

ENTAM - Test Report



Sprayer type:
Trade mark:
Model:

Trailed field crop sprayer
John Deere
R962i with centrifugal pump

Manufacturer:
John Deere Fabriek Horst B.V.
Energiestraat 16
NL—5961 HORST
Netherlands

Test report: D - 2029

Assessment table

No.	Contents	Assessment
1	Spray tank surface roughness	++
2	Spray tank over volume	++
3	Volume of total residual (here max. allowed 90 l)	++
4	Spray tank contents gauge up to 20% Filling	+
5	Spray tank contents gauge from 20% Filling	+
6	Agitation system	++
7	Width of nozzle bar section	+++
8	Boom height adjustment range	+++
9	Accuracy of pressure gauge	++
10	Accuracy of flow meter	see no.14
11	Regulation speed (section switching)	++
12	Even transverse distribution	++
13	Rinsing water tank	+
14	Regulation speed of volume/hectare adjustment device (spray computer) because of changing speed/gears.	++
15	Repeatability of volume/hectare adjustment device (spray computer)	+
16	Pressure drop between manometer and nozzle	++
17	Deviation of single nozzle output from table	+++

Fig.1+2: Assessment table and assessment keys of important test results.
 No.: 2;3;4;5;6;13 based on version with hydraulic driven centrifugal pump

No.	unit	+	++	+++	No.	unit	+	++	+++
1	µm	>70-100	30-70	<30	10	%	4-5	2-4	0-<2
2	%	5-8	>8-12	>12	11	%	>7-10	>3-7	0-3
3	of al-low.value	>2/3-3/3	1/3-2/3	<1/3	12	CV	>7-9	4-7	<4
4	%	7.5-5.0	<5.0-2.5	<2.5	13	times amount of dilutable residual	10-12	>12-14	>14
5	%	5.0-4.0	<4.0-2.0	<2.0	14	s	>5-7	2-5	<2
6	%	>10-15	5-10	<5	15	CV	>2-3	1-2	<1
7	m	4.5-6	>3-4.5	3 or less	16	%	>7-10	3-7	<3
8	m	1-1.5	>1.5-2.0	>2.0	17	%	>7-10	3-7	<3
9	bar	>0.10-0.20	>0.05-0.10	0.00-0.05					

Free download of the test under: www.ENTAM.net
 or www.jki.bund.de

Technical data of sprayer

- 6200 l nominal tank volume.
- 2 contents indicators (float with rope and electronical).
- 3 rotating nozzles for inner tank cleaning.

- 36 m working width (see test D1918)
- boom with 7 segments.
- lateral folding.
- recirculation system.
- boom lift: hydraulic with a height range of 2010 mm.
- boom pendulum with 10° range.
- slope compensation up to 13 %.
- damping system for horizontal and vertical boom movement.



Hydraulic driven centrifugal pump Hypro Pentair 9306 C with nominal 850 l/min at 3 bar.

Induction hopper with rotating can rinse nozzle.

Ground clearances 480 mm (drawbar) and 840mm (axle) with 520/85 R 46 tires.

Dimensions and weights :

total length:	7550 mm
height:	3320 mm
width:	3000 mm
unloaded weight:	5910 kg

Fig.3: Diagram of sprayer.

Description of sprayer



Fig.4: Sprayers right side view.

In this test the John Deere sprayer R962i was tested in a version with an optional hydraulic driven Hydro centrifugal pump.

Results not related to the pump and cleaning behaviour are based on the ENTAM test D1918.

The chassis of the sprayer is equipped with a suspended axle (polyurethane shock absorber). The trackwidth of this machine is 2.0 m. The chassis is designed for speeds up to 40 km/h (with full tank). For track following the drawbar is equipped with a steering sensor that is connected with the steering axle. The steering function can be operated via the joystick in the tractor cabin. The tank is designed without surge walls and with a round shape. Due to this the amount of depositions could be reduced and the effect of the agitation system and the cleaning device is increased. The pressure circulation system is with pneumatic nozzle control. When the pump is running and the main valve is off, liquid is pumped throughout the spray lines and returns to the tank. In this way the system charges the spray line up to the nozzles. When spraying starts, the return line changes into a supply line, which ensures a fast pressure build up within the boom.



Fig.5: Hydraulic driven centrifugal pump.

Description of sprayer

Both the flow sensor and the pressure sensor are fitted directly to the spray boom. The liquid system at the boom shows a uniform pressure build-up with a very low pressure drop in the spray lines. By means of a hydraulic lift system the boom height is continuously adjustable via a



Fig.6: Mid section of the boom.

parallelogram lifting system

with boom dampening system and hydraulic slope compensation. The inspected 36 m spray boom (Test D 1918) can also be moved around half folded as a 24 m spray boom. The automatic slope compensation works by means of two ultrasonic distance sensors (BoomTrac) at the boom, but it can also be controlled manually at the control terminal (GreenStar) in the driver's cabin. The boom slope compensation can level out slopes up to 13 % and the boom pendulum works in a range up to 10 °.

In the version with centrifugal pump the correct liquid flow rate is provided by the hydraulic regulated rotation speed of the pump. This includes functions like



rinsing, agitation and induction of chemicals to the tank. All hydraulic functions are controlled electronically, this means the tractor only needs a double-action control valve or a pressure connection with free return flow.

Fig.7: Folded boom with BoomTrac.

Description of sprayer

In order to fill or rinse the sprayer all necessary valves and connections are



Fig.8: Control centre and induction hopper on right sprayer side.

located on the left side of the sprayer. Emptying is also possible by pump. The induction hopper is fitted with: 3 rinse nozzles, 1 „anti-bridge“ nozzle for a better introduction of the chemicals into the suction line, 1 lid rinse nozzle and 1 can rinse nozzle with a spring-operated valve for internal cleaning of cans.

Result table

tested assembly			result (measured)		
spray tank	over volume			9.2 %	* min. 5 %
	contents gauge	graduation marks		50 l front;	
				1 l cabin screen	* max. 100 l
		deviation		6.0 %	* max. 7.5 % up to 1240 l filling
			-3.2 %	* max. 5 % between 1240 l and 6200 l	
surface roughness			0.047 mm	* max 0.1 mm	
rinsing tank	volume			695 l	* 10 times delutable residual on flat ground
	rinsing and dilution possible?			yes	
can rinsing equipment		rinsing efficiency		0.009 %	* max. 0.01 % of can contents
manometer	graduation marks			0.1 bar	* max. 0.2 bar
	deviation			0.2 bar	* max. 0.2 bar
agitation system	deviation from even concentration			7.6 %	*max. 15 %
residual in l		dilutable		49 l	* max. 103 l
		non dilutable		Non, recirculation system	
spray boom	height adjustment range			2010 mm	
	nozzle ground contact protection			yes	
	pressure loss between manometer and nozzle at 5 bar pressure			3.5 % (with DG 110 05)	* max. 10 %
	nozzle dripping after switch off			0 ml	* max. 2 ml
	transverse distribution				
			type of nozzle: TeeJet DG 11005 VS		
		pressure (bar)	distance (cm)	coefficient of variation (%) * (max. 9 %)	coefficient of variation (%) *(max. 9 %)
	1	50		5.9	
	3	50		5.4	
	5	50		5.5	

Fig.9: Result table 1.

Result table		
volume/hectare adjustment device		
repeatability of adjustment		
adjusted flow rate in l/ha	deviation from desired value % CV (max. 3 % CV)	deviation from desired value % CV (max. 3 % CV)
	ascending application rate	Descending application rate
240	2.1	0.34
300	1.3	0.38
360	1.7	0.28
<u>procedure</u>		regulation speed: deviation to adjusted value after 7 s
switching on / off		4.7 % after 7 s
switching of single sections		1.8 % after 7 s
<u>procedure</u>		reaching steady state after varying conditions (s)
change of driving speed by changing gears		steady state mean deviation
1.5 m/s to 2.0 m/s		0.6 s < 10 %
2.0 m/s to 2.5 m/s		0.3 s < 10 %
2.5 m/s to 2.0 m/s		0.6 s < 10 %
2.0 m/s to 1.5 m/s		1.1 s < 10 %

Fig.10: Result table 2.

Responsibility and recognition



Performing competent authority:
 Julius Kühn-Institute (Germany)
 Institute for Application Techniques in Plant Protection
 Messeweg 11-12
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This test is recognized by the ENTAM members:



BLT- Francisco Josephinum, Wieselburg - 029/15
 Biomass, Logistics, Technology (Austria)



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ENAMA Ente Nazionale per la Meccanizzazione Agricola (Italy) ENTAM „Rapporto di prova prestazionale“ 08/2015



HIAE Hungarian Institute of Agricultural Engineering (Hungary) D-106/2015



IRSTEA - National Research Institute of Science and Technology for Environment and Agriculture (France) IRSTEA/CEMAGREF/ENTAM/ 15/012



PIMR - Przemysłowy Instytut Maszyn Rolniczych Industrial Institute of Agricultural Engineering (Poland) PIMR-123/ENTAM/15