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A new approach to separate root and microbial contributions to soil respiration by non-structural root carbon

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Various methods have been suggested to separate root and microbial contributions to soil respiration. However, to date there is no ideal approach available to partition below-ground CO_2 fluxes in its components although the combination of traditional methods with approaches based on isotopes seems especially promising for the future improvement of estimates. Here we provide evidence for the applicability of a new approach based on the hypothesis that root-derived (rhizomicrobial) respiration, including root respiration and CO_2 derived from microbial activity in the immediate vicinity of the root, is proportional to non-structural carbon contents (sugars and organic acids) of plant tissues.

We examined relationships between root-derived CO_2 and non-structural carbon of rice (*Oryza sativa*) seedlings using ^{14}C pulse labelling techniques, which partitioned the ^{14}C fixed by photosynthesis into root-derived $^{14}CO_2$, and ^{14}C in sugars and or-

ganic acids of roots and shoots. After the ^{14}C pulse ^{14}C in both sugars and organic acids of plant tissues decreased steeply during the first 12 h, and then decreased at a lower rate during the remaining 60 h. Soil $^{14}CO_2$ efflux and soil CO_2 efflux strongly depended on ^{14}C pools in non-structural carbon of the plant tissues. Based on the linear regression between root-derived CO_2 and total non-structural carbon (sugars and organic acids) of roots, non-rhizomicrobial respiration (SOM-derived) was estimated to be 0.25 mg C g^{-1} root h^{-1}. Assuming the value was constant, root-derived CO_2 contributed 85–92% to bulk soil CO_2 efflux.