The production of EPA and DHA in transgenic plants as a sustainable, environmentally friendly source of omega-3 fish oils for use in novel foods

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There is wide-scale acceptance of the benefits of a diet containing oily fish as being preventative of metabolic pathologies such as CVD, and this health-protection is due to the presence of EPA and DHA, omega-3 long chain polyunsaturated fatty acids. These fatty acids are normally only present in the aquatic ecosystems, and as such, are sourced from either fish oils or microalgae. In the former, this requires environmentally undesirable depletion of ocenanic fish stocks, or in the latter, expensive culture by fermentation. A third alternative is to use transgenic plants engineered to make EPA and DHA as non-native enhancements to the seed oil profile.

Results: Transgenic Camelina sativa has been generated in which seven genes for the biosynthesis of EPA and DHA have been stably inserted into the plant genome. These genes (derived from microalgae) are under the control of seed-speciific promoters, ensuring that these non-endogenous fatty acids are only synthesise in seeds and during triacylglycerol deposition. Levels of up to 20% EPA+DHA has been routinely achieved in such plants and validated under “real world” conditions in multiple field trials (controlled environmental release of a GMO). Similarly, multiple aquafeed trials have demonstrated the safe and efficacious use of these novel feed as a dietary inclusion for important fish species such as salmon, tuna, trout etc.

Conclusion: The production of EPA and DHA in transgenic Camelina achieves levels of these important fatty acids similar or greater to that found in Northern Hemisphere fish oils, but without the concerns associated with co-accumulation of environmental pollutants or the impact on sustainability of marine fish stocks.