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Isolation of Root-specific Promoters and Generation of Abiotic Stress Resistance through Modulation of Antioxidant Expression in Cassava Storage Roots

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Abstract

Cassava (*Manihot esculenta*) is a perennial root crop providing food for more than 800 million people worldwide. It is vegetatively propagated and its breeding to generate improved elite cultivars is reported to be difficult due to its high heterogeneity. Therefore, biotechnological approaches represent valuable tools to blur the edges of cassava improvement. In the last decade, several scientific teams have reported transgenic cassava lines with various improved traits to comply with the eclectic needs from small-scale farmers to commercial growers. Stacking traits will require precise and timely expression of the transgenes. Genetic elements with low homology are also necessary to reduce the probability of transgene silencing and enhance trait stability. Currently, promoters available for transgene expression in cassava are restricted to a few promoters for constitutive expression with the exception of the patatin promoter. Because many traits to be improved in cassava are connected to the root (the storage and harvested part of the cassava crop), the present project aims at providing additional root-specific promoters to the cassava biotechnology community. Fourteen *Arabidopsis* promoter candidates were selected for root-specific expression based on microarrays (www.genevestigator.ethz.ch) and proteomics (www.atproteome.ethz.ch) data. Promoter sequences around 1.5 kb in size were cloned upstream of the uidA report gene to test its activity in cassava. Transgenic cassava lines were generated and analysed for each promoter-reporter gene system. Several promoters showed organ-specific expression pattern while others showed higher expression in roots compared to other organs. Promoters with interesting expression patterns were truncated into different size in order to determine the minimal promoter size retaining specific and determined expression activities. The most promising promoters will be shared with the cassava biotechnology network. At ETH Zürich, the new set of promoters generated in the present study will be included in strategies to engineer cassava roots with delayed post-harvest deterioration, improved level of protein and vitamins as well as transgenic cassava with enhanced drought tolerance.

Keywords: Biotechnology, cassava, promoter, root specific

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