Rapeseed Oil

THE ALTERNATIVE FUEL FOR TODAY AND TOMORROW

JOHN DEERE

“I will never put my name on a product that does not have in it the best that is in me.”

John Deere

THE CHALLENGE OF THE FUTURE

Rapeseed oil in diesel engines

John Deere engines are technologically up-to-date and prove their reliability even under the most demanding operating conditions. An indispensible prerequisite for this capacity is a fuel that matches the Diesel-Standard (EN 590).

The research at John Deere is working intensely on applications of alternative fuels. These new concepts must also reach a high performance and product reliability at all costs – the specific development is accordingly demanding.

During the testing of rapeseed oil as an alternative to diesel, John Deere will be cooperating with partners renowned in this area of expertise. The development is however, not yet completed; an approval for rapeseed oil can thus not yet be given at this time.

THE 2nd VegOil PROJECT

Ambitious targets for lasting solutions

Our goals:

- To demonstrate the reliability throughout the entire project period of various John Deere tractors (off-road exhaust emissions standard 3A) that run on vegetable oil fuel on a day-to-day basis. The demonstration is to take place at various sites in Europe
- To optimise and test engines and exhaust gas after-treatment components conforming to exhaust emissions standards 3B and 4 for operation with vegetable oil fuels
- Alongside this, to develop and optimise a local production process for 2nd generation* vegetable oil fuels – with a view to future exhaust emissions standards and exhaust gas after-treatment technologies
- To achieve lasting solutions beyond the current exhaust emissions standards

Project schedule:

2008	2009		
Engine oil development to extend the oil change interval			
Development of a vegetable oil fuel suitable for future ex-			
Development and testing of engines and exhaust gas after-			
			Demonstration

* *Further development of the vegetable oil fuel similar to diesel with respect to quality and compatibility with modern exhaust gas after-treatment technologies*

Project partners:

- John Deere Werke Mannheim (Germany)
  Vereinigte Werkstätten für Pflanzenöltechnologie (Germany)
  TU München, Lehrstuhl für Verbrennungskraftmaschinen (Germany)
- Lubrizol Ltd. (UK)
- Waldland Vermarktungsges. m.b.H. (Austria)
- Rhônalpénergie-Environnement (France)
  Fédération Régionale des CUMA Rhône-Alpes (France)
- Instytut Budownictwa, Mechanizacji i Elektryfikacji Rolnictwa (Poland)
- Nederlands Normalisatie-instituut NEN (Netherlands)

Supported by TFZ Straubing and TU Kaiserslautern

2010			2011			
2nd VegOil project term**						
haust gas after-treatment systems						
treatment systems for future emissions standards						
of tractors that comply with off-road exhaust emissions standards 3A, 3B and 4						

*** Proposal No FP7-219004*

VEGETABLE OIL FUELS

The particularities in comparison to diesel

Vegetable oil fuels are created from vegetable raw materials, mostly out of rapeseed. In comparison to diesel fuel, several particular requirements arise:

- Rapeseed oil fuel is currently specified in the prestandard DIN V 51605. There is no standard for any other vegetable oil at this time.
- Due to the chemical structure, the flow behavior of all vegetable oils differs from diesel in different variations. The flow behavior is generally temperature-dependent.
- Because of this, Two-Tank-Systems are generally offered. At low temperatures, they allow the starting of the engine with diesel fuel, and then the switch to rapeseed oil.
- Equally, different heating systems are often used to influence the flowability of the rapeseed oil.
- Low engine loads require a switch from rapeseed oil to diesel when Two-Tank-Systems are installed without internal engine adaptions.

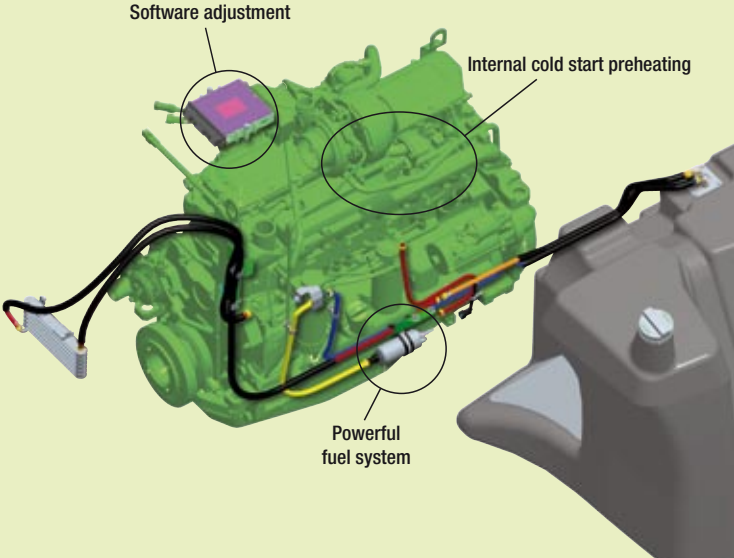
- Rapeseed oil tends to thicken the engine oil and sinks the concentration of the erosion protecting additives.
- Rapeseed oil is, in comparison to diesel fuel, more vulnerable to infestation by microbes. Special storage requirements and limited storage times are absolutely necessary.
- Rapeseed oil has a high energy content. 1 Liter equals to 96% of the energy in one liter of diesel (Biodiesel: 91%).
- Rapeseed can increase humus accumulation at up to 10% in proceeding wheat.

THE JOHN DEERE PROJECT SURVEY

Single tank solution with massive savings potential

How it works:

- Increased fuel supply system performance
- Software adjustment to improve cold start response and fulfil both current and future emissions standards
- Internal preheating for low temperature starts
- Preheating of the vegetable oil via circulation, no need for additional heat exchanger
- No additional filter or tank necessary



What it offers:

- Engine runs on vegetable oil, diesel or biodiesel
- External appearance not different from standard model, only little modifications required
- Same, familiar vehicle handling
- No additional fuel stops, no special diesel fuel station, no manual switchover from vegetable oil to diesel operation
- Greatest potential saving

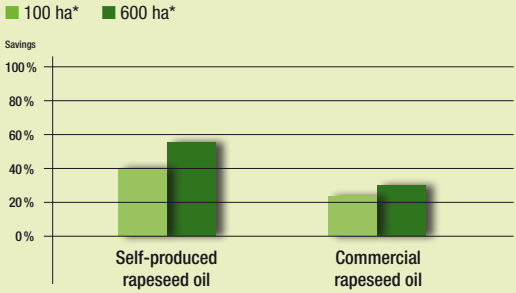
The developments up to the engine for off-road exhaust emissions standard 3A have been supported by FNR with the research reference code 22014905.

THE ADVANTAGES OF VEGETABLE OIL

Efficiency in every instance

- **Future proof and efficient:**
  Optimal reaction towards developments in energy markets. Free choice of fuel depending on price and availability
- **Minimal risk:**
  Utilization of latest technologies with full compatibility for conventional fuels
- **Sustainability:**
  Regional production and consumption

Potential savings compared to diesel fuel



** Model farm, reduced tillage, data from KTBL and commercial prices of July 2008*

- **Feed value:**
  Rapeseed cake and extraction groats are high-grade protein feed and can replace expensive soya imports
- **Simple manufacture:**
  Following pressing and cleaning, no other processing steps are necessary*
- **Regional added value:**
  Self-sufficiency in small, local systems

** For use as fuel, the "John Deere Biodiesel Protect 100" additive is needed*

THANK YOU FOR YOUR PATIENCE

Customer-Safety is priority

Further precision work is required

We know today that the newest generation of John Deere engines can be modified to work on rapeseed oil. The modifications of the fuel systems and the electronic engine control show the appropriate results.

Nevertheless, further precision work is essential. The optimization of the engine behavior at low temperatures is still a central point of our work, as well as the compliance with legal requirements regarding exhaust emission characteristics.

The modification kits that are offered on the market in the meantime, for mounting on John Deere machines, have no approval from John Deere. If they are mounted regardless, all warranty is lost. In addition – depending on the chosen modification concept – the license of the vehicle may be endangered.

Please have a bit more patience. We are working on secured, and then from us approved solutions.

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