

Final Project Summary

Project title	Wheat straw for biofuel production		
Project number	RD-2007-3690	Final Project Report	SR33
Start date	01 October 2009	End date	30 September 2012
AHDB Cereals funding	£37,500	Total cost	£82,500

What was the challenge/demand for the work?

Production of first generation liquid biofuels from feedstocks such as wheat and maize grains has been criticised due to competition for agricultural land between crops grown for food or fuel. An alternative is to produce liquid biofuels from non-food crops like *Miscanthus* and agricultural by-products such as cereal straw. Wheat straw represents a potential source of biomass for the production of liquid transportation fuels to replace petrol. Current commercial cultivars of wheat have been selected according to grain yield and quality, not straw yield or suitability for bioethanol production. There is no published work on the suitability of different UK cultivars of wheat straw for bioethanol production. However, wheat needs to be optimised for several key parameters to make this process more effective.

How did the project address this?

This study starts by investigating whether cultivars differ in their suitability for use as a dual purpose crop: grain for food and straw for fuel. A wide range of wheat cultivars were characterised for several key parameters: biomass production, partitioning between grain and straw, lodging susceptibility and straw digestibility. The impact of plant growth regulators on height which are used widely to reduce straw height and therefore to reduce lodging risk was also investigated. It is not known whether the digestibility of the wheat straw varies with cultivars, or if this is linked to lodging susceptibility (stem strength). Hence, the relationship between straw digestibility for bioethanol production and lodging resistance (stem strength) was investigated to identify traits with these important parameters and to determine which could be used to select for more efficient bioethanol production.

What outputs has the project delivered?

There were no significant differences between cultivars in total biomass production at harvest. However, there were differences in grain yield, straw yield, harvest index, straw glucose yield and straw digestibility. PGR application had no significant effect on total biomass or grain and straw yield; neither did PGRs affect straw glucose yield or straw digestibility but, as expected, PGR application significantly reduced cultivar height. There was a negative relationship between cultivar height and straw digestibility which is hypothesised to be due to the greater stem:leaf ratio of taller

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Final Project Summary

cultivars. There was no relationship between straw digestibility vs. stem material strength and stem failure wind speed. Although straw digestibility had no relationship with lodging resistance, the actual glucose recovered and available for bioethanol production was positively related to lodging resistance which is a good indicator for growing dual purpose wheat crop (food and fuel). Moreover, potential bioethanol yield varied between cultivars in both years.

Who will benefit from this project and why?

If wheat straw can be optimised for the production of bioethanol, without compromising grain yield and quality, and identify a wheat ideotype for dual purpose use (grain for food and straw for fuel) this would provide a new income stream for the growers and alleviate the competition for arable land between crops grown for food or fuel and would also benefit the biofuel industry.

If the challenge has not been specifically met, state why and how this could be overcome

N/A

How have you benefited from this studentship?

I am very grateful to AHDB Cereals & Oilseeds and the University of Nottingham for awarding me the scholarship to fulfil and undertake the studies. This studentship helped me to gain my practical experience and theoretical knowledge in the field of bioenergy/biofuel and at the same time developed my skills in developing methods for use and overcoming problems associated with said development. It also helped me to develop my own innovative thinking with strong communication and management skills including wide range of technical activities which will benefit the biofuel industry.

Lead partner	University of Nottingham
Scientific partners	BBSRC
Industry partners	N/A
Government sponsor	

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