Figure 1.

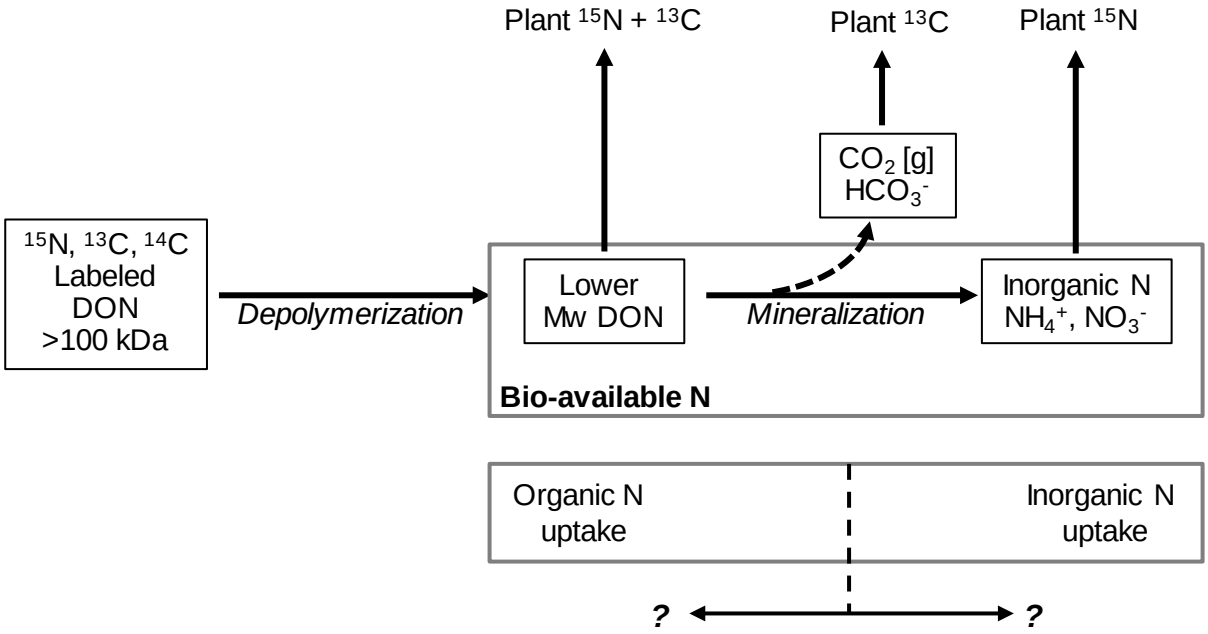

Figure 1. Conceptual figure showing the routes of ^{15}N and ^{13}C entry into plant from protein-sized dissolved organic N (DON, >100 kDa in the present study). Initially, protein-sized organic N needs to be depolymerized to lower molecular weight (Mw) DON, which can either be directly assimilated by plants or be mineralized to inorganic N forms before plant uptake. Thus, plant ^{15}N-enrichment is the result of either organic N or inorganic N uptake, and plant ^{13}C-enrichment is the result of either organic C uptake or inorganic C assimilation via photosynthesis or dark fixation. The lower box indicates that at present we lack knowledge of the proportion of total N uptake occurring via organic N forms.

Figure 2.

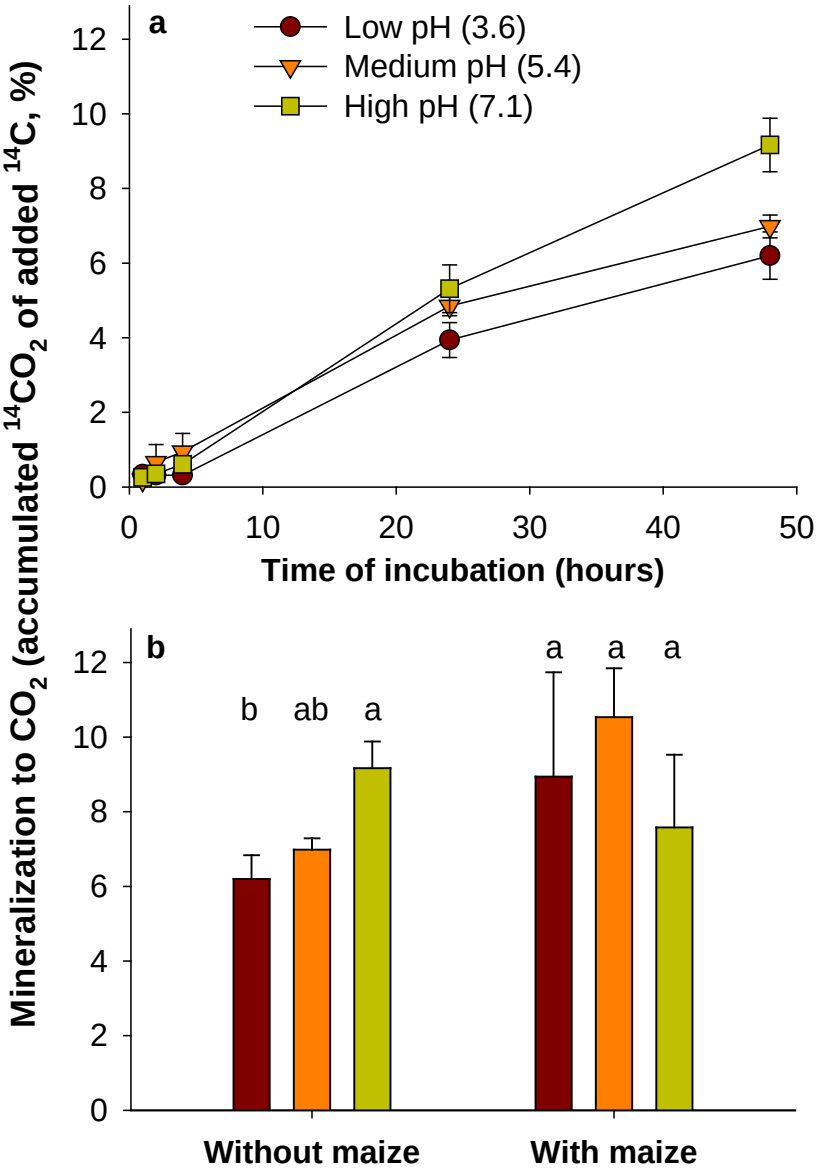

Figure 2. Mineralization of >100 kDa organic N to $^{14}CO_2$ in Jyndevad soils. (a) Temporal development of mineralization and (b) accumulated mineralization after 48 hours soil without and with maize. The three pH levels are low at pH_{CaCl_2} 3.6, medium at pH_{CaCl_2} 5.4, and high at pH_{CaCl_2} 7.1. Statistical differences among soil pH levels in accumulated $^{14}CO_2$ after 48 hours are indicated by different letters above the bars (n = 4).

Figure 3.

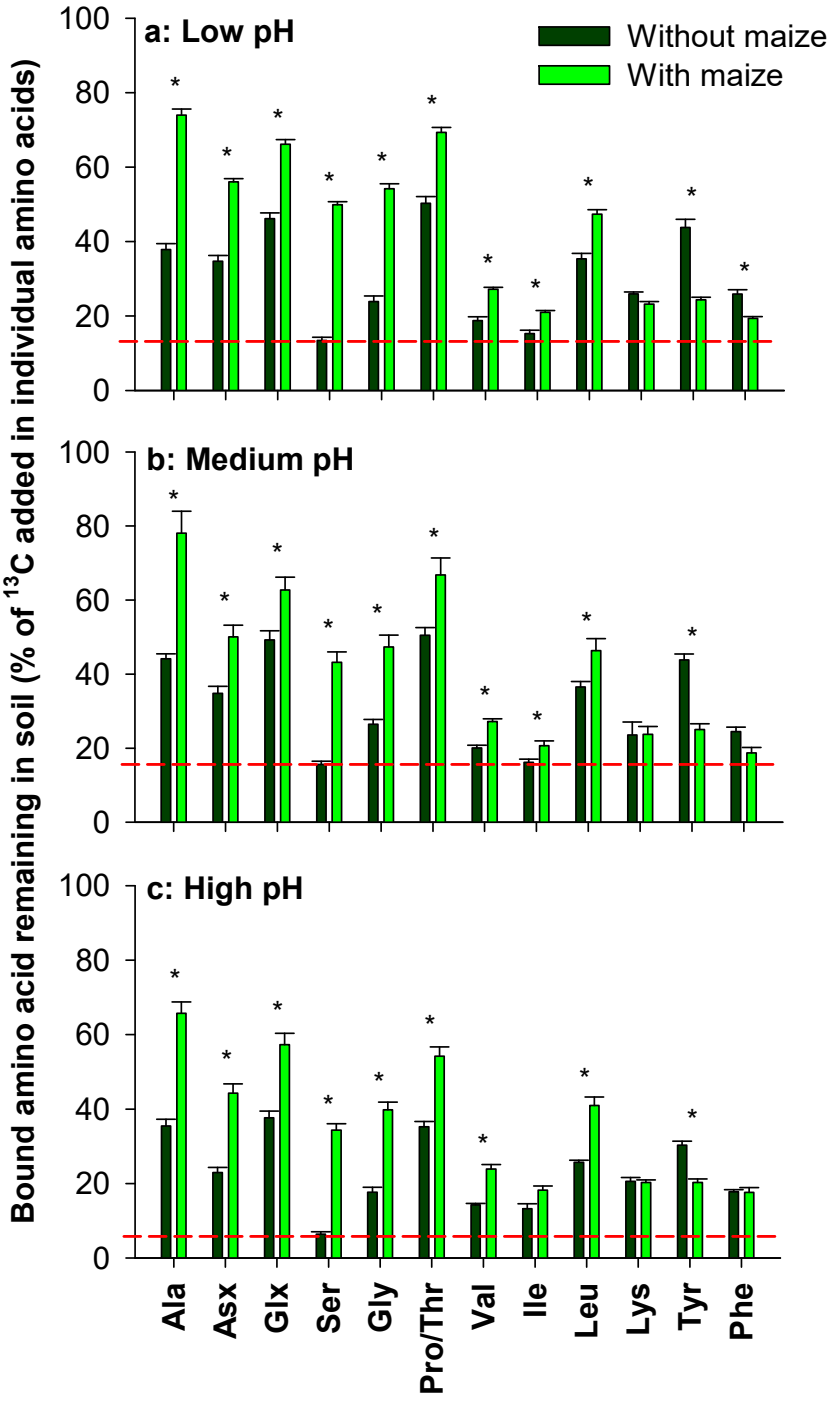

Figure 3. Bound amino acids from added >100 kDa organic N remaining in Jyndevad soils after 48 hours without and with maize in soil at (a) low pH, (b) medium pH, and (c) high pH. Significant differences between unplanted soil and soil with maize in ^{13}C remaining for individual amino acids are marked by an asterisk above the bars (n = 4). Amino acids are organized from left on right with increasing steps in their biosynthesis. The amino acids: asparagine and aspartate (Asx), glutamine and glutamate (Glx), and Proline and Threonine (Pro/Thr) elute together in the GC-C-IRMS analysis of acid hydrolyzed samples. The red dashed line indicate the lowest proportion of an individual amino acid remaining in soil without maize.

Figure 4.

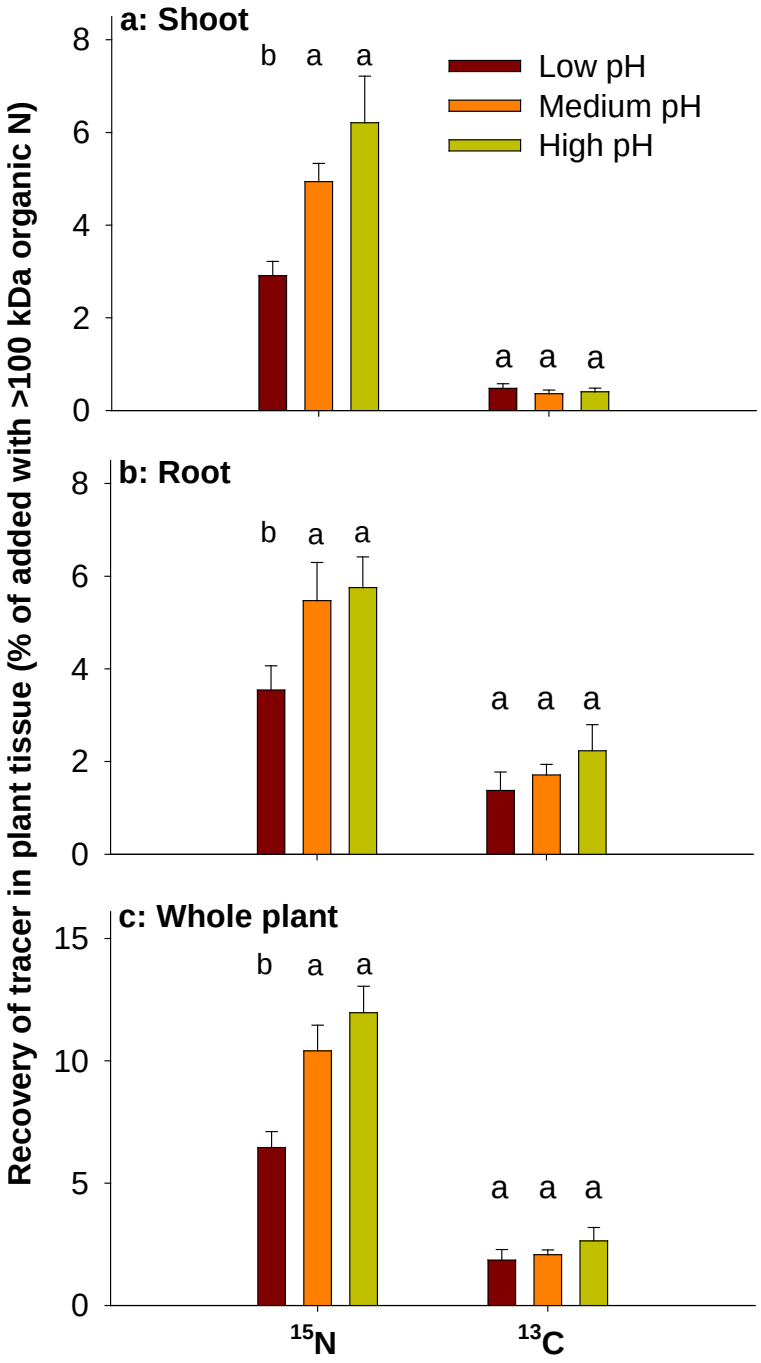

Figure 4. Bulk uptake of ^{13}C and ^{15}N from >100 kDa organic N 48 hours after addition in maize (a) shoots, (b) roots, and (c) the whole plant. Significant differences in uptake among soils with different pH are marked by different letters above the bars (n = 4).

Figure 5.

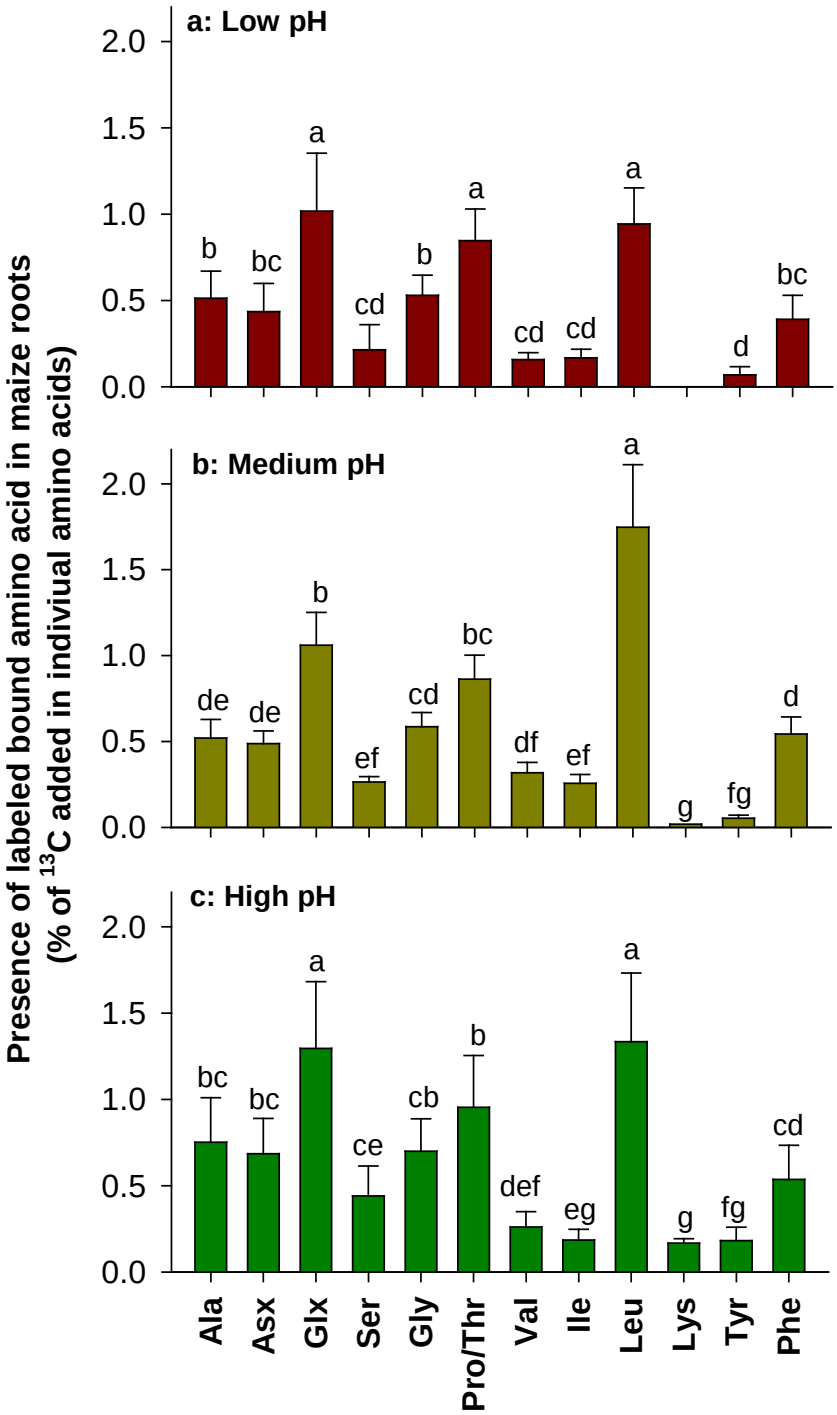

Figure 5. Presence of ^{13}C-labeled bound amino acids from added >100 kDa organic N in maize roots after 48 hours in Jyndevad soils in soil with (a) low pH, (b) medium pH, and (c) high pH. Significant differences between presence among individual amino acids within each soil pH level are marked by different letters above the bars (n = 4). Amino acids are organized from left on right with increasing steps in their biosynthesis. The amino acids: asparagine and aspartate (Asx), glutamine and glutamate (Glx), and Proline and Threonine (Pro/Thr) elute together in the GC-C-IRMS analysis of the acid hydrolyzed samples.

***New Phytologist* Supporting Information**

Article title: Newly depolymerized large organic N contributes directly to amino acid uptake in young maize plants
Authors: Kirsten Lønne Enggrob, Charlotte Marie Jakobsen, Ingeborg Frøsig Pedersen, and Jim Rasmussen
Article acceptance date: 13 July 2019

The following Supporting Information is available for this article:
Fig. S1 Concentration, ^{13}C and ^{15}N atom fractions of individual amino acids bound in the >100 kDa organic N added to the soils. Mean ± standard error (n = 4).

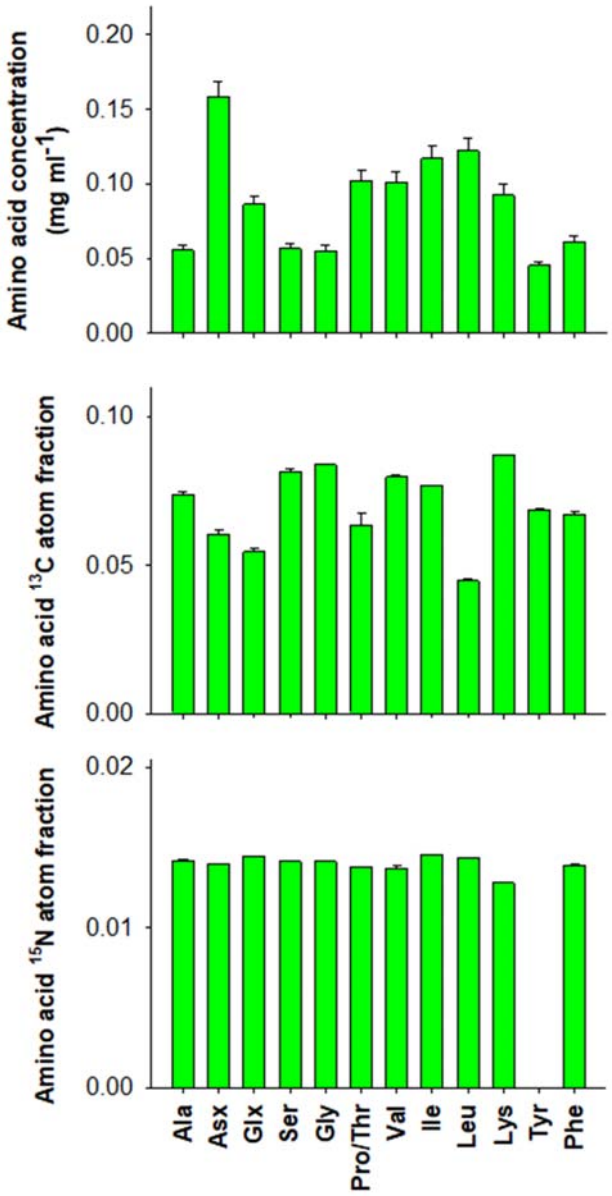

Fig. S2 Concentration of bound amino acids after 48 hours in soil with maize (a, c, e) and maize root tissue (b, d, f) from control added water and soil added protein-sized organic N (>100 kDa). Low pH (a, b), Medium pH (c, d), and High pH (e, f) in Jyndevad soils. Bars show mean ± standard error (n = 4). Amino acids are organized from left on right with increasing steps in their biosynthesis. The amino acids: asparagine and aspartate (Asx), glutamine and glutamate (Glx), and Proline and Threonine (Pro/Thr) elute together in the GC-C-IRMS analysis of the acid hydrolyzed samples. Significant differences are marked by an asterisk; 'nn' indicates non-normal distribution.

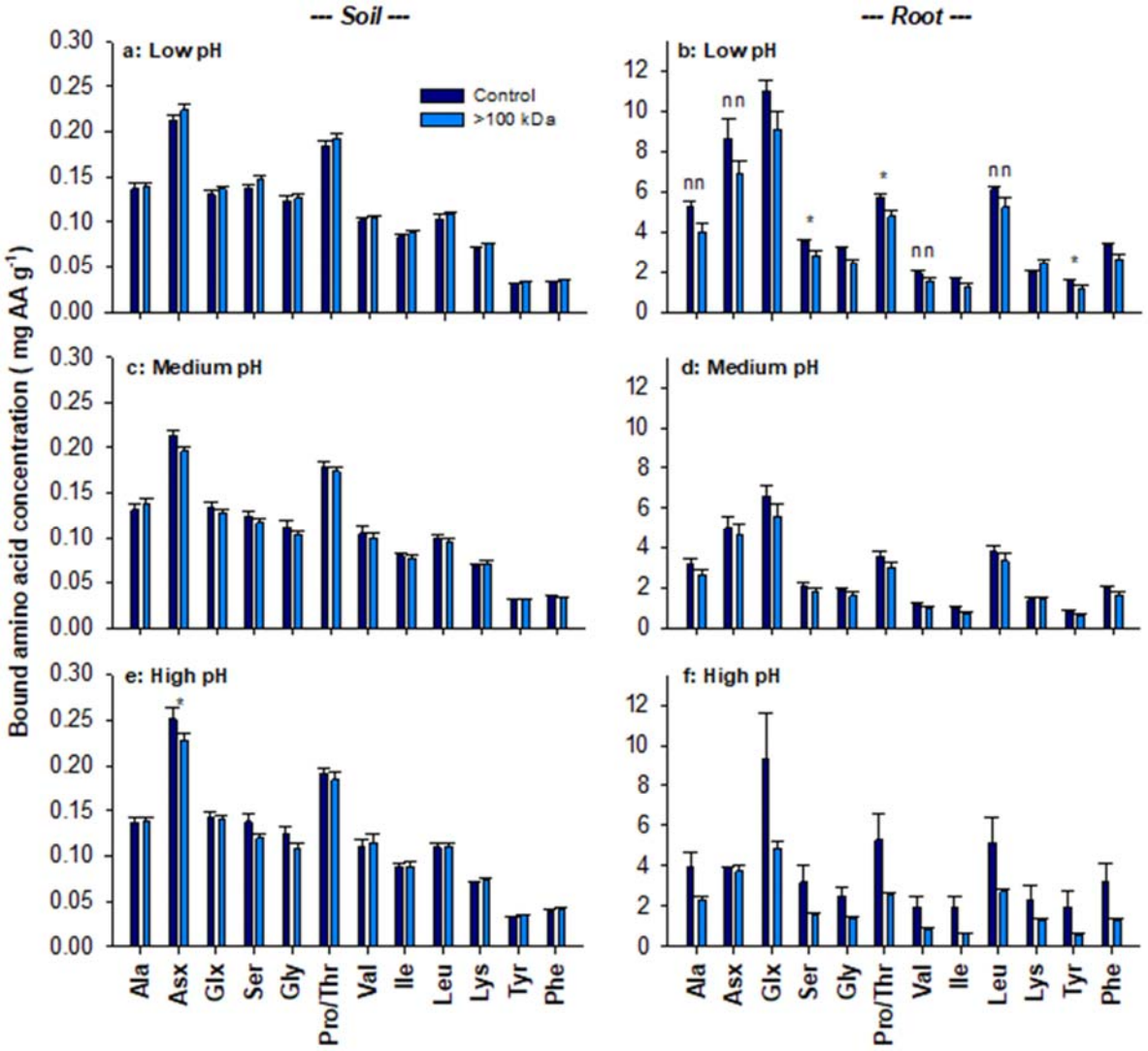

Fig. S3 Specific enrichment of ^{13}C-labeled bound amino acids from added protein-sized organic N (>100 kDa) in maize roots after 48 hours in Jyndevad soils at (a) low pH, (b) medium pH, and (c) high pH. Significant differences between specific enrichment among individual amino acids within each soil pH level are marked by different letters above the bars (n=4). Amino acids are organized from left on right with increasing steps in their biosynthesis. The amino acids: asparagine and aspartate (Asx), glutamine and glutamate (Glx), and Proline and Threonine (Pro/Thr) elute together in the GC-C-IRMS analysis of the acid hydrolyzed samples.