Proceedings of the XLIX Italian Society of Agricultural Genetics Annual Congress
Potenza, Italy – 12/15 September, 2005
ISBN **88-900622-6-6**

Poster Abstract - F.18

METABOLIC ENGINEERING OF CAROTENOID BIOSYNTHESIS IN POTATO (*SOLANUM TUBEROSUM*) TUBERS

G. DIRETTO*, D. PIZZICHINI*, F. MOURGUES**, S. AL-BABILI***, R. WELSCH***, P. BEYER***, V. PAPACCHIOLI*, R. TAVAZZA*, G. GIULIANO*

*) Ente per le Nuove tecnologie, l'Energia e l'Ambiente (ENEA), Biotechnology Unit, Casaccia Research Centre, PO Box 2400, Roma 00100AD, Italy
**) Ente per le Nuove tecnologie, l'Energia e l'Ambiente (ENEA), Biotechnology Unit, Trisaia Research Centre, 75026 Rotondella (MT), Italy
***) Albert-Ludwigs-Universitat, Institute for Biologie II, 79014 Freiburg, Germany

potato, beta-carotene, transgenic

Carotenoids are a class of pigments which are essential for photosynthesis and function as attractants in some higher plant organs. In humans and animals, the health benefits of dietary carotenoids are becoming increasingly apparent: they have, in fact, different beneficial effects, although the mechanisms of action remain unclear. For example, lycopene appears to have a protective effect against prostate cancer while Lutein and zeaxanthin intake appear to provide protection against age-related macular degeneration. The widespread occurrence of vitamin A deficiency is well documented.

In order to increase beta-carotene (pro-vitamin A) and total carotenoid content in potato tubers we produced transgenic plants with the antisense fragment of lycopene epsilon-cyclase (ε-lcy) cloned between the tuber-specific *Patatin* promoter and the *Nos* terminator. Transgenic plants (selected by *pcr* assay) were characterized through HPLC analysis, which revealed in different lines, an increase of 2-9 fold of ß carotene and important modifications of xanthophyll content. *Real-time PCR* experiments proved endogenous e-lcy gene silencing as well as perturbations of transcript levels of several carotenoid pathway genes. Furthermore, we transformed potato plants with bacterial genes, encoding for phytoene synthase (crtB), phytoene desaturase (crtI) and lycopene cyclase (crtY) introduced in sense orientation under the control of constitutive (CAMV 35S) or tuber-specific promoter (*Patatin*) promoter. Preliminary spectrophotometric analyses revealed, in several transgenic lines, increases in total carotenoids. Further analyses (HPLC, *real-time pcr*, microarray) are in progress to characterize these transgenic plants and to identify genes which are regulated by carotenoids.

References

- Giuliano, G., Aquilani, R. and Dharmapuri, S. (2000) Metabolic engineering of plant carotenoids. Trends Plant Sci 5 (10), 406-409.
- Romer, S., Lubeck, J., Kauder, F., Steiger, S., Adomat, C., and Sandmann, G. (2002) Genetic engineering of a zeaxanthin-rich potato by antisense inactivation and co-suppression of carotenoid epoxidation. Metab Eng 4, 263-272.
- Ducreux L., Morris W., Hedley P., Shepherd T., Davies H., Millam S. and Taylor M. (2004) Metabolic engineering of high carotenoid potato tubers containing enhanced levels of beta-carotene and lutein. J. Exp. Bot. 10, 1-9