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局部湿润方式下玉米对不同根区氮素的吸收与分配

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Uptake and allocation of nitrogen from different root zones of maize under local irrigation

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摘要
采用分根装置，对均匀灌水、固定灌水和交替灌水3种方式下，于1/2根区设施($^{15}NH_4)_2SO_4$的处理；另1/2根区施入等量的 ($^{14}NH_4)_2SO_4$，研究玉米不同根区氮素的吸收与分配特征。结果表明，处理15、20、40 d时，玉米累积^{15}N肥料氮量表现为，固定灌水下^{15}N施在灌水区分别是非灌水区的2.37、2.95和3.41倍；交替灌水下^{15}N施在先灌水区是后灌水区的1.57、1.08和1.06倍。作物自不同根区土壤或肥料吸收氮素占总吸氮量的百分数表明，交替灌水时，不同根区有同等贡献；固定灌水时，作物吸收的氮素绝大部分来自灌水区。根系的氮素吸收速率和根长均表现为，交替灌水两根区趋于相同；固定灌水的非灌水区明显小于灌水区，表明吸收速率和根长对作物吸收氮素都有重要作用。处理40d时，玉米各部分累积^{15}N肥料氮占根区总吸收量百分数为地上部：均匀灌水>交替灌水>固定灌水；^{14}N区根系：^{15}N施在固定灌水的非灌水区>其他4个处理；^{15}N区根系：^{15}N施在固定灌水的灌水区>固定灌水的非灌水区和交替灌水任一根区>均匀灌水。说明局部供水使根系的氮素分配明显增多，地上部减少；两种局部灌水所不同的是，固定灌水时，氮素向灌水区根系的分配大于非灌水区，交替灌水时，两根区相近。

关键词： 局部湿润方式 不同根区 氮素 吸收与分配 ^{15}N肥料 局部湿润方式 不同根区 氮素 吸收与分配 ^{15}N肥料

Abstract:
Effects of partial root-zone irrigation on uptake and allocation of nitrogen from different root zones of maize grown in split-root containers were studied. Maize was irrigated on both halves of the container (conventional irrigation, C), on one side only (fixed partial root-zone irrigation, F), or alternatively on both sides (alternative partial root-zone irrigation, A). Isotope-labled $^{15}N-(NH_4)_2SO_4$ was applied to one half of the pot with ($^{14}NH_4)_2SO_4$ to the other half so that N inflow could be tracked. Results showed that in the day 15, 20, 40, the ratios of N uptake from ^{15}N-fertilizer applied in the irrigated root zone（Fw）to that from the non-irrigated zone (Fd) of F treatment were 2.37, 2.95 and 3.41, respectively. For A treatment, the ratios of N uptake from ^{15}N-fertilizer applied in the early irrigated zone（Ae）to that from the late irrigated zone（Al）were 1.57, 1.08 and 1.06, respectively. The percentages of plant N absorbed from soil or fertilizer in different root zones to total N uptake for three irrigation methods also indicated that
the amount of N absorption from two root zones of A treatment was equal whereas for F treatment, the N accumulation in plant was mainly from the irrigated root zone. Considering the fact that root N inflow and root length in the irrigated zone were larger than those of the non-irrigated zone for F treatment, it could be concluded that both of root length and N absorption capacity contribute to plant N uptake largely. At 40 day, the percentage of ^{15}N-fertilizer N allocation in shoot to total accumulation for A treatment was higher than that for F treatment but lower than that for C. The ^{15}N allocation percentage of the subroot supplied with ^{14}N-fertilizer was higher for Fd than for the others. The ^{15}N allocation percentage of the subroot supplied with ^{15}N-fertilizer was higher for Fd, Al and Ae than for C treatment but lower than for Fw. Our results suggest that partial root-zone irrigation increased N allocation in root system but decreased N allocation in shoot. However, for A treatment, N allocation in two subroots was equal but for F treatment, N allocation of the subroot in the irrigated zone was higher than that of the non-irrigated zone.

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