John Deere Werke Mannheim

Tractor John Deere 8345R

Fuel Consumption

DLG Test Report 5926 F

Fig. 1: John Deere 8345R during DLG Powermix Test

FOKUS TEST
Mar 10 Fuel Consumption

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Brief description

The John Deere 8345R agricultural tractor tested is a conventional tractor with infinitely variable gearbox (type John Deere AutoPowr) and a suspended front axle. The engine is a John Deere six-cylinder diesel PowerTech Plus engine with:

- electronically controlled high pressure injection via Common Rail
- four valves per cylinder
- turbocharger with variable geometry
- cooled exhaust gas recirculation
- cooler fan with drive via V-belt variator (VariCool)

The tractor is equipped with Intelligent Power Management (IPM). This means that the engine power is increased by up to 26 kW during transport work and during non-stationary PTO work.

The engine complies with the requirements of exhaust gas stage TIER 3a.

The 8R series from John Deere consists of five tractor models with different engine outputs between 180 and 254 kW rated power (97/68 EC). Model 8345R is the strongest tractor in the series.

Test content

The fuel consumption of the tractor was determined for different test rig measurements (PTO power, drawbar power, Powermix).

Measuring results of comparable tractors at this engine output (rated power above 230 kW) and exhaust gas stage measured on the same test rigs using the same methods were studied for the purpose of comparison.

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Technical data

Engine		
Manufacturer		John Deere
Bore/stroke	mm	118.4/136*
Volume	l	8.98*
Rated speed	rpm	2100
Rated engine power	kW	254 to EC97/68 EC*
Maximum power at IPM**	kW	288 to EC97/68 EC*
Exhaust gas stage		TIER 3a*
Gearbox type		Infinitely variable, John Deere AutoPowr (50km/h)
Front axle		Hydropneumatic suspension, John Deere ILS
Tank capacity	l	681*
Empty weight without driver	kg	12300
Permissible total weight	kg	18000*
Tyres front		600/70 R30
Tyres rear		710/70 R42

* Manufacturer's data
** IPM stands for "Intelligent Power Management" (Boost).

Assessment in brief

Test feature	Test result	Assessment
Fuel consumption – PTO measurements	good	+
Fuel consumption – drawbar measurements	very good	+ +
Fuel consumption – Powermix measurements	very good	+ +

Assessment range: + + / + / ○ / – / – – (○ = standard)

Measuring methods

PTO power and fuel consumption

Measurement of the PTO power and fuel consumption in accordance with the rules of the OECD Standard Code.

Drawbar power and fuel consumption

Measurement of drawbar power and fuel consumption in accordance with the rules of the OECD Standard Code.

Fuel consumption

Measurement of the fuel consumption with changing loads in driving operation using the DLG Powermix method.

Test results and individual assessments

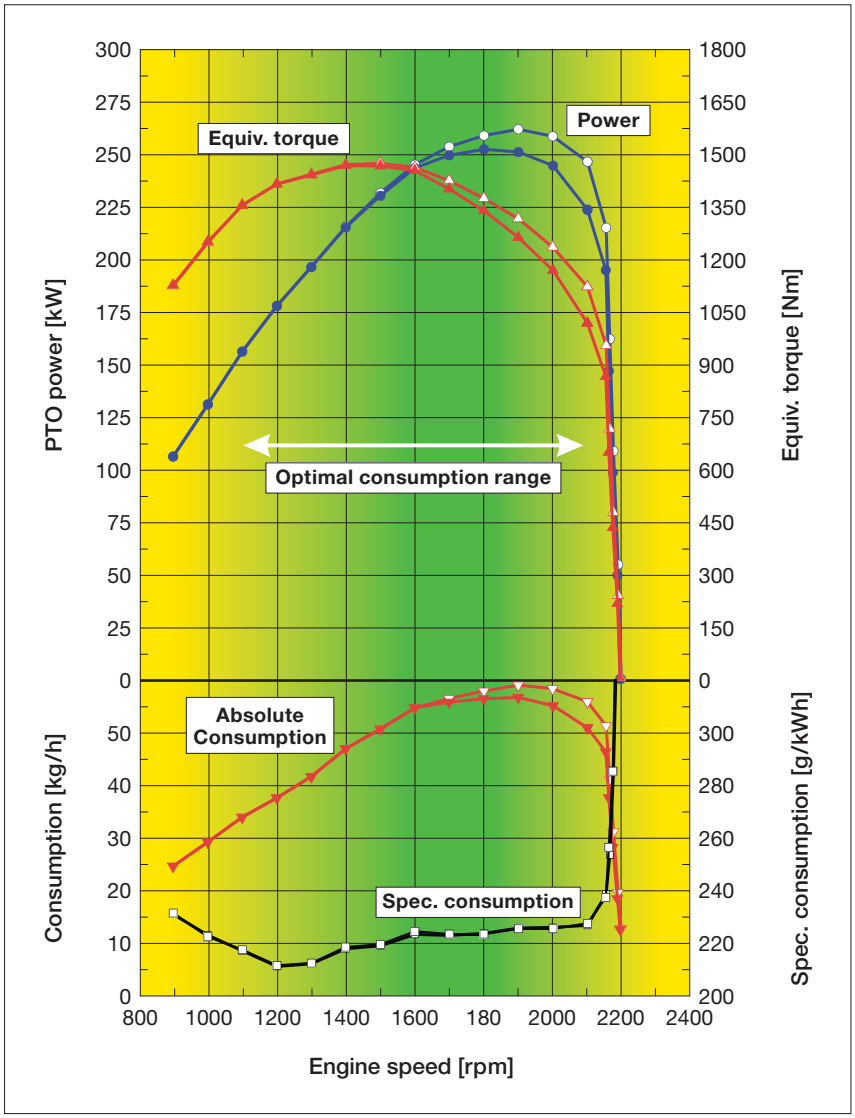

Fig. 2:
Torque, power and fuel consumption measured at the PTO, in each case with and without IPM

Measurement of PTO power and fuel consumption

In the factory setting, IPM is only switched on during driving operation. The boost was activated by service staff using an external computer for the purpose of carrying out the measurement.

The measuring points in lines 2 and 5 lie on the full load curve of the engine. The measuring points in lines 6 to 10 are part load operating points that are typical for practical operation of the tractor, as total tractor power is only required relatively seldom pro rata temporis.

The comparison between specific fuel consumption rates shows that consumption of the John Deere 8345R is up to 12 g/kWh lower than that of other tractors with a similar output at most operating points. Consumption is only 3 g/kWh higher at the operating point in line 9. These levels are assessed as good. The specific consumption figure is a measure for converting the energy contained in the diesel fuel into output and allows various tractors to be compared independently of their engine output.

Table 1:
Comparison of measurements at the PTO (1000/min)

	Tractor type		John Deere 8345R with IPM	Mean value of comparable tractors
1	PTO power at rated speed	kW	246.1	225.8
2	Specific consumption	g/kWh	226	238
3	Maximum PTO power	kW	261.4	244.2
4	At speed	rpm	1900	
5	Specific consumption	g/kWh	225	226
	Consumption at part load operating points			
6	Full speed, 80% of power at rated speed	g/kWh	242	252
7	90% of rated speed, 80% of power at rated speed	g/kWh	233	235
8	90% of rated speed, 40% of power at rated speed	g/kWh	264	268
9	60% of rated speed, 40% of power at rated speed	g/kWh	237	234
10	60% of rated speed, 60% of power at rated speed	g/kWh	212	223

Table 2:
Comparison of the drawbar measurements

Tractor		John Deere 8345R	Mean value of comparable tractors
Maximum drawbar power	kW	222,0	204,0
Specific consumption at maximum speed	g/kWh	255	275
Drawbar power at rated speed	kW	195,1	185,4
Specific consumption at rated speed	g/kWh	262	286

Measuring drawbar power and fuel consumption

The drawbar power was measured using a dynamometer car on the concrete track.

All tractors were driven in the speed range 7.5 to 17 km/h where the highest drawbar power is to be expected. Starting at high idling speed, the tractor is subjected to successively increasing loading until the engine speed at maximum power on the full load curve is reached. The engine/gearbox management is generally deactivated for this measurement. The wheel slip levels here are in the range of about 3 to 6 %.

Here too, the specific consumption is a reference measure for converting the fuel energy into drawbar power independently of the tractor output.

The drawbar measurements showed that the John Deere 8345R uses specifically about 8 % less fuel than comparable tractors for pure drawbar work. This result is assessed as very good.

Powermix measurements

The DLG Powermix is a measuring procedure in which the tractor is subjected to a combination of drawbar, PTO and hydraulic load. In the ploughing and cultivating cycles, only drawbar power is required. For disc harrowing and mowing, drawbar power and PTO power are needed and in the manure spreading and baling cycles hydraulic power as well. The power requirement is not constant, but changes with changing loads. This roughly maps the conditions encountered in practical farming. Starting from the basic cycle, the required output is scaled to the measured PTO power of the tractor. The measurements are conducted on the measuring track at the DLG Test Center. The time used to form a mean value is 250 seconds, except for the manure spreading and baling cycles, where it is 500 seconds.

Figure 3 shows the three different power types that the tractor must provide: drawbar power, PTO power and hydraulic power. The changing course of the power requirement over the cycle is clearly visible. The available engine output is only used in full for a brief period. The partial load range accounts for the largest time component in all cycles. The starting up and shutting down phases were discarded for the purpose of evaluation.
The mean values were formed from the remaining measuring time of 500 seconds (for the baling and manure spreading cycles, 250 s for all other cycles).

The engine and gearbox management settings, ballasting and other settings influencing consumption were specified by the manufacturer for all the tractors measured. They corresponded to optimal fuel-saving settings.

Related to the mean levels for all cycles, the 8345R consumed about 6.5 % less fuel by comparison with the comparable tractors.

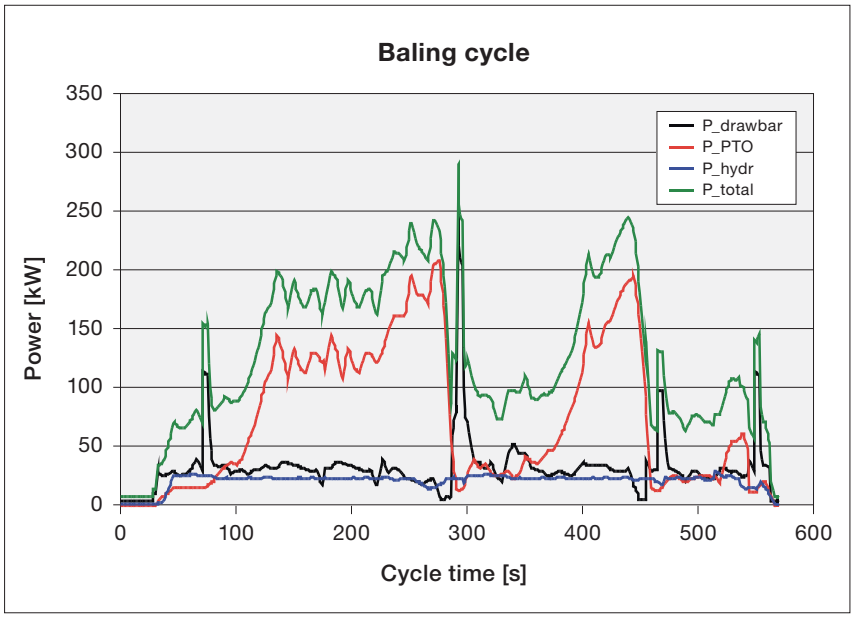

Fig. 3:
Example of the power requirement of the tractor in the baling cycle.

Table 3:
Specific consumption in the various cycles in g/kWh

Cycle		John Deere 8345R	Mean value of comparable tractors	Difference in consumption
Ploughing 100 %	g/kWh	259	278	-19
Ploughing 60 %	g/kWh	248	276	-28
Cultivating 100 %	g/kWh	259	280	-21
Cultivating 60%	g/kWh	251	280	-29
Disc harrowing 100%	g/kWh	236	241	-5
Disc harrowing 70%	g/kWh	247	255	-8
Disc harrowing 40%	g/kWh	278	295	-17
Mowing 100%	g/kWh	237	251	-14
Mowing 70%	g/kWh	256	271	-15
Mowing 40%	g/kWh	297	323	-26
Manure spreading	g/kWh	258	274	-16
Baling	g/kWh	281	305	-24
Mean value	g/kWh	259	277	-19

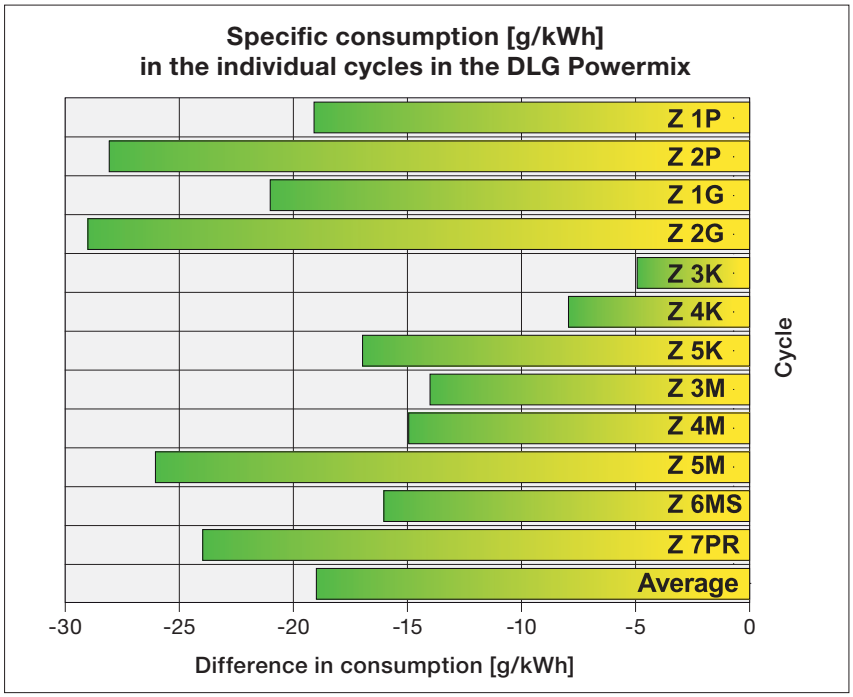

Fig. 4:
Graphic representation of consumption of the John Deere 8345R related to the mean value of comparable tractors.

Summary and assessment

Specific consumption in grams per kilowatt hour is used to compare tractors with different engine outputs.

The results of the PTO shaft measurements show that the consumption level of the John Deere 8345R is up to 12 g/kWh lower than that of comparable tractors. This result is assessed as good.

The drawbar power measurements revealed consumption rates that were lower by 24 g/kWh at rated speed and 20 g/kWh at maximum power by comparison with comparable tractors. This result was assessed as very good.

The measurements using Powermix showed a mean consumption level for all cycles that was 19 g/kWh lower than for comparable tractors.

Consumption levels were undercut most of all (from 19 g/kWh to 29 g/kWh) in the cycles with pure drawbar work. In cycles with additional PTO and hydraulic work, consumption levels were 5 g/kWh to 26 g/kWh below those of comparable tractors. These results too are on average assessed as very good.

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