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Genetic engineering could cut the cost of biofuels

Plant genetic engineering could play a major part in reducing the cost of biofuel production from food crop wastes such as rice straw or from non-food crops such as willow and poplar. A recent study suggests further research is needed to determine whether plants developed through genetic modification are better suited for biofuel production. This technology is closely regulated. Any products arising from ensuing research must be thoroughly assessed in accordance with the relevant legislation in order to ensure their safety to humans, animals and to the environment.

According to the study's author, biofuels have the potential to reduce the political instability and environmental issues that come with reliance on oil. The United States government and some commercial organisations are actively promoting and funding research into new sources of energy including biofuels. However, there are major obstacles which prevent the widespread use of biofuels including: the cost of the production process on an industrial scale; problems with transporting ethanol, the most common biofuel, which corrodes pipes, and the impact of using agricultural land to grow crops for biofuels instead of for food.

Most biofuel is currently in the form of ethanol generated from corn grain or sugarcane. Brazil produces ethanol from sugarcane which supplies one quarter of its own transport fuel needs. The United States uses corn grain and aims to replace 30 per cent of its foreign oil needs by 2030. However, even if all the corn grain produced in the US was converted into ethanol, this could only produce about 15 per cent of all fuel for the country's transport needs. Furthermore, using crops that would otherwise be used for animal feed, increases meat and dairy prices.

Ethanol can be produced from all plants and plant-derived materials, including non-food crops such as willow and poplar, animal manure and waste from food crops such as rice straw and corn stover. It is produced by converting the plant material into sugars, which are then fermented to make ethanol. The US government has funded six new refineries which use food crop waste or non-food crops to produce ethanol. However, ethanol derived in this way costs two to three times higher than corn grain ethanol; expensive enzymes are needed to convert the crop waste into sugars. The plants also need to be pretreated, further pushing up the production cost.

These challenges could be overcome by using genetic modification (GM) to alter both food and non-food crops.

Possible modifications include:

- The enzymes needed for fermentation could be inserted into the crops, for example they could be produced within the leaves and stalks of the crop itself
- Plant residues could be made to be more easily degraded, which would reduce the need for expensive pretreatment
- The overall amount of plant material or plant sugars needed for biofuel production could be increased in both food and non-food crops

Such research is in its infancy and in making such modifications it would be important to ensure that they do not interfere with the structural strength of the plant, or its ability to fight disease and insects and that they do not pose adverse effects to biodiversity or the environment. Challenges to be met outside the realms of plant biology include the impact on food prices of using agricultural land for growing biofuel crops, rather than food, animal feed or fibre crops such as cotton. Using food and feed crop waste is the ideal way to produce biofuels, for example, by converting rice straw into ethanol. At present, rice straw is burned as waste, contributing to air pollution problems.

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