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Biogeosciences Discussions

Interactive comment on "Fate of rice shoot and root residues, rhizodeposits, and microbe-assimilated carbon in paddy soil: I. Decomposition and priming effect" *by* Zhenke Zhu et al.

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Dear Anonymous Referee #1, Thank you very much for your valuable comments. We would like to answer your concerned points one by one (Q, plain, and A, blue font).

Q1. General comments. The manuscript submitted by Zhu et al. investigated the fate and priming effect of organic C incorporated into paddy soils by plants and microorganisms through a long incubation study. The four different 13C-labelled substrates, i.e., rice roots, shoots, rhizodeposits and microbial assimilated carbon were used to analysis the mineralization processes. The topic is within the scope of this journal,

and benefit for understanding the dynamics of C cycling and environmental protect in paddy soil ecosystem. They found that the mineralization of native soil organic matter was 2.6 and 2.0 fold higher in shoot-C and root-C, and positive priming effects were found in the two C substrates. The rhizodeposits and microbial assimilated C showed no significant differences in the total amount of emitted carbon compared with control and the negative priming effects. The above results can give new insights for soil C turnover and biogeochemical cycling mechanisms. In summary, this is a strong and well-done manuscript that needs only minor revisions.

A: Thank you for the positive comment.

Q2. The incubation study used 13C labeled microbial assimilated C and rhizodeposited C. How to label them? Please give more details about this.

A: To obtain the 13C labeled microbial assimilated C and rhizodeposited C we firstly labelled the rice and soil, then collected the soils containing microbial assimilated C and rice rhizodeposits. Namely: "Rice cultivation and 13CO2 labelling were performed as described by Ge et al. (2012; 2013), with some modifications. For 13C labelling, 30 pots (20 planted, 10 unplanted) were transferred to an automatically controlled gas-tight growth chamber (110 cm length, 250 cm width, 180 cm height) and exposed to 13CO2-fumigation for 18 d (May 14–31, 2013), during the vegetative growth period (including the entire tillering stage). The growth chambers were placed in a rice field to ensure that the environmental conditions of the labelled. The surface of each planted pot was covered with black plastic sheeting, to prevent algal photosynthesis in the floodwater and to ensure that only the rice shoots were exposed to 13CO2 (i.e., not phototrophic microbes in the soil or water), whereas the unplanted pots were left uncovered, so that the soils were directly exposed to 13CO2 and so phototrophic soil microbes could assimilate atmospheric 13CO2. All the pots were watered every few days, in order to maintain a water depth of 2–3 cm above the soil surface, until harvest. The CO2 concentrations of the growth chambers were measured using an infrared analyser (Shsen-QZD, Qingdao, China) and maintained at 360–380 μl L-1. The 13CO2

was generated by acidifying Na213CO3 (1.0 M, 99 atom % 13C; Cambridge Isotope Laboratories, Tewksbury, MA, USA) with H2SO4 (0.5 M) in beakers that were placed inside the growth chambers. During the labelling period, 13CO2 was only released when CO2 concentrations fell below 360 μl L-1, and at CO2 concentrations >380 μl L-1, the gas flow was diverted and passed through CO2 traps (NaOH solution). An air-conditioning system was used to control the temperature inside the chamber within 1 °C of the ambient temperature in the rice field. Two fans continuously circulated the air in the growth chamber. The soils were sampled destructively after 18 d of 13CO2 labelling. 13C-labelled rhizodeposits were obtained by gently shaking moist soil from the roots of rice plants and were prepared for incubation by removing root debris and mixing thoroughly. Meanwhile, to obtain microbe-assimilated 13C, we collected soil from 13C-treated, unplanted pots and mixed it thoroughly."

Q3. The study is a long incubation experiment. How to reduce the cross-feeding effect? Especially, all the rice shoots, roots, rhizodeposits can be assimilated into microbial biomass C. Did the formulas already take into account the cross-feeding effects between different C substrates?

A: Many thanks for the kind comments. We acknowledged that the cross-feeding effects occurred in our experiment, but we were focusing on the net effect of the different substrates (primers) on the decomposition of native soil organic carbon in our present study. We can further work on the cross-feeding effect as your argument.

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