Improving the energy efficiency of biodiesel : reducing energy input and improving sustainability

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Title of the project	**Improving the energy efficiency of biodiesel: reducing energy input and improving sustainability**
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Summary

In Europe, the primary feedstock for biodiesel production is currently the *Brassica napus* crop oilseed rape (OSR). However, lifecycle analysis, which among other aspects, looks at the energy used throughout the complete production and supply chain in comparison to the energy content of the fuel, has brought under question the environmental sustainability of using OSR as biodiesel. It is possible to improve the energy balance of a crop by reducing the energy inputs and/or improving the energy output.
This proposal is aimed at reducing the energy input and improving the sustainability of the OSR crop.
The majority of the energy used in OSR production can be accounted for by the manufacture and application of the large quantity of nitrogen fertilizer required to maximize oil yields. Application of nitrogen fertilizer can also result in emission of NOx which is an extremely potent greenhouse gas. OSR is a relatively recent crop with much potential scope for improving its carbon economy/environmental footprint by increasing the nitrogen use efficiency (NUE) through breeding.
B. napus is a tetraploid species containing two distinct diploid genomes, referred to as A and C. This genomic complexity significantly complicates candidate gene and trait based-genetic analysis, both through reducing the contribution of individual loci on the overall expression of a trait, and through the difficulty in discriminating between the sequences of loci present in each genome. To circumvent these problems the research will be carried out on the C genome diploid species *B. oleracea* and its interfertile wild species relatives. NUE is a complex trait, but a number of genes with key roles in nitrogen transport and assimilation have been identified and a number of component traits have been evaluated in OSR in other projects. Warwick HRI has developed structured diversity sets (DS) for both *B. napus* and these C genome species, together with a range of genetic mapping populations, in which the natural variation will be exploited. Allelic variation in a set of candidate genes involved in N assimilation and transport will be determined in these DSs and used to guide the optimal selection of a set of variable plant lines in which to perform detailed assessments of component traits. The association of trait variation with candidate genes may involve mapping individual genes and matching them to quantitative trait loci.
The outcome of this project will be genetic markers linked to component traits and genes of interest and an improved understanding of the genetic control of NUE in diploid Brassicas. The routes of exploitation of this work

include the incorporation of beneficial alleles into OSR via synthetic hybrids and the necessary tools for marker assisted selection and the potential development of a new diploid oilseed *Brassica* crop with an improved energy balance and enhanced sustainability.

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