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Priming and turnover of soil microbial biomass C and N

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Priming is the altered rate of mineralization of native soil organic matter (SOM) induced by an organic substrate and, depending on the nature of the amendment, can be either positive or negative. Coupled with the use of tracer (14C, 13C, 15N) techniques, measurements of the rates of CO_2 evolution and organic N mineralization are typically used to assess priming effects. In this study priming was also assessed from measurements of soil microbial biomass. Soil was amended with 14C-glucose and 15N-nitrate and incubated for 42 d during which unlabelled and labelled microbial biomass C and N were measured using the chloroform-incubation method. All of the 14C-glucose was metabolized within 24-30 h at a C-use efficiency of $\sim$60%, and resulted in a labelled biomass C:N of 9. After this period of rapid microbial growth, labelled microbial biomass C decayed at a rate of 19.3 x 10-3 d-1. Unlabelled microbial biomass C in the amended treatment decayed at 8.6 x 10-3 d-1 whereas in the unamended soil microbial biomass C decayed at half this rate (4.9 x 10-3 d-1). These data suggest that $\sim$25% of the native microbial biomass C responded to the addition of glucose-C and when it was depleted the newly formed microbial biomass, comprised of both labelled and unlabelled- C, collapsed and subsequently was mineralized. The period of rapid microbial biomass decay coincided with an increased evolution of soil (unlabelled) CO_2 and accumulation of (unlabelled) mineral N compared to that in the unamended soil. Thus, the apparent priming of soil C and N following addition of glucose can be attributed to biological recycling and increased turnover of native microbial biomass C and N. There was no evidence of priming of native soil organic matter during the first 21 days of the incubation.