DLG Test Report 7293

AGCO GmbH

Loader wagon Fendt Tigo 90 XR D

Functionality and quality of work

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Overview

A test mark „DLG-APPROVED for individual criteria“ is awarded for agricultural products which have successfully fulfilled a scope-reduced usability testing conducted by DLG according to independent and recognised evaluation criteria. The test is intended to highlight particular innovations and key criteria of the test object. The test may contain criteria from the DLG test scope for overall tests, or focus on other value-determining characteristics and properties of the test subject. The minimum requirements, test conditions and procedures as well as the evaluation bases of the test results will be specified in consultation with an expert group of DLG. They correspond to the recognised rules of technology, as well as scientific and agricultural knowledge and requirements. The successful testing is concluded with the publication of a test report, as well as the awarding of the test mark which is valid for five years from the date of awarding.

The following test was carried out on a Fendt Tigo 90 XR D loader wagon. The loader wagon was tested to the “Functionality and quality of work” test module which forms part of the DLG test framework for loader wagons. Tests under the “Functionality and quality of work” scheme cover the following parameters which are measured at two different forward speeds: weight of the loaded grass mass, throughput, tractor power input, crop compression in the load area, pick-up losses, contamination, unloading time and rate. In addition, the test also covered the fuel consumption of the tractor and the distribution of chop lengths as discussed below. Other criteria were not tested.

Assessment in brief

The performance of the Fendt Tigo 90 XR D loader wagon when tested to the criteria of the DLG test framework was impressive. Based on these results, the loader wagon is awarded the DLG APPROVED quality mark in the test module “Functionality and quality of work”.

Table 1: Overview of results

DLG QUALITY PROFILE	Evaluation*
Functionality and quality of work	✓

* Evaluation range:
Requirements fulfilled (✓) / not fulfilled (✗)

Table 2: Summary of results

Test parameters	Test results	
	at 19 km/h (the maximum forward speed possible) while loading	at 15 km/h forward speed while loading
Total grass weight per wagon load	9.85 t fresh mass (at 38.6 % DM this translates into 3.8 t dry mass)	10.09 t fresh mass (at 47.3 % DM this translates into 4.77 t dry matter)
Throughput	130 t/h FM	56.5 t/h FM
Total power input during loading	218 kW	124 kW
Pto input during unloading (discharge rollers at work)	18.8 kW	
Pto input when idling (no loading/unloading)	3.4 kW	
Fuel consumption during loading	0.44 l/t FM	0.65 l/t FM
	1.14 l/t DM	1.41 l/t DM
Compression rate in the load area	224 kg of fresh mass/m³	229 kg of fresh mass/m³
Unloading time (total) and unloading rate (kg FM/s)	92 s 108 kg FM/s	88 s 114 kg FM/s

Grass losses that were not picked up and contamination were measured at 15 km/h forward speed.
These pick-up losses were 0.3 % (DLG assessment*: very low (++)) and contamination was non-existent (DLG assessment**: low (+)). Hence, the machine achieved the best DLG scores for these test parameters.

* Scheme for assessing pick-up losses:
0 % to 0.75 % = very low (++) / > 0.75 % to 1.5 % = low (+) / > 1.5 % to 3.0 % = average (O) / > 3 % = high (–)
** Scheme for assessing contamination:
0 % to 1.5 % = low (+) / > 1.5 % to 3.0 % = average (O) / > 3 % = high (–)

The method

DLG test module “Functionality and quality of work”

In this module, forage wagons are field tested to criteria that are laid down in the relevant DLG test framework. This means, the forage wagon harvests at least one type of crop (permanent pasture grass or leys) from the first or second cut. The machine is set up in the field to the prevailing conditions and is operated at a speed that matches these conditions. In each setup variant, the machine is filled and emptied on the clamp at least three times. The following data are documented for the test: the topography of the field and the prevailing weather conditions as well as dry matter contents, swath width and height, grass mass per metre length. The preceding processes are also described (mowing, tedding, swathing).

Grass weight and throughput

The actual weight of each wagon load is measured by weighing the filled machine on a weighbridge. The machine’s throughput is determined by measuring the loading time and the mass loaded.

Pto input

The pto input is measured with a pto speed measuring hub while the machine is being filled and emptied and when running idle.

Crop compression in the load area

The cargo space of the loader wagon is measured and the data are used to determine the load volume. The compression level is calculated from the load volume and the actual weight of the crop loaded.

Pick-up losses

The loader wagon gathers the material from a swath of a defined length. The crop weight is then measured on a weighbridge. Afterwards those chops that were not gathered are raked up and weighed. This weight is compared with the original mass in the swath. Then these loss data are assessed to the DLG scheme.

Contamination

Samples are taken from the swath before it is harvested by the forage wagon. After the wagon has completed the pass, samples from the harvested material are taken in those areas of the body that correspond to the sampled areas in the swath. All samples are stored in a cool place and are then lab analysed for raw ash levels. The level of contamination is determined by comparing the results from the swath with those from the wagon load. The difference between these two values is assessed to the DLG scheme.

Unloading time and rate

The time the loader wagon takes to clear out the material on the clamp is measured with a stopwatch. The recorded time and the weight of the material load are used to calculate the amount of grass that is unloaded per second. The recorded unloading time and the weight of the loaded grass are used to calculate the unloading rate which is expressed in kg/s.

Fuel consumption

The test also included documenting the fuel consumption via the tractor’s CAN-Bus and evaluating the recordings.

Chop length distribution

The test also looked at the percentages of the various chop lengths in the sample. This is done by sampling the material each time the wagon is emptied on the clamp. The representative samples are stored in a cool place before they are analysed. Small particles are measured by sieving them in the DLG cascade sieve. The percentages of preferred chop lengths and overlengths are determined by an optical system.

The product

Manufacturer and applicant

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Fendt Tigo 90 XR D loader wagon

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Description und technical data

The Fendt Tigo 90 XR D loader wagon is coupled to the K80 hitch. The hydraulic assemblies (pick-up, bulkhead and chain-and-slat floor) are controlled by load-sensing hydraulics. Machines that have the hydraulic knife sharpening system FlexSharp (figure 2) have an extra oil line. The rotor and the three discharge rollers are driven by the pto. The test machine had the hydropneumatic Tridem axles and crop covers.

The Tigo 90 XR D can be conversed from a self-loading wagon to a forager-filled wagon, which is done by covering the rotor with a plate. Since Tigo 90 XR D has no hoops or ropes that would need removing, it is also suitable for transporting wood-chips and similar cargo.

The pick-up

The hydraulic pick-up is 2.20 m wide and has seven rows of tines spaced at 54 mm (figure 3). The tine-to-tine width of the unit is 1.99 metres. The pick-up is camless which makes for smoother running, reduced wear and cleaner rakes, says the manufacturer. Running in maintenance-free and self-aligning ball bearings, the pick-up itself is maintenance-free and has no grease points. Its hot-galvanised components protect the pick-up from exposure to rain and corrosive effluents. There are no metal stripper bars but plastic strippers. The manufacturer says these reduce tine friction more effectively than metal strippers, thereby reducing wear and enhancing the crop flow. The swath roller is one single roller. An 85cm wide rubber roller is mid-mounted behind the pick-up where it ensures the pick-up tines won't poke the ground in undulating fields, thereby reducing tine wear and crop contamination, says the company.

The cutting system

The rotor measures 800 mm in diameter. Its 45 knives are spaced at 37 mm (nominal chop length). This is doubled to 74 mm when half of the knives are taken out of the crop flow by operating a lever. The knives are retracted from the crop flow (to remove a blockage for example) either from the cab through the Isobus or by operating a button on the left machine side.

Figure 2:
The knife sharpener FlexSharp

Figure 3:
Pick-up and rotor

The bulkhead

The Fendt Tigo 90 XR D has a bulkhead that serves several purposes (figure 4). It slants up to 80° forward to increase the load volume by 6 m³ to 44 m³. This is done by two hydraulic cylinders that are triggered by pressure sensors on the bulkhead which forms also part of the integral VarioFill automatic loading/ unloading system in that it compresses the material during the filling cycle.

The VarioFill loading and unloading system

The force at which the bulkhead compresses the material in the load area can be set steplessly from the cab-based terminal. This allows operators to select a relatively high pressure for silage and maximum utilisation of the machine's capacity or a relatively low pressure for hay and reduced fragmentation. Once the pressure sensors inside the hydraulic cylinders that operate the bulkhead sense the pre-set force the floor chains automatically start moving toward the tailgate and continue moving until the sensors on the tailgate sense that the load area is filled to capacity. When this is the case, the headboard slants automatically forward into position 1 and will automatically pivot into position 2 and its end position when the pressure sensors in the cylinders sense the pre-set pressure. It is up to the operator to determine to which level this space is filled.

Unloading can also be done in auto mode and is then triggered by operating a button in the cab. The chain-and-slat floor starts moving and the headboard slants towards the tailgate, thereby pushing the crop heap to the rear. This reduces the torque on the chains and their drives. As the bulkhead slants all the way to the rear, it pushes even the very last batch of crop onto the chains.

The chain-and-slat floor

The chain-and-slat floor slopes 250 mm at the front. The 3 mm steel floor is hot-galvanised for protection against corrosive effluents. The four flat-link chains have a break load of 60 tonnes. The unloading rate is selectable from ten speeds. A fast advance mode is available and empties the body at a rate of 25 m/min. Both chains of the chain-and-slat floor are driven by a hydro motor that offers two speeds.

The discharge rollers

Two or three discharge rollers are available as an option for the Tigo. The Fendt Tigo 90 XR D that was submitted to the DLG test had three solid rollers. Each of the rollers can be removed to increase the capacity; this is done by pulling them out to the rear.

All Tigo XR models have two standard LED reverse lights and one LED light in the cargo space. Two extra LED side lights are options.

A 60 km/h homologation is also available for the machine.

TIM is available as an option for the Tigo model range. On a TIM controlled combination, the tractor's forward speed is controlled relative to the current swath volume

Figure 4:
The curved bulkhead

Detailed account of the test results

Functionality and quality of work

This test was carried out after the second cut in late June 2022. The test site was a grassland farm in Saxony-Anhalt. The yields in the test fields were not as high as in the previous years due lack of rain said the farm manager. The weather was sunny and the temperatures were 22.6 °C to 28.1 °C at humidity rates of 29.5 % to 59.4 % on the testing days.

The loader wagon was pulled by a Fendt Vario 942 (generation 6). This had the Isobus-compatible Fendt One terminal.

The grass had been cut by a Krone Big M and then swathed by a Fendt Former 14055 (Generation 2). Due to the high dry matter contents (35.5 % and 50.4 %) the latter was done only about 1 hour before the grass was gathered by the Tigo. The tractor pulling the Fendt Former used auto guidance for producing very straight swaths. The swaths were spaced between 18 m and 24 m.

The test consisted of two variants and each involved three machine fillings. In test variant 1, the wagon gathered the material while running at the highest possible speed which was 19 km/h. In test variant 2, the forward speed was 15 km/h.

Total grass weight per wagon load

The average load weight which was derived from three wagon loads gathered at the maximum forward speed of 19 km/h was 9.85 tonnes of fresh mass; at 15 km/h this figure was 10.09 tonnes. These results translate into 3.8 tonnes for 38.6 % DM at V_{max} and 4.77 tonnes for 47.3 % DM at 15 km/h. This means reducing the forward speed from 19 km/h to 15 km/h increased the fresh mass load by 2.4 %.

Throughput

At maximum ground speed (19 km/h) the throughput was 130 tonnes of fresh mass per hour. At 15 km/h, the throughput was 56.5 tonnes of fresh mass per hour. The lower throughput at 15 km/h was primarily accounted for by the slower forward speed and less material in the swath.

Tractor power input

At 19 km/h, the total power input was 218 kW; at 15 km/h this was 124 kW. 18.8 kW was taken off the pto when the machine was unloading at the clamp; when idling and not loading or unloading, this figure was 3.4 kW.

Specific fuel consumption

Harvesting at 19 km/h, the combination's specific fuel consumption was 0.44 litres per tonne of fresh mass and 1.14 litres per tonne of dry mass loaded. Loading at a forward speed of 15 km/h, the tractor's fuel consumption was 0.65 litres per tonne of fresh mass and 1.41 litres per tonne of dry mass. The fact that fuel consumption increased when the forward speed was reduced was primarily attributed to the lower throughput and the less-than-optimal load on the engine.

Compression

The measured load volume of the Tigo 90 XR D was 44 m³. The tests showed that at 19 km/h forward speed, the grass inside the cargo area was compressed to 224 kg/m³. At 15 km/h, the measured compression rate was 229 kg/m³. This means that the compression was higher when the forward speed was slower.

Pick-up losses

The DLG testers found that 0.3 % of the cut material was not picked up by the machine. This is a very small percentage which scores a "very good (++)".

Contamination

No contamination of the grass on board the Fendt Tigo 90 XR D was found in this test.

Unloading time and rate

The unloading time and rate was measured in both test variants. For the 19 km/h test variant, the unloading time at the clamp was 92 seconds (the rate was 108 kg FM/s). For the 15 km/h variant, the unloading time at the clamp was 88 seconds (the rate was 114 kg FM/s).

Chop length distribution

Preferred chop lengths:
The preferred chop lengths were quantified by using the optical test stand results (table 3). As Fendt Tigo 90 XR D 37 produces theoretical chop lengths of 37 mm, only the 25-50 mm sieve fraction was analysed for this test. The analysis showed that the 25-50 mm LOC fraction accounted for 40 % in the sample that was gathered at maximum speed and for 44 % when the forward speed was 15 km/h.

Percentages of overlengths:
The overlengths were also assessed with the optical test stand results (table 3). The combined 50-75 mm, 75-100 mm and > 100 mm fractions accounted for 25 % of the chopped material – irrespective of the forward speed.

Percentage of small particles: Table 4 shows the results from the DLG cascade sieve which was used to determine those particles that were smaller than 4 mm.

At 19 km/h, the percentage of < 4 mm particles was 12 % and 18 % when ground speed was 15 km/h. The fact that the percentage is higher when forward speed is lower may be attributed to the higher DM contents in the loaded material.

Table 3: Results from the optical chop length analysis – quantifying desired fractions and overlengths

Test variant	< 25 mm	25-50 mm	50-75 mm	75-100 mm	> 100 mm
Loading at the maximum possible forward speed of 19 km/h	Rest*	40 %	16 %	5 %	4 %
Loading at 15 km/h	Rest*	44 %	17 %	5 %	3 %

Table 4: Results from the DLG cascade sieve analysis – quantifying small particles

Test variant	< 4 mm	4-8 mm	8-16 mm	16-30 mm	> 30 mm
at 19 km/h (the maximum forward speed possible) while loading	12 %	17 %	25 %	21 %	Rest*
at 15 km/h forward speed while loading	18 %	16 %	28 %	15 %	Rest*

* The particles referred to as “Rest” in tables 3 and 4 are too small for being measured by this method which doesn’t provide for a sufficient accuracy.

Summary

The DLG test was carried out with a Fendt Tigo 90 XR D loader wagon in grassland in Saxony-Anhalt in 2022.

The conditions at the time of the test allowed the combination to harvest at a maximum forward speed of 19 km/h. In each pass, the wagon loaded 9.85 tonnes of fresh mass or 3.8 tonnes of dry mass of a DM content of 38.6 %; its fresh mass throughput per hour was 130 tonnes. In this test variant, loading absorbed a total of 218 kW pto power. The computed specific fuel consumption was 0.44 litres per tonne of fresh mass and 1.14 litres per tonne of dry mass. Clearing out the wagon took 92 seconds. This is a mean value that was obtained by averaging the measurements from three unloading cycles. The unloading rate was 108 kg FM/s.

At a ground speed of 15 km/h, the 10.09 tonnes of fresh mass or 4.77 tonnes of dry mass (47.3 %) were loaded into the machine. The fresh mass throughput was 56.5 tonnes per hour. The total input required for loading was 124 kW in this test variant. The specific fuel consumption computed was 0.65 litres per tonne of fresh mass and 1.41 litres per tonne of dry mass. Unloading the complete wagon load took 88 seconds. This figure was averaged from emptying three wagon loads. The unloading rate was 114 kg FM/s.

The losses on the pick-up and contamination were measured at 15 km/h forward speed. The losses on the pick-up were 0.3 % (DLG assessment: very low (++); no contamination found (DLG assessment: low (+)).

Based on these test results, the Fendt Tigo 90 XR D loader wagon is awarded the DLG APPROVED quality mark in the test module “Functionality and quality of work”

Further information

Testing agency

DLG TestService GmbH,
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The tests are conducted on behalf of DLG e.V.

DLG test framework

DLG test framework for forage wagons

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