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Comparison of different methods to assess root litter carbon input to the soil in a young deciduous forest

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Estimating fine root turnover and rhizodeposition remains a mayor challenge in natural ecosystems studies. In the present research we estimated root litter carbon (C) imputs to the soil during 2006 coupling one direct and one indirect method.

The study was carried out in a fifteen-year-old mixed hardwood plantation established in northern Italy on a former agricultural land (Clay content ∼60%). A first estimation of net rhizodeposition was obtained by the application of an isotopic method by using in-growth cores filled with "C4 soil". Plastic mesh bags (2.5 cm diameter, 60 cm long, 0.5 cm mesh size) were packed respecting the original soil bulk density with soil from a long term Zea mais crop system ($\delta\ ^{13}$C = –22.0 $\pm$ 0.2 ‰) and placed in the soil at different distances from the stem of trees. "Control" bags made with a special tissue, porous to water and gases but impenetrable to roots, were also placed nearby. By using the mass balance approach the flux of C to the soil was calculated. This latter estimation was then compared to the root litter input estimated by the application of the total belowground carbon allocation (TBCA) approach for forests far from the steady state that can be simplified as follows:

$R_a + L_r$+ Δ*rootC* = *TBCA* = $R_{soil} - -L_l$+ Δ*litterC* + Δ*soilC* + Δ*rootC (1)*

where and R_{soil} is total soil respiration, R_a is autotrophic soil respiration estimated by the "trenching method", L_r and L_l are belowground and aboveground litter respectively, Δ*litterC*, Δ*soilC* and Δ*rootC* are the variations of C of litter layer, soil and roots respectively. From equation 1 it is possible to extrapolate L_r:

$L_r = R_{soil} - -R_a$+ Δ*litterC* + Δ*soilC* + Δ*rootC (2)*

The two methods, that have never been exploited with the aim to estimate rhizodeposition, gave similar final results. Actually, the **net** rhizodeposition (C input to the soil by root minus heterotrophic respiration) was 3.27 Mg of C ha^{-1} by isotopic approach and the **total** rhizodeposition was 3.22 Mg of C ha^{-1} by TBCA approach.