Transformation of kiwi (*Actinidia deliciosa* A. Chev.) and olive (*Olea europaea* L.) with tobacco osmotin gene confers drought-stress tolerance and provides a health-promoting protein source.

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Abstract

Based on climate change projections, salinity and drought are viewed as the most important environmental stresses, the main causes in the decrease of crop production, and a major challenge for European agriculture. Thus, research efforts should be focused on the selection of more resilient crop genotypes for future agriculture. Despite the great availability of genetic resources and variability among fruit species, some traits, such as tolerance to drought, salinity and frost, are lacking in the common commercial cultivars. Transgenic approaches have generated opportunities for crop improvement. Both “Hayward” kiwifruit vines and “Canino” olive trees have been transformed with the tobacco osmotin gene under 35S promoter control and tested *in vitro* and *in vivo* for 10 years. The osmotin gene, which codes for a PR-5 protein, is commonly present in the genome of all plant species, but its expression and protein accumulation are elicited in response to both abiotic and biotic stresses, resulting in effective control of fungal diseases. Interestingly, the osmotin plant protein from tobacco was also found to be a homologue of the human hormone adiponectin, which is involved in mammalian glucose metabolism. It was also shown that the osmotin protein from tobacco is capable of activating the human receptors Adipor1/Sirt1, thus activating biogenesis in human cells *in vitro,* suggesting a new strategy for the treatment of various diseases (diabetes, cancer, central nervous system disorders). Physiological responses to drought stress imposed by PEG 8000 (1, 2 and 4 %) were compared i*n vitro* in transgenic and control shoots. PEG resulted in oxidative injury, as expressed in increased lipid peroxidation, and significant changes of enzyme activities involved in antioxidative mechanisms. The kiwi and olive transgenic shoots showed better adaptation to drought stress, confirmed by field observation on plants. In addition, the transgenic olive also resulted more tolerant to frost in vitro tests. Both transgenic species resulted more tolerant to biotic stress in artificial inoculation tests with *Botrytis cinerea* and *Cadophora luteo-olivacea* on ripe fruit epidermis. The transgenic fruits resulted significantly less rotten as compared to control fruits. Transgenic olive potted plants grown together to control plants in the same environment showed lower susceptibility to natural infection of *Spilocaea oleagina*, as evidentiated by fewer and smaller spots on the leaves.The creation of improved plants suitable for adverse abiotic and biotic conditions and the opportunity to also use their leaves and fruits as a source of the health-promoting osmotin protein both provide amazing perspectives for future research in human health and agricultural biotechnology.

Keywords: Drought and salt stress, Lipid peroxidation, proline, osmotin protein, adiponectin