Entry No. IRRC-0164

Category	: International Rice Research Conference
Select Theme	: Systems physiology
Keyword 1	: Photosynthesis
Endorsement email	:
Keyword 2	: Genetic engineering
Keyword 3	: Photosynthesis
Title of Entry	: Improvement of Photosynthetic Efficiency of rice through the introduction of C4 & E.coli glycolate catabolic pathway genes
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Select only one type of presentation	: 15 minute oral presentation
Abstract	: Global climate change and growing population causing pressure on the world's food supply. To keep pace with population growth, improvement in crop performance (in terms of grain productivity) is essential. In C3 plants like rice, yield potential is limited due to lower photosynthetic productivity results lower assimilation of CO2 into organic carbon compounds because Ribulose-1,5-bisphosphate carboxylase-oxygenase (RuBisCO) poorly discriminates between CO2 and O2. The enhancement of photosynthetic efficiency has emerged to provide a vital opportunity to address the challenge of sustainable yield increases needed to meet future food demand. The CO2 concentrating mechanism, together with modifications of leaf anatomy, enables C4 plants to achieve high photosynthetic capacity and ultimately high yield. As a consequence, the transfer of C4 traits to C3 plants is one strategy being adopted for improving the photosynthetic performance of C3 plants. To introduce C4-like pathway in rice, four genes CA, PEPC, PPDK and NADP-ME (Carbonic anhydrase, Phosphoenolpyruvate carboxylase, Pyruvate orthophosphate (Pi) dikinase and NADP-malic enzyme) from Sorgham bicolar and Seitaria italica were amplified and cloned in the TA cloning vector. Plant transformation constructs were designed by ligating these genes with suitable promoter followed by insertion in the binary vector (pCAMBIA 1301). Gene constructs were introduced in rice calli using Agrobacterium mediated transformation and transgenic plants generated through tissue culture. Another possible strategy for minimizing photorespiratory effect is the introduction of Escherichia coli glycolate catabolic pathway into rice chloroplasts to reduce the loss of fixed carbon and nitrogen and maintain photorespiration in plant. Five chloroplast-targeted bacterial genes encoding glycolate dehydrogenase (GLC-D,E,F), glyoxylate carboligase (GC) and tartronic semialdehyde reductase (TSR), have been amplified from E. coli (K12 strain) gDNA and cloned in pGEMT-Easy vector. Rice RuBisCO smaller subunit (rbcs) transit peptide (~150 bp) was amplified, cloned and tagged with these genes for chloroplastic transformation. Finally, gene expression cassettes were inserted into binary vector (pCAMBIA-1304) to generate plant transformation vector. This will generate plants in which chloroplastic glycolate would be

converted directly to glycerate. This would reduce, though may not eliminate, flux of photorespiratory metabolites through peroxisomes and mitochondria while increasing the rate of carbon fixation.

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