# GM Freeze Briefing on Agrofuels and GM

GM Freeze is extremely concerned at the amount of political, commercial and scientific attention being given to the development of agrofuels (biofuels produced from intensive crops grown in monocultures). The substitution of agrofuels for petrol and diesel in response to rising oil prices, energy insecurity and climate change is occurring despite the availability more sustainable solutions, such as reducing fossil fuel usage and improving energy efficiency.

GM Freeze recognises that there may be an important role for some sources of biomass in reducing the reliance on fossil carbon in oil, coal and natural gas for heat, electricity generation and transport fuel provided they are employed in a sensible way.

Some commentators are suggesting that genetic modification can help increase the potential production of agrofuels.

**We believe it is vital that the true potential of liquid agrofuels such as bio-diesel and bio-ethanol for tackling climate change is fully understood before further decisions leading to the use of farmland for agrofuels cultivation are made.**

## Biofuels

Biomass has been used as a source of fuel since soon after the human race first appeared on the planet. For millennia, wood was used for heat, cooking and to provide light. Today wood remains the most important biofuel in the world. In India rural populations get 90% of their energy from woody biomass. Countries such as the USA, Finland and Sweden are also big wood burners.

Sources of biofuels currently include: crops grown for the purpose; maize, soya, etc that are also used food/feed; timber and forest wastes; crop wastes and by-products (eg straw); and organic waste such as food processing wastes, manures and sewage sludge.

There are four basic types of biofuels:

- *Biomass* - plant residues and wood combusted to produce heat or steam;
- *Biogas* - anaerobic digestion of plants and organic wastes to produce a gas consisting mainly of methane;
- *Bio- ethanol* – produced by fermenting starches and sugars in plants into ethanol which can be either blended with fossil fuels or used on its own if engines have been converted. Referred to as agrofuels in this briefing;
- *Bio-diesel* – based on vegetable oil extracted from crops such as palm oil, soya and oilseed rape which can either be substituted for diesel or blended with it. Referred to as agrofuels in this briefing.

The raw materials for biofuels can come from trees, crop plants or organic wastes including abattoir wastes and sewage sludge.

## Why Bioethanol and bio diesel won't tackle climate change

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## Limit of photosynthesis

Only 3-6% of solar radiation is successfully converted into plant tissues by photosynthesis. This immediately presents a chemical and physical limit to how much plant material that can be used as raw materials for agrofuels can be produced annually. Some analysts estimate that we are already using 40% of the product of terrestrial photosynthesis[i] and this proportion is rising fast.

## Fossil Fuels Used in Production

**Agrofuels require large inputs of fossil fuels to produce them greatly reducing or neutralising their ability to reduce greenhouse gas emissions. Fossil fuels are used in many ways along the production chain of agrofuels:**

- to manufacture and operate farm machinery and equipment;
- to produce fertilisers and pesticides (NB nitrogen fertilisers also produce emission of nitrous oxide a very powerful greenhouse gas);
- to transport seeds, inputs and the harvested crop;
- to manufacture and operate processing equipment and containment;
- to pump irrigation waters;
- to transport and pump the final products.

To be worthwhile it is essential that agrofuel production provides significant benefits in terms of reduced carbon emissions. Some commentators suggest that this may not always be the case or at best the carbon emission benefits may be marginal[ii].

## Displacement of Food production

With world grain reserves at the lowest point for decades[iii] and evidence of rising food prices in relation to crops currently providing the feedstock for ethanol production in the USA, (eg China has paused biofuel development because pork price was rising due to maize for ethanol[iv]), the displacement of food crops by agrofuel crops makes little sense and is highly questionable from an ethical standpoint.

## Damage to biodiversity

Clearance of forest and other habitats to grow agrofuels is unsustainable. Destruction of forest and other habitats release massive amounts of carbon stored in trees and soils (eg peat soils under forest in Indonesia produce huge amounts of carbon dioxide if they are used to grow palm oil for biodiesel[v]). Allied to land use changes are the environmental and health impacts commonly associated with intensive farming systems (eg pesticide and nitrate pollution, soil erosion and greatly reduced biodiversity). In addition some agrofuel crops may also become invasive plants in some environments causing serious harm to natural ecosystems or becoming weeds on farmland or in forests[vi]. Seven plant species out of a total of 18 being considered as potential agrofuel crops have been banned from parts of Australia as noxious weeds.

## Displacement of people

The acquisition of land to grow agrofuels can displace indigenous people and wildlife by opening it up to an entirely different form of land management. An example of this type of effect comes from India where BP is to fund a $9.4 million project by The Energy and Resources Institute (TERI) in the Indian state of Andhra Pradesh to demonstrate the feasibility of producing biodiesel from *Jatropha curcas*, a non-edible oil bearing crop, on 8000 hectares of "wasteland" aimed at producing 9 million litres of biodiesel per annum[vii]. BP promise a full environmental and social assessment, but the wildlife and people who occupy the area at present will need to be very well organised to resist a global giant such as BP. The use of the term "wasteland" suggests a lack of understanding of the value of such land for the people who live there and of the biodiversity implications of such a wholesale change in land use. In common with other monocultural

developments in agriculture, biofuel plantations will also force many smaller farmers to leave their land.

### Diversion of Organic materials

Crop residues post harvest are traditionally incorporated back into the soil either directly after harvest or after being used for animal bedding. In this way soil organic (carbon) levels are maintained or enhanced and the soil provides a temporary store for carbon. Increasing soil organic matter not only increases the amount of carbon stored, but it also improves its structure and moisture holding capacity. This, in turn, can: make soils easier to cultivate (reducing the requirement for tractor fuel); reduce the need for irrigation (reducing the requirement to pump water); and improve yields (reducing pressure to expand crop lands into forest and other habitats). Thus how crop residues are managed can have an impact on the total of amount of carbon emissions from cropping systems. Crop residues can also be composted to produce peat substitutes or to improve soils fertility, which again reduces the pressure to drain peatlands for extraction purposes releasing huge of amounts of stored carbon into the atmosphere. It should not therefore be assumed that using crop residues to produce agrofuels or methane is necessarily the best use of those resources, particularly if they require transportation before and after processing. Further research is needed to ascertain the best use of crop residues in terms of benefiting the environment.

### Insufficient Land

Even if all the arable land in the UK were diverted to agrofuel production, the impact on replacing fossil fuels used in transport would be small and we would then have to import much more food. Bio-diesel from oilseed rape is a good example of the limitation of this approach in the UK.

"This means that using all the setaside land to produce biodiesel could displace 30.3 billion MJ of the energy contained within the petrol, this is a 4% displacement by energy. 30.3 billion MJ of energy equates to 0.8 billion litres of diesel"[viii].

## Conclusion

The production of agrofuels for the UK should be ethical and fair and avoid undermining the food security and biodiversity of producing nations and their farmers. It should also be fair to UK farmers.

### GM crops and Agrofuels

Proponents of biotechnology and GM crops have not been slow in coming forward to make claims about how genetic engineering can help produce more agrofuels.

These claims take several forms:

- GM crops have higher yields and therefore produce more agrofuels;
- GM can alter plants to produce more agrofuels (eg increase oil production);
- GM can enable more of the plant to be used for agrofuels.

Claims of GM crops producing higher yields are not supported by the available evidence because yields appear to be as variable as conventionally bred varieties[ix].

The latter claim is exciting the companies involved in bio-ethanol production because the hope is that the cellulose and lignin that goes to make up the bulk of the plant can be utilised more efficiently to produce ethanol. At present the breakdown of cellulose to produce sugar and starch that can be converted is very inefficient and expensive. By including enzymes in crops or using GM microbes, genetic engineers claim that they can make fuels more efficiently, increase the yields of agrofuels per hectare of land and open up the possibility of utilising food crop plant

residues. **These are the so-called second generation biofuels, which so far are unproven and are some way off commercial development.**

However, this will still not alter the basic efficiency of photosynthesis which will always limit the potential for utilising plants to produce liquid fuel. Whilst the emphasis is focussed on supply rather than demand management for liquid fuels, the tendency will be to expand the area under cultivation which will eat into marginal lands or increase monocultural agriculture. Although part of the crop may still be used for food, evidence from Argentina, where soya GM dominates, suggests it does not provide for the needs of local people[x].

GM agrofuels crops and GM trees pose similar risks to the environment as GM food and other crops. The risk assessment required needs to be every bit as rigorous. GM trees may require even more rigorous assessment because of the distances pollen and seeds can be transported and the longevity of tree species.

If food crops such as soya, maize and oilseed rape are genetically modified for agrofuels, they would still require assessment for health risks for people and animals because often production by-products will enter the food or feed chains. For example, oilseed cake, brewer's grains and beet pulp are all used for animal feed and therefore could not be placed on the market until a full risk assessment of their impact on human and animal health had been carried out in line with EU Regulation 1829/2003. In addition, the final food/feed products would need to be labelled as GM in line with EU Regulation 1830/2003. The risk of cross pollination and accidental mixing of the supply chains would also mean that GM agrofuel crops need to be assessed for food and feed safety.

At present it cannot automatically be assumed that the current generation of GM crops will gain the necessary EU commercial approval as agrofuels when, so far, the same crops used for food and feed have not been successful in receiving such licenses for a wide range of reasons. The environmental impact of GM crops grown for agrofuels will be the same as if they were grown for food or feed. In the case of herbicide tolerant crops, the farm scale evaluations demonstrated that the arable wildlife food chain was significantly harmed by herbicide tolerant spring and winter oilseed rape and fodder/sugar beet. The only crop which was found to improve the food supply of wildlife was fodder maize. However, this finding was controversial because the most used conventional maize crop weed killers, the triazines, were banned after the trials ended and therefore the data available from the FSE no longer provided a valid comparison for how weeds would be controlled in a non GM crop in the future. Attempts by the FSE researchers to re-work the data in the light of the ban on triazines[xi] did not present a convincing case that the FSE findings for fodder maize were valid.

Claims that GM crops could be managed in a different way to mitigate the impacts of the herbicide treatments on biodiversity have not been fully tested in the field. To receive approval under the EU Directive 2001/18 or EU Regulation 1829/2003, a GM herbicide tolerant agrofuel crop would have to come with a data set showing that mitigation measures were practical, effective and enforceable. No validated data of this nature exists to date.

Another assumption is the GM agrofuel crops would somehow be more acceptable to the EU public than food crops that are not. This ignores the broadly based concerns about GM within the EU population, which include environmental impacts, social and economic impacts and ethics.

## GM Freeze Position

GM Freeze supports research into utilising terrestrial plants to provide energy providing that the systems adopted are truly sustainable and do not introduce new and unpredictable risks (eg the introduction of exotic plants and the use of GM plants).

We believe that the potential for producing agrofuels to meet current demands for liquid fossil fuels is very limited by the availability of land, the need to protect local populations and biodiversity and the relatively low efficiency of photosynthesis in converting sunlight into plant materials. Politicians and industry spokespeople should be honest about these limitations and make it clear that greatly reduced use and massive improvements in fuel efficiency must be the priorities. GM Freeze believes that the utilisation of agrofuels must meet wider sustainability criteria as well as being proven to be truly beneficial in controlling climate change.

With over 800 million people on the planet undernourished in some way, GM freeze believes that the priority for land use should be food production and that research and development should assist countries to reach a high level of self reliance in this respect. The basic energy requirements of millions are also not being met. Bioenergy research should concentrate on providing local energy solutions to improve the quality of life for local people and ensure that they retain control over their local resources and land and benefit economically from any such developments. It is essential that production of biofuel crops by southern nations for use in northern nations is carried out on a fair trade basis and is fully transparent and non exploitative. Attempts by corporations to colonise the Global South for agrofuels farms should be resisted unless a full risk assessment covering the production style and the impact on local people and the local economy has been carried out and the crop shown to be beneficial on all counts.

Management of traditional crops and novel crops for agrofuels production must not further degrade biodiversity or the environment. We see no difference between the impacts of a biofuel monocultural production system dependent on fertilisers and pesticides and the current intensive monocultural food production system. Both are equally unsustainable.

GM applications for agrofuels crops should be treated and assessed in the same way as food crops for their impact on the environment. Food and feed assessments should be no less rigorous for a GM biofuel crops because of the risk of accidental contamination of food chains and the real possibility that some part of the crop may enter the food or feed chain. Transboundary movement of GM biofuel crops should be traceable and labelled to provide choice for consumers and allow for ongoing safety assessments. Agrofuels based on GM crops should be labelled as such.

Utilisation of forest, food and crop wastes and residues must be assessed to ensure that their diversion from other management systems is not detrimental to the environment. Risk assessment for GM crops should include the use of residues for biofuel production.

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[i] From *Investing in Natural Capital*, ISBN 1-55963-316-6, The International Society for Ecological Economics and Island Press, 1994
[ii] Examples in Brown L (2006), *Biofuels: Renewable Energy Or Environmental Disaster In The Making?*
[iii] USDA, *Grain: World Markets and Trade*, Circular Series FG 11-06, November 2006, FAO Food Outlook Nº. 2, Global Market Analysis, December 2006
[iv] www.timesonline.co.uk/tol/news/world/asia/china/article1917927.ece
[v] Fred Pearce (2005), "Forests paying the price for biofuels", 22 November 2005, NewScientist.com news service
[vi] The Invasive Species Council (2007), *The Weedy Truth About Biofuels.* www.invasives.org.au/issues/biofuels.html
[vii] www.azom.com/details.asp?newsID=4826
[viii] www.esru.strath.ac.uk/EandE/Web_sites/02-03/biofuels/quant_biodiesel.htm
[ix] www.ers.usda.gov/publications/aer810/aer810g.pdf
[x] Joensen L (2005), *Argentina: A Case Study on the Impacts of Genetically Engineered Soya,* Gaia Foundation, London
[xi] Firbank Let al, Letter to *Nature* 428, 313-316, 18 March 2004

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