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Cassava Mosaic Disease Resistance in Transgenic Cassava

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Abstract

Cassava (*Manihot esculenta*) is a staple food for 600 million people in the tropical and subtropical belt, as well as a feedstock for numerous industrial applications, including food, feed and starch. Cassava Mosaic Disease (CMD) is one of the major problems encountered in cassava fields in Africa where the disease can trigger overall yield losses up to 25 %. CMD is caused by whitefly-transmitted gemini-viruses. Synergism, recombination and pseudo-recombination between different cassava gemini-virus species have led to the recent pandemics of severe CMD in Africa. Our research aims at developing different CMD prevention strategies in transgenic cassava and therefore providing local farmers with gemini-virus resistant lines to secure cassava production.

Using antisense technology, the first cassava lines resistant to African Cassava Mosaic Virus (ACMV) have been produced in our lab and are about to be field-trialed in Africa. We are now trying to engineer broad-spectrum gemini-virus resistance in cassava. The new approach is based on down-regulation of viral protein production through the RNA interference (RNAi) pathway. RNA interference is a conserved silencing mechanism which accounts for mRNA regulation via post-transcriptional silencing (PTGS) and/or transcriptional gene silencing (TGS). The specificity of this RNA regulation is based on homologous short double-stranded interfering RNAs (siRNA). Transgenic cassava expressing hairpin double-stranded RNA (dsRNA) homologous to gemini-viral sequences are expected to reduce viral mRNA production leading to decreased levels of viral replication and movement in the infected plant. Highly conserved sequences amongst gemini-viruses species have been considered to be the best target candidates for a RNAi-based resistance.

We have successfully speeded up the recovery process in infected cassava plants by expressing hairpin dsRNA targeting the gemini-viral promoter region. *In vitro* and *in vivo* studies suggest that CMD resistance could be due to a reduced level of virus replication in transgenic cassava plants. We are currently combining different potential viral mRNA targets in order to optimise the RNAi strategy in cassava.

Keywords: Cassava virus resistance, RNAi

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