Treethanol: A remedy worse than the malady

Ethanol is a biofuel usually made from maize (corn) or sugar cane, which is being enthusiastically promoted as an alternative fuel which can be blended into ordinary petrol or burned directly in special "flex-fuel" engines.

Now, in the present agro-fuel rush, the idea of using trees for the production of ethanol is being put forward as a better solution. According to its promoters, "Treethanol" has the potential to be much more energy efficient than other crops like maize or sugar cane. The energy balance (the ratio of the energy yielded by a given amount of ethanol to the energy needed to produce it) for ethanol made from maize is estimated by the US energy department at 1.3; in other words, the ethanol yields 30% more energy than was needed to produce it. For ethanol made from sugar cane in Brazil, the energy balance is 8.3, according to the International Energy Agency. But for ethanol made from trees, which contain a lot of cellulose, the energy balance is said to be as high as 16, at least in theory. In practice, producing such "cellulosic" ethanol is much more difficult and expensive than producing it from other crops. But corporation researchers are racing to develop ways to chip, ferment, distil and refine wood quickly and cheaply.

Interest in cellulosic ethanol is growing as the drawbacks of making ethanol from maize and sugar become apparent. Both are important food crops, and as ethanol production is stepped up around the world, greater demand is driving up the prices of everything from animal feed to cola and biscuits. The price of corn rose by 70% between September 2006 and January 2007 to reach its highest level in a decade. Mexico's president, Felipe Calderón, even capped the price of corn tortillas in January as US’s fast-growing ethanol industry caused prices to rocket.

So in come the trees. The promoters of tree-ethanol argue that trees grow all year round and contain far more carbohydrates (the chemical precursors of ethanol) than food crops do. Ethanol is the result of the fermentation of sugars, which is why it can be so simply and efficiently made from sugar cane. Making ethanol from maize is a bit more complicated: the kernels are ground into flour and mixed with water, and enzymes are added to break the carbohydrates from the maize down into sugars, which can then be fermented into ethanol. Making ethanol from cellulosic feedstocks is harder still, however, since it involves breaking down the tough, winding chains of cellulose and hemicellulose from the walls of plant cells to liberate the sugars. This can be done using a cocktail of five or six enzymes. Although such enzymes exist, they are expensive.

However, tree-ethanol enthusiasts see that there is much money to be gained and are actively trying to find solutions. In the first place, they are searching for cheaper and more efficient enzymes. Two large producers of industrial enzymes -- Genencor, a US firm, and Novozymes, from Denmark -- are working to reduce the cost of cellulase enzymes, which can break down cellulose, to below $0.10 per gallon of ethanol. For its part, Diversa is developing enzymes capable of breaking down hemicellulose. One approach is to “tweak the structure” of existing enzymes (meaning genetic manipulation of enzymes) to try to make them more efficient. Another approach is "bio-prospecting" (meaning bio-piracy), which implies looking for natural enzymes in unusual places, such as in the stomachs of wood-eating termites.

To make the business even more profitable and matters worse, a second –and probably complementary- “solution” is to create new trees. A team led by Vincent Chiang, a biologist at North Carolina State University, is investigating the production of ethanol from genetically modified trees, with funding from the US Department of Agriculture.

They will try to get faster growing trees containing less lignin and more cellulose so they would both grow faster and also produce more ethanol. Some transgenic trees of this kind are being tested in the US. Dr Chiang and his team are also looking at ways to modulate the genes that determine the structure of a tree's sugar-containing hemicelluloses in order to make the breakdown and fermentation processes more efficient.

What those high-tech researchers are not even considering –as usual- are the environmental and social costs that the resulting expansion of large-scale –and genetically modified- fuel tree plantations would have: substitution of food crops by fuel crops –in a world where millions are malnourished- , displacement and impoverishment of local communities –and its accompanying repression- impacts on water, ecosystems, soil. Such impacts will almost certainly fall mostly on Southern communities, where the bulk of those plantations would be established. At the same time, the serious environmental threats of genetic manipulation of trees (see WRM Bulletin Nº 88) and enzymes are also ignored.

A simple question has yet to be answered by those promoting treethanol and other agro-fuels: can a solution to one problem (climate change) be considered a solution if it creates serious problems to other equally important problems? Large scale agrofuel crops and treethanol plantations will result in biodiversity loss, water depletion, soil degradation, impoverishment, malnutrition, human rights abuses –to name only the more obvious. Our answer to the question is that this is an unacceptable solution which must be opposed.

Source of information used: “Energy: Could new techniques for producing ethanol make old-fashioned trees the biofuel of the future?”, Derek Bacon, March 2007, The Economist Newspaper, sent by STOP Genetically Engineered Trees Campaign, e-mail: info@stopgetrees.org, http://www.stopgetrees.org