

研究论文

开放式空气CO₂浓度增加对水稻生育期的影响及其原因分析

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摘要 2001—2003年利用农田开放式空气CO₂浓度增高(FACE)系统平台,以武香粳14为供试品种,设置不同施氮量处理,研究大气CO₂浓度比对照高200 μmol·mol⁻¹的FACE处理对水稻生育期的影响及其可能原因。结果表明,FACE使水稻播种—抽穗期、抽穗—成熟期和全生育期的天数分别比对照缩短3~5、1~5、4~9 d,平均分别缩短3.4、2.4、5.8 d,增施N肥可以减缓FACE对水稻生育期的缩短程度;FACE使水稻不同生育期植株含N率明显降低,使不同生育期植株含P率和茎鞘可溶性碳水化合物含有率明显提高;多元回归和通径分析表明,对水稻全生育期有显著影响的因素从大到小依次为拔节期植株含N率、抽穗期植株含P率、抽穗期茎鞘可溶性碳水化合物含有率和够苗期植株含N率。作者推测,FACE使水稻够苗期和拔节期的植株含N率明显降低、使抽穗期的植株含P率和茎鞘可溶性碳水化合物含有率明显提高可能是FACE水稻生育期缩短的生理原因之一。

关键词 水稻 FACE 生育期 含N率 含P率 茎鞘可溶性碳水化合物含有率

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Effects of Free-air CO₂ Enrichment (FACE) on Growth Duration of Rice (*Oryza sativa* L.) and Its Cause

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Abstract Global atmospheric CO₂ concentrations ([CO₂]) are projected to reach levels of 650—780 μmol·mol⁻¹ at the end of this century (IPCC, 2000). The increase in atmospheric [CO₂] has the potential to enhance the growth and development of rice. However, little is known about the effect of free-air CO₂ enrichment (FACE) on growth duration of rice and its physiological cause. So we conducted a FACE experiment at Anzhen, Wuxi, Jiangsu province, in 2001-2003, using the Japonica cultivar Wuxiangjing 14. The target [CO₂] of the FACE plots was 200 μmol·mol⁻¹ above that in the ambient air. Three levels of N were supplied: low (LN, 150 kg·hm⁻²), normal (NN, 250 kg·hm⁻²) and high N (HN, 350 kg·hm⁻²). Results showed that: Compared with CK, the duration from sowing to heading, from heading to maturity and the whole growth duration of rice shrank 3—5 d (mean value 3.4 d), 1—5 d (mean value 2.4 d), 4—9 d (mean value 5.8 d) days in FACE treatment. Increment of nitrogen application rate could weaken the effect of FACE on growth duration. FACE treatment resulted in the obvious decrease of N content in rice plant and obvious increase of P content in rice plant and soluble carbohydrates content in stem and sheath at different growth stage. Multiple regression and path analysis indicated that the sequence of factors that had significant effect on whole growth duration from the biggest to the smallest were N content in rice plant at jointing stage, P content in rice plant at heading stage, soluble carbohydrates content in stem and sheath at heading stage and N content in rice plant at N-n leaf stage. This suggests that one of the physiological reasons for the reduction of whole growth duration is the obvious decrease of N content in rice plant at jointing stage and obvious increase of P content in rice plant and soluble carbohydrates content in stem and sheath at heading stage.

Key words Rice; Free-air CO₂ enrichment (FACE); Growth duration; Nitrogen content; Phosphorus content; Soluble carbohydrates content in stem and sheath

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