

SPECIAL REPRINT

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Tractor test: Claas Axion 820 Cmatic

Claas apart



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profi Tractors and Farm Machinery: Goblands Farm · Court Lane · Hadlow · Tonbridge · Kent · TN11 0EB · UK

Tel: + 44 (0) 1732 852 383 · Fax: + 44 (0) 1732 852 488 · E-mail: marketing@profi.com

profi Tractors and Farm Machinery: D-48084 Münster · Tel: + 49 (0) 2501 801 281 · Fax: + 49 (0) 2501 801 359 · E-mail: sewald@profi.com

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When it first arrived in fields in late 2006 the then five-model Claas Axion 800 family could only be supplied with a Hexashift semi-powershift gearbox. One year on, the firm added the ZF-sourced S-Matic CVT transmission option that Claas dubbed, and continues to dub, the Cmatic on its 120kW/164hp to 177kW/240hp (ECE R24) 810, 820 and 840 models. Falling into the 200hp segment has helped the 820 to take the Axion lead in UK sales, followed closely by the 850, and then the 810 and 840 picking up the pieces; as an aside, the 830 is no longer offered. Claas says there is no clear-cut case as to which customers spec the slightly more expensive CVT option, because as well as those who need the infinite working range for speed-sensitive jobs, there are others who just want the flexibility the Cmatic has to offer. The transmission itself is a familiar unit, being a ZF S-Matic, and it appears in several other breeds of tractor including Case IH's CVX and the Deutz-Fahr TTV630. All of that said, however, as far as sales stats go, the semi-powershift Hexashift still attracts many more buyers than the CVT. Bottom line, semi-powershift still remains the mass market product.

Introductions complete, it's back to our test candidate. According to brochure data, the Axion 820 Cmatic is rated at 135kW/183hp (to ECE R24) and boosts to 166kW/227hp. The manufacturer points out that these are not 227 mythical horses, because the 24kW/32hp boost kicks in for pto work including stationary jobs, as well as when the tractor starts travelling above 7km/hr and as soon as the transmission reaches the second of its four mechanical ranges. Responsible for this muscle is a six-cylinder Deere Power Systems (DPS) 6.8-litre motor with its four

valves per pot, common-rail injection and variable geometry turbo. Significantly it's also Stage IIIA- but not IIIB-compliant.

So, time to hand the Axion 820 over to the DLG, to add some testing meat to these company claims. Hitched up to the DLG's dyno, as much as 139.0kW/186.4hp made its way through to the shaft with the boost engaged and running at rated speed. Power rose up to 148.0kW/198.5hp when the engine speed dipped to 2,000rpm. Other key statistics included a 36% torque rise, a 25% constant power range and nearly 7% extra power – admittedly not overwhelming figures but still good enough, ably assisted by a 130% start-off torque.

Equally important is fuel efficiency. Considering the Hexashift Axion 850 in the Oct 2008 profi tractor test managed some top results, including a Powermix average of 282g/kWh, we were expecting a similarly strong performance from the Axion 820 with its Cmatic CVT.

And we weren't disappointed. The Axion 820 managed 259g/kWh at rated pto speed and 251g/kWh at maximum pto speed. The stepless transmission wasn't quite able to meet the drawbar efficiency of the semi-powershift box, delivering 119.0kW/159.6hp to the wheels while consuming 304g/kWh. And as engine revs dipped, drawbar power rose to a maximum of 128.0kW/171.7hp and fuel consumption was reined back to 290g/kWh. Looking at more typical fuel consumption figures during the Powermix test we see that the 820's engine and transmission worked very well together with an average of 290g/kWh. That's around 3% better than the average of all the tractors we have put through our test so far.

Now for a more detailed assessment of the CVT. Unlike many of its competitors, once in the cab it is hard to distinguish Cmatic



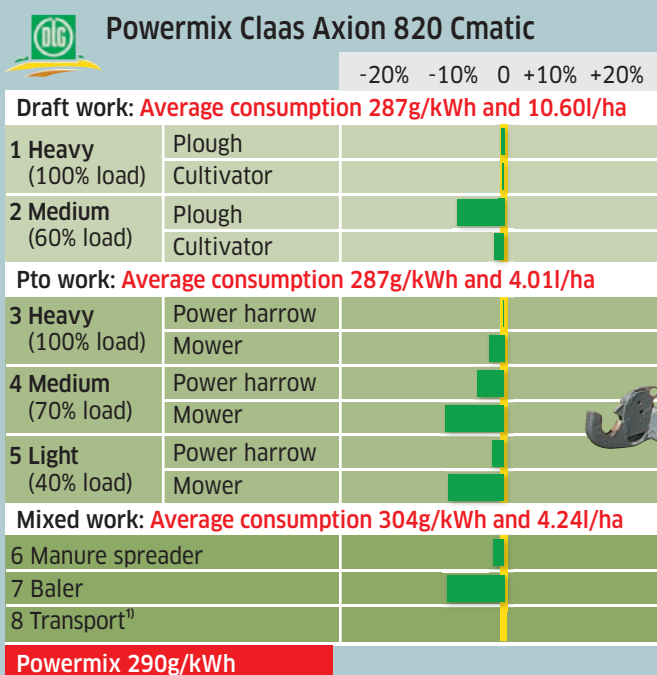


Stage IIIA or Stage IIIB ■

Engine exhaust regs are funny things. Even though the deadline for all tractors over 130kW/177hp to be Stage IIIB compliant was January of this year, there are still ways to continue installing Stage IIIA motors – as is the case with the Axion 820 featured here. The often-quoted transitional period means that, as long as the engine was built by the end of 2010 and put into storage, the manufacturer can choose to use these motors until the end of 2012. Like a number of other manufacturers, Claas has opted to adopt this policy. There are two main benefits: firstly, it allows the firm to technically skip Stage IIIB and go straight to Stage IV emission

regulations; secondly, the company can continue to supply tractors with the less complex and ultimately cheaper Stage IIIA motors so that its tractors should be priced very competitively.

As you would expect, though, there is a countering flipside to this argument. Initial tests on Stage IIIB tractors – for example, the Fendt Vario 828 with its SCR catalyst in our September issue – suggest that these models are more economical, even when the cost of the diesel exhaust fluid is included, and this clearly helps to offset their higher purchase price. Again, it's horses for courses.



The Powermix figure is shown at the bottom to the right and is arrived at by averaging the seven individual tests. The table shows average results for the categories draft work, pto work and mixed work, measuring fuel consumption in grams per kilowatt hour and in litres per hectare.

The yellow line marks the average result obtained from all previous Powermix tests. The length of the individual bars indicates the degree to which tractor performance in this specific type of work is better than (green) or falls short of (red) the average result of all Powermix candidates to present. The average Powermix parameter, obtained from 62 test tractors to present, is currently 300g/kWh. ¹⁾ Results from the transport cycle tests are not published yet. In our Powermix measurements, the Claas Axiom 820 Cmatic (still Stage IIIA compliant) delivered better than average results in nearly all categories. The overall result is about 3.4% better than the average result obtained from previous Powermix tests.

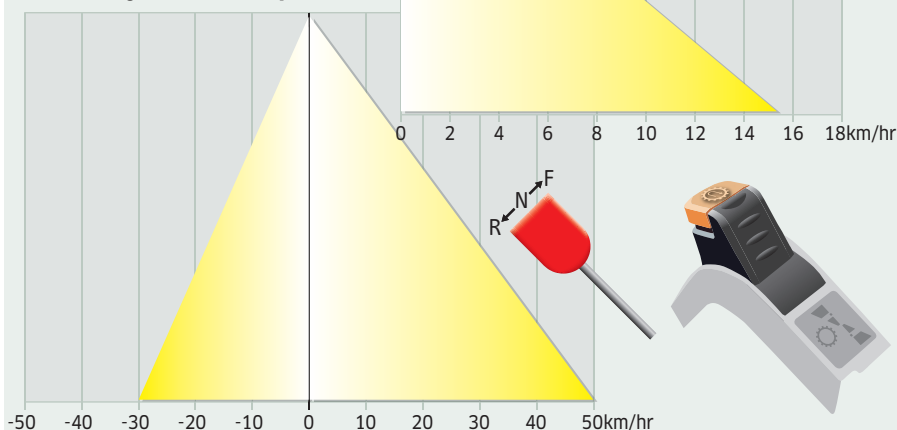
Claas is taking advantage of the two-year transitional period to continue to install the Stage IIIA-compliant 6.8-litre DPS engine. In the test this motor produced a robust power curve. Fuel efficiency was impressive, too.

from Hexashift tractors: only extra items are two inconspicuous buttons on the multi-function armrest for presetting the three speed bands. Factory settings in forwards are 0-15, 30 and 40 or 50km/hr, the latter being possible at a low revving 1,720rpm, while in reverse they are 0-8, 20 and 30km/hr. The operator can alter the speed of the two lower bands in both directions, and, in addition to setting the top speed, operators can also tap in a cruise control speed for each band in either direction to give a total of six preset speeds.

Claas Axiom 820 Cmatic: The stepless gearbox has four travel ranges, which can't be detected by the operator in work. The machine accelerates steplessly from 0 to 50km/hr, its top speed being achievable at 1,720rpm. There are three cruise control speeds.

Infinitely variable in the main speed band

Forward and reverse at infinitely variable speeds



To swap from drive pedal model to stick mode, operators must navigate their way through the Cebis terminal's sub-menus. Here 'Auto' stands for drive pedal mode, where the operator uses the pedal to alter the ground speed and the tractor automatically manages the engine revs. In 'Drive-stick' mode the tractor still manages the engine while the operator moves the lever to proportionally set the ground speed - or he can still press the foot pedal. The third option is 'Manual' mode, where the stick is used for setting the travel speed and the foot pedal reverts to acting as a conventional throttle.

In the next menu the operator adjusts the rate of acceleration, which also has an effect on how aggressive the powershuttle reacts to driver-requested direction changes. If the response is too sluggish, then there's always

the option of using the accelerator to dial in more power. The last menu item is for setting the amount of engine droop from 0% to 40% in Auto and Drivestick modes.

Cruise control is engaged via the orange button on the top of the drivestick: press and hold it for three seconds and the current speed will be stored. The operator can override this by working the drivestick, but sadly this means that the memorised speed is overridden as well. Other useful details include the active standstill feature and the auto park lock, the latter placing the tractor in active standstill as soon as the operator leaves the seat, engaging the park lock after five seconds. One final CVT point to note: there was a slight 'box' hiccup during our test that required a brief workshop stop. Potential Axion 820 buyers have a choice of two pto speed combinations; 540, 540E and 1,000 or 540E, 1,000 and 1,000E. Apart from that, there are simple automatic headland shifting programs in addition to the main headland management system.

Hydraulics and front/rear linkages? These can be summed up in double-quick time. The rear linkage has a capacity of up to 8.5t – enough to handle even the heaviest of kit. And up on the nose, the factory-fit front linkage is listed in either 3.3t or 5.4t rated variants, and there's also a £355 electric position control option.

A plentiful 110-litre swash plate pump is part of the standard UK spec – the £400 optional 150-litre pump was fitted to our test tractor – and other stand-out details are the spool valve couplers with their convenient release levers. More plus points go to the electrically governed remote valves with their multiple timing and flow setting options via the Cebis terminal, although they lack the option of being able to retrieve a specific function for a customised lever. The lift height and spool status are simple enough to identify on the colour screen. Which brings us to driver accommodation. The six-post Axion cabin recorded a noise level of 76dB(A) under load – average for



Rear linkage is tough. The 110-litre pump supplies plenty of oil to all of the spools.

FURTHER DETAILS from our field test

This is not a summary of overall assessments but a list of positive and less positive details.

Positive +

- + Simple to program the cruise control
- + Cebis offers direct access to recent functions
- + Sturdy battery box is easy to get at and features an isolator switch



Cebis is excellent for recording job times, acreage and fuel consumption rates.



The rear spools with relief levers provide convenient coupling and are clearly marked.



CSM headland management system is simple to program and edit.

- + External controls for linkage, pto and one (selectable) spool (incl. standard ISObus provision)
- + Upholstered passenger seat
- + Uncluttered work light control panel
- + Automatic climate control, sadly without vents in the roof
- + Doors close firmly without slamming
- + Cooling box under the steering wheel
- + Generously sized toolbox next to the steps to the left

Negative -

- Park brake should also control the trailer brakes



Door handle is a stretch. It's positioned more than 2m high.

- Some of the switches on the control panel are not backlit
- Lack of stowage space
- Bulky steering column



The three pto speeds are engaged from two levers with a cable. Not a modern solution.



If the 3.3t front linkage isn't powerful enough, buyers can opt for a 5.4t package. The headlights in the bonnet aren't as bright as the supplementary working lights without using the main beam. Illumination could be improved on the Axion.



Multi-function armrest and Cebis monitor are excellent. There are also 'F' keys for ISObus control, though a joystick would be even better.



The dash is uncluttered, and the parking lock button on the left is rarely operated, because the lock is activated automatically. Glitch here is that the trailer brake is not included in the automatic braking system. Photos: ST.



The cab is roomy and fully suspended as part of the tractor's standard spec. There are still six posts, and the noise level tested at 76dB(A) – an average return.



Air-con and the light panel are supplied as standard. Climate control is a £555 option.

this power bracket – while the controls are well laid out in an ergonomic fashion. We had no major problems operating ISObus implements from a second terminal like the Communicator display, and Claas also looks to be sorting our wish for a joystick judging by the one in the forthcoming Axion 900. Down below, the mechanical four-point cab suspension continues to be standard spec. Then again, if you're willing to stump up an extra £2,800, there is the option to go for

the Z-Active suspension, which relies on a magnetic fluid in the rear shock absorbers to allow tweaks to the amount of damping.

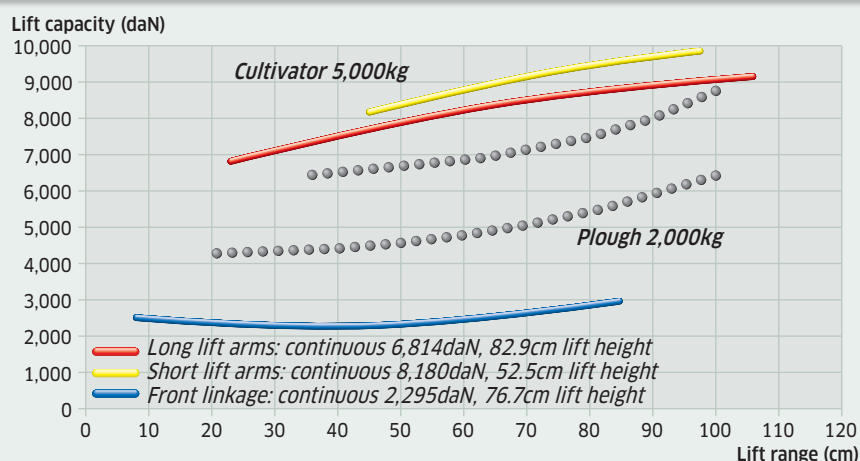
As for axles and running gear, the turning circle measured over 13m, which rates as reasonably manoeuvrable bearing in mind the fitted 600/65 R28 front footwear (1.95m track width, 2.98m wheelbase). Drawback with our test 820 was its limited payload, a miserly 3.2t that can be attributed to the

tractor's considerable 8.8t weight. Where top speed is capped at 40km/hr, the Axion 820 redeems itself with a 13t gross weight. Lastly, the brakes appear to be up to spec, although we weren't able to confirm this view with our customary measurements: the DLG equipment was out of action at the time of our test. Also of note, the Axion's standard suspended front axle hails from Dana and looks a heavy-duty unit, though a slight disappointment on our test tractor was that the axle ride wasn't that smooth.

Summary: Among the other conclusions of this test, it does show how a CVT isn't, by default, hugely more fuel efficient than its semi-powershift counterpart. That said, both output and fuel consumption are more than adequate on the Axion Cmatic. So, does this tractor merit consideration if you're after a 200hp model? Absolutely – and especially if Claas's decision to stick with a Stage IIIA engine for a while longer means that there are some decent deals on the table. Do watch out for that limited payload on 50km/hr units, though.

MN, HW

Claas Axion 820 Cmatic: Lift power and lift requirement



Claas Axion 820 Cmatic: Red curve shows recorded lift capacity (90% of max lift) as continuous lift power on the link ends, whereas the yellow curve displays recorded lifting power with lift rods shortened. There's plenty of muscle available at the rear; in contrast, the front linkage barely lifts 2.3t, which may leave the tractor struggling when attempting to hoist bulky kit.

Claas Axion 820 Cmatic



Width | 267cm

Length | 574cm (incl. front linkage)

Height | 318cm (cab)

Technical data

Engine | 135kW/183hp at 2,200rpm; max 166kW/227hp (boosted); water-cooled Deere Power Systems 6068HRT83 six-cylinder engine, Stage IIIA with common-rail, variable geometry turbocharger and intercooling; 6,788cm³ capacity, 377-litre fuel tank

Transmission | 'Cmatic' CVT with four automatic travel ranges, load limit sensing control and cruise control, powershuttle, 50km/hr (at 1,720rpm engine revs)

Brakes | Wet single-disc brakes at the rear, hydraulic engagement, 4WD engagement on front axle; mechanical park brake; standard air brake system

Electrics | 12V, 157-amp battery, 175-amp alternator, 4.2kW/5.7hp starter power

Linkage | Category III, ELC with draft link control and shock absorption, std slip control option. Front linkage (with electric position control) and front pto are options

Hydraulics | 150-litre/min swash plate pump (UK standard is 110 litres/min), 200 bar; four double-acting spool valves are standard (max of eight); available oil for external use by trailed and mounted implements is 40 litres

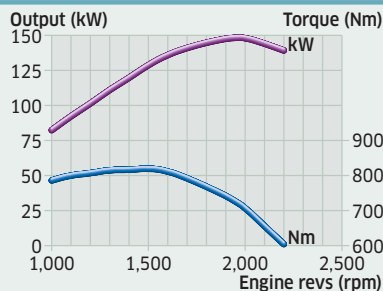
Pto | 540/540E/1,000; 1 3/8in, six splines, electrohydraulic engagement

Axles and running gear | Planetary axle with multi-plate differential lock, electrohydraulic engagement just as with front axle; standard front axle suspension; 600/65 R28 and 650/65 R42 test tyres

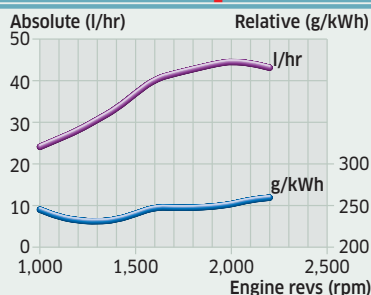
Service and maintenance | 22 litres of engine oil (500hr intervals), 45 litres of gearbox oil, 104 litres of hydraulic oil (1,000 hours), 27-litre cooling system

Price | Axion 820 Cmatic with Cebis terminal and 50km/hr in base specification and with suspended front axle £126,800 (excl. VAT); £3,025 front linkage and £3,860 front pto

Output and Torque



Fuel consumption



Results from the test station

Pto output (boosted) |
Max (2,000rpm) 148.4kW
At rated speed 139.1kW

Fuel consumption |
Specific at max draft output 251g/kWh
Specific at rated speed 259g/kWh
Maximum at rated speed 44.6/43.1l/hr

Torque |
Max 821Nm (1,500rpm)
Torque rise 36%
Engine speed drop 32%
Start-off torque 130%

Transmission |
No. of gears in 4-12km/hr range Stepless

Rear lift capacities | (90% max oil pressure, cor.)
Bottom/middle/top 6,814/8,374/9,164daN
Lift height under load 82.9cm (23.0-105.9cm)

Front lift capacities | (90% max oil pressure, cor.)
Bottom/middle/top 2,512/2,298/2,965daN
Lift range under load 76.7cm (8.0-84.7cm)

Hydraulic output |
Operating pressure 187 bar
Max flow 145.8l/min
Max output 37.2kW (134l/min, 166.7 bar)

Drawbar power |
Max (2,000rpm) 127.6kW (290g/kWh)
At rated speed 118.9kW (304g/kWh)

Noise level | (Under load at driver's ear)
Cab closed/open 76/83dB(A)

Braking |
Max mean deceleration Measuring equipment
Pedal force was defective at DLG

Turning circle |
4WD disengaged/4WD 13.00/13.40m

Test weight |
Front axle 3,890kg
Rear axle 4,915kg
Kerb weight 8,805kg
GVWR 12,000kg
Payload 3,195kg
Power-to-weight ratio 65kg/kW
Wheelbase 298cm
Track width front/rear 195/200cm
Ground clearance 43cm

Fuel economy at typical performance

Working areas	Out-put	Speed	g/kWh	l/hr
Standard speed pto 540rpm	100%	1,890	249	43.8
Economy pto 540E	100%	1,520	241	37.1
Standard speed pto 1,000rpm	100%	1,930	249	44.0
Economy pto 1,000E	100%	-	-	-
Engine in top speed range	80%	max.	272	36.1
High output	80%	90%	257	34.2
Transport work	40%	90%	322	21.4
Low output, 1/2 speed	40%	60%	262	17.4
High output, 1/2 speed	60%	60%	240	24.0

The test results

Engine | +
Performance characteristics 1.8
Fuel economy 2.0
Pto output/drawbar power 2.2
Strong performance characteristics, good fuel efficiency - 3% better than the average consumption level in this power bracket. Excellent pto output; drawbar power is satisfactory for a CVT tractor.

Transmission | +++
Gearbox ratios/functions 1.2
Shifting 1.1
Clutch, throttle 1.2
Pto 2.0
Simple-to-operate stepless transmission with 50km/hr at 1,720rpm engine revs; only three pto speeds.

Axles and running gear | +/0
Steering 2.5
Four-wheel drive and diff lock 1.5
Hand and foot brake 1.5
Front axle/cab suspension 2.0/2.0
Weight and payload 3.4
Agile tractor with direct steering; park brake almost makes the conventional hand brake unnecessary; front axle and cab suspension, powerful brakes, payload not enough for 50km/hr version.

Linkage/hydraulics | +++
Lift power and lift height 1.2
Operation 1.5
Hydraulic output 1.4
Spool valves 1.2
Hydraulic couplers 1.0
Impressive hydraulic output and capacity, large lift range and simple operation. Spools and couplers are beyond reproach.

Cab | +
Space and comfort 1.8
Visibility 1.8
Heating/ventilation 1.8
Noise level 3.1
Electric system 2.0
Build quality 2.0
Maintenance 2.0
Space and visibility are excellent for a tractor of this bracket; 76dB(A) noise level is OK.

Ability	Basic standards	Average standards	High standards	Field work	Grassland work	Transport work	Loader work

Price | Low High
£96,000 to £104,00

Typical farmer buying price after discount excl VAT for base specification Claas Axion 820 (50km/hr)

Grading system |
+++ very good, ++ good, + average,
- below average, -- poor

The individual marks are extracts from our assessments and do not necessarily result in a mathematically conclusive overall mark



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