

This response was submitted to the consultation held by the Nuffield Council on Bioethics on *New approaches to biofuels* between December 2009 and March 2010. The views expressed are solely those of the respondent(s) and not those of the Council.

Dr Peter J Leggo

QUESTIONS ANSWERED:

Question 1

ANSWER:

Sources of fossil hydrocarbons, coal, oil and gas are a finite resource and will become unavailable with time. Bearing this in mind it is logical to assume that biofuel will become an important source of future energy. Two problems confront the future of biofuel. One is that plants take time to grow and two, the growth of biofuel crops will require land that otherwise would be used to grow food plants. It is therefore desirable to use marginal and abandoned land to support the growth of biofuel crops.

Question 2

ANSWER:

The most important ethical challenge would appear to be where to grow these crops so that essential food crops are not compromised. It would be unacceptable to harvest crops too frequently. An example would be uncontrolled felling of forest trees. Mining of metal ores produces waste which is abandoned on open country. This behaviour presents a grave environmental problem as metals are non-biodegradable. Again, the discard of industrial organic waste and the use of polychlorinated aromatic compounds (PCB's, Lindane, Aldrin, Dieldrin etc.,) produces phytotoxic soil environments. These compounds are not found in Nature and in many cases undergo slow metabolism and consequently are persistent in living organisms. Recent research indicates that by the use of soil amendments, i.e. biofertilizers to promote plant growth, much can be done to eradicate this problem.

Question 3

ANSWER:

Yes, in as much that my research is in biofertilizers by which use biofuel crops can be grown on contaminated land unsuitable for food crops. This subject is new and thus not widely published in the scientific literature. However, progress is being made in making this knowledge generally available in the form of research papers and an chapter on the subject in book form. On associated topics the main source of information comes from papers published in the scientific literature.

Question 4

ANSWER:

Considering the articles written in the British Bio-Energy (Supergen Bioenergy) News more attention should be given to the production of feed stock. The fundamental factor in driving the development of biofuels is research and development. in the area of soil science; without the availability of healthy soil the concept of obtaining energy from bio-fuels is limited. More attention should be focused on fundamental areas such as soil microbiology, biochemistry and ecology. Plant sciences, in particular botany, plant physiology and chemistry will also continue to be of great importance. The new area of geobiochemistry will undoubtedly play an important role in the understanding of interactions between soil microbes and mineral surfaces. This knowledge is vital if the loss of biodiversity is to be avoided and soil health maintained.

Question 5

ANSWER:

I can only quote what I have read on GHG emission savings. Apparently the concept of building CHP plants at natural gas pressure reduction stations and using locally sourced rapeseed oil to generate heat and power, such a plant run continuously can achieve more than 70% electrical efficiency and save a

minimum of 56% GHG emissions when compared with the UK grid mix.

Question 6

ANSWER:

This is a complex question and there are no simple answers. Due to the great diversity of climate, soil types and natural resources countries worldwide will be forced to adopt different approaches. All I can say on this is that biofertilizers, of the type we are working with, have allowed the sustainability of enhanced growth in regions as different as sub arctic Canada and semi-arid S.E.Spain. Trials on mine waste, with grasses and clover at Lynn Lake, Manitoba, Canada are now entering their tenth growing season under natural climatic conditions with no further treatment than the initial amendment with the organo-zeolitic biofertilizer. An example is shown in Chapter X of "Fertilizers:Properties,Applications and Effects" published by Nova Science Publishers Inc., New York,2009. The Spanish trial is now entering its second growing season and indigenous plants have been sustained in semi-arid conditions without additional water except for sparse rainfall (ca.300mm.yr-1).