 Inspection of sprayers in Germany – results and experience over the past decades

Summary

Voluntary inspections of field sprayers have been offered in the Federal Republic of Germany since the end of the sixties and for air-assisted sprayers for orchards, vineyards and hops since the mid-eighties. As a result, Germany has gathered plenty of experience with the inspection of plant protection equipment. The inspections were based on uniform inspection requirements (BBA Guideline 1-3.2.1) and are carried out in about 1000 recognised workshops in about 2000 places. Workshops must be officially approved and use in most cases test facilities which have been approved by the BBA. Up to 1993 around 30 000 sprayers were inspected every year; in the meantime – after the introduction of the obligatory inspection of field sprayers in 1993 – the number of inspected sprayers has increased to about 63 000 per year. The inspection fee for field sprayers increased from 40 € per inspection in the year 1992 to 130 € in the year 1994 and to at last 145 € in the year 2003. Dripping nozzles, faulty manometers and unsatisfactory distribution were often the reason for not meeting minimum requirements. Future activities will be harmonising the national sprayer inspection with the European norm EN 13790.

1. Introduction

<table>
<thead>
<tr>
<th>Timeline - Inspection of sprayers in Germany</th>
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<td>End of the sixties to the beginning of the seventies</td>
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<td>1970</td>
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<td>1976 voluntary</td>
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<td>1983</td>
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<td>1993 obligatory</td>
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<td>2002</td>
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<td>2003</td>
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Fig. 1: Timeline – Inspection of sprayers in Germany
Already in 1970 the first test facilities for the testing of field sprayers were available. Still, from the beginning, all inspections were based on uniform inspection requirements throughout Germany which were published in BBA - leaflet 44. The guideline contains requirements for inspection, a code of inspection, an example of an inspection protocol, an example of a control label and a kind of code for approval of workshops. Workshops for agricultural equipment were and still are recognised workshops where the inspections are carried out on a regular basis. At present there are about 1000 inspection workshops which inspect plant protection equipment in about 2000 places. These inspection workshops are officially approved by the official plant protection authorities of the federal states ("Länder") in accordance with the code of approval.

BBA - leaflet 44 (first edition: 1976)

**Target:** All inspections everywhere in Germany should be uniform and the results must be comparable

Working group with official authorities and experts of plant protection equipment (manufacturer, dealers)

Uniform inspection requirements throughout Germany published in BBA - leaflet 44

Authority of the German „Länder“

Code of approval for workshops

Inspections are carried out only from recognised workshops in accordance with the code of inspection

Well trained personnel

Test facilities with good precision (in most cases approved by the BBA)

Example of control labels

Fig. 2: Workshop of the BBA – leaflet 44 with the target of uniform inspections and comparable results

The approved workshop must be able to show evidence of trained personnel and perform the inspections according to a uniform code of inspection. In most cases, only test facilities which have been approved by the BBA for the respective measuring task are used for the inspections.
2. The situation today – results and experience

Today - Obligatory Inspection in Germany

Basis

German Plant Protection Act with the ordinance, which regulates the inspection first on a voluntary way, later on (since 1993) an obligatory inspection of Sprayers already in use was established.

1993: Obligatory Inspection for field sprayers already in use
2002: Obligatory Inspection for air-assisted sprayers already in use

Two General Guidelines + Code of Approval + Code of Inspection

Working group (BBA + Official authorities of the „Länder“)

BBA - guideline 1-3.1.1 Requirements for facilities to test plant protection equipment already in use.
BBA - guideline 1-3.2.1 Features for testing field sprayers and air-assisted sprayers already in use.

Fig. 3: Situation today – Obligatory inspection in Germany

In the year 1983 the voluntary inspection of air-assisted sprayers started and changed to an obligatory inspection in the year 2002. The requirements for plant protection equipment already in use (Guideline 1-3.2.1 'Features for testing field sprayers and air-assisted sprayers already in use') were established by a working group consisting of representatives at the official plant protection service from the various federal states led by the BBA. These requirements are constantly adjusted to meet new technological developments and were last amended in December 2001. The BBA guideline 1-3.2.1 contains the main features for testing field sprayers and air-assisted sprayers already in use.

Sprayer parts to be tested are

? Drive - protection device for power transmission
? Pump - capacity, leakage, pulsation, pressure-relief device
? Agitator - clearly visible agitation
? Tank – no leakage, strainer in the tank dome, filling devices, collection at the outlet
? Controls – no leakage, function, readable during work, pressure gauge – accuracy
? Pipe-system – no leakage, no marks of bending
? Filtering – suction filter, pressure line filter
? Spray boom – stable design, no deformation or deflection, no liquid shall be sprayed onto the sprayer itself.
? Nozzles – all nozzles the same type, no dripping, cross distribution
? Blast – no deformation or corrosion
Following the introduction of the obligatory inspection for field sprayers in 1993 and for air-assisted sprayers in 2002, there was a sudden increase in the total amount of inspections carried out. Up to 1993, around 30,000 field sprayers were inspected; in the meantime, this number has increased to almost 63,000 per year. With the introduction of the obligatory inspection a transition period of 3 years took place. Sprayers which are inspected in 1993 have got a period of 3 years until the next cycle. The transition period is the reason for the big increase of the inspection numbers in the year 1996 and in the following two-year periods (1998, 2000 and 2002). The effect of the structural change in farming (number of farms decrease and farm areas increase) may be the reason for the decrease of total numbers of field sprayers in Germany from 170,000 in the year 1986 to 130,000 sprayers in the year 2003.

For air-assisted sprayers, the extent of inspections remained fairly constant over the years at around 3,000 inspections per year. However, it is expected that, because inspections have been compulsory since 2002, there will be a definite increase in the number of inspections carried out annually in the years to come.

Fig. 4: Number of inspections and total number of field sprayers in Germany
The inspection fee for field sprayers increased from 40 € per inspection in the year 1992 to 130 € in the year 1994 (after introduction of compulsory inspections) to at last 145 € in the year 2003. One reason for the increased inspection fee may be, that the inspection workshops invested in new test facilities, for example, equipment for measuring the cross distribution.

Originally, dripping nozzles, faulty manometers and unsatisfactory distribution were often the reason for not meeting minimum requirements; today this is also often due to controls, pipe systems and spray booms.

Fig. 5: Average inspection fee for field sprayers.

Fig. 6: Defects of field sprayers 1993 in relation to 2003
The measuring of the cross distribution is in Germany a central instrument to guarantee the spray quality and the chemical application later on in the field. Defects at the cross distribution decreased continually to at least round about 15% of the inspected sprayers. The knowledge and the training of farmers are going to be better and nozzles with poor spray quality are changed earlier than 20 years ago.

![Diagram showing defects at the cross distribution over years](image)

**Fig. 7: Cross distribution defects**

### 3. Conclusions

Basis for the inspections in Germany is the Plant Protection Act with the ordinance. A working group with members of the BBA and official authorities of the German federal states work out requirements for facilities and features for testing sprayers already in use. Inspection workshops must be recognised corresponding to the code of approval and carry out the inspections in accordance with the code of inspection. Inspected sprayers can reduce the environmental contamination, improving the biological efficiency and guarantee the chemical application in a proper way and also the intended use.

Future activities will be concentrated on harmonising national sprayer inspections with the European norm EN 13790. The necessary legal conditions already exist in Germany so that inspections carried out in the EU Member States and candidate countries in accordance with EN 13790 are also acceptable in Germany.
References


BBA-Merkblatt 1-3.2.1. Merkmale für die Prüfung in Gebrauch befindlicher Spritz- und Sprühgeräte für Flächen- und Raumkulturen.


Inspection of sprayers in Germany

Results and experience over the past decades

H.-J. Osteroth
Federal Biological Research Centre for Agriculture and Forestry
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1960s - 1970s</td>
<td>Acquisition of uniform requirements for the inspection of field sprayers by official plant protection service</td>
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<tr>
<td>1970</td>
<td>First test-benches for testing cross-distribution, pump-capacity and pressure-gauge are available</td>
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<tr>
<td>1976</td>
<td>Publication of „BBA-Leaflet 44“ with guidelines (requirements) for the inspection and a code of the inspection</td>
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<tr>
<td>1983</td>
<td>First inspections of sprayers for wine, hops and fruits</td>
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<tr>
<td>1993</td>
<td>Obligatory inspections for field sprayers every two years (since 1991: electronic test-benches for cross distribution are available)</td>
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<tr>
<td>2002</td>
<td>Obligatory inspections for sprayers for wine, hops and fruits every two years</td>
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<tr>
<td>2003</td>
<td>EN 13790 is established</td>
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</tbody>
</table>
BBA - leaflet 44 (first edition: 1976)

**Target:** All inspections everywhere in Germany should be uniform and the results must be comparable.

Working group with official authorities and experts of plant protection equipment (Manufacturer, Dealers)

- **Uniform inspection requirements throughout Germany** published in BBA - leaflet 44
- **Authority** of the German „Länder“
- **Code of approval** for workshops
- Inspections are carried out only from recognised workshops in accordance with the **code of inspection**
- Must have:
  - Well trained personnel
  - Test facilities with good precision (in most cases approved by the BBA)

Example of control labels

Example of an inspection protocol

Work out
Since 1970: Approved test facilities are available

A very early version of a patternator by G. Uhl (RHG-Germany <1970) - not approved, but mobile!

“Dositest”

“Quantitest“

“Manotest“

“Dositest“
Today - Obligatory Inspection in Germany

Basis

German Plant Protection Act with the ordinance, which regulates the inspection first on a voluntary way, later on (since 1993) an obligatory Inspection of Sprayers Already in Use was established.

1993: Obligatory Inspection for Field Sprayers Already in Use
2002: Obligatory Inspection for Air-assisted Sprayers Already in Use

Two General Guidelines + Code of Approval + Code of Inspection

Working group (BBA + Official Authorities of the German „Länder“)

BBA - Guidline 1-3.1.1
Requirements for Facilities to Test Plant Protection Equipment Already in Use.

BBA - Guidline 1-3.2.1
Features for Testing Field Sprayers and Air-assisted Sprayers Already in Use.
### BBA - Guidline 1-3.1.1: Requirements for Facilities to Test Plant Protection Equipment Already in Use.

| Facilities for cross distribution: | Paternator with 100 mm groove-width +/- 2,5 mm, 80 mm groove-depth, measuring-zylinders with 500 ml capacity min., scale 10 ml, accuracy 10 ml or 2 % or electronic facilities with the same accuracy |
| Facilities for pump capacity: | Measuring error < 2 % of the measured value or < 2 l/min |
| Facilities for flow-meters: | Measuring error < 1,5 % of the measured value |
| Facilities for pressure gauges: | min. 100 mm diameter, 0,1 bar precission (0-6 bar), 0,25 bar precission (6 - 16 bar) and 1,0 bar precission (> 16 bar) |
| Facilities for single nozzle output: | Measurement range 2 l, scale deviding 20 ml, max. error 20 ml |
BBA - Approved Facilities to Test Plant Protection Equipment Already in Use.
BBA - Approved Facilities to Test Plant Protection Equipment Already in Use.

AAMS „FR16“

Herbst „ED 16-2L“

LH-Agro „LH 1300“

AAMS „PT1“

Herbst „ROT 1200“
BBA - Guidline 1-3.2.1
Features for Testing Field Sprayers and Air-assisted Sprayers Already in Use.

Sprayer parts to be tested

1. Drive ✓
2. Pump ✓
3. Agitator ✓
4. Spray liquid tank ✓
5. Controls ✓
6. Pipe System ✓
7. Filtering ✓
8. Sprayboom ✓
9. Nozzles ✓
10. Blast ✓

Annex: Example of an inspection protocol
Experience of the last decades

Average of the Inspection Fee (€) for Field Sprayers from 1989 - 2003

Since 2000 in Bavaria only the Inspection Fee (without the amount for the work)

Estimated Inspection Fee with the amount for the work (Bavaria)

Span width 2003: 60 € - 340 €
Experience of the last decades

Average of the Inspection Fee (€) for Air-assisted Sprayers from 1996 - 2003

Span width 2003: 48 € - 120 €
Number of inspections of field sprayers and of air-assisted sprayers in the years 1984 to 2003

- **Field Sprayers**
- **Air assisted Sprayers**
- **Total Number of Field Sprayers in Germany**

Years: 1984 to 2003

- **Number of Inspections**
- **Year**
Experience of the last decades - Number of inspections

Two-Year average of inspections of Field Sprayers (1993 - 2004)
(values for 2004 were estimated)

Number of inspected Field Sprayers
Number of Field Sprayers in Germany (mostly estimated)

Average over two year time period: 115000
Experience of the last decades - Number of inspections

Number of inspections of Air-assisted Sprayers in the years 1984 to 2003

- Number of inspections of Air-assisted Sprayers in the years 1984 to 2003
- Total Number of Air-Assisted Sprayers in Germany

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Inspections</th>
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<tbody>
<tr>
<td>1984</td>
<td>19</td>
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<td>1985</td>
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</table>

- Air-assisted Sprayers
- Total Number of Air-Assisted Sprayers in Germany
Experience of the last decades - Defects at inspected Sprayers

Defects at the anti drip devices 1979 - 2003

Trend

Ball valves

Membran valves

(%) of the Inspections

Year

79 81 83 85 87 89 91 93 95 97 99 01 03
Experience of the last decades - Defects at inspected Sprayers

Defects at the Manometer 1979 - 2003

Trend

(% of the Inspections)

Year


35
30
25
20
15
10
5
0
Experience of the last decades - Defects at inspected Sprayers

Defects at the Controls

<table>
<thead>
<tr>
<th>Year</th>
<th>(%) of Insections</th>
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<tbody>
<tr>
<td>79</td>
<td>Controlers by hand</td>
</tr>
<tr>
<td>81</td>
<td>Controlers with electric valves</td>
</tr>
<tr>
<td>83</td>
<td></td>
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<td>85</td>
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Trend
Experience of the last decades - Defects at inspected Sprayers

Defects at the cross distribution

Farmers changes nozzles earlier than 20 years ago
Experience of the last decades - Defects at inspected Sprayers

Defects at Field Sprayers in the years 1993 and 2003

- Drive
- Pump
- Agitator
- Tank
- Controls
- Manometer
- Pipe System
- Filtering
- Sprayboom
- Nozzles/Crossdistribution
- Anti drip device

(%) of Inspections

- 1993
- 2003
### Summary

**Basis** for inspections in Germany is the [Plant Protection Act](#) with the Ordinance

A [working group](#) (BBA + Official Authorities of the German „Länder“) work out Requirements for Facilities and Features for Testing

Workshops must be [recognised](#) corresponding to the [code of approval](#) and carry out the inspections in accordance with the [code of inspection](#)

**Approved** facilities are very helpful and are always mobil

Inspected Sprayers can:
- reduce the environmental contamination
- improving the [biological efficiency](#)
- guarantee the chemical application in a proper way and the intended use
- reduce the [amount of chemicals](#) in some cases
The costs for the inspection is 75 € per year - that represent <1,5 % of the annual effort of plant protection chemicals even of a small farm (35 ha = Average farm size in Germany)
Future activities

Harmonising of the national sprayer inspections with the European norm EN 13790

The national legal conditions already exists so that inspections carried out in the EU Member States and candidate countries in accordance with EN 13790 are also acceptable in Germany!