DLG Test Report 7491

MAXAM Tire Solutions Co, Ltd

Agricultural tires for tractors

MAXAM AGRIXTRA XL

710/70 R42 & 600/70 R30

Fuel saving, Traction

www.DLG-Test.de

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.

This test was conducted with the agricultural standard tractor tyres MAXAM AGRIXTRA XL 710/70 R 42 and MAXAM AGRIXTRA XL 600/70 R 30. These were tested against five reference tyres, one of which was from a premium manufacturer. Overall, three standard tyres and three VF tyres were tested in this test. They were tested according to the DLG test module "Resources Protection". As part of these tests, the traction and the transmitted tractive forces, the effect of the tyres on the ground and the fuel consumption under real-life conditions in the field and on the road are all measured.

Other criteria were not tested.

Assessment in brief

The agricultural tractor tire combination MAXAM AGRIXTRA XL 710/70 R 42 and MAXAM AGRIXTRA XL 600/70 R 30 partially convinced in the DLG test. Based on the results achieved, the DLG-Approved test mark is awarded for the "resource conservation" testing module for the fuel economy and traction sub-modules. The criteria for the soil conservation sub-module were not met.

With a measured wheel load of 3,000 kg on the rear axle, the wheel contact area of the MAXAM AGRIXTRA XL at a soil-protecting tyre inflation pressure of 0.6 bar is 4,690 cm² (or 3,712 cm² at 1.3 bar). At 0.6 bar, the MAXAM AGRIXTRA XL therefore has only the fifth-largest wheel contact area of the tyres examined in the test and generates a corresponding contact surface pressure of 0.64 kg/cm².

The measured soil pressures show a clear correlation between the wheel contact area and the depth of penetration. At a tyre inflation pressure of 0.6 bar, the MAXAM AGRIXTRA XL generated a soil pressure of 0.23 bar at a measured soil depth of 40 cm.

The track depth of 7.9 cm was the lowest value measured at a tyre inflation pressure of 0.6 bar.

Table 1:
Overview of results

DLG QUALITY PROFILE	Evaluation*
Soil protection	
Wheel contact surface	🟥 ☐ ☐ ☐ ☐
Ground pressure	🟨 🟨 ☐ ☐ ☐
Track depth	🟨 🟨 ☐ ☐ ☐
Fuel savings	
Field work	🟩 🟩 🟩 🟩 ☐
Transportation journeys	🟩 🟩 🟩 ☐ ☐
Traction	
Area performance	🟩 🟩 🟩 🟩 🟩

* The DLG test framework provides the following options in its evaluation schemes: 🟩🟩🟩 or better = meets, exceeds or clearly exceeds the specified DLG standard, 🟨🟨 = meets the legal requirements for marketability, 🟥 = failed

The MAXAM AGRIXTRA XL achieves a work rate of 2.68 ha/h at 10 kph and an average tractive force of 45 kN and therefore delivers the best result together with a reference tyre.

In the field test, the MAXAM AGRIXTRA XL had the lowest fuel consumption among the standard tires and the second lowest compared to all tires tested. The MAXAM AGRIXTRA XL has the lowest fuel consumption among the standard tires in the transport test on the DLG chassis dynamometer and the fourth lowest consumption compared to all tires tested.

Das Produkt

Manufacturer

MAXAM Tire Solutions Co, Ltd, Qingdao – 266000, China

Product:
MAXAM AGRIXTRA XL 710/70 R 42 und MAXAM AGRIXTRA XL 600/70 R 30

Description and technical data

The following tyre combination for the front and rear axle was tested:

Rear axle R: MAXAM AGRIXTRA XL 710/70 R 42

- Tubeless radial tyre, R-1W
- Tyre width [mm]: 716
- Overall diameter [mm]: 2,061
- Recommended rim: DW 23 B
- Alternative rim: –

Front axle F: MAXAM AGRIXTRA XL 600/70 R 30

- Tubeless radial tyre, R-1W
- Tyre width [mm]: 611
- Overall diameter [mm]: 1,602
- Recommended rim: DW 20 B
- Alternative rims: DW 18 L, W 18 L

Figure 2:
MAXAM AGRIXTRA XL

Table 2:
MAXAM AGRIXTRA XL technical data

	Tyre pressure [bar]							
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
Driving speed [kph]	**Wheel load, rear axle/front axle [kg]**							
10	4,520/2,865	5,120/3,245	5,725/3,630	6,325/4,010	6,930/4,395	7,530/4,775	7,835/5,010	8,135/5,245
15			4,874/3,090	5,384/3,414	5,900/3,742	6,410/4,065	6,670/4,265	6,925/4465
65			4,255/2,700	4,705/2,980	5,150/3,265	5,600/3,550	5,825/3,725	6,050/3,900

Further technical data can be found on the manufacturer's homepage:
https://maxamtire.com/de/tire/agrixtra-xl/

The method

DLG test module 'Resources Protection'

The objective of testing agricultural tyres for tractors in the DLG test module 'Resources Protection' is to examine the tyres in terms of their effect on the soil and fuel consumption. To do this, the tyres are fitted on suitable tractors and tested in two sub-areas.

Section 1 is a field test under practical conditions and section 2 is the transportation task test on the DLG chassis dynamometer.

Section 1 – Field Test

The measurement runs are conducted on suitable agricultural land under comparable conditions. The test areas must be sufficiently large, homogeneous, flat and prepared for the tests. The soil type and texture, vegetation if applicable, field history and test conditions such as the weather, soil moisture and characteristics are documented for this. During the test, the moisture volume in the soil is measured at a depth of 0 to 30 cm.

The measurements are conducted with a vehicle combination consisting of two tractors. The front tractor is fitted with the tyres to be tested and the rear tractor serves as a braking tractor. Both are connected using a sling with an integrated load cell (Figure 3). This enables field work to be simulated and tractive force/slip curves to be recorded at various tyre inflation pressures.

The tyre pressures to be set are selected from the manufacturer-specific air pressure tables (Table 1). It must be ensured in this process that the maximum permissible wheel loads are not exceeded.

Two pressures are selected for the measurements

- Minimum permissible tyre pressure for 10 kph (field work): 0.6 bar
- Average tyre pressure for 50 kph: 1.3 bar

In order to classify the measurement results, comparison tests are conducted using reference tyres that are available on the market.

The following measurements are carried out for the evaluation

- Lead ratio [%]
- Tractive force/slip curve [kN; %]
- Wheel contact surface [cm²]
- Ground pressure [bar]
- Track depth after passage [cm]
- Tractive power [kW]
- Area performance [ha/h]
- Fuel consumption [l/h]

The lead ratio is calculated from the rolling circumference of the front and rear tyres as well as the mechanical ratio of the tractor (front axle to rear axle) in all-wheel drive mode. The lead ratio can change depending on the tyre manufacturer. The lead ratio should be between 0.5 % and 5 %. Optimum values lie between 1.5 % and 3.5 %.

The wheel contact surface of the individual tyre types is made visible by dusting the tyres and is then measured (Figure 4). The depth of the tyre imprint is also measured.

Figure 3:
Vehicle combination

Figure 4:
Wheel contact surface

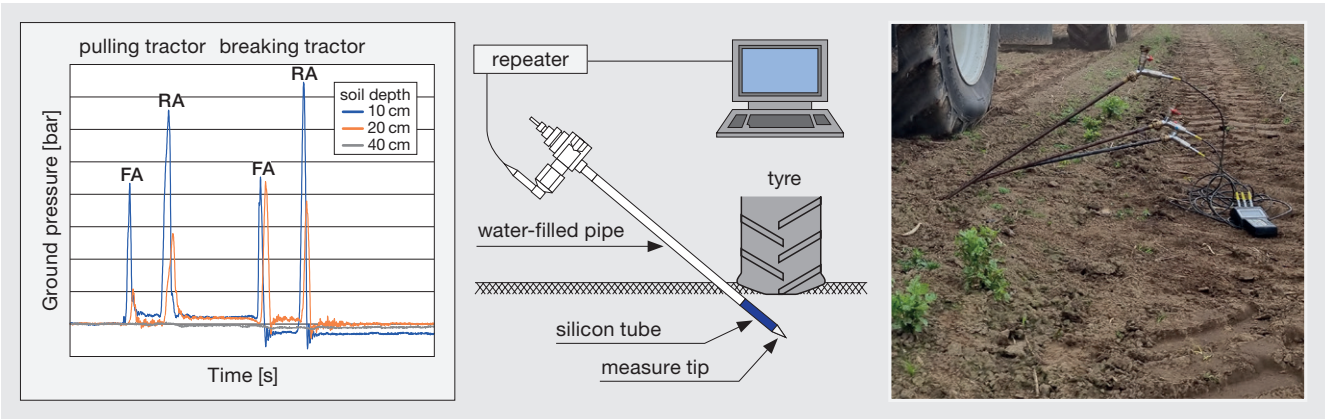

Figure 5:
Soil pressure measurement with Bolling probes

The soil pressure generated on passage is measured with Bolling probes during the test. In this process, the pressure is measured at depths of 10 cm, 20 cm and 40 cm (Figure 5). The soil pressure decreases as the soil depth increases and (at a constant wheel load) is primarily influenced by the size of the tyre contact surface. The tyre contact surface can be changed via the tyre inflation pressure.

Section 2 –
Transportation run on the
DLG chassis dynamometer

In order to simulate transportation tasks, measurement runs are carried out on the DLG chassis dynamometer. The test method is based on the 'DLG-PowerMix' testing framework. The overall transport test route consists of two different route sections

- Uphill route that necessitates high tractive force
- Flat land route that necessitates relatively low tractive force

The height profiles are determined in advance on real routes and stored in the test programme. The complete traction weight (tractor and trailer) is simulated from 10 t to 40 t depending on the output category of the tractor. The tyre pressure is set to 1.6 bar for all tyres. The position of the test vehicle on the dynamometer is not changed during the comparison test, which is why the tyre change takes place on the chassis dynamometer. Three measurement runs are carried out in each case: the run on the flat at both 40 kph and 50 kph, whereby the first measurement run is used for conditioning.

Figure 6:
Transportation run on the DLG chassis dynamometer

The following are recorded during the measurement

- Engine speed [rpm]
- Specific fuel consumption [g/kWh]
- AdBlue consumption [g/kWh]
- Speed and time required [kph, s]

The essential technical parameters of the vehicles used that are relevant for the test are recorded and documented.

Detailed account of the test results

Figure 7:
Versuchsfläche nach Überfahrt

Test area

The tests were carried out in March 2024 in the vicinity of Neumünster (Schleswig-Holstein) on a field sown with a frozen catch crop (oil radish).

The soil type at the test location is sandy loam and the test area is extensively homogeneous and flat.

The moisture volume measured at random in the soil at a depth of 0 to 30 cm over the test period was around 40 %; the test area is therefore regarded as relatively wet.

Axle and tyre loads, rolling circumference, lead ratio and tyre inflation pressure

For the test, the tyres to be tested were fitted on a STEYR Absolut 6280 CVT. An AGCO Fendt Vario 933 was used as the braking tractor. The axle and tyre loads were subsequently determined.

The static weight distribution of the pulling tractor was 42 % on the front axle and 58 % on the rear axle.

Table 4 shows the initial data and the lead ratio values measured for the tested tyres at 0.6 bar. Apart from reference tyre A, the lead ratio of all tyres was between 0.5 % and 5 %. The MAXAM AGRIXTRA XL and reference tyres B, C and D lay in the optimum range from 1.5 % to 3.5 %.

Tractive force/slip curve

The tractive force/slip behaviour at a tyre inflation pressure of 0.6 bar shows that the tested tyres transfer tractive forces of 35.0 kN to 54.5 kN with 20 % slip.

The MAXAM AGRIXTRA XL achieves a tractive force of 47.0 kN. Even higher tractive forces can be trans-

Table 3:
Axle and wheel loads

STEYR Absolut 6280 CVT			
	Axle load [kg]	**Distribution [%]**	**Wheel load [kg]**
Front axle	4.400	42	2.200
Rear axle	6.000	58	3.000
Total weight	**10.400**		

Table 4:
Rolling circumference and lead ratio

	Rolling circumference and lead ratio					
	MAXAM AGRIXTRA XL	Reference tyres A	Reference tyres B	Reference tyres C	Reference tyres D	Reference tyres E
Front axle	600/70 R30	600/70 R30	600/70 R30	600/70 R30	600/70 R30	600/70 R30
Rolling circumference [mm]	4,790	4,760	4,774	4,783	4,649	4,711
Rear axle	710/70 R42	710/70 R42	710/70 R42	710/70 R42	710/70 R42	710/70 R42
Rolling circumference [mm]	6,162	6,195	6,174	6,106	6,100	6,182
Lead ratio at IP 0.6 bar [%]	2.93	1.52	3.92	1.67	0.05	3.47

ferred at higher slip values. From an energetic and agricultural point of view, however, operation with a higher slip makes little sense. Lower tractive forces can be transferred with both low and high slip at a tyre inflation pressure of 1.3 bar. At 20 % slip, the tested tyres can transfer tractive forces of 27.9 kN to 46.0 kN.

The MAXAM AGRIXTRA XL achieves a maximum tractive force of 43.0 kN.

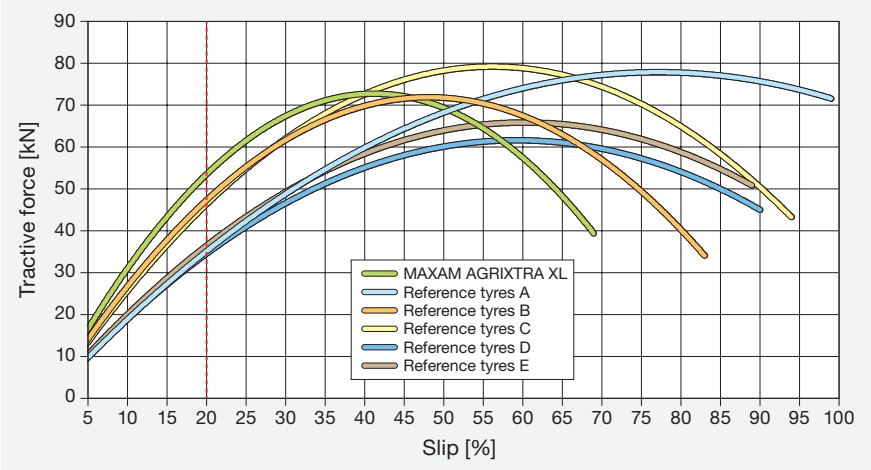

Figure 8:
Tractive force/slip curve at a tyre inflation pressure of 0.6 bar

Wheel contact surface and track depth at 0.6 bar

Reducing the tyre inflation pressure from 1.3 bar to 0.6 bar increases the wheel contact surface of the tested tyres by 7.5 % to 27.5 %. At a constant wheel load, this results in a reduction in the contact surface pressure in kg/cm². In this case, the MAXAM AGRIXTRA XL achieves a contact surface pressure of 0.64 kg/cm².

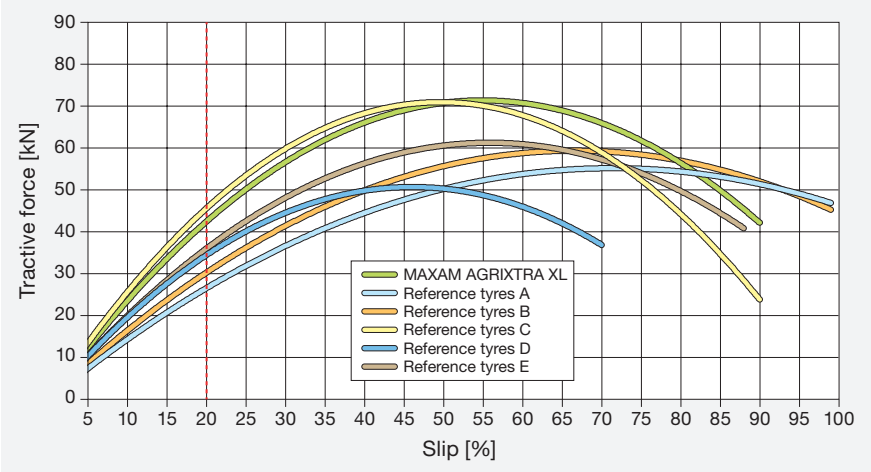

Figure 9:
Tractive force/slip curve at a tyre inflation pressure of 1.3 bar

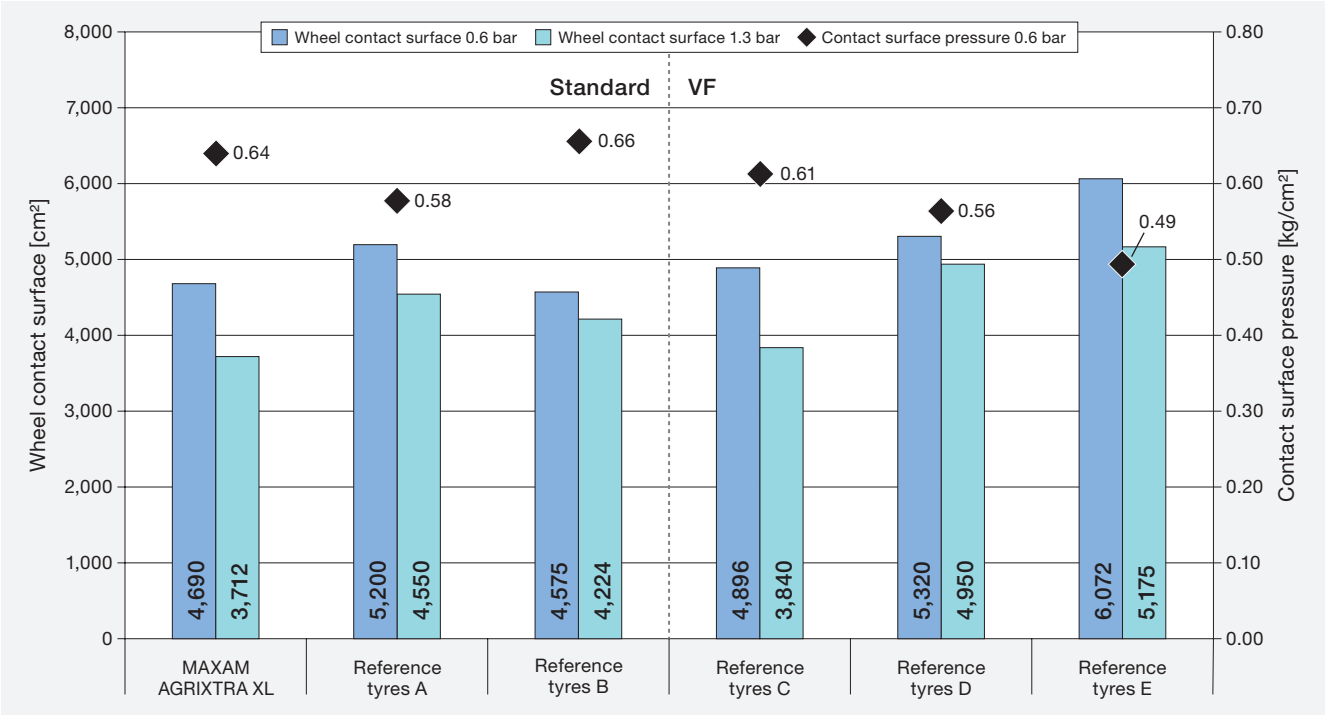

Figure 10:
Wheel contact surface

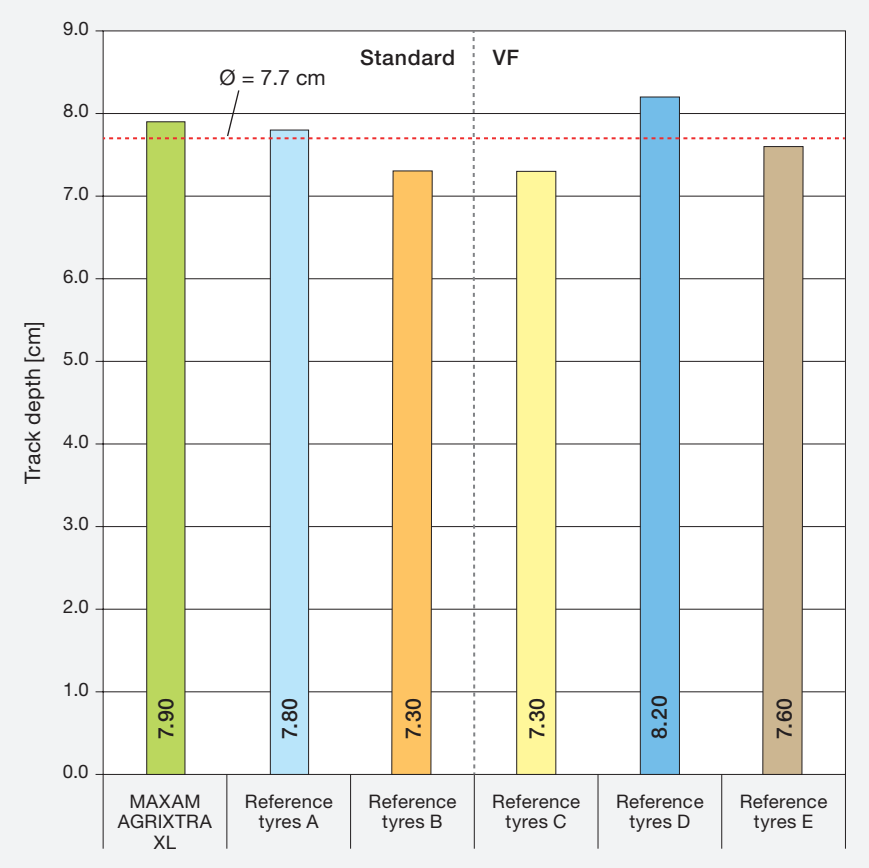

Figure 11:
Track depth in cm

The low contact surface pressure also acts on the measured track depth, which is an average of 7.7 cm.

The MAXAM AGRIXTRA XL generates a track depth of 7.9 cm.

Ground pressure

A close correlation between the pressure values measured at a depth of 10 cm and the set tyre inflation pressure was revealed on the whole. Above all, the ground pressure at a depth of 40 cm is influenced by the size of the contact area (at a constant wheel load). It was shown that the MAXAM AGRIXTRA XL generates a ground pressure of 0.23 bar in a depth of 40 com and lies over the limit of 0.2 bar described in the literature.

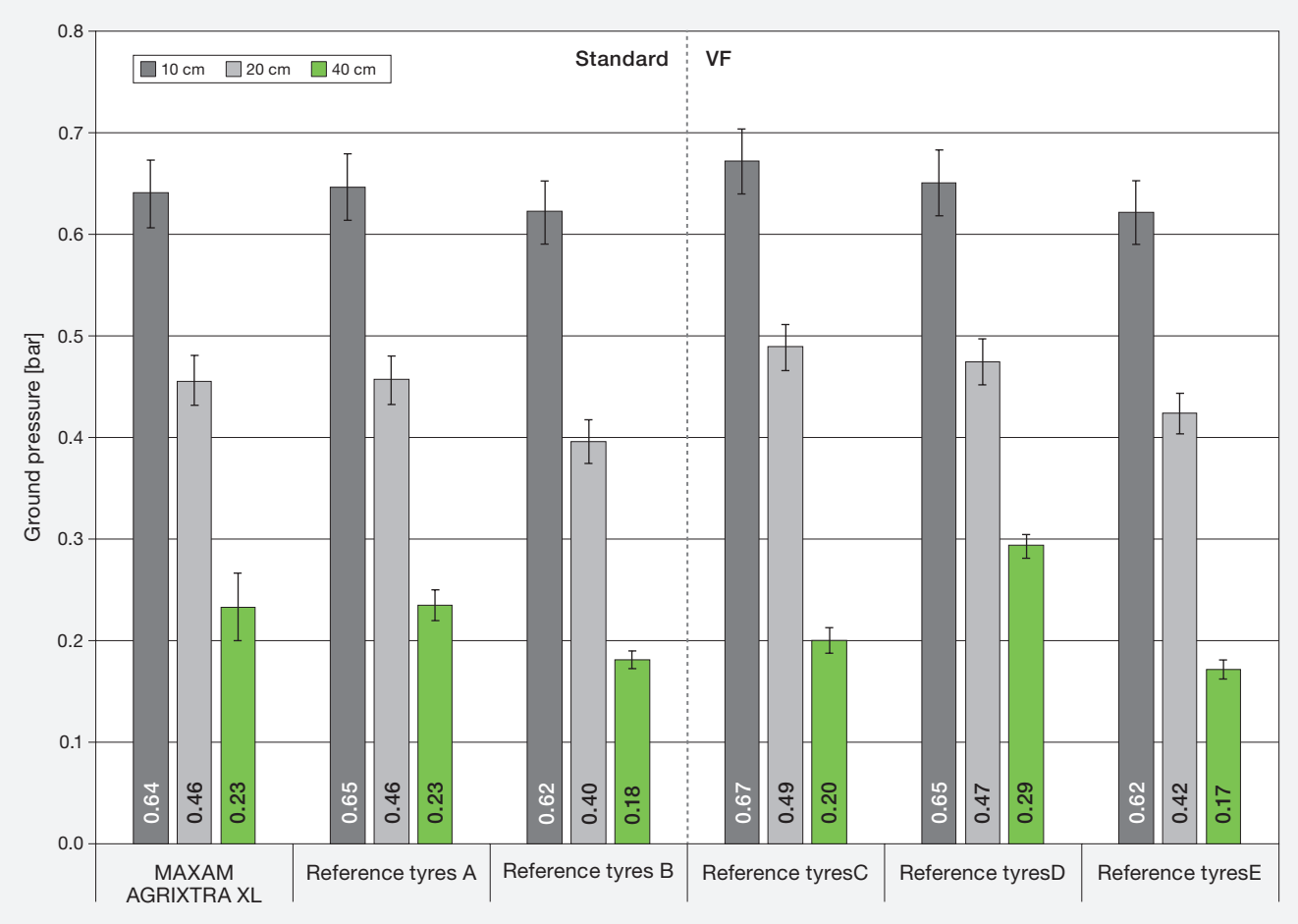

Figure 12:
Ground pressure at 0.6 bar at a soil depth of 10 cm, 20 cm and 40 cm

Tractive power and area performance

The tractive power is calculated from the tractive force and the driving speed. In this test, a tractive force of 45 kN is set in order to simulate a 3 m wide soil tillage implement. Depending on the traction (slip), different driving speeds arise depending on the tyres.

In the field test, the average value of the transferable tractive power of all tested tyres was 108.7 kW. The value of 113.5 kW achieved by the MAXAM AGRIXTRA XL is the highest value of all tested tyres.

The area performance (ha/h) is calculated from the width of the soil tillage implement and the driving speed achieved. The average across all tested tyres was 2.6 ha/h. Three of the tested tyre sets are higher and three lower than the average. Along with reference tyre C, the MAXAM AGRIXTRA XL achieved the highest work rate of 2.68 ha/h. The MAXAM AGRIXTRA XL is therefore 3 % better than the average and an impressive 9.3 % better than the poorest competitor in the test.

Fuel consumption in the field test

High work rates tend to lead to low fuel consumptions. In the test, the average consumption at a tyre inflation pressure of 0.6 bar and a traction force of 45 kN was 18 l/ha. At 17.43 l/ha, the consumption of the MAXAM AGRIXTRA XL was the second lowest of all of the tested tyres.

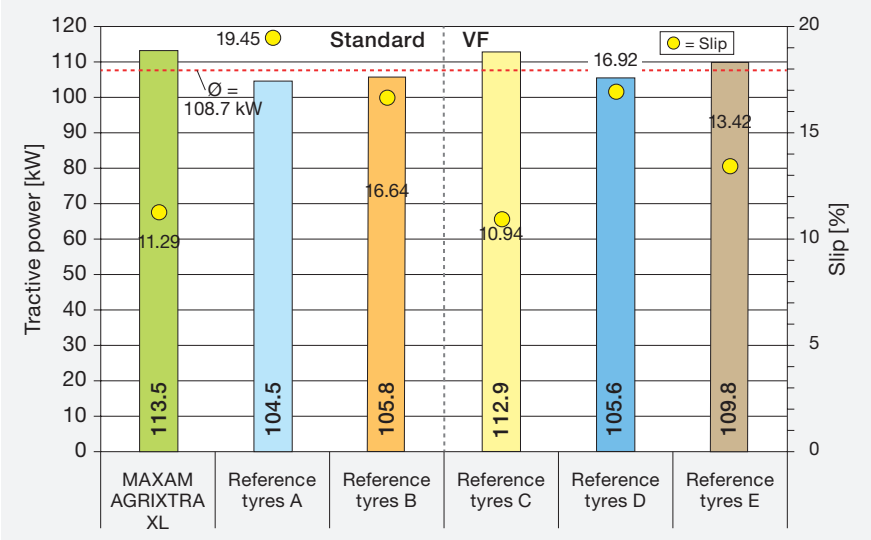

Figure 13:
Tractive power [kW] and slip [%] at a tyre inflation pressure of 0.6 bar and 45 kN tractive force

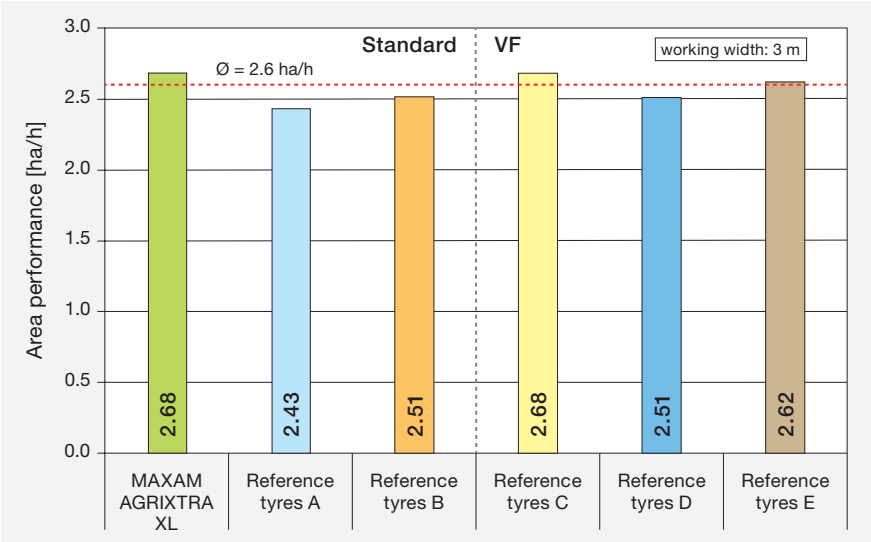

Figure 14:
Work rate at a tyre inflation pressure of 0.6 bar and 45 kN traction force

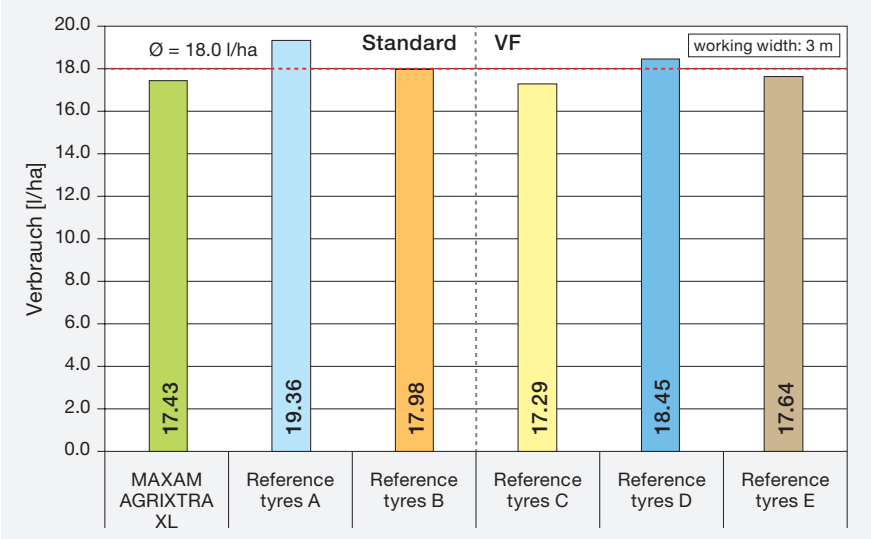

Figure 15:
Consumption [l/ha] at tyre inflation pressure of 0.6 bar and 45 kN traction force

Fuel consumption during transportation runs on the chassis dynamometer

The differences in fuel consumption in the transportation runs lie in the 3 %-4 % range.

In the 40 kph transport test variant (DLG-PowerMix), the MAXAM AGRIXTRA XL reveals a specific fuel consumption of 402 g/kWh. In the 50 kph variant, the MAXAM AGRIXTRA XL reveals a specific fuel consumption of 403 g/kWh.

The same picture emerges with respect to the fuel consumption per tonne per 100 kilometres (l/t · 100 km). In the 40 kph variant, fuel consumption with the MAXAM AGRIXTRA XL is 4.44 l/t · 100 km.

In the 50 kph variant, fuel consumption with the MAXAM AGRIXTRA XL is 4.48 l/t · 100 km.

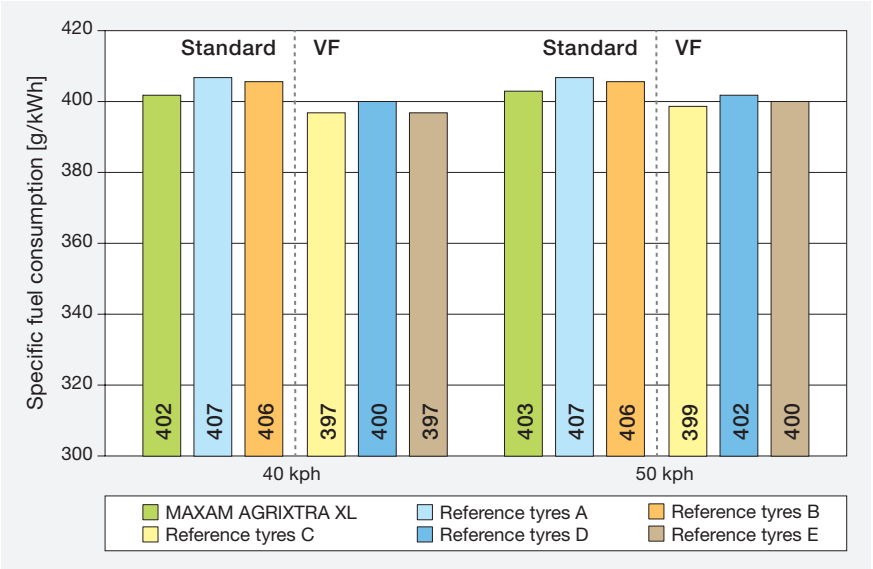

Figure 16:
Specific fuel consumption in g/kWh

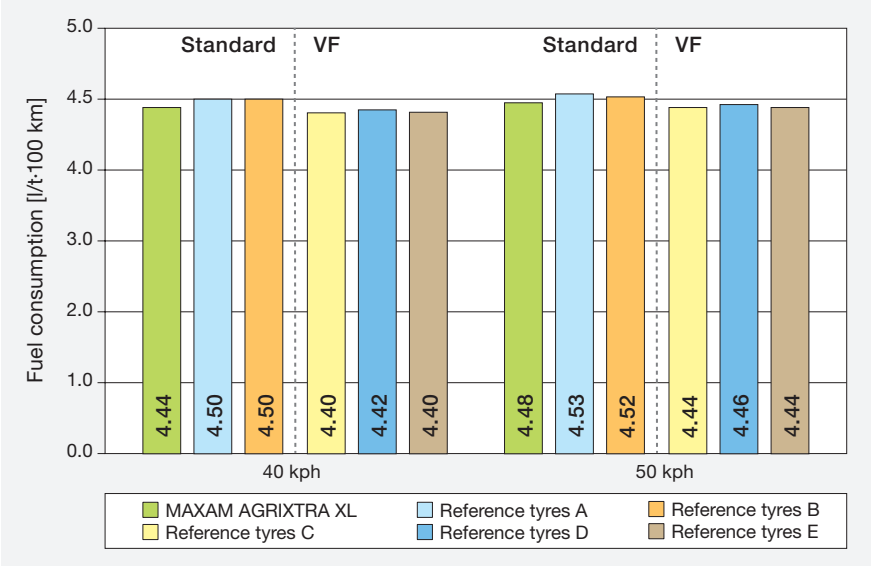

Figure 17:
Fuel consumption in l/t·100 km

Summary

This report describes the standard tractor tire combination MAXAM AGRIXTRA XL 710/70 R42 and MAXAM AGRIXTRA XL 600/70 R30 with regard to the DLG test module “Resource Protection”. The tested tires are three standard tires and three VF (Very High Flexion) tires. Compared to standard tires, VF tire technology improves the conservation of resources. With these tire types, it is possible to increase the wheel contact area and thus reduce the ground pressure by significantly reducing the internal tire pressure. Compared to standard tires, VF tires can be operated with up to 40 % less internal tire pressure for the same load. This has an effect on soil compaction and promotes soil sustainability. Compared to VF tires, standard tires are designed for higher internal tire pressures, which results in a smaller contact area. Due to the greater penetration depth of the lugs, the tractive force transmission can still be at a high level depending on the soil type.

This is assessed by measuring the following values: wheel contact area, ground pressure, track depth, fuel consumption in the field test and in transportation runs on the DLG chassis dynamometer, tractive force/slip curve as well as the tractive power and area performance.

The MAXAM AGRIXTRA XL is within the typical range for standard tires in terms of wheel contact area and ground pressure. The VF tires have a clear advantage here. In terms of tracking depth, the MAXAM AGRIXTRA XL achieved the second highest value.

The MAXAM AGRIXTRA XL performed well in the comparison group for fuel consumption in the field test and during transportation on the DLG chassis dynamometer. The MAXAM AGRIXTRA XL, together with a reference tire, achieved the best result in terms of area coverage.

In the 5 % to 15 % slip range that typically occurs in practice, the MAXAM AGRIXTRA XL transfers high tractive forces at a tire inflation pressure of both 0.6 bar and 1.3 bar.

Further information

Testing agency

DLG TestService GmbH, Gross-Umstadt location, Germany, in cooperation with the Kiel University of Applied Sciences, Faculty of Agriculture, Dept. Agricultural Engineering

The tests are conducted on behalf of DLG e.V.

DLG test framework

DLG Test Framework for Agricultural Tyres (current as 07/2023)

Department

Vehicle technology

Examiner

Prof. Dr. Yves Reckleben
(University of Applied Sciences Kiel)

Martin Hanstein (DLG)*

Photos and graphics

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DLG – the open network and professional voice

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As one of the leading organisations in the agricultural and food market, DLG organises international trade fairs and events in the specialist areas of crop production, animal husbandry, machinery and equipment for farming and forestry work as well as energy supply and food technology. DLG's quality tests for food, agricultural equipment and farm inputs are highly acclaimed around the world.

For more than 130 years, our mission has also been to promote dialogue between academia, farmers and the general public across disciplines and national borders. As an open and independent organisation, our network of experts collaborate with farmers, academics, consultants, policymakers and specialists in administration in the development of future-proof solutions for the challenges facing the agriculture and the food industry.

Leaders in the testing of agricultural equipment and input products

The DLG Test Center Technology and Farm Inputs and its test methods, test profiles and quality seals hold a leading position in testing and certifying equipment and inputs for the agricultural industry. Our test methods and test profiles are developed by an independent and impartial commission to simulate in-field applications of the products. All tests are carried out using state-of-the-art measuring and test methods applying also international standards.

Internal test code DLG: 2401-0083

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