Final Project Summary

Reducing the carbon footprint of the lubricants industry by the substitution of mineral oil with rapeseed oil

Project number	RD-2007-3356	**Final Project Report**	PR533
Start date	1 April 2008	**End date**	31 March 2014
HGCA funding	£125,000	**Total cost**	£1.1 million

What was the challenge/demand for the work?

The challenge was to underpin the development of oilseed rape varieties for the production of oil for use in the lubricants industry.

How did the project address this?

Excessive content of polyunsaturated fatty acids (PUFAs) in rapeseed oil produced from high-yielding winter varieties severely limits its use in all but the least thermally stressed applications. A key knowledge gap was an understanding of how to substantially reduce oil PUFA content. We addressed this knowledge gap by: (a) The genetic improvement of oilseed rape by mutation breeding enhanced by the selection of specific genes in order to produce, from a winter crop, oil very low in PUFAs. (b) Assessment of the physical properties of the oil produced in order to validate its utility. (c) Provision of characterised oilseed rape lines to the breeding industry for the development of cultivars. We also catalysed the assembly of a supply chain.

What outputs has the project delivered?

The project has:

- Identified the complement of genes controlling PUFA content.
- Produced a mutagenized population enabling predictive mutation breeding in OSR.
- Identified OSR lines with mutations in specific genes controlling PUFA content.
- Produced OSR lines that synthesise oils with a range of PUFA content from 16% (wild-type for the variety used) down to 4.6% (our best line) (Wells *et al*.The control of seed oil polyunsaturate content in the polyploid crop species *Brassica napus*. Molecular Breeding 33:349-362, 2014).
- Characterised the physical properties of oil from one of our better lines (K0047; 5.8% PUFA), confirming enormous enhancement of thermal stability, as expected (Oxidative Stability Index of 11.3 h, compared with 4.0 h for typical rapeseed and 10.9 h for high oleic sunflower).
- Provided germplasm to breeders for the development of future varieties.
- Enabled the assembly of a supply chain including breeders, farmer, crusher and lubricants manufacturer.

Final Project Summary

The project has delivered outputs in addition to its original aims:

- Developed an efficient new method for mutation detection based on Next Generation Sequencing (Wells *et al*. Sequencing-based variant detection in the polyploid crop oilseed rape. BMC Plant Biology 2013, 13:111).
- Assessed the hypothesis that mutation of a specific gene in OSR (GL2) may increase seed oil content (it probably doesn't).

Who will benefit from this project and why?

The principle beneficiaries will be:

- Farmers, who will (when new varieties have been developed) be able to produce rapeseed attracting a significant premium due to the enhanced properties of the oil.
- The general public, as a result of the environmental benefits of substituting renewable rapeseed oil for mineral oil in a range of applications.

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

The challenge has been fully met.

Lead partner	Prof. Ian Bancroft, University of York (formerly of John Innes Centre)
Scientific partners	None
Industry partners	In-kind contributions from: Cargill, Fuchs, KWS UK, Monsanto UK, Saaten Union, Velcourt
Government sponsor	BBSRC