JD 7750i: Output, fuel use, wear rates

Green forager embarks on an 18-month European tour

Researchers from Cologne University monitored John Deere's big self-propelled forager on its travels across Europe over an 18-month period – from May 2010 until October 2011 – through a wide range of crops. Here's what they found

Why not see for yourself? A 75min DVD is priced at £18.50. Order on p66.

During its European trip, John Deere's 7750i forager harvested around 2,500ha of maize, 1,700ha of grass/lucerne and 1,300t of whole-crop silage. Photos: GE.

Contractors who buy a high-output forager expect a lot from it. Fair enough – the investment is substantial, the hours will be long and the work hard. Their customers expect a quick, tidy job; the operator wants a comfortable, stress-free environment; and the contractors themselves look for dependability, high output and low running costs. Not much of an ask from any machine, then.

Very little hard information exists on how forage harvesters actually deliver those goods. Where it does, it's not obviously in the public domain. Naturally, manufacturer brochures lay out a harvester's goodies in the most tempting way – the abundance of power, the wealth of electronic trickery, the luxury of the cab – but they're strangely silent on wear rates, fuel consumption and outputs in specific conditions. Maybe the last bit isn't quite true, because outputs are quite often quoted. The catch is that these are usually maximum spot figures, recorded in undefined conditions. A potential buyer must then attempt to interpret printed values through the lens of local experience.

Which suggests that reliable baseline data on forager performance, in a wide range of crops and conditions, would be quite handy. So in 2010 the Institute of Farm Machinery and Renewable Energy (part of Cologne's Applied Sciences department) got together with John Deere to make something happen. The basic plan was to take a top-spec 625PS/614hp 7750i and:

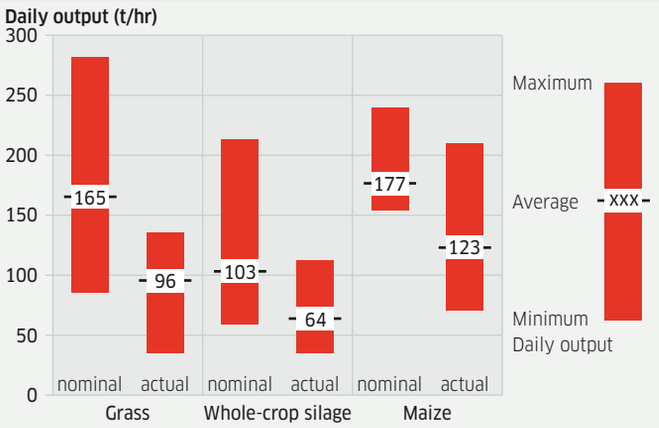
- Record performance during commercial operation in a diverse range of European crops/field conditions
- Collect information in as many areas as possible, including specific fuel consumption and wear.

The result would be reliable info that could be used by contractors and farm managers in forming decisions. Beyond that it would focus the company's R&D effort, provide useful back-up to the sales force, help in formulating lease and maintenance contracts and stoke the marketing department's fires.

The wrapper for the exercise was the European tour outlined last month (profi 02/12, page 52) and filmed by profi's video team. Starting in May 2010 and ending in October 2011, the trip took in four countries, 30 different harvesting operations and a broad range of geographies and conditions. The stats are impressive: while logging around 2,500 engine hours and 1,700 drum hours, the 7750i harvested over 160,000t of grass, lucerne, maize and whole-crop. In Germany it clocked up 1,640 hours, in Italy 588 hours, across in England 175 hours and in France 130 hours.

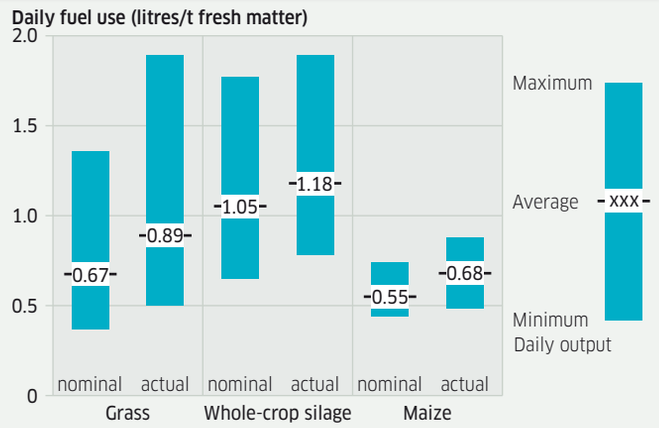
Data logged by John Deere's HarvestDoc software were backed up by measurement of fuel put into the tank and yield off the field. Parallel comments were also noted on the site, prevailing conditions, the transport

John Deere 7750i output



Differences between nominal output and actual output were down to lower yields, poor logistics and field size. On average, nominal output was around 30% higher than actual output – a typical result.

John Deere 7750i fuel consumption



Average fuel consumption in maize and grass was very low – down to 0.37 litres/t when cutting Cornish grass. The average consumption in whole-crop silage was higher because yields were lower. Graphs: ST.

7750i performance during 24 hours of non-stop work

Maize, October 14th/15th 2010
Schleswig-Holstein

Performance	
Output (ha/hr)	4.1
Output (t/hr)	160.8
Fuel use (l/ha)	22.0
Specific consumption (l/t)	0.56
Machine data	
Engine hours	24.0
Drum hours	22.7
Drum/engine hour ratio	1:1.06
Chop length (mm)	8
Cracker setting (mm)	2
Absolute fuel use (l)	2,170
Crop	
Area harvested (ha)	98.6
Crop harvested (t)	3,860
Fresh matter yield (t/ha)	39.1 (38–43)
Dry matter (%)	33 (30–35)

chain taking material off the field and on machine service.

Performance peaks make good headlines. In 2010 the research team measured outputs during a 24-hr maize marathon in north Germany. The transport chain up to and including clamping wasn't a limiting factor, but fresh-matter yields weren't especially high at 38t/ha to 43t/ha. Test results were good: see table '24 hours of non-stop work' (left). In a 30%-35% dry matter crop, chopping at 8mm and with a 2mm corn cracker gap, average output during work (excluding stops and turns) was 204t/hr. Specific fuel use (ie fuel per tonne) varied from 0.46 litres/t to 0.52 litres/t.

Including stops and turns naturally brings the figures down. Overall fresh matter output averaged 160.8t/hr, the specific fuel use 0.56 litres/t. Looking at absolutes, by the end of the operation the forager had been in ten fields, cleared 98.6ha and put 3,860t of fresh matter into the trailers.

It's clearly important to factor in the conditions when looking at such figures. As yield goes up, travel speed goes down. Throughput tends to increase slightly and specific consumption drops. The 7750's low fuel use is largely a product of its engine-speed management system, which operates in tandem with the forager's ProDrive stepless transmission to match engine rpm (and so power delivery) to changing crop requirements. All through the 24 hours the machine operated in engine-speed management Mode 1. This automatically reduces engine rpm when the machine is stationary (with the hydrostat in neutral) and empty of crop; it also reduces the rpm while maintaining travel speed on headlands. Rpm ramp back up automatically as the harvester returns to work and load increases (profi 05/10).

Day-to-day harvester performance carries more weight than headline figures from a non-stop marathon. Outputs and consumptions logged over hours of fieldwork are useful when buying, and can be compared with a user's own records.

The two graphs at the top of this page sum up the 7750i's performance in grass, whole-crop silage and maize over the project's two seasons. They lay out maximum, minimum and average values for fresh matter crop output and for specific fuel consumption. Two different ranges are shown for each crop: one for when the forager was actually at work (nominal output) and one including all stops, turns, waits for a trailer, field site changes and road travel (actual output).

Generally, nominal output was around 30% higher than the actual output. This confirms what operators know – that shortcomings

in transport from the field or hold-ups at the clamp throttle a machine's potential. For example, the 7750i chopped maize at an average of 177t/hr, but the overall figure came down to 123t/hr once all stops, turns, transport, etc were included. Clearly transport chain capacity must match forager output. Equally interesting are the huge ranges in both nominal and actual crop outputs, which reflect yields, field size and transport – see the graphs on the previous page.

A high-output forager must be paired with high-capacity transport to release its full potential.

Switching now to grass, the two-season output average was 165t/hr (nominal) and just under 96t/hr (actual) – quite a difference. The 2010 campaign started in Brittany in April, where the going was easy, but grass and lucerne yielded only around 10t fresh matter/ha. The fields were small so a lot of time was spent moving around, with the result that while the forager cut at 78t/hr (still quite good for the yields), the actual daily average was just 41t/hr.

Things changed with a move to Cornwall. The forager had to squeeze through narrow gateways, but once in the field it met big swaths yielding 25t/ha-37t/ha at 30%-45% dry matter. Chopping up to 270t of fresh matter every hour boosted both rates.

After output, fuel consumption is the thing most dear to owners' hearts. As with output, consumption can be split in two: fuel used solely while chopping (nominal consumption) and the fuel used overall (actual consumption). Nominal fuel use is naturally lower than actual use, as it doesn't include unproductive driving – see the right-hand graph on p51 for values across a range of crops.

Minimum fuel consumption coincides with the best going, ie the times where yield, haulage and field conditions come together.

Good quality silage stems from a quality chop plus effective compaction at the clamp. Performance results from the test confirm what most already know – that capacity of the carting and clamping team has a huge bearing on harvesting output.

The lowest values show what the forager can achieve. In Cornwall, diesel use while chopping grass dropped to an impressive 0.37 litres/t fresh mass – the least in any crop. Fat, consistent and nicely shaped West Country swaths enabled the 7750i to put most of its energy into the job rather than travelling.

At the other end of the scale, high nominal fuel use typically reflects low yields. The operator increases ground speed to fill his machine; the ground drive takes a bigger slice of the available power so less is left for work. In grass the only way to minimise nominal consumption is to rake up bigger swaths; in whole-crop silage and maize, the solution (where possible) is to use a wider header and reduce ground speed.

Average nominal consumption across crops was pretty impressive – 0.67 litres/t fresh matter in grass, 1.05 litres/t in whole-crop and 0.55 litres/t in maize. And it's maize that showed the smallest gap between nominal and actual daily consumption. One reason was the 7750i's engine-speed management control; by dropping revs on the headlands when stationary and on the road, it kept fuel use down. Other reasons were good trailer supply and reasonably sized fields.

A big gap between nominal and actual consumptions usually suggests smaller fields or perhaps an inadequate transport set-up and/or shortcomings at the clamp. Another factor could be chop length.

A third driving factor behind Deere's two-season tour was data collection on component wear rates. Page 54's table sums up the findings across a range of parts. Four cylinder sharpening stones were used, a pre-compression roller bearing failed and chute wear plates were changed.

Researchers measured the thickness of the Deere forager's DuraLine coatings with an Echometer probe, to test DuraLine's effect.

Maize knives were changed after chomping through 96,000t of crop. One grass knife was swapped after completing 32,000t.

Deere offers the option of DuraLine tungsten-based coating for the wear side of the spout, the flap, the liners of the cylinder and blower and other major crop-contact items. After 1,700 drum hours and over 160,000t of crop, the cylinder/blower liners showed no visible signs of wear and their surface was still smooth. Measurement confirmed wear at 19% and 62%. Projecting results forward suggests a life of 9,000 cylinder hours for the blower entrance plates and 2,800 cylinder hours for the blower liner.

The maize shear bar and matching knives both dispatched 2,000ha/96,000t of crop before a change was due, at which point the knives still had 1mm-2mm of their DuraLine facing left. In fact a chunk of stainless steel picked up in Italy had prompted an early change of maize knives and shear bar, but wear was still followed on the undamaged knives. As the first side of the shear bar was just about worn out, the damage didn't affect the eventual outcome. Side one of the reversible grass shear bar saw off around 18,000t of material before a change-round; then the second edge managed 8,000t before sustaining damage. At that point the grass knives were changed too, even though they still had 4mm-5mm of DuraLine material left on them. Overall, the extra cost of the DuraLine option was more than repaid in extended service life.

The small but high-yielding grass fields of Cornwall, England, saw the Deere 7750i forager performing at its most economical. Fuel consumption dropped to as low as 0.37 litres/t of fresh mass.

Parts replacement, John Deere 7750i

Over 160,000t of material chopped between May 2010 and October 2011

Part (Part no)		Replaced after		
		Drum hours	Area (ha)	Crop weight (t)
Grass knives [1]		413	2,024	31,892
Grass shear bar	Side 1	313	1,411	18,407
	Side 2 [2]	380	1,810	26,454
Maize knives [3]		799	2,043	96,526
Maize shear bar		799	2,043	96,526
Plate over blower (AZ102719)		1,145	4,293	104,695
Chute liner [4] (AZ103382)		726	2,341	68,602
		1,368	4,709	126,394
Chute liner (Z65657)		1,368	4,709	126,394
Chute liner (AZ54609)		1,406	4,808	131,062
Sharpening stone		Four used		

[1] Grass knives had 4-5mm coating left; [2] changed early after damage; [3] 1-2mm coating left; [4] changed twice in two seasons

Summary: Across two seasons John Deere's 7750i SP forager produced a fine demonstration of performance and reliability. It cut over 160,000t across three different crops, logging over 2,500 engine hours and 1,700 drum hours in the process. Its electronics – specifically Deere's engine-speed management package – had a significant impact on fuel use, while the optional DuraLine coating proved cost-effective.