First results from the inspection of soil-disinfection machines in Belgium

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Belgian situation: General overview

- Mandatory sprayer inspection in Belgium since 1 September 1995 (3 year cycle)
- Federal Agency for Food Security (FAVV) responsible and supervising
- FAVV delegates the inspection to 2 independent regional authorities

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

Walloon region:
- Agricultural research centre (CRA-W)
- Responsible for the Walloon region and the German speaking region.

- Regional authorities are responsible for organisation, administration, accreditation ISO 17020, inspections, follow up, ...
- Close collaboration between the two regional authorities (same equipment, software, accreditation, ...)
Belgian situation : General overview

- **Field crop and orchard sprayers:**
  - Inspection services temporarily hire locations and invite farmers.
  - During spring, summer and autumn.
- **Greenhouse and soil disinfection machines:**
  - Are inspected on the farmyard.
  - During winter if possible (85%).

- **5 Inspection teams** in Belgium with 2 inspectors per team. (3 Flemish + 2 Walloon)
- **5 vans** with similar testing equipment:
  - Nozzle test bench,
  - Pressure gauge test set,
  - Nozzle adaptors,
  - Measuring cylinders,
  - Computer, tablet
  - ...
## Inspected PAE in Belgium

<table>
<thead>
<tr>
<th>Since</th>
<th>Type of PAE</th>
<th>Picture</th>
<th>Number</th>
<th>Price</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>Field crop</td>
<td></td>
<td>20.005</td>
<td>≤12m $→$ 82,5€ +1m=$+7,5€</td>
<td>20 min to 45 min</td>
</tr>
<tr>
<td>1995</td>
<td>Orchard and vineyard</td>
<td></td>
<td>1.770</td>
<td>≥24m $→$ 173,5€</td>
<td>20 min to 45 min</td>
</tr>
<tr>
<td>2011</td>
<td>Greenhouse and ornamental</td>
<td></td>
<td>815</td>
<td></td>
<td>20 min to 40 min</td>
</tr>
<tr>
<td>2014</td>
<td>Soil disinfection machines</td>
<td></td>
<td>16</td>
<td>Fixed 82,5€</td>
<td>45 min to 60 min</td>
</tr>
</tbody>
</table>

Note: Images of each type of PAE are provided in the table.
Belgian inspection procedure.

Most EU countries:
Inspections performed by the workshop.

Belgium:
Inspections performed by independent accredited regional authorities.

Inspections and reparations at the same time.

Inspections with detailed report:
Category I: Rejection (reparation within 4 months)
Category II: Reparation within 3 years (next cycle)
Category III: Advisory, no obligations

Cat I and/or Cat II minus 3year = OK?

Y

N

Repair(s) (owner or workshop)

INSPECTED MACHINE: Valid report and a sticker on the machine
Soil Disinfection: First inspection protocol

**Development:**
- Draft, based on existing Belgian protocols and EN 13790
- Adapted based on overviewing some machines
- Legally accepted march 2011
- Rejection (category I) only for 4 severe problems

**Actual Inspection started in 2014:**
- Due to:
  - The very small number of machines (wait for notifications)
  - Safety items to clear out (hazardous substances)
- Almost all machines were inspected in succession
- Performed by one inspection team

→ First inspections to be considered as advisory / trial!
Soil disinfection machine: Working principle

**AIR PRESSURE PART**
1) Compressor with air filter
2) Air pressure tank
3) Air pressure gauge air tank
4) Pressure shutoff valve
5) Pressure regulator
6) Air pressure gauge pesticide tank
7) Pressure relief valve
8) Depressurizing valve
(or 1-5 = scuba tank)

**LIQUID PART**
9) Pesticide filling valve
10) Pesticide tank
11) Filter (optional)
12) Flowmeter (optional)
13) Main valve
14) Flow valve (optional)
15) Section/dividing block
16) Pesticide pressure gauge (optional)
17) Injectors

**Belgian soil disinfection machines:**
- All known Belgian machines (19) use this working principle (16 inspected).
- Protocol focusses on this principle!
- BUT we know about the use of machines with small pumps = similar to normal (row) sprayers
  - Possibility to inspect with same protocol
  - Also foreseen to inspect rate controllers
Category I: Rejection

Rejection only possible for 4 items:

- Bad attachment from the machine to the tractor
- No pressure gauge
- Major leaks (> 30mL/min)
- Worn nozzles and inhomogeneity of the nozzle set

→ No problems for the first 3 items
→ BUT the 4th item was problematic!

Legally stated worn “nozzles” BUT:

- Most of the machines don’t use nozzles to calibrate the flow!
  - Small tubes per injector
  - Individual taps
  - Calibrated plates
- Measurement on a nozzle test bench is not possible for a lot of machines
- Terminology “nozzles” also not correct

→ Final choice was to downgrade “nozzle” remarks to Category II!
Category II: Reparation within 3 years

- [CATEGORYENAAAM] 50%
- [CATEGORYENAAAM] 50%
- [CATEGORYENAAAM] 12,5%
- [CATEGORYENAAAM] 18,8%
- [CATEGORYENAAAM] 6,3%
- [CATEGORYENAAAM] 6,3%
Category II: Reparation within 3 years

Uneven distribution for 50% of the machines: Individual difference >5% when compared with average flowrate of all injectors.

3a: MACHINES WITHOUT NOZZLES:
- Positioning a similar bucket underneath each injector.
- One weighing scale and a stopwatch

3b: MACHINES WITH NOZZLE INJECTOR:
- Nozzle flowrate measurement on machine with orchard nozzle test bench and a stopwatch
**Example 1 uneven distribution: Inspection number A13300016:**

- Self made machine with calibrated plates at injector height
- 7 injectors with measured flowrate from 0.72 L/min to 0.54 L/min
- Average flowrate 0.62 l/min
- Trendline shows a decreasing flow from 1 to 7:
  - Small section block?
  - Different hose lengths?
  - Injector 3 partly blocked?

![Distribution machine Nr A13300016](image)
Example 2 uneven distribution: Inspection number A13300004:

- Self made machine with calibrated plates in the dividing block
- 7 injectors with flowrate measured from 0,6 L/min to 1,04 L/min
- Average flowrate 0,94 l/min → difference injector 7 = 36%!
- Only injector 7 poses a problem (is not always used):
  - Long hose?
  - Excessive bended hose?
  - Blocked calibrated plate?

Category II: Reparation within 3 years
Category II: Reparation within 3 years

Bad working pressure gauge for 18.8% of the machines: difference >10% when compared with calibrated reference gauge.

Minor leaks for 12.5% of the machines: Minor < 30 ml/min.

Replace the single worn nozzle 6.3%: One of the machines with nozzles, one nozzle worn >10%.
Category II: Reparation within 3 years

Pressure instability for one machine: Difference >10%.

Replace or repair the bad compressor for the same machine: Bad dimensioned, self made machine.
Category III : Advisory

- CATEGORIENAAM: 19%
- CATEGORIENAAM: 19%
- CATEGORIENAAM: 25%
- CATEGORIENAAM: 25%
- CATEGORIENAAM: 31%
- CATEGORIENAAM: 68%
Category III : Advisory

Main issue is the liquid filtering:
- No pressure filter on 31% of the machines.
- No nozzle filter on 25% of the machines.
- No section filter on 25% of the machines.

→ BUT several distributions show problems with blockages !

Reasons:
- A lot of self made machines.
- Use of concentrated products → Assuming no contamination
- Probably cause of the blockages:
  - Tank rust?
  - Old disinfectant rests that dried up en loosen?

Solution = mounting minimum one liquid filter.
Category III : Advisory

When was given a remark:
- No filtering at all.
- Best option for the machine was indicated during the inspection.

Example 1: Machine with small tubes.
- A pressure filter was advised.
- Installing before the flowmeter.

Example 2: Machine with nozzles.
- Nozzle filters were advised.
- Easiest solution.
Category III : Advisory

Second important issue = tank contents indicator:
- Bad visibility/readability for 67,75%.
- No tank contents indicator at all for 18,75% of the machines.

→ Even with a flowmeter always interesting as a 2\textsuperscript{nd} line reference!

**Example 1:** Machine with glasses.
- Dirty glasses.
- Only rough estimation.

**Example 2:** Machine with hose.
- No markings on the tank.
- Rough estimation of contents.
Extra items notified

Some interesting extra items were notified during inspections:
- Those items were manually noted on the reports.
- Discussed during technical meetings.
- If relevant implemented in the updated protocol.

1) Important safety aspects:
Machines use a pressurized tank with hazardous pesticide.

A: Unsafe filling valve.
B: Safe depressurization.
C: Pressure safety valve.

On almost every machine there was a problem with A, B or C!
Extra items notified

2) Presence of a flowmeter on most of the machines:
Different types:
- Counters
- Counters + actual flow
- Only actual flow

All flowmeters were tested during inspections and captured flow was compared to flowmeter value

No problems and difference always <10%
Thank you

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