INTRODUCTION

The two main types of liquid biofuel are biodiesel and bioethanol. Biodiesel can be blended with diesel and bioethanol is primarily blended with petrol. Currently the majority of vehicle engines are designed to run on blends of at least 5% biofuel.

At present, the main vegetable oil used for biodiesel comes from oilseed rape, and bioethanol is produced from sugar beet or cereal grains. In future it may become possible to produce sugar, hence alcohol, from plant biomass, which is much cheaper and more plentiful. Using crops to produce fuel will help the UK to meet targets for reducing greenhouse gas emissions such as carbon dioxide (CO_2).

The renewable transport fuel obligation (RTFO) set by the UK government gives targets for the percentage of transport fuel that must be from a renewable source of 2.5% after 2008, 3.75% after 2009 and 5% after 2010. By 2010, it is predicted that 1.2 million tonnes of biodiesel and 0.8 million tonnes of bioethanol will be required each year in the UK.

GROWING CROPS FOR BIOFUELS

Biodiesel

- The best UK crop for producing biodiesel is oilseed rape.
- Other crops grown for biodiesel outside the UK include palm oil, soya and sunflower.
- Growers must maximise the economic production of oil per hectare similar to oilseed rape grown for food.
- Varieties should be chosen with the greatest gross output (seed yield x oil %). See HGCA recommended Lists (www.hgca.com).
- Applying below the optimum rate of nitrogen recommended in MAFF Reference Book 209 will reduce seed yield; applying more nitrogen will reduce the oil %.

Bioethanol

- UK crops for producing bioethanol include wheat, triticale, barley and sugar beet.
- Other crops grown for bioethanol outside the UK include sugarcane and maize.
- Growers must maximise the economic production of ethanol per hectare.
- Ethanol production depends upon the yield of starch and the ease with which it can be processed.
- For wheat use Group 3 and 4 varieties with good starch/distilling properties. See HGCA recommended Lists (www.hgca.com). See www.swseeds.co.uk for variety information on other crops (e.g. Triticale).
- Crop inputs, except nitrogen, should be applied at economically optimum amounts for yield.
- Nitrogen increases grain protein at the expense of starch, so N applications should be made earlier and at a slightly lower rate than for other markets.
- Processors may pay a premium for grain giving higher alcohol yields, which can be maximised through variety choice and nitrogen management.

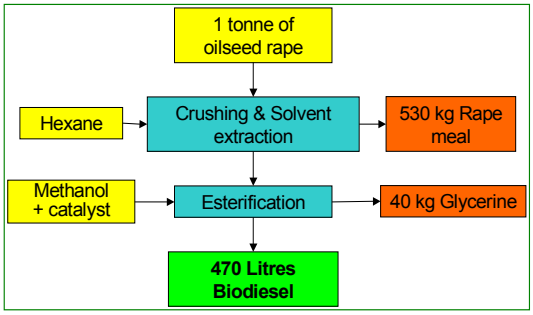
PROCESSING

Oilseed rape for biodiesel

- Oil is extracted from the oilseed by crushing and solvent extraction with hexane.
- The oil is then converted to biodiesel by adding methanol in a process called esterification.
- One tonne of oilseed rape (at 9% moisture) will produce about 470 litres of biodiesel, 530 kg of rape-meal and 40 kg of glycerine.
- If solvent extraction is not used then the amount of oil produced by crushing is up to 300 litres per tonne of oilseed rape.

The rape-meal is a valuable bi-product which can be used as animal feed or burned to generate energy. Glycerine is also a valuable bi-product with many markets.

Figure 1: Processing rape for biodiesel

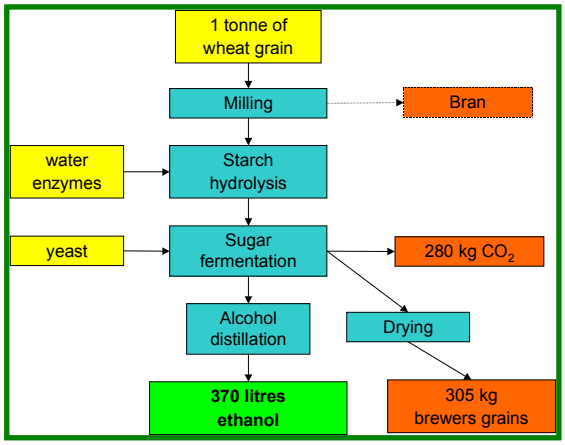


Cereals for bioethanol

The production of bioethanol is an industrial scale process.

- Cereal grains such as wheat are milled; water and enzymes are added to convert the starch to sugar; and the sugars are fermented by yeasts.
- Ethanol is then distilled from the fermented mixture.
- One tonne of wheat grain (at 15% moisture) will produce about 370 litres of ethanol, 305 kg of brewers grains and 280 kg of CO_2.
- The brewers grains can be used as animal feed or, after drying, for energy production. The CO_2 is sometimes collected as a useful bi-product.

Figure 2: Processing of grain for bioethanol



ADVANTAGES OF LIQUID BIOFUELS

- Liquid biofuels can be produced from crops currently grown in the UK.
- They will help the UK reduce emissions of green house gases.
- They will increase demand for crop products which should strengthen prices.
- Crops grown for liquid biofuels qualify for the energy payment of 45 euros per hectare if grown on non set-aside land.
- Biofuel crops can be grown on set-aside as industrial crops.

OUTLETS FOR LIQUID BIOFUEL CROPS

- Oilseeds can be crushed on-farm then converted into biodiesel. A range of crusher sizes are available (e.g. www.alvanblanch.co.uk).
- Most grain traders offer contracts for biodiesel or bioethanol.
- A biodiesel plant is being proposed for Humberside (www.greenergy.co.uk).
- Whilst there are no plants in Wales producing biodiesel or bioethanol directly from crops, Sundance Renewables are producing biodiesel in South Wales from used vegetable oils.

FUTURE DEVELOPMENTS

- Accreditation schemes are being developed to ensure that biofuel crops are produced and processed using methods that guarantee a reduction in green house gas emissions compared with fossil fuels, see www.hgca.com for more details.
- In the medium to longer term it is likley that premiums will be paid according to the extent to which the production process reduces greenhouse gas emissions. Some cropping practices and inputs, especially nitrogen fertilisers, may need to be adjusted to minimise greenhouse gas emissions.