CO-ORDINATED EXPRESSION OF *CRTB*, *At-VTE3*, AND *VTE4* TO ENHANCE PRO-VITAMIN A AND VITAMIN E IN TRANSGENIC SOYBEAN

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ABSTRACT

Although soybean is an excellent general nutritional source, it is not very rich in particular vitamins. The main goal of this study is to enhance both pro-vitamin A (carotenoids) and vitamin E (tocopherols) content in soybean seeds. We have genetically engineered the carotenoid and the tocopherol biosynthetic pathways in soybean seeds by ectopically expressing three genes: *Erwinia uredovora phytoene synthase* (*crt*B) to increase carotenoid content, *Arabidopsis 2-methyl-6-phytylbenzoquinol methyl transferase (At-VTE3*) and soybean γ-*tocopherol methyl transpherase* (*VTE4*) to increase α-tocopherol using the self-cleavage activity of FMDV 2A sequence to join two adjacent proteins. This 2A-polyprotein construct was introduced to soybean via *Agrobacterium*-mediated cotyledonary node transformation method. One inheritable transgenic event displayed "golden"- colored seeds. The presence and expression of the three genes were detected in golden soybean event HYX-7-1 by qRT-PCR analyses. HPLC analysis of individual golden soybean lines revealed that the seeds accumulated as high as 128µg/g of total carotenoids, approximately 25- fold higher than wild type and 45-fold higher than empty vector control seeds. Of total carotenoids, 98% was pro-vitamin A (β-carotene and β-carotene equivalents). By contrast, golden seeds showed a decrease of tochopherol and a significant change of fatty acid profile. Transgenic golden soybean lines also displayed a delay in germination with a decreased rate (50%) and dwarf phenotype at early developmental stage, but showed normal development later.