Development of new types of oilseed rape (Brassica napus l.) with genetically modified tocopherol composition

RACLARU Mirela, LÜHS W., ZARHLOUL M.K. - Institut für Pflanzenbau und Pflanzenzüchtung I, Justus-Liebig-Universität, Giessen, Deutschland
GRUBER J., SADRE Radin, WEIER Dagmar,
FRENTZEN Margrit - Institut für Biologie I Spezielle Botanik, Aachen, Deutschland
FRIEDT W. - Institut für Pflanzenbau und Pflanzenzüchtung I, Justus-Liebig-Universität, Giessen, Deutschland

Modification of seed oil composition has been an important objective in the genetic improvement of oilseed rape (Brassica napus). Although double-low rapeseed (canola) is highly recognized as food raw material further enhancement of its nutritional value and health effect has become more important in the last few years. With the advent of so-called "functional food., the benefits of scientific research are now reaching the consumer. Genetic engineering offers the possibility to modify plant storage lipids and valuable secondary compounds in order to meet specific nutritional and even therapeutic requirements. The goal of the German collaborative project .NAPUS 2000. is the multifaceted improvement of rapeseed quality for human nutrition, including the augmentation of the content of tocopherols (TOC). Due to their biological activity in scavenging oxygen free radicals, lipid peroxy radicals and singulet oxygen, TOC have an important role as vitamin E and natural antioxidants. Preliminary results from analyses of breeding material revealed that actual rapeseed germplasm shows a considerable variation in total TOC content ranging from 510- 925 mg/kg oil. Regarding the TOC pattern rapeseed oil contains about 25-40% α-TOC and 55-70% γ-TOC as major individual tocopherols. Whereas the highest vitamin E activity is evident in the case of α-TOC, the best antioxidant property has been shown for γ-TOC. Aside of a total increase of TOC content, one of the goals is to enhance the α-TOC content in rapeseed oil in order to improve natural vitamin E supply. At the same time it is important to achieve better oxidative stability of unsaturated fatty acids through an increase of γ-TOC content. In combination with conventional breeding procedures genetic engineering is applied to introduce relevant genes of the TOC biosynthetic pathway in order to create novel genetic variation for these traits. In a first step we investigate the effect of overexpressing heterologous 4-hydroxyphenylpyruvate dioxygenase (HPPD) genes in genetically engineered spring canola cultivars. Interest in this plant enzyme has raised by recent results that HPPD is the target enzyme in the biosynthesis of both plastoquinones and tocopherols acting as essential elements of the photosynthetic electron transport chain and of the antioxidant system, respectively.