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Mechanism of High Photosynthetic Capacity in BC_2F_4 Lines Derived from a Cross between *Oryza sativa* and Wild Relatives *O. rufipogon*

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Abstract: We found that several BC_2F_4 lines had high leaf photosynthetic rates under light-saturated and ambient CO_2 conditions. These lines are progenies of BC_2F_1 plants with high photosynthetic capacities which were generated by backcrossing between *Oryza rufipogon* (W630) and *O. sativa* cv. Nipponbare, as a recurrent parent. Some photosynthetic characteristics of the BC_2F_4 lines were investigated to identify the factors increasing photosynthetic rates. Photosynthetic rates of these lines under light-saturated conditions at 50 to 700 ppm CO_2 concentrations were higher than those in Nipponbare. The estimated-maximum photosynthetic rates under light-saturated and CO_2-saturated conditions in BC_2F_4 lines were also higher than that in Nipponbare. The photosynthetic rate under light-saturated and ambient CO_2 conditions was positively correlated with the carboxylation efficiency as an indicator of ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco) activity *in vivo* rather than stomatal conductance. Initial and total Rubisco activities *in vitro* tended to be higher in the BC_2F_4 lines than in Nipponbare. The content of active Rubisco calculated from the activation state of Rubisco was also higher in the BC_2F_4 lines than in Nipponbare. These results suggest that high photosynthetic capacities of BC_2F_1 plants can be maintained high in their progenies and high photosynthetic rates under light-saturated and ambient CO_2 conditions in the BC_2F_4 lines are achieved mainly by the high activity of Rubisco due to the high active Rubisco content.

Keywords: Gas exchange rate, *Oryza rufipogon*, Photosynthesis, Rice, Rubisco, Rubisco activase, Sucrose synthesis

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