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Operation Characteristics of Rapeseed Oil Fuelled Tractors in Practice

Investigations on two rapeseed oil fuelled tractors showed high operating reliability without increased wear or deposits. Engine power was higher with rapeseed oil than with diesel fuel, specific volumetric fuel consumption was equal.

Keywords:

Rapeseed oil fuel, tractors, operation characteristics

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The use of rapeseed oil fuel in vegetable oil compatible tractors contributes to climate protection. Additionally, there are further advantages as soil and water protection, increase of security of energy supply and a rising agricultural value added due to regional forage and fuel production. Because of the exemption from energy tax on rapeseed oil fuel used in agriculture, a reduction of fuel costs can be achieved in many cases. Uncertainties, inhibiting higher market relevance, are long term operation reliability and the characteristics of engine performance and fuel consumption. To answer these questions the Technologie- und Förderzentrum in Straubing was investigating together with the LVFZ Kringell two rapeseed oil fuelled tractors in practical use.

Method

During the investigated period of two years two rapeseed oil fuelled tractors, which were operated at the LVFZ Kringell, were controlled recurrently four respectively five times at the test stand of the Technologie- und Förderzentrum regarding power out-put, torque and fuel consumption.

Objects of investigation were a Deutz-Fahr Agrottron TTV 1160 (119 kW, year of construction 2005, exhaust gas stage II) adapted to rapeseed oil fuel by a single-tank-system of the company Hausmann and a Fendt Farmer Vario 412 tractor (94 kW, year of construction 2003, exhaust gas stage I), retrofitted with a single-tank-system of the company VWP (Table 1).

Results

Within the investigated period of 22 months from March 2006 to December 2007, the two tractors proved their full suitability in practical use completing 1.300 operating hours, each. During that time technical malfunction did not occur.

The accumulation of rapeseed oil fuel in the motor oil requires earlier engine oil exchange for rapeseed oil fuel than for diesel fuel operation. Results with the Deutz-Fahr tractor

showed a linear increase of fuel content in the engine oil of 5 % within 60 operating hours. For the Fendt tractor the increase was 5 % within 130 operating hours (Figure 1).

A maximum tolerable fuel content in the motor oil can not be quoted as an absolute value because it depends on oil composition and engine operation characteristics. For the Fendt tractor the same oil exchange interval of about 200 operating hours is necessary despite a lower fuel entry rate in comparison to the Deutz-Fahr tractor. This can be deduced from motor oil analyses that showed an increase in viscosity at some 200 operating hours after an initial decrease, caused by rapeseed oil entry.

The cleanness of cylinders, pistons, valves and exhaust-turbochargers of both tractors were a sign of good combustion. The fuel injectors showed deposits (Figure 2), but in the entire observation period of about 1.300 operating hours no significant affection of neither the spray picture nor the emissions was recognized in comparison to new ones. Possibly the formed deposits chip off during operation, at least partially. Latter is confirmed by the porous structure of the deposits on the injection nozzles. Because of the very good cylinder liner surface and the

Table

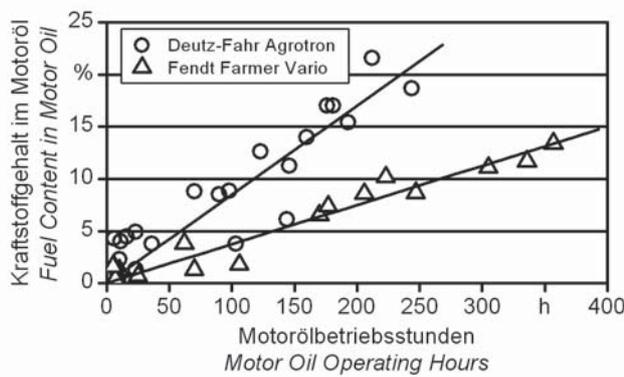
Technical Data

	Deutz-Fahr Agrottron TTV 1160	Fendt Farmer Vario 412
Anzahl der Zylinder Number of Cylinders	6	4
Leistung in kW / PS Engine Power in kW / PS	119 / 162	94 / 125
Motortyp Engine Type	Deutz BF6M1013EC	Deutz BF4M2013C
Baujahr Year of Manufacture	2005	2003
Abgasstufe Exhaust Gas Stage	II	I
Umrüstfirma Adaptation Company	Hausmann	VWP
Betriebsstunden bei Umrüstung Operating Hours at Adaptation	256	<50

uniform compression of all cylinders, no wear on cylinder walls and piston rings was noticed.

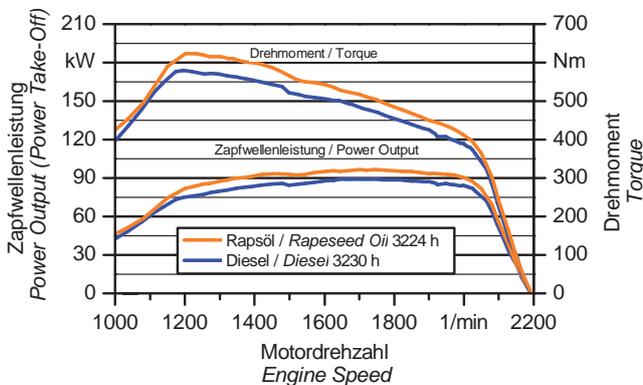
The investigations showed a slight increase of power output and torque up to 10 % during rapeseed oil operation (Figure 3). At about the same percentage (10 %) as the power output, the mass related specific fuel consumption increased as well, when using rapeseed oil fuel. However, the volume based rapeseed oil fuel consumption was just about equal to diesel fuel operation, due to the higher density of rapeseed oil fuel (Figure 4). The increase of power output for mechanical controlled injection systems can be explained by higher injected fuel amounts in consequence of earlier injection nozzle opening and higher fuel pressure in the nozzle due to differences in fuel characteristics, such as viscosity and compressibility.

Fig. 1



Fuel content in motor oil in dependence on motor oil operating hours for different motor oil fillings

Fig. 3



Power output (power take-off) and torque of the Fendt Farmer Vario 412 operated with diesel and rapeseed oil fuel

Conclusions and Prospects

Both rapeseed oil fuelled tractors were operated highly reliably. The basis therefore was a careful technical supervision and maintenance, skilled operators, a convenient operational profile as well as a high rapeseed oil fuel quality according to pre-standard DIN V 51605. For reducing maintenance work and minimise risk of engine breakdown, future development should aim at decrease of deposit formation on injection nozzles and reduction of fuel entry into the engine oil. Concerning torque, engine power and specific fuel consumption no disadvantage had to be accepted compared to diesel fuel operation. Because of the full suitability for practice use, confidence of operators was very high and tractors are further operated with rapeseed oil fuel.

Summary

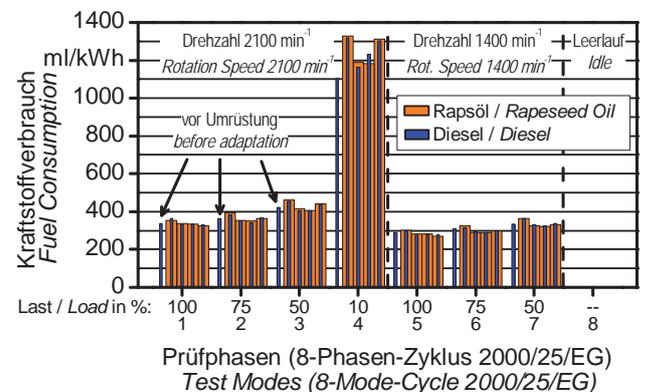
The utilization of rapeseed oil fuel causes uncertainties about the operation characteristics. Investigations on two tractors showed high operational reliability. Due to the accumulation of rapeseed oil fuel in the engine oil, a more frequent engine oil exchange was necessary. Cylinders, pistons, valves and exhaust-turbochargers of

Fig. 2



Deposits on the injection nozzle of cylinder 1 of the Fendt Vario 412 after 2653 operating hours

Fig. 4



Specific fuel consumption of the Deutz-Fahr TTV 1160 during 1300 operating hours

both tractors were very clean. The fuel injectors showed deposits, which affected neither the spray picture nor the emissions significantly. Engine power was slightly higher with rapeseed oil than with diesel fuel.

Literature

- [1] Thuneke, K.; Gassner, T.; Emberger, P.; Remmele, E. (2009): Untersuchungen zum Einsatz rapsölbetriebener Traktoren beim Lehr-, Versuchs- und Fachzentrum für Ökologischen Landbau und Tierhaltung Kringell. Berichte aus dem TFZ. Straubing: Technologie- und Förderzentrum im Kompetenzzentrum für Nachwachsende Rohstoffe (in Vorbereitung)

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Notice

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