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Effects of long-term fertilizer applications on decomposition of ^{14}C labelled Lolium shoots (*Lolium perenne* L.) and ^{14}C labelled glucose

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The effects of fertilizer applications on decomposition of ^{14}C labelled Lolium shoots (*Lolium perenne* L.) and ^{14}C labelled glucose were determined in a long-term field trial included control, organic-mineral fertilizers with herbicides, organic-mineral fertilizers without herbicides, mineral fertilizers only. The incorporation of ^{14}C-labelled substrates to soils allows for differentiation between substrates-derived carbon and native soil organic carbon, and provides precise estimates of decomposition rates. Two types of ^{14}C-labelled substrates: glucose and plant residues of *Lolium perenne L.* were incubated in a silt loam Podzoluvisol to test the importance of substrate-soil relationships by decomposition of soil organic matter and turnover of C through microbial biomass.

We sampled Podzoluvisol of a long term field trial located in Moscow region, Russia. In the field trial four fertilizer systems were applied during 38 years. The first treatment (1) was control without any fertilizer; the second one included (2) organic-mineral fertilizers with herbicides; the third one (3) - organic-mineral fertilizers without herbicides; the fourth one (4) – mineral fertilizer only. The incubation was conducted under controlled conditions in closed vessels for 90 days at 20 ˚C. Fifteen grams of air-dried soils were weight into 250 ml glass vessels. For each of the four field treatments the following additions were tested: (i) glucose: 14,4 mg C of ^{14}C-labelled glucose (spe-

cific ^{14}C activity 18,7 kBq mg^{-1C}); (ii) plant residue: 14,4 mg C of ^{14}C-labelled plant residues (*Lolium perenne L.*) ground with ball mill (specific ^{14}C activity 4,8 kBq mg^{-1C}); and (iii) control without glucose or plant residues. The decomposition of ^{14}C labelled plant residue and ^{14}C labelled glucose was estimated by measuring the $^{14}CO_2$ emissions. Small vials with 3 ml of 1.0 M NaOH were placed into the vessels for trapping CO_2. The traps were changed after 1, 2, 4, 7, 11, 19, 29, 41, 71 è 90 days (10 samplings). Biomass C in soil was analysed after 8, 19, 41 and 90 days by the fumigation-extraction method (Vance et al., 1987). Deionized water was added to the vessels as needed to keep soil moisture at 70% of WHC.

To compare the CO_2 efflux rates from field treatments having initially different C_{org} content, all results are presented as percentage of SOC. At the first day all soil treatments showed initially CO_2 efflux rate accounting for 0.15-0.18% and 0.10-0.11 % of SOC day^{-1} for glucose and plant residues, respectively. Then the CO_2evolution from soil dropped to 0.06 and 0.07% of SOC day^{-1} for glucose and plant residues by day 3. Thereafter, the CO_2 evolution rate became lower and generally constant, remained at 0.01% of SOC day^{-1} for both substance additions until the end of 90 day incubation. The cumulative CO_2 production over 90 days fitted very well to the double exponential model (R^2 >0.99 for the four soils) (Bonde et al., 1988).

The effects of four fertilizer systems on the mineralization of ^{14}C-labelled glucose and plant residues showed that mineralization of glucose and plant residues began immediately with the maximum rate occurring within 2 days, ranging 22.4 % and 7.89 % of added ^{14}C activity per day for glucose and plant residues, respectively. At the end of the incubation, the cumulative $^{14}CO_2$ evolved amounted to 77 and 66 % of added C of glucose and plant residues, respectively. The decomposition rate (k) of labile ^{14}C-labelled glucose was higher in control treatment (1) and in soil treatment with organic-mineral fertilizers without herbicides (3) (0.31, 0.29 d^{-1}, respectively) comparing with organic-mineral fertilizers with herbicides (2) and mineral fertilizer only (1) (0.24, 0.25 d^{-1}, respectively). k of labile ^{14}C-labelled plant residues had the same tendency. In the same treatments (1,3) with addition of glucose microbial biomass C was higher during 20 days of incubation (1 mg C/1g soil for 1 and 3 treatments and less 0.8 mg C/1g soil for 2 and 4 treatments).

We determined no significant effect of organic-mineral and mineral fertilizers systems (2,3,4) on CO_2 native carbon mineralization. There was significant effect only in control comparing with fertilizer application. Initially glucose decomposition was 2.7 times faster than plant residues decomposition. The decomposition rates of labile ^{14}C-labelled plant residues and ^{14}C-labelled glucose were higher in control treatment and in soil treatment with organic-mineral fertilizers without herbicides and related to microbial biomass C.