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Biotechnology for Hydroxy Fatty Acid Production

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Castor (*Ricinus communis*) oil is the commercial source of hydroxy fatty acid (HFA) which contains 90% ricinoleic acid (18:1OH). HFA and its derivatives are used as raw materials for numerous industrial products, such as lubricants, plasticizers and surfactants. The production of castor oil, however, is hampered by the presence of the toxin ricin and hyperallergic 2S albumins. Lesquerella does not have such biologically toxic compounds and also contains a major HFA, lesquerolic acid (20:1OH), at 55-60% of seed oil. Therefore, lesquerella is being developed as a new industrial oilseed crop in the US. Biotechnology methods are effective for improving lesquerella through Agrobacteria-mediated genetic transformation. Lesquerella seed developmental studies show changes of morphology and physiology, as well as temporal details of fatty acid composition and gene expression patterns. Synthesis of 20:1OH is through elongation of 18:1OH, and the step is regulated largely by gene transcription of an elongase, PfkKCS3. By silencing PfkKCS3, transgenic lesquerella increased 18:1OH content from ~3% to ~27%. It is known that most of the HFAs in lesquerella are located only at sn-1 and sn-3 positions of

triacylglycerols (TAG). To improve HFA levels in lesquerella seeds, castor lysophosphatidic acid acyltransferase gene 2 (RcLPAT2) have been introduced into lesquerella. The resulted transgenic lesquerella seeds increase 18:1OH content at the sn-2 position of TAG from 2% to 17%, and consequently, oil accumulates more TAGs with all three sn positions occupied by HFA. Regiobiochemical analysis reveals the role of castor LPAT2 in the accumulation of hydroxy fatty acids in transgenic lesquerella seeds by exclusively acylating 18:1OH at the sn-2 position of tri-HFA-TAG in lesquerella seed oil. The results enhance our understanding of plant lipid metabolism and provide invaluable guidance for future research, not only for enhancing HFA content in lesquerella, but also for HFA production in other oilseeds.

Biography

Grace Chen has completed her PhD in 1995 from University of Wisconsin at Madison, USA. She is a Senior Research Plant Physiologist at US Dept of Agriculture at Albany California. She has over 95 publications that have been cited over 4000 times. She has been serving as an editor of for two reputed Journals.

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