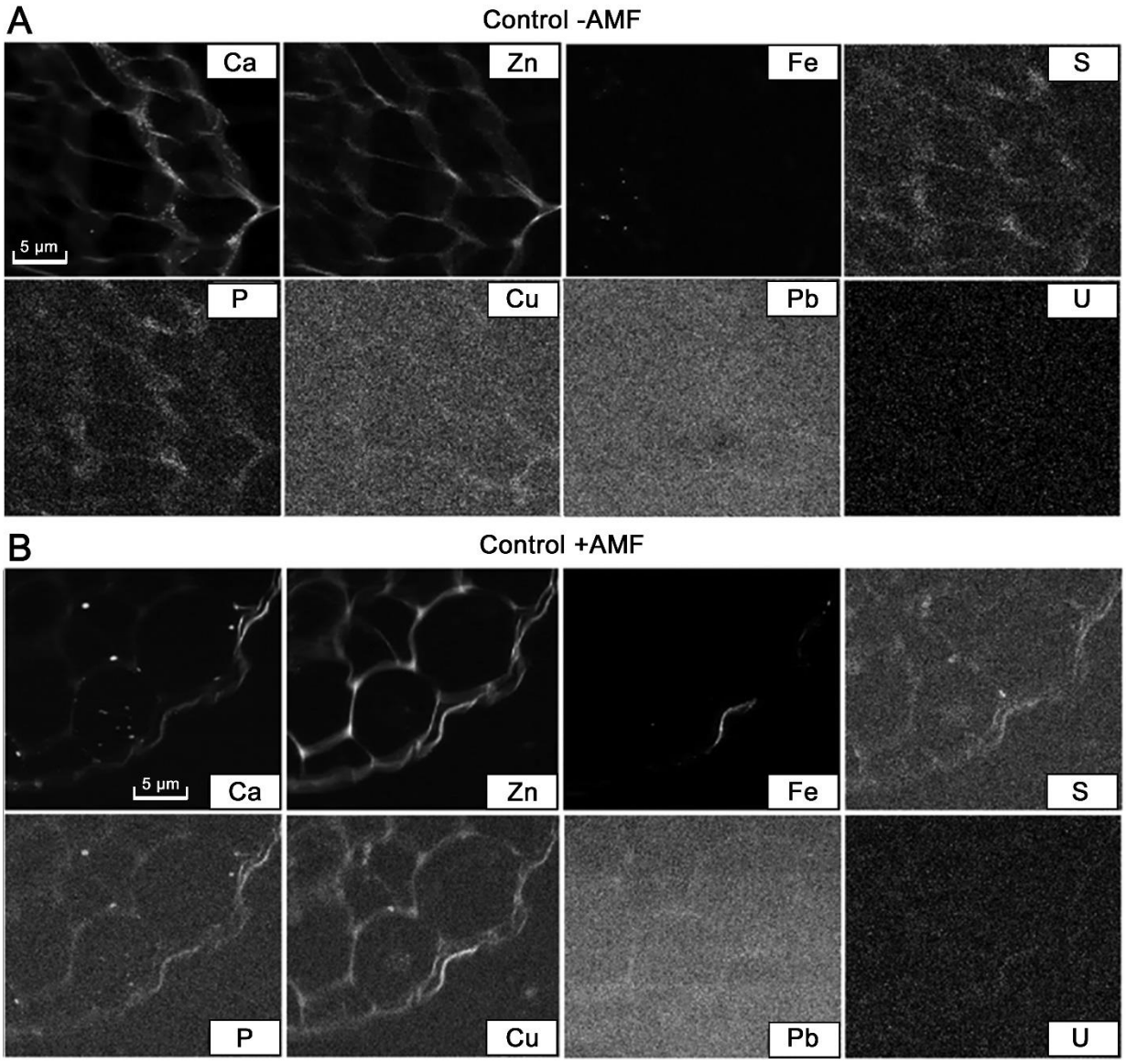

Fig. S6. SR µ-XRF imaging of un-dosed (control) roots. Element maps show Ca, Zn, Fe, S, P, Cu, Pb and U distribution in selected epidermal cells from representative transverse root sections of control non-mycorrhizal (-AMF) seedlings (A) and mycorrhizal (+AMF) seedlings (B). Brighter regions represent a greater concentration of the target element. Scanned regions were 25 µm x 25 µm at 100 nm per pixel resolution.

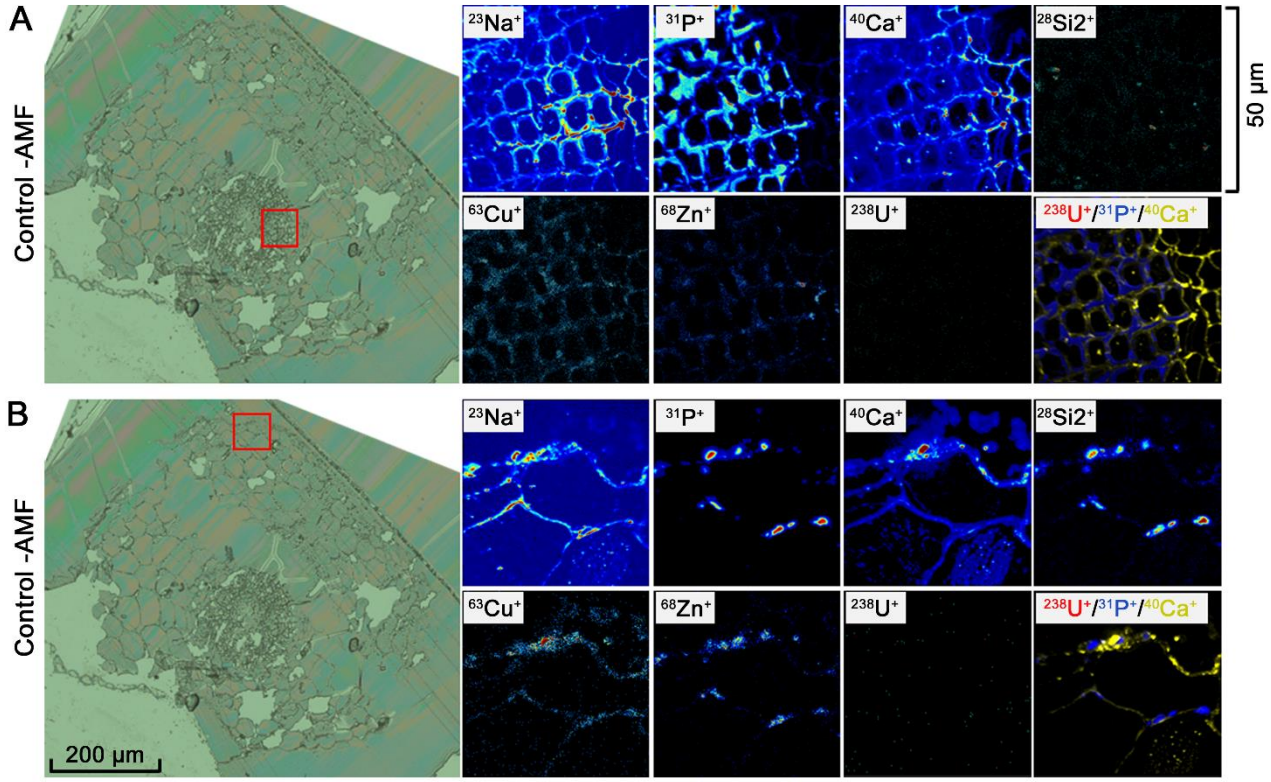

Fig. S7. NanoSIMS imaging of un-dosed (control) non-mycorrhizal roots. Optical photomicrographs of the root section (left) with NanoSIMS chemical maps (thermal colour scale) depicting elemental distributions of Na, P, Ca, Si2, Cu, Zn and U within the stele of representative control non-mycorrhizal (-AMF) root cross sections (A), and within the epidermis of representative control non-mycorrhizal (-AMF) root cross sections (B). Colour merge images show the relative location of U (red), P (blue) and Ca (yellow) with whiter regions exhibiting near-equivalent concentrations of all three chemicals.

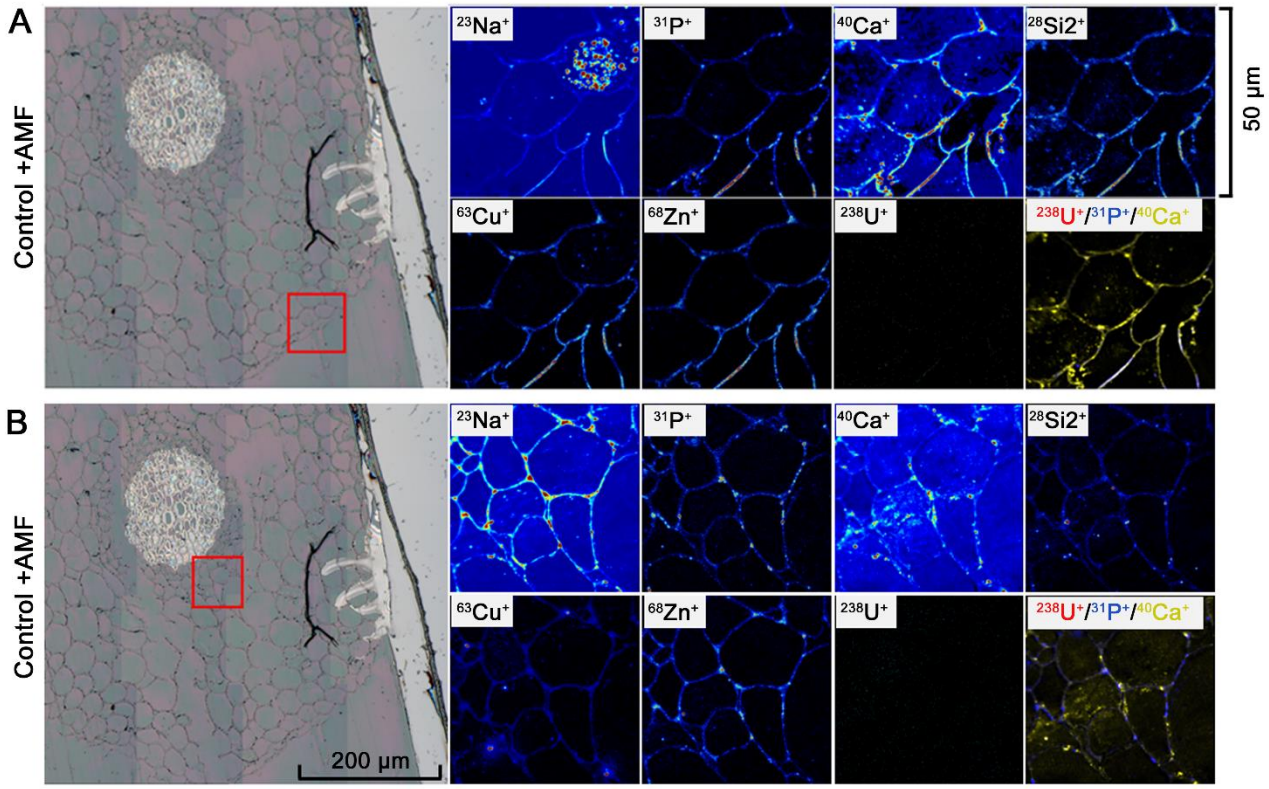

Fig. S8. NanoSIMS imaging of un-dosed (control) mycorrhizal roots. Optical photomicrographs of the root section (left) with NanoSIMS chemical maps (thermal colour scale) depicting elemental distributions of Na, P, Ca, Si2, Cu, Zn and U within the epidermis of representative control mycorrhizal (+AMF) root cross sections (A), and within the endodermis-cortex boundary of representative control mycorrhizal (+AMF) root cross sections (B). Colour merge images show the relative location of U (red), P (blue) and Ca (yellow) with whiter regions exhibiting near-equivalent concentrations of all three chemicals.

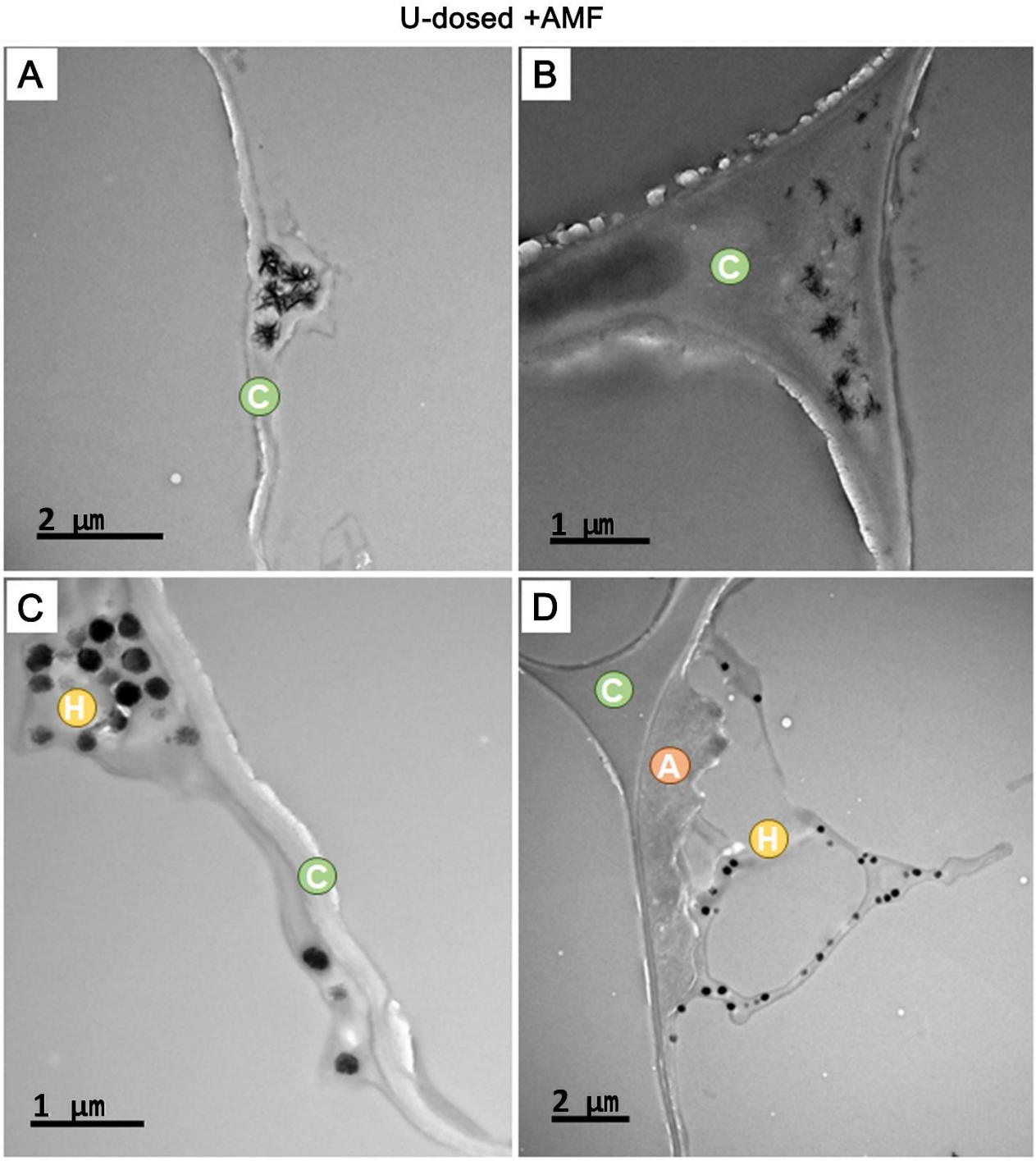

Fig. S9. TEM images of U-rich crystals in U-dosed mycorrhizal roots. (A and B) Acicular U-rich crystals present within the cell walls of representative mycorrhizal (+AMF), U-dosed root section. (C and D) U-rich rounded aggregates present within the fungal hyphal tissues of a representative mycorrhizal, U-dosed root section. Plant cell walls (indicated by 'C'), arbuscules (indicated by 'A') and hyphae (indicated by 'H') are annotated in each image.

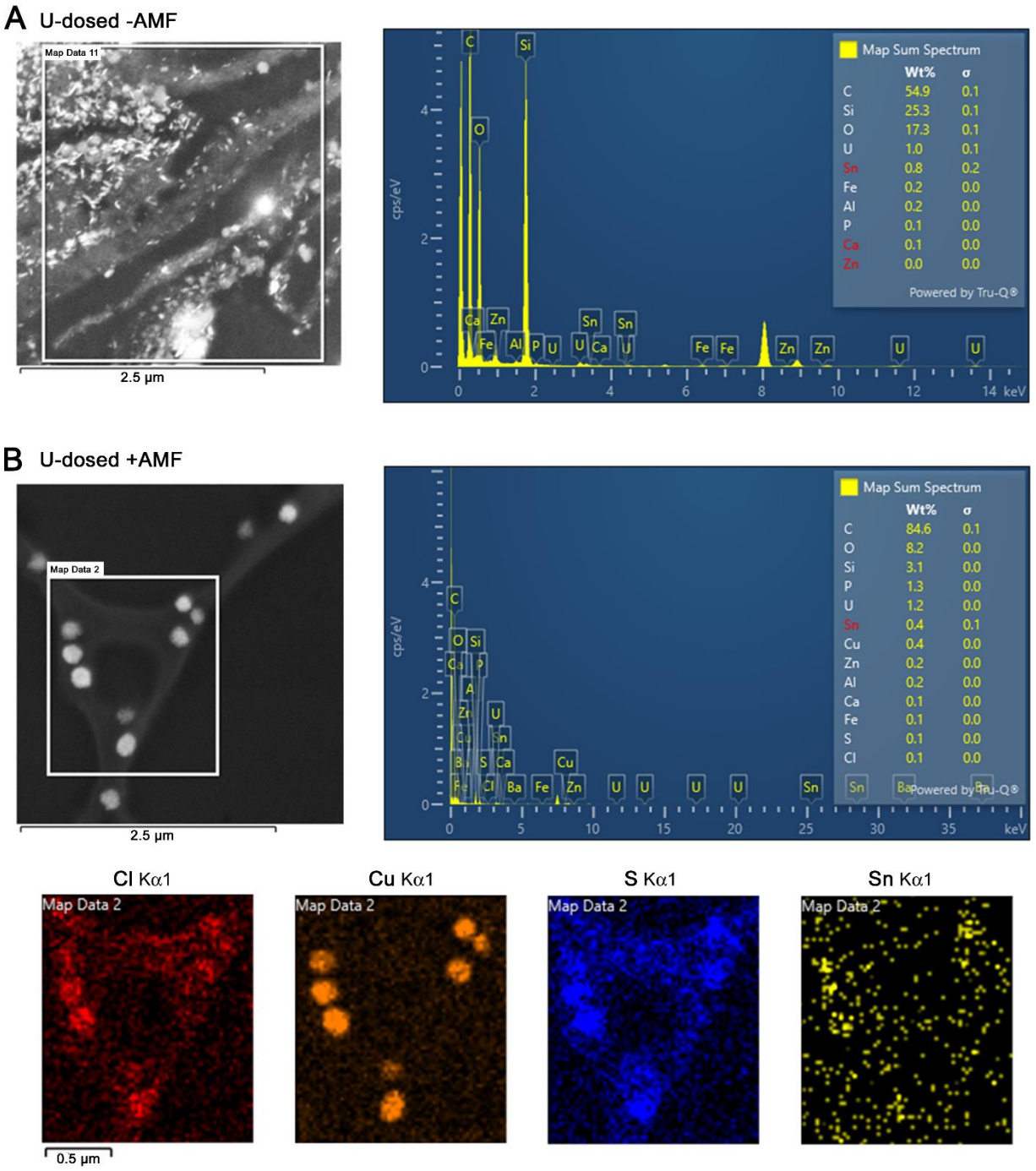

Fig. S10. BSE images of U-rich crystals in U-dosed roots. (A) U-rich acicular crystals present within the cell wall of a representative non-mycorrhizal (-AMF) root section of U-dosed seedlings. (B) U-rich rounded aggregates present within a representative mycorrhizal (+AMF) root section of U-dosed seedlings. STEM-EDS spectra giving percentage by weight (wt%) of each element within the mapped region is shown for each BSE image. Elemental maps generated by STEM-EDS for Cl, Cu, S and Sn of the mycorrhizal root section are also shown, with brighter colouration corresponding to a greater concentration of that element.

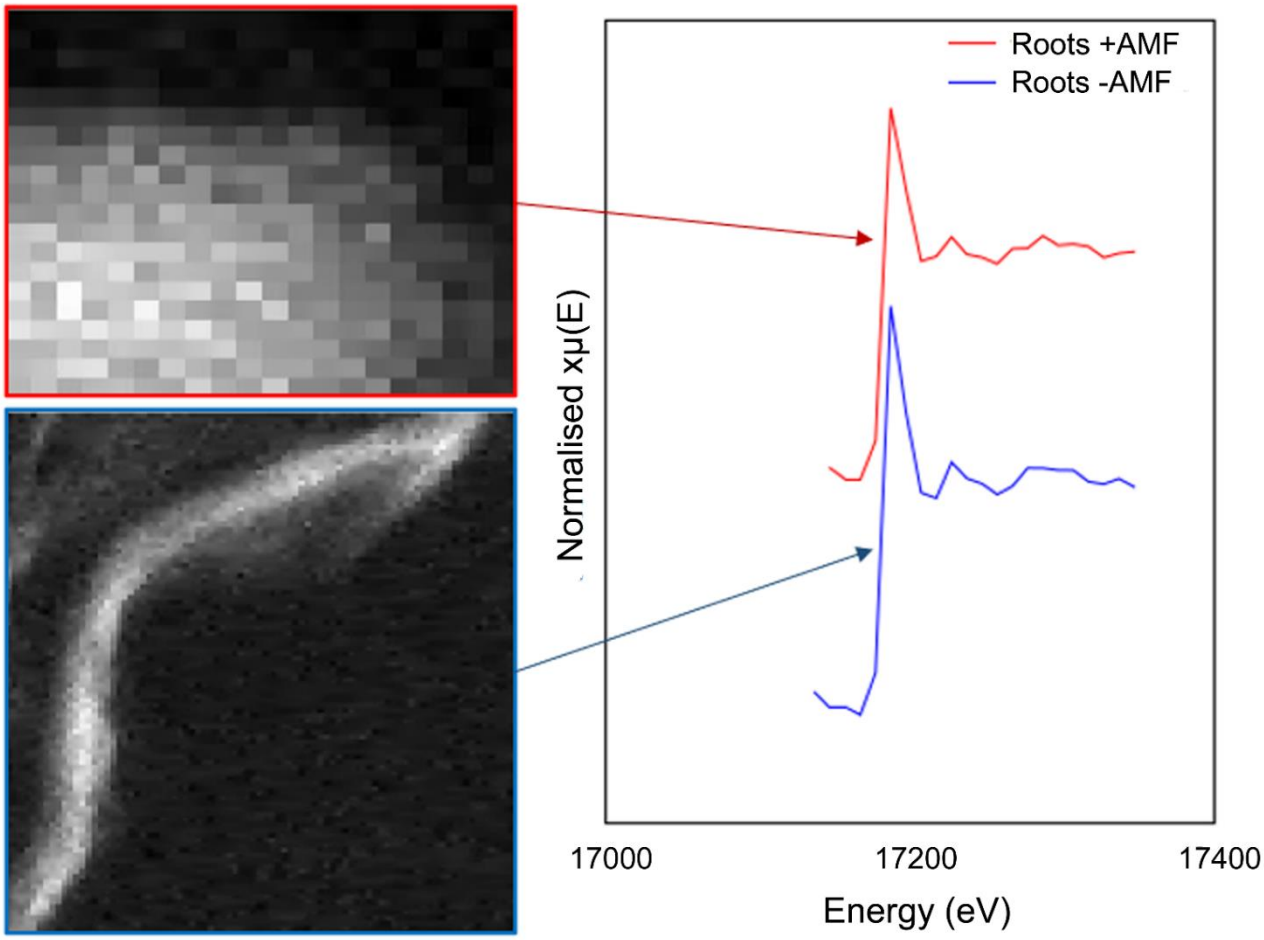

Fig. S11. μ-XANES spectra at the L_3 edge acquired for U-dosed non-mycorrhizal (-AMF) and mycorrhizal (+AMF) root samples. Spectra were collected in tandem with SR μ-XRF via μ-XANES mapping of selected U-rich particles (images shown in red and blue boxes) present within root epidermal cells over increasing energy (eV) levels.

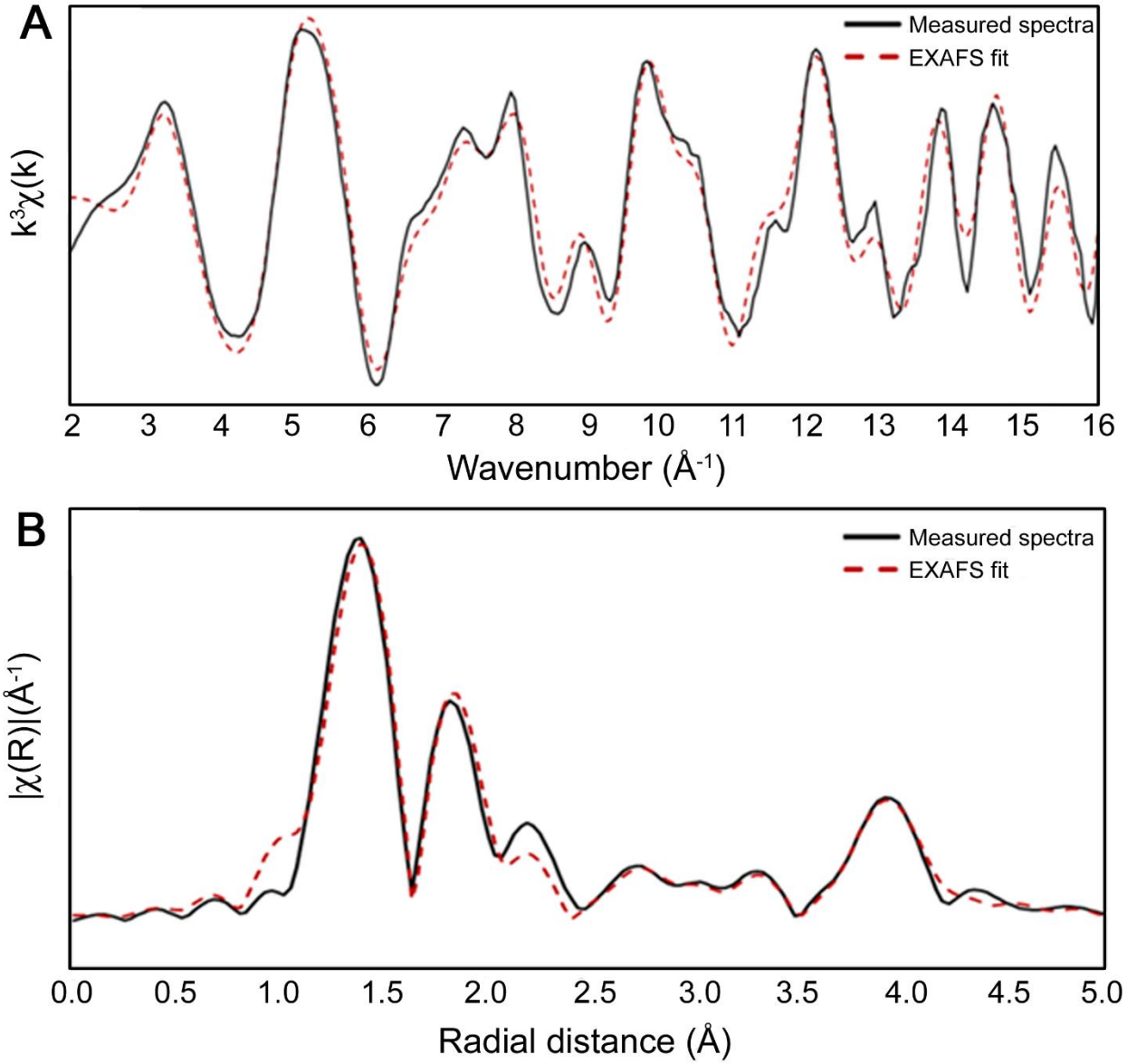

Fig. S12. U EXAFS k-space spectra (A) and Fourier Transform spectra (B) acquired from L_3-edge analysis of a standard compound of uranyl orthophosphate.

Table S1. Summary of EXAFS fit parameters for non-mycorrhizal (-AMF) and mycorrhizal (+AMF) shoots and roots, and U standards. R factor values < 0.02 indicate a high quality of fit between the model and measured spectra. Low Debye-Waller factor values (σ^2) for the fitted shells (between 0.002 – 0.03 Å^2) indicate that the location of atoms within the plant U structures align well with the theoretical position that they would possess in a pure, crystalline structure of the same compound.

				EXAFS Fitting Parameters†			
Sample Type	**Treatment**	**Shell**	**N**	**R (Å)**	**σ^2 (Å^2)**	**ΔE_0**	**R Factor**
Shoots	- AMF	U-O_{ax}	2	1.79 ± 0.04	0.00258	6.58 ± 2.10	0.017
		U-O_{eq1}	3	2.33 ± 0.03	0.00337		
		U-O_{eq2}	2	2.48 ± 0.01	0.00337		
		U-P_1	1	3.17 ± 0.01	0.00626	10.99 ± 1.66	
		U-P_2	1	3.58 ± 0.02	0.00626		
		U-P_3	2	3.74 ± 0.01	0.00626		
		U-U	1.5	3.99 ± 0.03	0.01173		
	+ AMF	U-O_{ax}	2	1.80 ± 0.04	0.00235	6.46 ± 1.66	0.009
		U-O_{eq1}	3	2.33 ± 0.04	0.00269		
		U-O_{eq2}	2	2.49 ± 0.00	0.00269		
		U-P_1	1	3.18 ± 0.02	0.00632	10.95 ± 1.32	
		U-P_2	1	3.59 ± 0.01	0.00632		
		U-P_3	2	3.75 ± 0.01	0.00632		
		U-U	1	4.01 ± 0.01	0.00914		
Roots	- AMF	U-O_{ax}	2	1.76 ± 0.05	0.00301	14.07 ± 1.60	0.006
		U-O_{eq1}	2	2.30 ± 0.01	0.00313		
		U-O_{eq2}	3	2.45 ± 0.04	0.00263		
		U-P_1	1	3.15 ± 0.01	0.00928	8.67 ± 1.24	
		U-P_2	2	3.64 ± 0.11	0.00837		
		U-U	1.5	3.94 ± 0.08	0.01275		
	+ AMF	U-O_{ax}	2	1.76 ± 0.06	0.00289	12.39 ± 1.54	0.011
		U-O_{eq1}	2	2.30 ± 0.02	0.00590		
		U-O_{eq2}	3	2.49 ± 0.04	0.00687		
		U-P_1	1	3.17 ± 0.02	0.01215	11.64 ± 1.33	
		U-P_2	1	3.61 ± 0.01	0.01215		
		U-P_3	2	3.71 ± 0.04	0.01215		
		U-U	2	3.93 ± 0.08	0.01355		
Uranyl Orthophosphate Standard		U-O_{ax}	2	1.77 ± 0.01	0.00165	8.94 ± 1.40	0.009
		U-O_{eq1}	3	2.35 ± 0.05	0.00323		
		U-O_{eq2}	2	2.49 ± 0.00	0.00323		
		U-P_1	1	3.18 ± 0.02	0.00286	10.14 ± 1.05	
		U-P_2	1	3.59 ± 0.01	0.00371		
		U-P_3	2	3.81 ± 0.05	0.00623		
		U-U	2	4.02 ± 0.00	0.00797		
Uranyl Orthophosphate (Catalano and Brown, 2004)		U-Oax	2	1.77 ± 0.03	0.0032	8 ± 1	N/A
		U-O_{eq1}	2.67	2.31 ± 0.09	0.0042	7 ± 2	
		U-O_{eq2}	2.33	2.47 ± 0.01	0.0051	7 ± N/A	
		U-P_1	0.67	3.16 ± 0.07	0.0070	7 ± N/A	
		U-P_2	0.67	3.56 ± 0.05	0.0050	7 ± N/A	
		U-P_3	2	3.80 ± 0.09	0.0090	7 ± N/A	
		U-U	1.33	4.03 ± 0.06	0.0061	4 ± 2	
Meta-torbernite (Catalano and Brown, 2004)		U-Oax	2	1.77 ± 0.06	0.0042	8 ± 1	N/A
		U-Oeq	4	2.28 ± 0.06	0.0037	8 ± N/A	
		U-P	4	3.59 ± 0.02	0.0040	8 ± N/A	
		U-U	4	5.23 ± 0.05	0.0120	4 ± 4	
Meta-autunite (Catalano and Brown, 2004)		U-Oax	2	1.78 ± 0.04	0.0035	4 ± 2	N/A
		U-Oeq	4	2.28 ± 0.04	0.0036	3 ± 1	
		U-P	4	3.59 ± 0.01	0.0050	4 ± N/A	
		U-U	4	5.22 ± 0.06	0.0140	1 ± 7	

†EXAFS fitting parameters include the co-ordination number (N), the radial distance of the bonds (Å), energy shift (ΔE_0) and σ^2 represents the Debye-Waller factor, a measure of the displacement of atoms from their ideal, crystal lattice positions. N/A represents a value that is unknown based on the work of the referenced study.

Table S2. Total concentration (mg kg^{-1}) of P, K, Ca, S, Cu and Zn in root and shoot tissues from control (un-dosed) and U-dosed non-mycorrhizal (-AMF) and mycorrhizal (+AMF) *P. lanceolata* seedlings. Data are mean values ± SEM, n = 5. Different lowercase letters indicate statistically significant differences for that element between treatments ($p < 0.05$) as determined by 2-way ANOVA and Tukey's post-hoc test.

Sample Type	Dosing Treatment	AMF Treatment	Element	Mean Concentration (mg kg^{-1}) (± SEM)
Shoots	Un-dosed	- AMF	P	4744.40 (± 321.42) [a]
			K	32990.80 (± 812.49) [a]
			Ca	34065.80 (± 2028.26) [a]
			S	5541.20 (± 406.48) [a]
			Cu	16.25 (± 1.66) [a]
			Zn	19.62 (± 2.48) [a]
		+ AMF	P	4495.80 (± 370.05) [a]
			K	28483.80 (± 2148.15) [a]
			Ca	27791.60 (± 3333.03) [a]
			S	6401.20 (± 770.69) [a]
			Cu	15.20 (± 1.29) [a]
			Zn	29.00 (± 5.21) [a]
Roots	Un-dosed	- AMF	P	2104.90 (± 258.10) [b]
			K	29617.20 (± 2226.36) [a]
			Ca	6531.40 (± 482.37) [b]
			S	2553.80 (± 167.64) [b]
			Cu	76.64 (± 18.52) [b]
			Zn	18.16 (± 1.53) [a]
		+ AMF	P	4343.16 (± 1149.97) [a b]
			K	33670.40 (± 5660.20) [a]
			Ca	7114.40 (± 931.98) [b]
			S	4211.60 (± 862.78) [a b c]
			Cu	77.12 (± 27.38) [b]
			Zn	33.22 (± 8.84) [a]
Shoots	U-dosed	- AMF	P	5037.16 (± 370.27) [a]
			K	29794.40 (± 1504.77) [a]
			Ca	23288.80 (± 2166.26) [a]
			S	4037.00 (± 198.93) [c]
			Cu	12.12 (± 0.74) [a]
			Zn	25.88 (± 3.29) [a]
		+ AMF	P	5859.60 (± 300.59) [a]
			K	31676.75 (± 3974.58) [a]
			Ca	23915.25 (± 2815.04) [a]
			S	3640.50 (± 336.04) [b c]
			Cu	12.03 (± 0.88) [a]
			Zn	24.18 (± 2.78) [a]
Roots	U-dosed	- AMF	P	3958.22 (± 1057.54) [a b]
			K	17053.60 (± 1696.43) [b]
			Ca	12202.60 (± 3117.93) [b]
			S	2230.60 (± 452.52) [b]
			Cu	21.52 (± 5.44) [a b c]
			Zn	31.36 (± 12.06) [a]
		+ AMF	P	3779.60 (± 1051.76) [a b]
			K	22856.75 (± 2247.98) [a b]
			Ca	9023.00 (± 1007.79) [b]
			S	1703.25 (± 272.30) [b]
			Cu	17.73 (± 1.12) [c]
			Zn	18.78 (± 2.13) [a]