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研究论文

玉米生长和光合作用对土壤呼吸$\delta^{13}C$的影响

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摘要 在玉米盆栽试验期间，运用碱吸收法采集土壤呼吸样品，转化成碳酸钡后，运用质谱法测定其$\delta^{13}C$值，以研究玉米生长和光合作用对土壤呼吸$\delta^{13}C$值的影响。结果表明，在玉米生长下，土壤呼吸的$\delta^{13}C$值随玉米生长时期而变化，变化在-14.57‰-12.30‰间，呈喇叭期>成熟期>开花期，而在裸土下，土壤呼吸的$\delta^{13}C$值在-19.34‰-19.13‰间，不随时间发生显著变化。开花期土壤呼吸$\delta^{13}C$值降低的主要原因是光合产物土壤输入的下降和根系活性的降低，成熟期玉米土壤呼吸$\delta^{13}C$值的增加主要是由于衰老死亡根系的分解腐烂。玉米生长下，无论开花期还是成熟期，白天土壤呼吸的$\delta^{13}C$值显著大于夜间；玉米植株遮光处理后，土壤呼吸的$\delta^{13}C$值显著降低。该试验结果证明玉米生长和光合作用显著影响土壤呼吸的$\delta^{13}C$值，在玉米生长期间，土壤呼吸主要来自于新近合成的光合产物。

关键词 玉米生长 光合作用 土壤呼吸 $\delta^{13}C$值。

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Effects of maize growth and photosynthesis on $\delta^{13}C$ in soil respiration

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Abstract As a safe, stable and practical labelling method, the natural abundance of ^{13}C has being widely used in the carbon cycle in soil-plant system. In order to investigate the effects of maize growth and photosynthesis on the value of $\delta^{13}C$ in soil respiration, the value of $\delta^{13}C$ in soil respiration was determined by mass spectrum after being trapped in a NaOH solution under a closed static chamber and then turned into barium carbonate in a pot experiment. The results showed that maize growth and photosynthesis significantly affected the value of $\delta^{13}C$ in the soil respiration. In maize-planted soil, the value of $\delta^{13}C$ in soil respiration had a clear seasonal variation. It changed with maize growth in the range of -14.57‰ to-12.30‰ and decreased during the period of tompeting>ripening>flowering stages. The difference of $\delta^{13}C$ in soil respiration during various maize growth stages added up to about 2.3‰. However, in bare soil, $\delta^{13}C$ in soil respiration ranged from -19.34‰ to-19.13‰ and did not change significantly over time. The $\delta^{13}C$ in soil respiration in maize-planted soil was lowest at flowering stage. This was mainly due to the decline of the input in assimilates into soil and the decrease in root activity. However, the $\delta^{13}C$ increased at ripening stage, due to the decomposition and ingestion of senescent and died roots by soil microorganisms. In planted soil, $\delta^{13}C$ in soil respiration was significantly higher during daytime than at nighttim

e at flowering and ripening stage. The difference of $\delta^{13}C$ in soil respiration between day and nigh t periods added up to about 1.4‰ and 2.1‰ during flowering and ripening stage, respective hading maize plants at the trumpeting stage decreased the value of $\delta^{13}C$ in soil respiration significa ntly. The difference of $\delta^{13}C$ in soil respiration between the treatment of non-shading and shadin g plants added up to 2.85‰. It was conclude that $\delta^{13}C$ in soil respiration was remarkably control led by maize growth and photosynthesis in planted soil. Soil respiration was mainly derived from t he recent assimilates during maize growth.

Key words maize growth _ photosynthesis _ soil respiration _ $\delta^{13}C$

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