Biofuels ›
Volume 4, 2013 - Issue 5

Editorial

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Pages 459-461 | Published online: 09 Apr 2014

Cite this article https://doi.org/10.4155/bfs.13.29

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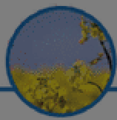
EDITORIAL

Grazers: the overlooked threat to the sustained production of future algal biofuels

Biofuels (2013) 4(5), 459–461



"We are currently at an exciting and dynamic phase in the development of new biofuels, with algae being seen as a realistic, commercially viable option. However, there are clearly still significant biological constraints to their commercialization, with grazing being largely overlooked by most researchers."

John G Day*

Keywords: algal biofuel ■ amoeba ■ biological constraints ■ ciliates ■ grazers

A brief search on the internet will provide any reader with sufficient information and misinformation to convince them that microalgae are clearly the answer to future transport fuel poverty, and simultaneously that algal biofuels are not practicably feasible. What is true is that algae, a hugely diverse group of organisms, include taxa that: are capable of very high levels of productivity/solar energy conversion [1]; can produce oils and other products with biofuel potential [1,2]; do not need to compete with potable or irrigation water supplies; and, importantly, have a proven track record of upscaling and commercialization [3,4]. The author is convinced that algae will in the future be a major platform for the production of a wide range of biotechnological products and that they have, in the longer term, huge potential as biofuel producers. Irrespectively of the product, economics will drive processes towards large-scale production plants and for relatively cheap products such as fuels lower cost open-pond-based systems are inevitable. If one makes a 'back of the envelope' calculation using *Nannochloropsis oculata* with 10 pg of lipid $cell^{-1}$ [5] as a starting point, then based on cell densities routinely obtained in the author's laboratory (~5.0×10^7 cells ml^{-1}) and a pond system with a depth of 10 cm, assuming no significant harvesting or extraction/processing losses, approximately 2000 l of algae/20 m^2 of pond need to be harvested to produce 1 kg of oil. Clearly, even with enhanced lipid levels per cell and higher cell densities at harvest, future microalgal biofuel production facilities will have very large geographical footprints. Such large open-pond facilities make the likelihood of 'contamination' by other microorganisms an inevitability, not a probability.

Interactions of biofuel algae with other microorganisms

In vivo, even in uni-algal cultures, complex microbial interactions are the norm, with algae providing sources of fixed carbon through leakage from healthy cells for commensal bacteria providing the algae with vitamins, for which many photo-autotrophic algae are auxotrophic [6]. There are a variety of other advantageous bacterial/algal relationships including facilitation of iron uptake by the production of extracellular iron-binding siderophores, by specific bacteria associated with phytoplankton [7]. However, not all interactions are positive, as in terrestrial crops 'disease' is a significant threat. Many phytoplankton are susceptible to fungal

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