Inspection method for spray rate controllers in Belgium. (Flanders)

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1. Historically

- Inspection in Belgium mandatory since 1 September 1995.
- Federal Agency for Food Security (FAVV) responsible and supervising.
- Delegates the inspection to 2 independent regional authorities.
- Regional authorities are responsible for: Organisation, finances, accreditation, inspections, follow up,....
- Close collaboration between the two regional authorities.

**Flemish Region:**
- Institute for Agricultural and Fisheries Research (ILVO).
- Responsible for the Flemish region and Brussels capital region.

**Walloon region:**
- Centre Wallon de Recherches Agronomiques (CRA-W)
- Responsible for the Walloon region and the German speaking region.
1. Historically

- In the past decade the number of sprayers equipped with a spray rate controller increased significantly especially on field crop sprayers.
- First inspection cycle (1996-1997-1998) only 4.58% of the field crop sprayers was equipped with a rate controller.
- In the fifth inspection cycle (2008-2009-2010) this percentage increased to 20.37%.
- Also orchard sprayers are more and more equipped with a rate controller.
- Existing method was time and space consuming.
- Need for a less time and space consuming method.
2. Belgian law.

- Belgian legislation describes the inspection of spray rate controllers as follows:

“Mechanical and electronic regulation systems with a flow equal with the driving speed and the electronic indication from the sprayed volume per hectare are inspected (respectively D.P.A.m and D.P.A.e systems). The driving speed and the sprayed amount during a certain period are determined. The amount that is sprayed in reality is calculated and compared with the set values on the rate controller. When the difference between the amount that is sprayed in reality with the set value on the rate controller is more than 10% then the sprayer is rejected.”

- There is NO description on how to inspect this item!
- Inspection authorities need to set up a test protocol themselves.
3. Original test protocol (used until 2009)

**Step 1:**
- Set two marking points with 100m distance in between.
- “Run in Track” from at least 10 m desired.

![Diagram of a tractor with marking points](image)

**Step 2:**
- Program spray rate controller at desired rate.
- Drive “run in track” while spraying with rate controller in automatic mode and reaching desired speed.
3. Original test protocol (used until 2009)

**Step 3:**
- After driving run in track (pre-regulation of control valve)
- Close main valve and stop driving.
- Attach spraytest bags underneath 3 nozzles.

**Step 4:**
- Restart and drive at constant desired speed.
- Start up stopwatch at first marking point and open main valve.
- Close main valve after 100m and stop timer.

**Step 5:**
- Poor the contents of the test bags in an accurate measuring cup.
- Calculate the average.
- Put measured values into the spray rate calculation program.
3. Original test protocol (used until 2009)

**Disadvantages and inaccuracies:**

- When re-opening the main valve at the first “zero” marking point there is a re-regulation from the control valve.

- Difficult for driver:
  - maintaining constant speed,
  - opening main valve and closing while driving and at the correct marking point,
  - continuous concentration demanded

- Time consuming:
  - start-stop-start,
  - attaching bags,
  - pooring over bags,

- Long test track desired to line out inaccuracies
  - difficulties finding suitable locations
4. New test method (used from 2010 on)

**Basic idea:**

- In Belgium the nozzles are tested on a nozzle test bench.
- Average flow rate of the nozzle set is known.
- Select a nozzle that has a flow leaning on to the average flow of the complete nozzle set on the sprayer.
- Replace the test bags by a flowmeter between this nozzle and nozzle holder.
- Simultaneously activate a stopwatch and start the volume measurement through the flowmeter while driving. (no more stops)

**Main goals:**

- Shortening test track
- Decreasing test time
- Maintaining or even improving accuracy
- Easy to use
- Maintenance free
- Use of standard parts
- Low price
4. New test method (used from 2010 on)

**Development:**
- At first two different prototypes were developed (2008-2009)
- Different flowmeters were tested with a range suited to normal spray volumes.
- Different read out units were tested.

- In 2010 five final versions were made
  - 3 for daily use (3 teams) and 2 spares.
  - Flowmeter is built into a polycarbonate housing.
  - At the inlet a universal festo adaptor.
  - At the outlet a standard teejet nozzle holder.
  - Wired (+/- 9m) to a rate/volume read out unit through a double pole toggle switch.
  - Toggle switch interrupts pulses from flowmeter and also commands the stopwatch.
  - Single calibration point read out unit.
  - Standard long lasting Li-ion AA battery (2 year)
  - Usage from 1 l/min - 1.5l/min.
    
    (=200l/ha – 300 l/ha @ 6 Km/h)
  - Used in 2010 and 2011
4. New test method (used from 2012 on)

- For 2012 3 new versions were made due to range limitations from former version.
  - The same flowmeter is used.
  - But different read out unit with extended possibilities:
    - multiple calibration point possibilities depending on meter frequency.
    - usage from 0.75l/min-4l/min (=150l/ha – 800 l/ha @ 6Km/h)
    - enhanced programming facilities
    - stable read out of real time flow rate
    - firmer housing
5. Usage of the test unit

**Step 1:**
- Set two marking points with a 50 m distance in between (or even smaller distance).
- “Run in Track” from at least 10 m desired for preregulation.
- Mount the flowmeter on the nozzle holder with measured nozzle and put the read out unit into the cab.

![Diagram of test unit with marking points and flowmeter]

**Step 2:**
- Program spray rate controller at desired rate.
- Drive “run in track” at constant desired speed while spraying with rate controller in automatic mode.
- By passing first marking point activate flowratecounter and stopwatch by toggle switch and by passing second point deactivate ratecounter and stopwatch by toggle switch.
5. Usage of the test unit

**Step 3:**
- Read out the measured volume and time.
- Put the measured values into the spray rate calculation program.

<table>
<thead>
<tr>
<th>Computer</th>
<th>Gemeten waarden</th>
<th>Snelheid (km/h)</th>
<th>Volume (l/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Afgelegde afstand (m)</td>
<td>30</td>
<td>6,8</td>
</tr>
<tr>
<td></td>
<td>Chronometer tijd (sec)</td>
<td>27</td>
<td>6,67</td>
</tr>
<tr>
<td></td>
<td>Liter per dop over afgelegde afstand ()</td>
<td>0,18</td>
<td>98,04</td>
</tr>
<tr>
<td></td>
<td>Aantal doppen (stuk)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slip (%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Afstand tussen de boorrijten (m)</td>
<td>3,9</td>
<td></td>
</tr>
</tbody>
</table>
5. Usage of the test unit

**Advantages:**
- Driver can completely concentrate on driving and maintaining constant speed.
- No stop and start needed after preregulation but “on the go” measurement.
- Accurate measurement.
- No pouring over of sacks and extra calculations needed.
- Shorter test track possible.
- While testing real time flow rate can also be read out.
- Time saving.
- The equipment could also be used for nozzle flow rate measurement.

**Disadvantages:**
- For flows <0.75l/min another flowmeter should be used to obtain a good accuracy.
- Demands validation on a regularly base.
6. Conclusion

Conclusion:

- After 2 years of daily use we can conclude that the main goals were achieved:
  - Shortening test tracks.
  - Less time consuming test procedure.
  - Maintaining accuracy.

Thanks for your attention!