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Rice rhizodeposition and its utilization by microbial groups depends on nitrogen fertilization

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Rhizodeposited carbon (C) has received considerable attention because it plays an important role in regulating soil C sequestration and global C cycling, and represents the main C source for rhizosphere microorganisms. However, limited information exists on the utilization of rhizodeposited C by different microbial groups, its role in the turnover of soil organic matter (SOM) pools in rice paddies and how this is influenced by nitrogen (N) fertilization. Rice (*Oryza sativa* L.) was grown in soil at one of five N fertilization rates (0, 10, 20, 40, or 60 mg N kg^{-1} soil) and then continuously labeled by exposure to a $^{13}CO_2$ atmosphere for 18 days. The utilization of root-derived C by microbial groups within the rhizosphere was assessed by following the incorporation of ^{13}C into phospholipid fatty acids (PLFAs). Rice shoot and root biomass strongly increased with N fertilization rate. Rhizodeposition was greater, but total ^{13}C incorporation into microorganisms was lower, in N-fertilized soils than in unfertilized soil. The contribution of root-derived ^{13}C to SOM formation increased with root biomass. The roots tended to grow into large aggregates (0.25-2.0 mm diameter), and N fertilization stimulated incorporation of ^{13}C into these macroaggregates, presumably due to the relatively high root biomass. The ratio of ^{13}C in soil pools (SOM, microbial biomass) to ^{13}C in roots decreased as a result of N fertilization. N fertilization increased ^{13}C incorporation into fungi (18:2ω6, 9c, 18:1ω9c), AM fungi (16:1ω5c), and actinomycetes (10Me 16:0, 10Me 18:0), but decreased ^{13}C incorporation into Gram-positive (i14:0, i15:0, a15:0, i16:0, i17:0, a17:0) and Gram-negative (16:1ω7c, 18:1ω7c, cy17:0, cy19:0) bacteria. Thus, the uptake and processing of root-derived C by microbial groups depended on soil N status. Relative to the unfertilized controls, the contribution of rhizodeposited-C to SOM and microorganisms was increased by low to intermediate N fertilization rates, but decreased by the maximum N fertilization rate. We conclude that belowground C allocation and rhizodeposition by rice plants, its microbial utilization, and its distribution within SOM pools strongly depend on N fertilization.