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安婷婷,汪景宽,李双异,付时丰,裴久渤,李 慧.用^{13}C脉冲标记方法研究施肥与地膜覆盖对玉米光合碳分配的影响[J].土壤学报,2013,50(5):948-955.An Tingting,Wang Jingkuan,Li Shuangyi,Fu Shifeng,Pei Jiubo and Li Hui.Effect of fertilization and plastic film mulching on distribution of photosynthetically fixed carbon in maize : Explored with ^{13}C pulse labeling technique[J].Acta Pedologica Sinica,2013,50(5):948-955

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用^{13}C脉冲标记方法研究施肥与地膜覆盖对玉米光合碳分配的影响

Effect of fertilization and plastic film mulching on distribution of photosynthetically fixed carbon in maize : Explored with ^{13}C pulse labeling technique

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Key Words:Pulse labeling ^{13}C labeling Fertilization Plastic film mulching Photosynthetically fixed carbon

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中文摘要:

基于沈阳农业大学棕壤长期定位试验站不同施肥与地膜覆盖处理，采用原位$^{13}CO_2$脉冲标记的方法示踪了^{13}C在玉米-土壤系统中的转移与分配，探讨了施肥与地膜覆盖对玉米光合碳动态变化的影响。结果表明：玉米-土壤系统光合固定碳转移较快，且分配差异较大，其$\delta^{13}C$值在标记1 d表现为茎叶>根>根际土壤>土体，且同一施肥处理下传统栽培高于覆膜栽培。标记15 d玉米植株和根际土壤$\delta^{13}C$值降低，而土体$\delta^{13}C$值却略有升高。传统栽培不施肥处理对^{13}C富集程度最大，其中茎叶和根$\delta^{13}C$值在标记1 d分别为1 568‰和598‰；标记15 d为178‰和147‰。玉米-土壤系统^{13}C固定比例在标记1 d和15 d分别为64.01%和38.65%，且^{13}C分配按茎叶、根、根际土壤、土体顺序依次降低。覆膜施有机肥处理显著提高了光合固定^{13}C数量及^{13}C在玉米和土壤中的分配比例，是促进^{13}C同化与分配的主要方式。

Abstract:

The in-situ $^{13}CO_2$ pulse labeling technique was used to trace the fate of ^{13}C in maize-soil system and asses the effect of fertilization and plastic film mulching on the dynamics of photosynthetically fixed carbon by maize planted in the long-term Brown Earth Experiment Station in Shenyang Agricultural University. Results show that the carbons were quickly translocated and distributed unevenly in the maize-soil system on D 1 (the first day after labeling), showing an order of shoots > roots > rhizosphere soil > bulk soil, and unmulched > mulched in $\delta^{13}C$ value. The $\delta^{13}C$ values declined in maize plants and rhizosphere soil, but slightly increased in bulk soil with the time passing by from D 1 to D 15. Treatment CK was the highest in ^{13}C enrichment with average $\delta^{13}C$ value in shoots and roots reaching 1 568‰ and 598‰, respectively, on D 1 and 178‰ and 147‰, respectively, on D 15. The ^{13}C fixed in the maize plants accounted for 64.01% of the total in the system on D 1 and for 38.65% on D 15. The distribution of ^{13}C showed a declining trend in the order of shoots > roots > rhizosphere soil > bulk soil in the plant-soil system. The experiment clearly demonstrated that the treatment of mulching plus organic manure significantly increased photosynthetical fixation of ^{13}C and the allocation of ^{13}C in maize plant and soil, which means that it is an important practice to improve carbon assimilation and distribution in the maize-soil system.

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