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Converting Sugarcane into Oilcane by Metabolic Engineering for Production of Biomass Oil

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Converting Sugarcane into Oilcane by Metabolic Engineering for Production of Biomass Oil



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Informació de l'esdeveniment

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Sugarcane is the world's largest crop by biomass production, grown on 27 million hectares across 110 countries, accounting for 80% of global table sugar and 40% of commercially used biofuel. Its well-established infrastructure and high productivity make it an ideal candidate to become a cornerstone of the emerging bioeconomy through metabolic engineering. Lipids are increasingly critical as feedstock for biofuels, bio-lubricants, pharmaceuticals, and bio-based plastics, driven by a global shift toward sustainable alternatives to petroleum-derived materials. However, current oilseed crop production is insufficient to meet the surging industrial demand, creating a significant supply gap that necessitates new and innovative sources of lipid feedstocks. Notably, triacylglycerols (TAGs) carry twice the energy content of carbohydrates like sucrose, yet vegetative plant tissues accumulate little oil because fatty acid synthesis primarily serves membrane construction and TAGs undergo rapid turnover.



To address this, our objective is to engineer sugarcane to divert carbon flux from sucrose to oil, boosting lipid yields per acre for industrial use. Our metabolic engineering strategy targets four key steps: increasing fatty acid synthesis, enhancing TAG assembly, optimizing TAG storage, and minimizing TAG hydrolysis in vegetative tissues. We present results from a laboratory-to-field-to-fuel pipeline encompassing modular construction of recombinant DNA expression vectors, introduction into sugarcane cell cultures, recovery and regeneration of transgenic plants, and rigorous molecular, biochemical, and phenotypic selection for field trials. Harvested transgenic sugarcane is then processed in a biorefinery to recover biomass oil, with yields benchmarked against conventional oilseed crops.

These outcomes add significant value to one of the most productive bioenergy feedstocks and validate a promising strategy for advanced biofuel production.

Converting Sugarcane into Oilcane by Metabolic Engineering for Production of Biomass Oil. FREDY ALTPETER (1,2); Viet Cao (1,2); Guangbin Luo (1,2); Moni Qiande (1,2); Isidre Hooghvorst (1,2); Qasim Ali (1,2); Baskaran Kannan (1,2); Sofia Cano Alfano (1,2); Hui Liu (3); Shraddha Maitra (4); Vijay Singh (4); John Shanklin (3).

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Biography

Dr. Fredy Altpeter has been a University of Florida (UF) faculty member since 2001, promoted to Professor in 2012. He previously led a research group at IPK Gatersleben, Germany, and completed postdoctoral work with Indra Vasil at UF. He holds degrees in Crop Science and Plant Breeding and Biotechnology from the University of Hohenheim, Germany. Twice awarded the UF Research Foundation Professorship, his research integrates genome editing and translational genomics to improve grasses, particularly sugarcane, with 100 peer-reviewed publications. He is a Fellow of the American Association for the Advancement of Science (AAAS), Crop Science Society of America (CSSA), and Society for In Vitro Biology (SIVB), received the SIVB Distinguished Scientist Award, and currently serves as SIVB Vice President and Associate Editor for several scientific journals.

We hope you find this seminar interesting and relevant.