Julius Kühn-Institut
Federal Research Centre for Cultivated Plants

ENTAM

# ENTAM - Test Report


**Sprayer type:** Built on field crop sprayer
**Trade mark:** John Deere
**Model:** R4050i WS

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

**Test report: D - 2051**

March 2017

## Assessment table

| No. | Contents | Assessment |
|---|---|---|
| 1 | Spray tank surface roughness | +++ |
| 2 | Spray tank over volume | + |
| 3 | Volume of total residual (here max. allowed 97 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 | +++ |
| 12 | Even transverse distribution | ++ |
| 13 | Rinsing water tank | + |
| 14 | Deviation of volume/hectare adjustment device (spray computer) from desired value | + |
| 15 | Repeatability of volume/hectare adjustment device (spray computer * | ++ |
| 16 | Pressure drop between manometer and nozzle | +++ |
| 17 | Deviation of single nozzle output from table | ++ |

Tab.1+2: Assessment table and assessment keys of important test results. *) changed requirement

| 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 | % | >7-7.5 | >3-7 | 0-3 |
| 3 | of allow.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 | 10-12 | >12-14 | >14 |
| 5 | % | 5.0-4.0 | <4.0-2.0 | <2.0 | 14 | s | >4-7 | 2-4 | <2 |
| 6 | % | >10-15 | 5-10 | <5 | 15 | deviation % | >4-6 | 2-4 | <2 |
| 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.julius-kuehn.de*

# Technical data of sprayer

- 36 m working width.
- 12 hydraulic sections.
- Carbon fiber / steel boom.
- Infinitely variable from 430mm - 2480 mm.

- 5000 l tank.
- Electronic contents indicator.
- Spray computer Continental AXE 52210.
- 507 l rinsing water tank.

- 21 l hand wash tank.

Fig.1: Overview of the spray equipment.

- 2.0 - 2.5 m track width.
- 910 mm ground clearance.
- all wheel steering.

- pump „Hypro 9306 C“ with 711 - 446 l/min at 2 - 6 bar.

Dimensions and weights :

| | |
|---|---|
| total length: | 9050 mm |
| height: | 3700 mm |
| width: | 3070 mm |
| unloaded weight: | 12000 kg |

## Description of sprayer

Fig.2: View of the left sprayer side with equipment box, control centre and induction bowl.

The framework of the sprayer is made of steel profiles with the tank situated on the top. The sprayer is connected at four support points with the carrier vehicle. The carrier is equipped with a 190 KW engine, hydraulic 4 wheel drive and pneumatic spring mounted axles. It is designed for a road speed of 40 km/h. The spray tank with a nominal volume of 5000 l is made of polythene and without splash walls. He keeps an over volume of 6 % to hold back foam. The pressure agitation system in the spray tank is indefinitely adjustable from 0 to maximum. The two clean water tanks for rinsing and diluting hold a volume of together 507 l. The hand wash tank for the operator has a volume of 21 l.

Fig.3: 36m steel / carbon fibre boom.

## Description of sprayer

Fig.4: Boom lift for the lateral folding boom.

The boom is made from steel and carbon fiber elements. Thanks to the use of carbon fiber the weight can be reduced, compared with steel.
The boom can be adjusted in height indefinitely between 430 mm and 2480 mm.
As option, the boom can be equipped with the “Boom Trac Pro” system. There 3 ultrasonic sensors (at the boom tips and in the middle) control the boom height.

Via pneumatic single nozzle switching the nozzles can be selected individually. The nozzle stations are equipped with fivefold nozzle holders with bayonet caps. The nozzles are connected with a pressure circulation system which assures that the full spray concentration is available for all nozzles right at the beginning of the spray operation and on the other hand the fluid conduction parts of the boom can be rinsed independently. The boom can also be used partly folded as a 18 m boom.

Fig.5: Right sprayer side: filters and filling connections.

## Description of sprayer

Fig.6: Induction bowl with rotating nozzle for can cleaning.

Functions like filling, cleaning, agitation, emptying can be controlled from the control centre at the left sprayer side or the control panel in the cabin.

In the cabin the functions can be controlled via a Greenstar 3 touch-screen (10”) and a lever on the right armrest which also integrates all important hydraulic functions.

The induction bowl with a nominal capacity of 45 l is equipped with cover, container rinsing nozzle and a circular pipe. All functions perform electromechanically. In use the opening is lowered to 850 mm height.

Fig.7: Drivers place with 10“ touch-screen terminal and lever for steering of sprayer functions.

# Result table

| tested assembly | | | | result (measured) | |
|---|---|---|---|---|---|
| spray tank | over volume | | | 6.3 % | * min. 5 % |
| | contents gauge | | graduation marks | electronical display | * max. 100 l |
| | | | deviation | -0.9 %<br>4.5 % | * max. 7.5 % between 500l and 1000 l.<br>* max. 5 % between 1000 l and 5000 l |
| | surface roughness | | | 0.027 mm | * max 0.1 mm |
| rinsing tank | volume | | | 507 l | *10 % of nominal volume |
| | rinsing and dilution possible? | | | yes | |
| | Cleaning performance (main tank) (concentration after cleaning) | | | 2876 | Min.factor 400 of concentration before cleaning |
| can rinsing equipment | | rinsing efficiency | | <0.01 % | * max. 0.01 % of can contents |
| manometer | graduation marks | | | 0.1 bar | * max. 0.2 bar |
| | deviation | | | -0.1 bar | * max. 0.2 bar |
| agitation system | deviation from even concentration | | | 14.6 %** | *max. 15 % |
| residual in l | | | dilutable | 60.1 l | * max. 97 l |
| | | | non dilutable | Non, recirculation system | |
| spray boom | height adjustment range from - to | | | 430 mm - 2480 mm | |
| | nozzle ground contact protection | | | yes | |
| | pressure loss between manometer and nozzle at 3 bar pressure | | | -1.9 % | * max. 10 % |
| | nozzle dripping after switch off | | | 0 ml | * max. 2 ml |
| | single nozzle flow rate | | | | |
| | | pressure (bar) | flow rate (l/min) | max. deviation from table in % *(max. 10 %) | max. deviation from mean in % *(max. 5 %) |
| | | 3.0 | 1.188 | -4.2 | 3.5 |
| | transverse distribution | | | | |
| | pressure (bar) | | distance (cm) | coefficient of variation (%) *(max. 9 %) | |
| | | 2.0 | 50 | 2.9 | |
| | | 3.0 | 50 | 4.3 | |
| | | 5.0 | 50 | 4.2 | |
| | Measured with : | | | Hypro GA 110-03 | |

Tab.3: Result table

* limit
**< 10 % if more than 500 l remain in tank

## Result table

| volume/hectare adjustment device | | | |
|---|---|---|---|
| repeatability of adjustment | | | |
| | adjusted flow rate in l/ha | deviation from desired value % ** ascending application rate | deviation from desired value % ** descending application rate |
| | 230 | -0.8 | -1.4 |
| | 320 | 0.1 | 0.6 |
| | 420 | -1.7 | 4.0 |
| procedure | | regulation speed: deviation to adjusted value after 7 s | |
| | switching on / off | 0.5 % | after 7 s |
| | switching of single sections | 1.9 % | after 7 s |
| procedure | | reaching steady state after varing conditions (s) | |
| | change of driving speed by changing gears | | steady state mean deviation |
| | 1.5 m/s to 2.0 m/s | 4.0 s | * |
| | 2.0 m/s to 2.5 m/s | 4.1 s | * |
| | 2.5 m/s to 2.0 m/s | 4.4 s | * |
| | 2.0 m/s to 1.5 m/s | 4.5 s | * |

Tab.4: Result table 2.

* limit: < 10 % after 7 s
** limit: m,ax. 6 %

Explanation on testing:

Testing takes place according to the Technical Instructions for ENTAM-Tests of Field Crop Sprayers (Rel.5). This procedure was developed by the competent testing authorities of the European countries participating in ENTAM and is based on the standard EN ISO 16119. This test is only a technical performance test which takes place without an accompanying field test. The test results apply only to the tested appurtenances of the sprayer. Statements on the behaviour of the sprayer with different appurtenances cannot be derived from these results.

## Responsibility and recognition

Performing competent authority:
Julius Kühn-Institute (Germany)
Institute for Application Techniques in Plant Protection Messeweg 11-12
D-38104 Braunschweig

## This test is recognized by the ENTAM members:

| | |
|---|---|
| **HBLFA** Francisco Josephinum<br>**BLT** Wieselburg<br>(Austria) | 024/2017 |
| **CMA** Generalitat de Catalunya<br>Centre de Mecanització Agrària (CMA)<br>(Spain) | EPH 03/17 |
| **ENAMA** Ente Nazionale per la Meccanizzazione<br>(Italy) | ENTAM „Rapporto di Agricola prova prestazionale" 04/2017 |
| **HIAE** (MGI) Hungarian Institute of Agricultural Engineering<br>(Hungary) | D-149/2017 |
| **IRSTEA** - National Research Institute of Sience and Technology for Enviroment and Agriculture<br>(France) (formerly CEMAGREF) | IRSTEA/CEMAGREF/ENTAM/ 17/019 |
| **PIMR** - Przemyslowy Instytut Maszyn Rolniczych Industrial Institute of Agricultural Engineering<br>(Poland) | PIMR-163/ENTAM/17 |