Expression of Transgene under Stress Inducible Promoter for producing Salt Tolerant rice

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Among the various stresses that impair crop productivity, salinity is a major threat to agriculture. Salinity tolerance is a multigenic trait. Therefore it has been difficult to obtain salt tolerance by using single genes. Many genes are now reported to confer salt tolerance in plants, particularly in the case of dicots like, tobacco. In most of these cases, the genes have been expressed by the constitutive cauliflower mosaic virus promoter (CaMV35S). The same genes with the CaMV35S promoter when transformed into rice do not perform as well because this promoter is not good for monocots such as rice. It can cause yield penalty. Therefore it is necessary to find efficient promoters for rice gene transformation and expression.

The promoters of the NHX1 (vacuolar Na^+/H^+ antiporter) from the salt tolerant landrace Pokkali (PKN) and sensitive cultivar IR-64 (IRN), respectively, were isolated and characterized. Promoter efficiency is generally measured by promoter-reporter gene constructs, used to transform rice. In transgenic T_2 rice homozygous for the promoter-GUS gene, the PKN promoter was found to be salt-inducible with tissue-specific expression in leaf epidermal tissues whereas IRN shows all over expression except in the epidermal layer. The significance of this result is that, like salt tolerant barley, the landrace Pokkali is likely to partition Na^+ away from the photosynthesizing mesophyll layer, and thus require high activity of the antiporter during salt stress. Antiporter constructs with the CaMV and PKN promoter were used to transform rice.

Other stress related promoters- HKT8, Asr1, CCOMT and APX have also been isolated from Pokkali and are being characterized as they are known to be expressed under salt stress conditions. By sequencing and comparing HKT8 promoter region with the sequence of database of Nipponbare rice sequences, 20 single nucleotide polymorphisms (SNPs) were observed. Further work with this construct can confirm the role, if any, of the SNPs in salt inducibility.