# 'ALGAL BIOFUELS ARE NO ENERGY PANACEA'

Algal biofuels, like crops, demand land, water, fertilisers, pesticides and inputs that are costly for India.

Of late, there is heady euphoria over 'green' algal biofuels that are dangled as a panacea for developing countries such as India. While it is true that algal biofuels can contribute to a fossil fuel-free future, the promises of runaway successes are unrealistic. Scientists and policy makers need to address several critical issues that raise doubts over the sustainability of an extensive algal biofuel system. Do we need to re-learn sustainability lessons all over again in the light of first 'green revolution' which raised crop yields but left a trail of environment impacts?

Sustainability criteria need to be spelt out before anyone claims breakthroughs in this field. All claims need to be demonstrated on appropriate field-scale sizes; and an authenticated overall energy and resource balance established. Such a filter will make awareness, research, action and policy elements more realistic, achievable, accountable and transparent.

**The spectre of more land, water, chemicals and pollution**

Algal cultivation, like crops, will need land, water, farmers, fertilisers, pesticides and weedicides.

As it is, water-deficit India can barely meets it agricultural needs cumulative losses due to transpiration are 50-100 per cent higher than the rainfall. Producing 10 grams of algae per square metre from a water body daily will lead to a water loss of 10 litres and a conservative oil content of 20 per cent from the algae. So, producing a kilogram of algal oil will need 5,000 litres of water. A typical rainfed crop would function at a tenth to a fifth of this water use.

All cultivable land in India is already under crops, and wastelands suitable for algae are sparse. Large-scale, high-density algal cultivation can be done simultaneously with constantly flooded paddy crop covering 20 million hectares. The sodic wastelands of Kachch in western India offer three million hectares and the coastal shelf a similar area. With urban wastewaters amounting to 40,000 million litres per day, the equivalent of 10 million hectares of dedicated cultivable area could be reached

To produce one kilogram of algal fuel, one kilogram of naptha is needed for adequate nitrogen, tilting the energy balance to zero or negative

Learning from agricultural crops especially paddy where nitrogen uptake efficiency is about 30 per cent achieving high nitrogen efficiency is difficult in a short time-frame. Raised simultaneously with flooded paddy, nutrients taken up by algae could be fed back to paddy fields, after extracting oil and biometha nation of the residue. As the nitrogen is in organic form, its losses are low and the overall efficiency could be high. However, this requires intensive farm nutrient management.

In short, the problems of algal biofuel are akin to those of high-yielding agriculture. Taking the algal biofuel path would require India to double its area under cultivation, more than double its water budget and double its fertiliser use. This is unaffordable for Indias economy and environment.

## Contested productivity claims

Algal productivity is widely contested. Most productivity data are derived from small-scale studies, with projections ranging between 18360 tonnes per hectare each year. The higher values arise from feeding sugar and providing light for 1824 hours daily to the algal system.

Algal cultivation is likely to be in open pond systems where yields are likely to be in the range of 510 grams per square metre daily. The perceived higher yields in sterile monocultures in laboratories are difficult to replicate in the field where a host of algae feeders and algal competitors thrive. In typical fast-growing algal ponds, nearly 3040 per cent of the algal biomass is consumed by grazers and feeders.

Studies show that in short growth cycles of 510 days lipid accumulation is at best a paltry 1015 per cent; and reaches 80 per cent in cycles beyond 30 days. It is misleading to multiply the highest lipid content of 80 per cent with the upper limit of yields of 360 tonnes per hectare per year (obtained by feeding sugar and artificial light at one to three per cent energy efficiency) to project a potential yield of 288 tonnes from every hectare each year. In the field, a potential oil yield in the range of three tonnes per hectare each year would be more realistic.

And the energy and solvent needs for oil extraction operations are still unclear. Unless very efficient processes are evolved, algal biofuel extraction would have poor energy balance.

Making algae ecologically competitive is something few understand. If we do not resolve the issues, we will end up with a system similar the current model of poorly sustainable, high-input agriculture, something that we don't need and would like to avoid.

Source: http://www.scidev.net/global/biotechnology/opinion/-algal-biofuels-are-no-energy-panacea-.html