

研究报告

开放式空气二氧化碳浓度增高(FACE)条件下水稻的根系活力和氮同化能力

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摘要

利用FACE(Free Air Carbon-dioxide Enrichment)平台技术,用伤流量法研究了低氮(LN 150 kg·hm⁻²)和常氮(NN 250 kg·hm⁻²)水平下,大气CO₂浓度升高对水稻分蘖、抽穗期和穗后35 d根系活力和根系N同化能力(氨基酸合成能力)的影响.结果表明,就整株水稻来看,CO₂浓度升高和N处理对根系活力无显著影响;但由于FACE条件下水稻分蘖数增加14.5%(LN)和20.7%(NN),使每茎根系活力(伤流强度)降低1.4%~21.7%.在分蘖和抽穗期,虽然FACE处理促进了根系吸收的无机N向氨基酸转化,根系伤流液中氨基酸氮/无机氮提高11.1%~143.1%,但氨基酸浓度和合成总量和对照相比无明显差异.在穗后35 d,FACE处理减弱了水稻根系的N同化能力,表现为根系伤流液中氨基酸/无机氮降低38.1%(LN)和29.2%(NN);同时氨基酸浓度降低34.0%(LN)和44.7%(NN),氨基酸合成总量降低50.8%(LN)和40.0%(NN).提高施氮水平促进了抽穗期水稻根系对无机氮的吸收,伤流液中无机氮含量增加51.1%(对照)和155.2%(FACE),但并未增加氨基酸合成量,由此导致抽穗期氨基酸氮/无机氮显著降低19.5%(对照)和36.8%(FACE);同时,氮处理在这个时期与FACE处理表现出明显的交互作用.

关键词 [FACE,CO2浓度升高,水稻,根系伤流液,根系活力,氨基酸合成](#)

分类号

Root activity and nitrogen assimilation of rice(*Oryza sativa*)under Free-Air CO₂ Enrichment

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Abstract

With Free-Air CO₂ Enrichment(FACE) technique, this paper studied the root activity and amino acid(aa) synthesis of rice(*Oryza sativa*) at low N(LN, 150 kgN·hm⁻²) and normal N(NN, 250 kgN·hm⁻²) under ambient air and elevated atmospheric CO₂ (Ambient+200 μmol·mol⁻¹). Under elevated CO₂, the xylem exudates per hill changed little, while the xylem exudates per stem declined by 1.4%~21.7% as the result of greater tiller numbers. At tillering and heading stages, elevated CO₂ increased aa N/inorganic N in xylem exudates by 11.1%~143.1%, but did not affect the aa concentration in xylem exudates and the total amount of aa in roots significantly. However, at 35 days after heading, the aa N/inorganic N ratio decreased by 38.1%(LN) and 29.2%(NN) under elevated CO₂. FACE also declined the aa concentration in xylem exudates by 34.0%(LN) and 44.7%(NN), and the total amount of aa by 50.8%(LN) and 40.0%(NN), which meant the retarded

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capability of aa synthesis in roots. N amendment led to a decrease of aa N/inorganic N in xylem exudates by 19.5% (Ambient) and 36.8% (FACE) at heading stage, as the result of unaffected aa and increased inorganic N concentration. There existed a significantly antagonistical CO₂ × N interaction on aa N/inorganic N at heading stage.

Key words [FACE](#) [Elevated CO₂](#) [Rice](#) [Xylem exudates](#) [Root activity](#) [Amino acid synthesis](#)

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