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Transgenic flax/linseed (*Linum usitatissimum* L.) – expectations and reality

M. Ludvíková, M. Griga

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This review summarizes the history, important milestones, current status and perspectives of biotech flax/linseed (*Linum usitatissimum* L.), supplemented with some of our original research, breeding and data on environmental safety. We show how recent biotechnology methods and genetic engineering contributed to the flax/linseed breeding in order to speed up the breeding process (doubled haploids technology; *in vitro* selection with the use of pathogenic toxins or heavy metals; genetic transformation) and for the creation of new flax/linseed cultivars. The focus is laid on genetic engineering which represents an excellent technology to enrich the flax/linseed gene pool with genes of interest, which are not naturally present in the flax/linseed genome. Different methods of flax transformation are mentioned, as well as various genes of interest that have been used for flax transformation to date aimed at improving transgenic flax properties, affecting both qualitative and quantitative traits. The fatty acid content and composition, the lignan (especially secoisolariciresinol diglucoside – SDG) content, flax fibre quality, tolerance to herbicides and resistance to diseases belong, among others, to flax traits that have already been modified by genetic engineering. Selection genes, reporter genes and also promoters that have been used for the vector construction are also summarized. This paper describes different fields of utilization of genetically modified (GM) flax with different improved properties. The history of the only so far officially registered transgenic linseed cultivar Trifid is described in detail. Finally, potential risks and benefits of flax modification are evaluated and also the prime expectations of GM flax and real current state of this technology compared. Unfortunately, the products created by this technology are under strict (albeit not scientifically-based) legislative/political control in the European Union (EU), which prevents the access of products, created by breeders using this top technology, to the EU market.

Keywords:

biotechnology in plant breeding; fibre crops; heavy metal tolerance/accumulation; lignan content; oil composition; transformation/genetic modification

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Contact

Ing. Markéta Knížková
Executive Editor
phone: + 420 227 010 373
e-mail: cjgpb@cazv.cz

Address

Czech Journal of Genetic Plant Breeding
Czech Academy of Agricul Sciences
Slezská 7, 120 00 Praha 2, Republic

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