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Plant inter-species effects on rhizosphere priming effect and nitrogen acquisition by plants

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Rhizosphere interactions play a central role linking roots-soil system and regulate various aspects of nutrient cycling. Rhizodeposition inputs are known to change soil organic matter (SOM) decomposition via rhizosphere priming effects (RPEs) through enhancing soil biological activity and altering microbial community structure. The magnitude of RPEs varies widely among plant-species and root biomass possibly due to different quality and quantity of rhizodeposits. However, it is virtually unknown whether the RPEs are influenced by plant inter-species interactions and how these processes affect N mineralization and available N for plants.

Monocultures of maize (M) and soybean (S), and mixed cultures of maize/maize (MM), soybean/soybean (SS), maize/soybean (MS) were grown over a 45-day greenhouse experiment. We labeled them with plant litter that was enriched in^{13}C and ^{15}N. The ^{15}N distributions in plants and microbial biomass were measured at 14, 35, and 45days after labeling.

The RPEs were positive under all plants, ranging from 11.7% to 138.3% and gradually decreased with plant growth. The RPE in the SS was significantly higher than these in others treatments at 14 days, while at 45 days it was higher in the MS than these from their monocultures, suggesting that the RPE was enhanced by the inter-species effects of maize and soybean. The litter decomposition ratio and ^{15}N recovery of plants and microorganism increased with the root growth across all plants. The ^{15}N recovery of plants in the MS (14.2%) was higher than these in the MM (12.3%) and SS(9.7%) at 45 days. Similarly, the ^{15}N recovery of microorganism in the corresponding treatments was 6.7%, 2.2%, and 6.8%, respectively. The MS showed higher soil organic N mineralization amount than that from all soybean and maize monocultures at 45 days. We conclude that plant inter-species interactions may have significant effect on rhizosphere priming and modify the plant N uptake from litter resource and SOM.