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Carbon and nitrogen mineralisation and N recovery from ^{15}N labelled plant residues under controlled conditions

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Abstract

This study was carried to evaluate the dynamic of carbon and nitrogen under different conditions. Five different labeled plant species (cacao, mucuna, lablab, flemingia and maize) by ^{15}N and sandy soil were used in this study. About 2g of ^{15}N residues mixed with 1.5kg of 2mm soil and were mixed into soil or were maintained on the surface under greenhouse condition in 7 months. In the meanwhile, approximately 2 g labelled residue was mixed with 500g soil in 3L closed-pot and incubated for 119 days. In general, ^{15}N recovery from added residues was significantly influenced by the harvested time and the season rather than by method application. The amount of ^{15}N recovery in plants at 6 weeks after planting (WAP) was higher significant than at 12 WAP in all treatment. After 6 WAP in the first season, the total amount of ^{15}N recovery in almost treatments reached about 50% compared with following seasons. The residues application has not influenced on the N recovery, especially in the third season. After 3 seasons, total ^{15}N recovery mainly depended on the residue types rather than the residue application and harvesting time. Linear regression analysis showed strongly related between total ^{15}N recovery and the lignin content. All residue-amended treatments resulted in similar immobilisation of N for the first 6 weeks. After 6 weeks, following by a short mineralisation of N, the net N immobilisation was mainly dominant in all added residues when mixed them with soil. In contrast, there was a slightly net N mineralisation when applied residues on the surface after 12 weeks and this process maintained till the end of treatment. Over 17 weeks of the incubation, cumulative $\text{CO}_2\text{-C}$ from flemingia treatment was much higher than from other treatments ($14325 \mu\text{g CO}_2\text{-C kg}^{-1}$ soil). During the first 4 weeks of incubation, there was a rapid increase of $\text{CO}_2\text{-C}$ flux release from lablab, maize and mucuna accounting for around 70% compared with the total amount of $\text{CO}_2\text{-C}$ flux during treatment. A negative correlation between lignin content and the CO_2 release was observed after 7 days of incubation whereas the positive relationship was found in the later of the decomposition. The net N mineralization was recognised from lablab and mucuna in the beginning of the incubation. Meanwhile this process was occurred after a short immobilisation (1st week) in other residues.

Keywords: Carbon, Nitrogen, Mineralisation, Immobilisation, ^{15}N , Nitrogen recovery
