

Biodiesel from trees

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As the world debates climate change, much attention has been paid to wind and solar power electricity production, to reduce greenhouse gas emissions. Renewable fuels are needed if we are serious about halting global warming. The big question is how to do this without clearing more trees or causing food shortages?

Large quantities of ethanol are now produced from sugar cane in Brazil and from corn in the USA. Increasing the use of grain for fuel will cause food shortages. Already, high grain prices are restricting ethanol production in Australia, and from a limited surplus of grain we could not produce more than 2% of our fuel. Producing ethanol from crop residues is not an answer because it will reduce soil carbon and the future productivity of agriculture.

Biodiesel is also on a rocky road, with several production facilities in Australia closed due to the high price of feedstocks, which include tallow and canola.

Planting oil palms to produce biodiesel has attracted world-wide criticism, because large areas of rainforest have been cleared in south-east Asia for plantations. This not only emits a lot of greenhouse gases, it is threatening the future of the Orangutan, the Sumatran tiger, Asian elephants and several other Asian rainforests animals.

Australia is not suited to oil palms, except on the northern coastline, with irrigation during the dry season. *Jatropha* is a large shrub which is more suited to arid lands. The fruit contains seeds with oil which can be converted into biodiesel. *Jatropha* is a toxic plant and requires careful hand harvesting. Although it can grow on marginal land, it is still in competition with food production and there is an energy cost to replace nutrients removed in the harvested fruit.

In Queensland there has been recent interest in a 'diesel tree', *Copaifera* from Brazil. A latex like oil can be extracted and converted to biodiesel. *Copaifera* does not need as much rain as oil palm but still grows in rainforest areas, which in Queensland are already cleared for sugar cane or have high conservation value. The tree takes 15 years to mature and must be hand harvested like a rubber tree. Although labour is cheaper in Brazil, it has not taken off there, where an expansion of sugar cane for ethanol is still going on.

More promising is an Australian native. *Pongamia*, *Milletia pinnata*, sometimes known as Native Wisteria, because it produces purple flowers. It has been grown as an ornamental in Brisbane and will tolerate drought, frost and salty soils and produces large seeds with a high oil content. The tree is fast growing, but it takes 5 or 6 years until the first harvest. With moderate summer rain, a yield of 3000 litres/ha of biodiesel is possible. The byproducts would be 10 tonnes of pod shell and 7 tonnes of high protein meal, which could be worth more than the diesel.

An advantage of a legume is that energy inputs are low because it produces its own nitrogen and being a tree it does not need to be planted each year. This means it has a high net energy balance for biodiesel.

If grown on pasture land, the byproduct may well produce as much beef as by grazing the replaced pasture. However, with some modification, the meal may be valuable for feeding to dairy cattle or as a high protein ingredient in fish food. It could be possible to produce all of Queensland's fuel requirements from around 1.5 million hectares of legume trees and rather than compete with food production, more beef, milk and fish could be produced from this area at the same time.

At the recent Bioenergy Conference, held on the Gold Coast, Professor Peter Gresshoff reported on research at the University of Queensland to improve the quality and quantity of oil from *Pongamia*, However, despite some trial plantings, the success of this crop has yet to be proven in the field and there is a lot of work to be done to develop a biodiesel industry based on legume trees.