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The Characteristics of CO_2 Assimilation of Photosynthesis and Chlorophyll Fluorescence in Transgenic Rice Expressing Maize C_4 Photosynthesis Enzymes

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Objectives

With maize phospho*enol* pyruvate carboxylase (PEPC), pyruvate, orthophosphate dikinase (PPDK), rice NADP-malic enzyme (ME) and PEPC+PPDK transgenic and untransformed rice (*Oryza sativa* L.), the activities of related C_4 photosynthesis enzymes, the chlorophyll fluorescence parameters, CO_2 exchange and other physiological indexes were compared, in which the physiological characteristics of PEPC transgenic rice were mainly studied.

Materials and Methods

1. Plant Materials : Untransformed wild-type (WT, cv. Kitaake) and four transgenic rice lines were included in this study: homozygous transgenic rice overexpressing the rice NADP-ME(ME), the maize C_4-specific PEPC(PC), PPDK(PK) and CK(PEPC & PPDK hybrid).
2. Methods : Assays of enzymes, Measurement of CO_2 exchange, Western immunoblot analysis, Photo-oxidative treatment and chlorophyll fluorescence analysis

Results and Discussion

1. The activites of PEPC in PEPC transgenic rice plant were about 20-fold higher than those in untransformed rice,; the light-saturation photosynthetic rates and the carboxylation efficiency of PEPC transgenic rice were increased by 55% and 50% more than those of untransformed rice, respectively, while the CO_2 compensation point decreased by 27%.
2. The PSII photochemical efficiency (Fv/Fm) and photochemical quenching (qp) of transgenic PEPC rice decreased less in comparison with those of untransformed rice after the treatment with high light intensity (3 h) of methyl viologen (MV), a photooxidative reagent, which demonstrated that the tolerance of PEPC transgenic rice to photoinhibition and photooxidation was enhanced.
3. Under the condition of hight light intensity, the activity of RuBPCase in PEPC transgenic rice did not obviously vary while the activity induced of carbonic anhydrase (CA) in PEPC transgenic rice in creased by 1.8 fold. These results would provide some beneficial enlightment for revealing the mechanism of high photosynthetic efficiency and breeding with high photosynthetic efficiency in rice.

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