Julius Kühn-Institut
Federal Research Centre for Cultivated Plants

ENTAM

# ENTAM - Test Report


**Sprayer type:** **Self propelled turf sprayer**
**Trade mark:** **John Deere**
**Model:** **HD 200 SelectSpray**
(European Version)

**Manufacturer:**
John Deere Turf Care
6501 Highway 55 East
Fuquay-Varina, NC 27625
USA

**Test report: D - 1849**

Jun 2015

## Assessment table

| No. | Contents | Assessment |
|---|---|---|
| 1 | Spray tank surface roughness | +++ |
| 2 | Spray tank over volume | ++ |
| 3 | Volume of total residual (here max. allowed 16.5 l) | + |
| 4 | Spray tank contents gauge from 10 % 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 | non |
| 9 | Accuracy of pressure gauge | ++ |
| 10 | Accuracy of flow meter | - |
| 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 | +++ |

Fig.1+2: Assessment table and assessment keys of important test results.

| 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 | s | >5-7 | >2-5 | 0-2 |
| 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 | % of tank vol. | 10-12 | >12-14 | >14 |
| 5 | % | 5.0-4.0 | <4.0-2.0 | <2.0 | 14 | % | >4-6 | 2-4 | <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

- 700 l tank with 8.9 % over volume.
- flush type liquid indicator.
- 71 l rinsing water tank.

- 17.8 kW diesel engine.

- 6.5 m boom.
- electro-hydraulic boom folding.
- obstacle avoidance feature on the last 2 m length of the boom.
- foam indicators at the boom tips.

Hydraulic driven membran pump; type Hypro D115 with 96,5 l at 15 bar.

- rear wheel drive
- five speed gearbox
- differential lock
- 150 mm ground clearance with tyre size 26x12.00 + 23x10.5

Dimensions and weights :

| | |
|---|---|
| total length: | 3980 mm |
| height: | 2230 mm |
| width: | 2330 mm |
| unloaded weight: | 1272 kg |

Fig.3: Diagram of sprayer.

## Description of sprayer

The John Deere HD 200 is a spraying unit mounted on a ProGator 2030A carrier vehicle. It is designed for spraying of turf grounds like golf courses and is not equipped for road use. The tested carrier is motorized by a 17.8 KW Diesel engine from Yanmar (Tier 4 emmission class) with rear wheel drive and 5 speed gearbox and differential lock. According manufacturer´s data the carrier is also available as 4 WD version.

Fig.4: Carrier with mounted spraying unit with folded up support legs (between driver seat and tank), unfolded boom and foam marker

The complete spraying unit with tank, pump and boom can be put down from the carrier, than it rests on support legs in the front and at the centre part of the boom. The spray tank contains up to 700 l spray liquid (over volume 8.9 %). The tank is made from polyethylene and is without wash plates. For mixing of the spray liquid the tank is equipped with a pressure agitation system which consists of a central pipe with 8 injection nozzles and two pipes with additional 4 injection nozzles positioned near the left and right side of the tank. The tank can be rinsed by a rotating rinsing nozzle, positioned in the centre of the tank. The rinsing liquid is comming from a 71 l tank. For the cleaning of the outer surfaces of the sprayer, a tube connector is located near the control centre. For to show the remaining spray liquid in the tank, a tube indicator is mounted at the left side of the tank.

Fig.5: Shifter section for driving functions.

## Description of sprayer

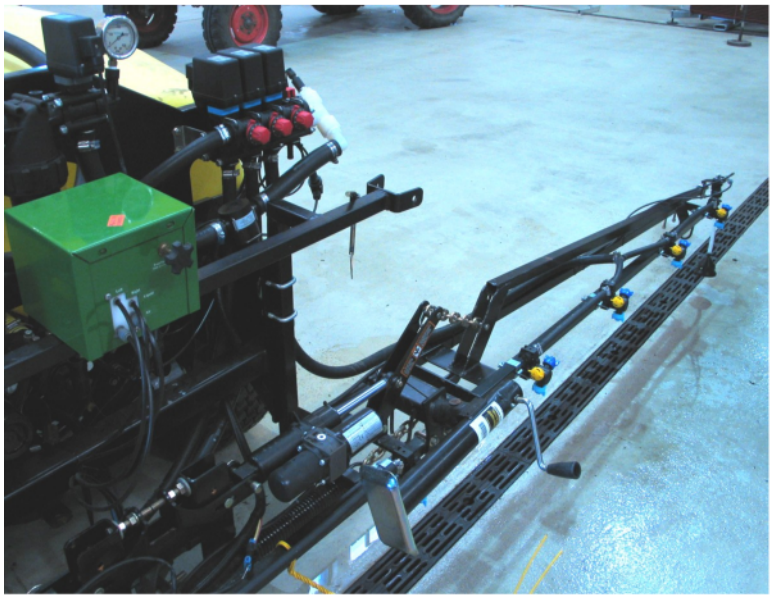

Fig.6: View of the right rear side with pressure gauge, section valves, boom folding device and support leg.

The spray liquid is pressurized by a hydraulic driven 3-chamber membrane pump, type Hypro D 115. The pump deliveres 96.5 l at a pressure of 15 bar (motor speed 2800 rpm). The boom has a working width of 6.5 m. The boom height can be fixed for a working heigth of 50 cm, it can`t be changed during spraying, the adjustable range of working height is less than 20 cm, therefore the sprayer can`t be used in higher plants. It is specialized for spraying on low grass like golf courses. The boom works without slope compensation and pendulum device. The outer boom segments (2m) are equipped with an obstacle avoidance device (coil spring), so in case of obstacle contact, these segments can give way to the front or the rear. The tested version was equipped with optional available foam markers at the boom tips, to make the borders of the working width visible on the grass. This makes it more easy to find the next track without spray gaps or overlapping areas between the tracks. For adjustment and control of the speed depending flow rate or pressure a TeeJet 844 spray computer is build in. The computer panel also contains the switches for the actuation of the main functions for spraying, like boom folding, switching of section valves, start / stop of spraying and switching the foam markers. The intensity of the agitator can be adjusted by a bypass valve located and operated at the boom mounting.


Fig.7: Spray computer,display and control panel near the drivers seat.

## Result table

| tested assembly | | | result (measured) | |
|---|---|---|---|---|
| spray tank | over volume | | 8.9 % | * min. 5 % |
| | contents gauge | graduation marks | 50 l | * max. 100 l |
| | | deviation | 1.0%<br>-4.0 % | * max. 7.5 % up to 140 l filling<br>* max. 5 % between 140 l and 700 l |
| | surface roughness | | 0.023 mm | * max 0.1 mm |
| rinsing tank | volume | | 71l corresponding to 10 % of nominal volume | * min. 10 % of nominal contents |
| | rinsing and dilution possible? | | yes | |
| can rinsing equipment | rinsing efficiency | | Not installed | * max. 0.01 % of can contents |
| hopper internal rinsing efficiency | | | Not installed | * max. 0.01 % of hopper cont. |
| Internal tank cleaning | cleaning efficiency | | 95.1 % | |
| Residue after cleaning | Resiude concentration | | 1036 | Reducing factor of PPP conc. in residual |
| manometer | graduation marks | | 0.1 bar | * max. 0.2 bar |
| | deviation | | 0.1 bar | * max. 0.2 bar |
| agitation system | deviation from even concentration | | -9.4 % | *max. 15 % |
| residual in l | | dilutable | 12.9 l | * max. 16.5 l |
| | | non delutable | 2.1 l | |
| spray boom | height adjustment range from - to | | 500 mm | fixed |
| | nozzle ground contact protection | | no | |
| | pressure loss between manometer and nozzle at 3 bar pressure | | 5.0 % (with Hypro ULD 04 ) | * max. 10 % |
| | nozzle dripping after switch off | | 0 ml | * max. 2 ml |

single nozzle flow rate

| type of nozzle: Hypro ULD 120-04 | | | |
|---|---|---|---|
| pressure (bar) | flow rate (l/min) | max. deviation from table in % *(max. 10 %) | max. deviation from mean in % *(max. 5 %) |
| 4.0 | 1.848 | 2.3 | - 1.1 |

transverse distribution

| type of nozzle: Hypro ULD 120-04 | | |
|---|---|---|
| pressure (bar) | distance (cm) | coefficient of variation (%) *(max. 9 %) |
| 1 | 50 | 4.4 |
| 3 | 50 | 6.3 |
| 4 | 50 | 5.9 |

Fig.8: 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) ascending application rate | deviation from desired value % CV (max. 3 % CV) Descending application rate |
| | 210 | 1.3 | 0.4 |
| | 300 | 1.1 | 1.0 |
| | 390 | 0.5 | 0.8 |
| procedure | | regulation time to adjusted (s) | |
| | switching on / off | 2.4 s | max 7 s |
| | switching of single sections | 1.5 s | max 7 s |
| procedure | | reaching stady state after varing conditions (s) | |
| | change of driving speed by changing gears | | stady state mean deviation |
| | 1.5 m/s to 2.0 m/s | 0.7 s | < 10 % |
| | 2.0 m/s to 2.5 m/s | 1.8 s | < 10 % |
| | 2.5 m/s to 2.0 m/s | 1.8 s | < 10 % |
| | 2.0 m/s to 1.5 m/s | 2.4 s | < 10 % |

Fig.9: Result table 2.

Explanation on testing:

Testing takes place according to the Technical Instructions for ENTAM-Tests of Field Crop Sprayers (Rel.5c). This procedure was developed by the competent testing authorities of the European countries participating in ENTAM and is based on the EN ISO standard 16119 „Sprayers and liquid fertilizer distributors - Enviromental protection“. 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:

| | |
|---|---|
| **BLT-** Francisco Josephinum, Wieselburg - Biomass, Logistics, Technology (Austria) | 035/15 |
| **CMA** Generalitat de Catalunya Centre de Mecanització Agrària (CMA) (Spain) | EPH 001/15 |
| **ENAMA** Ente Nazionale per la Meccanizzazione Agricola (Italy) | ENTAM „Rapporto di prova prestazionale" 11/2015 |
| **HIAE** Hungarian Institute of Agricultural Engineering (Hungary) | D-109/2015 |
| **IRSTEA** - National Research Institute of Sience and Technology for Enviroment and Agriculture (France) (formerly CEMAGREF) | IRSTEA/CEMAGREF/ENTAM/ 15/013 |
| **PIMR** - Przemyslowy Instytut Maszyn Rolniczych Industrial Institute of Agricultural Engineering (Poland) | PIMR-124/ENTAM/15 |

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