

Berichte

aus der Biologischen Bundesanstalt für Land- und Forstwirtschaft

Reports

from the Federal Biological Research Centre for Agriculture and Forestry

Heft 57

2000

Second revised edition of Heft 25

Synopsis of Testing Plant Protection Equipment in the Federal Republic of Germany



Published on the Occasion of the
50th Anniversary

of Testing Plant Protection Equipment at the
Federal Biological Research Centre for Agriculture and Forestry
in Braunschweig

Bearbeitet von
compiled by

Siegfried Rietz

Abteilung für Pflanzenschutzmittel und Anwendungstechnik

Department for Plant Protection Products and Application Techniques



BBA

Herausgeber

Biologische Bundesanstalt für Land- und Forstwirtschaft
Braunschweig, Deutschland

Verlag

Eigenverlag

Vertrieb

Saphir-Verlag, Gutsstraße 15, D-38551 Ribbesbüttel

Telefon 0 53 74/65 76

Telefax 0 53 74/65 77

ISSN 0947-8809

Kontaktadresse

Dipl.-Ing. Siegfried Rietz und Dipl.-Ing. Dirk Rautmann
Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik

Messeweg 11/12

D-38104 Braunschweig

Telefon +49/(0)5 31/2 99 36 52

+49/(0)5 31/2 99 36 53

Telefax +49/(0)5 31/2 99 36 12

+49/(0)5 31/2 99 36 12

E-Mail S.Rietz@BBA.de

D.Rautmann@BBA.de

© Biologische Bundesanstalt für Land- und Forstwirtschaft

Das Werk ist urheberrechtlich geschützt. Die dadurch begründeten Rechte, insbesondere die der Übersendung, des Nachdrucks, des Vortrages, der Entnahme von Abbildungen, der Funksendung, der Wiedergabe auf fotomechanischem oder ähnlichem Wege und der Speicherung in Datenverarbeitungsanlagen, bleiben, auch bei nur auszugsweiser Verwertung, vorbehalten.

Preface

This report represents the second revised edition of book 25 of the reports from the Federal Biological Research Centre for Agriculture and Forestry which was first published in 1997.

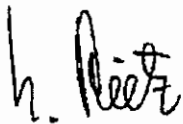
It contains Legal Requirements and Publications of the Federal Biological Research Centre for Agriculture and Forestry (BBA) on the testing of plant protection equipment.

This new edition became necessary because book 25 was out-of-print. Changes in the Plant Protection Act and in the Regulation on Plant Protection Products and Plant Protection Equipment had been taken into consideration. A new section on the newly established 'List of Loss Reducing Equipment' had been included. In some cases the translation was revised.

The present document provides a completed compilation of the most important regulations governing the testing of plant protection equipment in the Federal Republic of Germany. Those sections of the Plant Protection Act and of the Regulation on Plant Protection Products and Plant Protection Equipment which refer to plant protection equipment have been extracted. Please note that in law cases the German text is legally binding.

Note of the author

At the end of this year, after 23 years of a rich working life in the 'Biologische Bundesanstalt für Land- und Forstwirtschaft, Braunschweig' (Federal Biological Research Centre for Agriculture and Forestry), I am going to retire and would therefor like to thank all my colleagues at home and abroad, especially the head of the 'Application Techniques Division', Dr.-Ing. Heinz Ganzelmeier, for a smooth and, I trust, fruitful co-operation.

A handwritten signature in black ink, appearing to read 'H. Rietz'.

Content

	Page
Preface	1
Section I - Obligatory Testing of Plant Protection Equipment	5
Preliminary Remarks to the Procedure of Declaration for Plant Protection Equipment	7
Act Concerning the Protection of Crop Plants (Plant Protection Act -Pflanzenschutzgesetz) of 14 May 1998	9
Regulation on Plant Protection Products and Plant Protection Equipment (Regulation on Plant Protection Products) of 17 August 1998	15
Features for the Testing of Plant Protection Equipment	21
Explanations on the Procedure of Declaration	37
Section II - Voluntary Testing of Plant Protection Equipment	51
A. BBA-Approval	
Preliminary Remarks to the Voluntary Testing of Plant Protection Equipment	53
Regulations for Testing Plant Protection Equipment (Guideline VII, 1-2.3.1)	55
Explanations for the Testing of Plant Protection Equipment (Guideline VII, 1-2.3.2)	61
Application Form	67
Supplementary Requirements and Recommendations for Plant Protection Equipment to be Tested in Compliance with Article 33 of the Plant Protection Act (Guideline VII, 1-2.1)	69
Requirements for Nozzles	91
Guideline for the Test of Tank Agitators (Guideline VII, 1-1.2.1)	93
Determination of the Rest Volume of Liquid (Guideline VII, 1-1.2.2)	97
Examination of Flow Control Devices on Field Crop and Orchard Sprayers (Guideline VII, 1-1.2.3)	101
Determination of Droplet Size Characteristics of Spray Nozzles for Plant Protection Equipment (Guideline VII, 1-1.2.4)	105

	Page
B. Loss Reducing Technique	109
Preliminary Remarks to the Official List of Drift Reducing Technique	111
Procedure for the Entry of Plant Protection Equipment in the Chapter Drift of the List of Loss Reducing Equipment (Guideline VII, 1-2.3.3)	113
Measuring Direct Drift when Applying Liquid Plant Protection Products Outdoors (Guideline VII, 2-1.1)	121
SECTION III - Inspection of Plant Protection Equipment - Already in Use	133
Preliminary Remarks to the Testing of Plant Protection Equipment Already in Use (Inspection)	135
Proposal for Uniform Enforcement of Plant Protection Equipment Inspections in the Federal States (Laender)	137
Proposal for Administrative Regulations in the Federal States (Bundeslaender) (Inspection Regulation for crop protection equipment)	143
Requirements for Facilities to Test Plant Protection Equipment Already in Use (Guideline VII, 1-3.1.1)	147
Features for Testing Field Sprayers Already in Use (Guideline VII, 1-3.2.1)	153
Features for Testing Air-assisted Sprayers for Bush and Tree Crops Already in Use (Guideline VII, 1-3.2.2)	163
Optimum Adjustment of the Vertical Distribution of Air-assisted Sprayers for Orchards	173
Optimum Adjustment and Handling of Air-assisted Sprayers in Vinyards	177
Section IV - Appendices -	181
Appendix A Guidelines for the Application of Plant Protection Products with the Use of Aircraft	183
Appendix B A historical Survey of the Development of Plant Protection Testing in the Federal Republic of Germany	193
Appendix C Description of Test Facilities Used in the Application Techniques Division	197

SECTION I

Obligatory Testing of Plant Protection Equipment

Preliminary Remarks to the Procedure of Declaration for Plant Protection Equipment (§§ 25 to 29 of the Plant Protection Act)

The Act on the Protection of Crop Plants (Plant Protection Act) of 15th September 1986 (revised 14th May 1998) significantly widened the official testing of plant protection equipment. From 1st July 1988, a procedure of declaration which regulates the placing of plant protection equipment on the market became legally binding.

Under the law, plant protection equipment may only be placed on the market if it is designed in such a way that, when used properly and as intended for the application of plant protection products, it will not produce any harmful effects on human or animal health or on groundwater nor shall it have any other harmful effects, particularly on the natural balance, which can be avoided by using state of the art techniques (Article 24 Plant Protection Act). The requirements for plant protection equipment are specified in detail in the Regulation on Plant Protection Products and Plant Protection Equipment of 28th July 1987 (revised 17. August 1998).

They apply to all plant protection equipment except small devices. The Federal Biological Research Centre for Agriculture and Forestry (BBA) works out and publishes criteria (features) against which compliance with these requirements is measured. For this purpose, it has set up an expert group on the equipment declaration procedure composed of representatives of the official crop protection services and of manufacturers. The group advises the BBA on the criteria which have to take account of the current state of technology. A number of BBA guidelines which summarize the criteria valid for the different types of equipment and lay down regulations and provisions concerning the examination procedure are generally available.

Covering plant protection equipment except small equipment, the procedure of declaration took effect on 1st July 1988 under which the manufacturer, the distributor (if it intends to market the plant protection equipment for the first time) or the person importing the plant protection equipment for the first time for commercial purposes shall declare to the Biologische Bundesanstalt that the equipment type meets the requirements set out in Article 24 of the Plant Protection Act. The declaration has to be supplemented by comprehensive and detailed documentation on the basis of which BBA examines compliance with the mentioned legal requirements (features).

The BBA keeps and regularly publishes a list of plant protection equipment which registers only equipment which complies with the mentioned requirements. If equipment is suspected of not fulfilling the requirements, the BBA may request the equipment to be sent in for examination. If an examination shows that the equipment does not comply with the requirements, it will be deleted from the plant protection equipment list. As a consequence, it is not marketable. Intentional or negligent contravention of this legal regulation may be punished by a fine.

Extract which Refer to Plant Protection Equipment of the

Revision of the

Act Concerning the Protection of Crop Plants

(Plant Protection Act - Pflanzenschutzgesetz)

14 May 1998

published:

Bundesgesetzblatt I, 1998, pp. 971, 1527 and 3512

Section One General Provisions

Article 1 Purpose

The purposes of this Act are:

1. to protect plants, particularly crop plants, against harmful organisms and non-parasitic impairments,
2. the protection of plant products against harmful organisms,
3. (deleted)
4. to avert dangers that may result from the use of plant protection products or other plant protection measures, especially those relevant to human and animal health and the natural balance,
5. to enforce legal instruments issued by the European Community in the field of plant protection.

Article 2 Definitions

(1) For the purpose of this Act, the following terms are defined as follows:

11. "*plant protection equipment*" means:
equipment and devices intended for the application of plant protection products;

Section Five
Plant Protection Equipment

Article 24
Marketing; importation

Plant protection equipment may be placed on the market or imported only if it is designed in such a way that, when used properly and as intended for the application of plant protection products, it will not produce any harmful effects on human or animal health or on groundwater nor shall it have any other harmful effects, particularly on the natural balance, which can be avoided by using state of the art techniques.

Article 25
Declaration

(1) Before plant protection equipment, with the exception of small devices, is placed on the market or imported for the first time, the manufacturer, the distributor (if it intends to market the plant protection equipment for the first time) or the person importing the plant protection equipment for the first time for commercial purposes shall declare to the Biologische Bundesanstalt that the equipment type meets the requirements set out in Article 24.

(2) The declaration must contain:

1. the name and address of the manufacturer, distributor or importer;
2. the designation of the equipment type and the area of use.

(3) The declaration must be accompanied by:

1. the instructions for use;
2. a description of the equipment type and
3. any other documents necessary for assessment.

(4) The documents referred to in paragraph (3) must be resubmitted or supplemented in the case of modifications to the equipment type influencing the application of plant protection products.

(5) The Federal Biological Research Centre may waive the declaration if the plant protection equipment is intended for research, investigation, trial or exhibition purposes.

Article 26
Plant protection equipment list

(1) The Biologische Bundesanstalt shall keep a list of the equipment types for which a declaration under Article 25 has been submitted (plant protection equipment list).

(2) The Biologische Bundesanstalt shall announce entries in the plant protection equipment list and the deletion of such entries in the Bundesanzeiger.

Article 27

Testing

(1) The Biologische Bundesanstalt may test plant protection equipment to establish whether it meets the requirements of Article 24. It shall give priority to testing plant protection equipment whose declaration or accompanying documents give rise to doubts as to whether the plant protection equipment meets the requirements of Article 24.

(2) In specific cases, the Biologische Bundesanstalt may order the manufacturer, distributor or importer to supply it with one plant protection machine for testing.

Article 28

Results of the testing

If testing reveals that the plant protection equipment does not meet requirements, the Biologische Bundesanstalt shall delete the relevant entry from the plant protection equipment list. In case of minor shortcomings, the Biologische Bundesanstalt may initially refrain from deleting the entry and set the manufacturer, distributor or importer a reasonable deadline for eliminating them. Until this period has elapsed, plant protection equipment of this type may continue to be marketed with these shortcomings in derogation of Article 24.

Article 29

Instructions for use

In the case of importation and marketing of plant protection equipment, the instructions for use must be supplied in German. They must also include:

1. the name and address of the manufacturer, distributor or importer,
2. the designation of the equipment and the area of use.

Article 30

Empowerments

(1) The Federal Ministry of Food, Agriculture and Forestry shall, with the consent of the Bundesrat, be empowered to issue ordinances

1. as far as this is necessary for attaining the purpose stated in Article 1 no. 4,
 - a) to specify in greater detail the requirements for plant protection equipment under Article 24,
 - b) to require holders of a right of disposal and owners to have plant protection equipment already in use tested,
 - c) to prohibit the use of plant protection equipment which does not meet the requirements laid down in an ordinance as specified in a) or which has not been tested as specified in b);
2. to define the term "small devices" as referred to in Article 25 (1),
3. to lay down details of the procedure for testing plant protection equipment, and in particular the nature and scope of documentation required under Article 25 (3).

(2) The governments of the Länder shall be empowered to issue ordinances requiring holders of rights of disposal and owners to have plant protection equipment already in use tested and to lay down details of this procedure if the Federal Ministry of Food, Agriculture and Forestry does not exercise its own powers in the matter and insofar as this is necessary for attaining the purpose set forth in Article 1 no. 4. They may also stipulate that testing shall be carried out by officially recognised inspection facilities and may lay down the requirements to be met for approval, loss of approval and the procedure for granting approval. The governments of the Länder may, by ordinance, delegate these powers to supreme state authorities while stipulating that these authorities may in turn delegate the aforementioned powers, by ordinance, to subordinate authorities or authorities otherwise under their control.

Section Eight
Authorities; Monitoring

Article 33
Biologische Bundesanstalt

(1) The Biologische Bundesanstalt is an autonomous superior federal authority under the jurisdiction of the Federal Ministry of Food, Agriculture and Forestry.

(2) In addition to the tasks which have been or shall be assigned to it by this Act, by ordinances as specified in Articles 7 and 17 (1), Article 18a (3), Article 19 (2), Article 30 (1), Article 31a (1) sentence 4, Article 31c (2) sentence 2, Article 31d (2), and Article 38b sentence 2 or by other legal provisions, the Biologische Bundesanstalt shall have the following tasks:

4. to participate in the monitoring of plant protection equipment of the equipment types in the plant protection equipment list;
5. to test plant protection equipment;
6. to test and develop plant protection methods as well as participate in the closing of control gaps,

(3) The Biologische Bundesanstalt may test:

3. equipment and devices used in plant protection which do not constitute plant protection equipment.

(4) The Biologische Bundesanstalt shall publish a descriptive list of

2. plant protection equipment registered in the plant protection equipment list, detailing the features and properties important for the use of plant protection equipment;

Use may be made of test results from plant protection practice.

Article 34
Implementation in the Länder

(1) In the Länder, the enforcement of this Act, including the monitoring of compliance with its provisions as well as the ordinances issued and requirements stipulated under this Act, shall be the responsibility of those authorities designated under state law.

(2) In their role as the plant protection services, the designated authorities shall have the following terms of reference in particular:

5. testing plant protection products, plant protection equipment, plant protection methods, the resistance of plant species as well as co-operation in closing control gaps,
6. performing the studies and trials required for the tasks described in nos. 1 to 5.

Article 34 a
Official directives

In individual cases the designated authority may make arrangements for eliminating infringements of this Act or for preventing future infringements of this Act or of ordinances issued pursuant to this Act. It may, in particular, prohibit

2. the marketing of a plant protection product, plant resistance improver or plant protection equipment if the required authorisation or approval has not been shown or if the plant resistance improvers or plant protection equipment have not been entered in the respective lists as required.

Article 35
Co-operation with customs offices

(1) The Federal Ministry of Finance and the customs offices it has designated shall be involved in the importation, transport and exportation of harmful organisms and infested objects as well as the importation and exportation of plant protection products and plant protection equipment.

Article 37
Charges

(1) The Biologische Bundesanstalt shall levy charges (fees and expenses) for

1. official acts under this Act and

(2) Acting in agreement with the Federal Ministries of Finance and of Economic Affairs, the Federal Ministry of Food, Agriculture and Forestry shall be empowered to stipulate by ordinance, without the consent of the Bundesrat, the elements liable to charges and to provide for fixed or basic rates. Reasonable account shall be taken of the benefits of plant protection products, plant protection equipment, plant protection methods as well as of the devices and equipment used in plant protection for the general public. The expenses to be refunded may be regulated in derogation of the Administrative Expenses Act.

Section Nine
Obligation to Give Information; Transfer of Data; Penal and Administrative Fine Provisions

Article 38
Obligation to give information

(1) Natural and legal persons as well as associations of persons not having legal capacity shall, upon request, provide the designated authority with the information necessary for carrying out the tasks assigned to the authority by this Act or by virtue of this Act.

(2) Within the scope of paragraph (1), persons acting on behalf of the designated authority may, during office hours, set foot upon land and enter business premises and workrooms and means of transport belonging to the party required to furnish information and

1. carry out inspections and examinations for the presence of harmful organisms and examine plant protection equipment.

They may be accompanied on these inspections by experts of the Commission of the European Community or other member states. In order to prevent imminent dangers to public safety and public order, such land, business premises and workrooms and means of transport may also be entered in cases where they are at the same time used for residential purposes by the party required to furnish information. The latter shall tolerate the measures, assist the persons charged with the monitoring activities and submit the necessary business documents.

Article 40
Provisions concerning administrative fines

(1) An administrative offence is committed by any person

13. who, contrary to Article 24, markets or imports plant protection equipment which does not comply with an ordinance issued under Article 30 (1) no. 1a,
14. who, contrary to Article 25 (1) to (3) in conjunction with an ordinance issued under Article 30 (1) no. 2 or 3, fails to submit a declaration or fails to do so correctly, completely or in due time or, contrary to Article 25 (4), who fails to submit or supplement documents,
15. who, contrary to Article 29, sentence 1, fails to supply the instructions for use with the equipment,
17. who, contrary to Article 38 (1), fails to furnish information or fails to furnish it correctly or completely or who, contrary to Article 38 (2) sentence 3, fails to tolerate a measure, assist a person charged with the task of monitoring or supply business documents or who fails to tolerate a measure contrary to Article 38 (3) sentence 2.

(2) In the cases specified in paragraph (1) nos. 1, 2a, 2c, 4, 6, 7, 9, 10, 13 and 16a, the administrative offence may be punished by a fine of up to one hundred thousand German marks; in the cases specified in paragraph (1) nos. 2b, 5, 8, 8a, 11 to 12, 14 to 16 and 17, the offence may be punished by a fine of up to twenty thousand German marks.

(4) In the cases of paragraph (1) nos. 2b, 8 and 14, the Biologische Bundesanstalt shall be the administrative authority as defined in Article 36 (1) no. 1 of the Administrative Offences Act.

2 May 2000

Dear reader,

The discussion on the BBA-Guideline Part VII, No. 1-2.3.3, "Procedure for the entry of plant protection equipment in the chapter 'drift' of the list of loss reducing equipment", which came into force on 1 November 1999, made it necessary to modify this guideline. The updated version of this guideline has now been published and came into force on 1 May 2000.

Please replace pages 113 to 119 of book 57 of the 'Reports from the Federal Biological Research Centre for Agriculture and Forestry' with the new pages enclosed.

S. Rietz

Federal Biological Research Centre for Agriculture and Forestry

- Application Techniques Division -

- in particular in field crops, as tractor-mounted, attached or trailed equipment or as self-propelled sprayers.
- (2) The inspection has to extend over the criteria spelled out in appendix 1, paragraph (1) nos. 1 to 3, 6, 7, and 10 to 15. The machine parts to be inspected are listed in appendix 3.
 - (3) New sprayers must be inspected at the latest by the end of the sixth calendar month after they were taken into use. The owner must produce documents which plausibly show at which time the sprayer was taken into use. This first inspection is confined to seeing whether the sprayer parts listed in appendix 3 nos. 2, 6 and 9 meet the relevant requirements of appendix 1.
 - (4) The owner has to prove the calendar half-year when the sprayer has to be inspected according paragraph (1) sentence 1 by a sticker or label as shown in appendix 4. The inspection service fills the label in with its address and with the calendar year and half-year when the next inspection is due and sticks it on the machine after the inspection has shown that the machine functions without fault. The inspection service may also imprint an inspection number on the label. The label may also be handed out if the sprayer has minor defects which the owner undertakes to remove immediately.
 - (5) The label must be clearly visible and stick on the machine firmly; it must be of such

quality that it is destroyed when it is removed.

- (6) The test label turns invalid with the end of the calendar half-year imprinted on it.
- (7) If used crop sprayers subject to obligatory inspections are imported, they have to be inspected according to paragraph (2) before they are first used in the country.

Article 7a Prohibition of use

Plant protection equipment in the meaning of Article 7 (1) sentence 2 which has not undergone inspection or has no valid test sticker, must not be used.

Article 7b Offences

Anyone who, intentionally or negligently, uses a crop sprayer in contravention of Article 7a, commits an offence within the meaning of Article 40 (1) no.1a of the Plant Protection Act.

Chapter Three Final provisions

Article 8 (Coming into force)

Appendix 1

(To Article 4 (1) and Article 7 (2) sentence 1)

Quality of Plant Protection Equipment

(1) Plant protection equipment must have a quality so that

1. it functions reliably,
2. it can be used properly to its intended purpose,
3. plant protection products can be dosed and distributed sufficiently accurate,
4. if it is used properly to its intended purpose, the plant protection product is deposited sufficiently on the target object,
5. parts of it which heat up during operation cannot come into contact with plant protection products during filling or draining of the tank,
6. it can be filled safely,
7. it is protected against dirt so as not to be impaired in its functions,
8. filling levels of tanks (full and low) are easily visible,
9. there is a sufficient difference between nominal and total capacity of the tank,
10. plant protection products cannot leak,
11. the supply of plant protection products can be easily known,
12. adjustment is simple, accurate and reproducible,
13. it is fitted with the necessary and sufficiently accurate measuring devices,
14. it can be safely operated, controlled and immediately stopped from the operator's place,
15. it can be drained safely, easily and completely,
16. it can be cleaned easily and thoroughly,
17. wear-and-tear parts can be exchanged,
18. measuring devices can be connected for inspection and test purposes.

(2) Sufficient and easy readable dosage tables or diagrams must be permanently fitted to the equipment or, if this is not possible, must be delivered with the equipment in a durable form. The designation of type of equipment as well as the year of construction must be identifiable on the plant protection equipment. Nozzles must be labelled so as to show the design, size and important operating data.

Appendix 2
(to Article 6 (2))

Instructions for use

The instructions for use must contain information

1. on the intended outfit of the plant protection equipment,
- 1a. for correct adjustment of the plant protection equipment,
2. for filling of the equipment and safety precautions,
3. on operating and setting ranges of the equipment,
4. on tank residues which can no longer be applied properly,
5. on how to drain and clean the equipment,
6. on how to check dosage,
7. on the mesh width of filters,
8. on time intervals after which the equipment has to be checked for correct function and for accuracy of dosage and distribution,
9. on restrictions concerning the use of certain plant protection products,
10. on how to equip the plant protection equipment for other functions,
11. on possible connection with other machines and equipment and relevant safety precautions,
12. concerning inspections of the equipment.

Appendix 3
(to Article 7 (2) sentence 2)

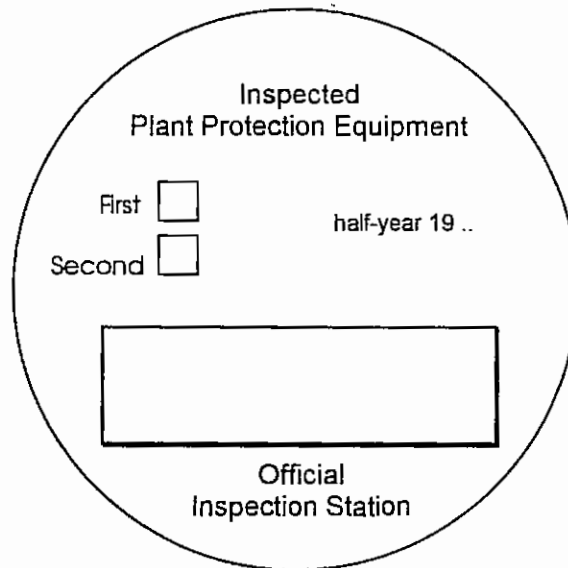
Parts to be inspected:

1. drive,
2. pump,
3. mixing,
4. spray tank,
5. controls,
6. hoses and lines,
7. filters,
8. spray boom,
9. nozzles.

Appendix 4

(to Article 7 (4) sentence 1)

Sample of an inspection label



If the inspection is carried out by a service workshop officially recognised under state law, the words 'official inspection service' are replaced by 'officially recognised inspection service'.

Features for the Testing of Plant Protection Equipment

In conformity with Article 4, paragraph 2 of the Regulation on Plant Protection Products and Plant Protection Equipment (Federal Bulletin volume 1998, part I no. 53, issued in Bonn on 19 August 1998) the Federal Biological Research Centre for Agriculture and Forestry, Braunschweig (BBA) published quality criteria (so-called features) in the Federal Law Gazette which it regards as necessary to assess whether the requirements are fulfilled.

The features are published for the following 7 types of equipment:

1. Field sprayers
2. Air-assisted sprayers for orchards, vineyards and hops
3. Pedestrian manual powered sprayers
4. Pedestrian motor powered sprayers and blowers
5. Seed treatment machines
6. Granules applicators
7. Fogging machines

Explanation:

At the left side of each page you see the 7 columns which represent the seven types of equipment. A "number" in the column says that the text on the right side is applicable for that special type of equipment, indicated in the previous paragraph. A "0" says not applicable. The columns are followed in row by figures which show the numbering of the requirements and features. A figure followed by two zeros says, that this is a requirement (extra bold print) published in the Regulation on Plant Protection Products and Plant Protection Equipment, all other numbers belong to features.

Examples:

Type of equipment	No.	Explanation
1 2 3 4 5 6 7	2.0.0	means the legal requirement number 2 and is applicable for all types (1 to 7) of plant protection equipment.
0 0 0 0 5 0 0	10.3.1	means feature 3.1 of the legal requirement number 10 and is applicable for seed treatment machines (5).

Type of equipment								No.	text of the legal requirement or feature
1	2	3	4	5	6	7	1.0.0	Plant protection equipment (machines for applying plant protection products) must have a quality so that it functions reliably.	
1	2	0	0	0	0	0	1.1.1	On p.t.o.-pumps the tolerable maximum revolutions per minute shall be indicated on the data plate.	
1	2	0	0	0	0	0	1.2.1	Armatures for connecting spray-hoses shall allow a safe positioning of the hoses to avoid sharp bending.	
1	0	0	0	0	0	0	1.3.1	Spraybooms with a working width up to 10 m shall be able to move backwards automatically in case of contacts with obstacles in the field. Explanation: If the sprayer is moved forward with at least 4 km/h and the obstacle is in a distance of 90 % of the half working-width, measured from the middle of the track, the sprayboom shall be able to give way without being damaged.	
1	0	0	0	0	0	0	1.3.2	Spraybooms with a working width more than 10 m shall be able to move back- and forward automatically in case of contact with obstacles in the field. Explanation: If the sprayer is moved forward with at least 4 km/h or backwards with at least 2 km/h and the obstacle is in a distance of 90 % of the half working-width, measured from the middle of the track, the sprayboom shall be able to give way without being damaged.	
1	0	0	0	0	0	0	1.3.3	Spraybooms or boom sections shall return immediately to their original position after contact with obstacles. Explanation: In stationary position spraybooms or sections of them which had been moved according to explanation 1.3.1 and 1.3.2 shall return immediately and automatically to their original position after having been released.	
1	2	3	4	0	0	7	1.4.1	Non pressurized spray-tanks shall have pressure compensation.	
0	0	0	4	0	0	0	1.5.1	The throttle lever of the motor shall not change position itself. Explanation: The duration of test is 5 minutes.	
0	0	0	0	0	0	7	1.5.2	A chosen running position shall not change itself.	
0	0	0	0	0	6	0	1.6.1	Rubbing off or damaging of granules shall be prevented up to an unavoidable degree.	
0	0	0	0	0	6	0	1.7.1	The machine shall be protected against dripping water (rain) in such a way, that no humidity reaches granules in the machine.	
1	2	3	4	5	6	7	2.0.0	Plant protection equipment must have a quality so that it can be used properly to its intended purpose. Explanation: Details about the use in correspondence to its purpose will be provided by the instruction manual.	
0	2	0	0	0	0	0	2.10.1	The application to one side only shall be possible by switching off the other.	
0	2	0	0	0	0	0	2.10.2	The equipment has to be constructed in such a way, that the required working width and -height can be obtained at both sides by hydraulic pressure spraying or air assisted spraying - irrespective of the number of rows-.	

Type of equipment	No.	text of the legal requirement or feature
1 2 0 0 0 0 0	2.11.1	For spray tanks with 200 l and more the nominal tank capacity shall always end up at complete 100 l.
1 2 3 4 0 0 0	2.12.1	Each nozzle shall form a uniform spray jet, the pattern of which shall not change unintentionally during operation.
1 2 0 0 0 0 0	2.12.2	The jet direction and, if applicable, jet pattern of the nozzles shall be adjustable in a reproducible manner by suitable technical aids. Explanation: Suitable aids are, e. g., fixed marks, locking devices, or adjusting gauges.
0 2 0 0 0 0 0	2.12.3	It shall be possible to switch off each single nozzle.
0 2 0 0 0 0 0	2.13.1	It shall be possible to obtain the required pressures.
0 0 3 4 0 0 0	2.14.1	The weight of the equipment with a filled tank shall not be more than 28 kg, and one person shall be able to pick it up, to carry it and to put it down.
0 0 3 4 0 0 0	2.14.2	The distance between the centre of gravity and the back plate of knapsack equipment, also with filled tank, shall not exceed 150 mm. Explanation: The distance is to calculate from the measured support force and -distances of the horizontal standing equipment. The accuracy of measurement should be at least 2 mm for distances and 0.2 N for force. Other methods with a corresponding accuracy can be used.
0 0 0 0 0 0 7	2.14.3	The weight of equipment - with filled tank - which shall be carried during action shall not be more than 28 kg, and one person shall be able to pick it up, to carry it and to put it down.
0 0 3 4 0 0 0	2.15.1	The carrying straps of knapsack equipment shall be adjustable in length.
0 0 3 4 0 0 0	2.15.2	One carrying strap of knapsack equipment shall be hooked easily. Explanation: Easy hooking is provided if one can do it with one hand and the necessary force will not be more than 1.5 daN.
0 0 3 4 0 0 0	2.15.3	They shall not press into the shoulders. Explanation: For filled equipment up to a total weight of 7.5 kg the width of the carrying straps shall be at least 25 mm, for heavier equipment at least 30 mm.
0 0 3 4 0 0 0	2.15.4	They shall not loosen unintentionally. Explanation: Straps shall be safe against loosening themselves e. g. by force of gravity or spring.
0 0 0 0 0 0 7	2.15.5	If there are carrying straps they shall not press into the shoulders. Explanation: For filled equipment up to a total weight of 7.5 kg the width of the carrying straps shall be at least 25 mm, for heavier equipment at least 30 mm.
0 0 3 4 0 0 0	2.16.1	Within 40 cm from the nozzle the process of droplet development shall be finished and the spray jet shall be fully developed.
0 0 3 4 0 0 7	2.17.1	Flexible tubes shall follow their way without sharp bending.

Type of equipment	No.	text of the legal requirement or feature												
0 0 0 4 0 0 0	2.18.1	Vibrations shall be absorbed against the carrying frame. Explanation: Vibrations are thought to be absorbed if the motor unit is fixed elastically to the carrying frame.												
0 0 3 4 0 0 7	2.19.1	The nominal volume of the tank shall be specified in whole litres.												
0 0 3 0 0 0 0	2.19.2	Spray tanks which are pressurised at intervals shall have an additional capacity of at least 25 % of their nominal capacity.												
1 0 0 0 0 0 0	2.2.1	It shall be possible to switch spray booms off and on in at least two sections.												
1 0 0 0 0 0 0	2.2.2	For working width up to 18 m the boom sections shall not be wider than 4.5 m and for working width more than 18 m they shall not be more than 6 m.												
0 0 0 4 0 0 0	2.20.1	The air-flow of the blower shall be at least 400 m ³ /h. Explanation: When measuring the air-flow the maximum allowable error evaluates to 5 %.												
0 0 0 4 0 0 0	2.20.2	The velocity of air 6 m away from the outlet shall be at least 3 m/s. Explanation: The velocity of air is to measure with a maximum allowable error of 5 %.												
0 0 0 4 0 0 0	2.20.3	When the equipment stands on the ground, the blowers running in idle motion shall not suck foreign parts from the ground. Explanation: This will be fulfilled if the sucking whole will be for instance at least 10 cm off the ground.												
0 2 0 0 0 0 0	2.21.1	The velocity of air shall not exceed the following values. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>cultivation</th> <th>air velocity</th> <th>measuring position</th> </tr> </thead> <tbody> <tr> <td>vineyard</td> <td>30 m/s</td> <td>0.6 m from the middle of blower</td> </tr> <tr> <td>orchard</td> <td>40 m/s</td> <td>0.75 m from the middle of blower</td> </tr> <tr> <td>hops</td> <td>40 m/s</td> <td>1 m from the middle of blower</td> </tr> </tbody> </table> Explanation: The measurement positions are located at the vertical planes left and right of the vertical middle plane of the blower. Measurement has to take place in the direction of air-flow. In case, the instruction manual has to name those equipment adjustments which prevent exceeding of the maximum allowed velocity for the respective cultures.	cultivation	air velocity	measuring position	vineyard	30 m/s	0.6 m from the middle of blower	orchard	40 m/s	0.75 m from the middle of blower	hops	40 m/s	1 m from the middle of blower
cultivation	air velocity	measuring position												
vineyard	30 m/s	0.6 m from the middle of blower												
orchard	40 m/s	0.75 m from the middle of blower												
hops	40 m/s	1 m from the middle of blower												
0 2 0 0 0 0 0	2.21.2	The maximum air velocity produced by the blower shall be symmetric at the right and the left of the blower. The deviation at comparable measuring points shall not exceed 10 % of the mean. Explanation: The measurements shall be performed at distances corresponding to feature 2.21.1, up to 3 m height every 25 cm and for more than 3 m height every 50 cm up to the required working height.												
1 0 0 0 0 0 0	2.22.1	The nozzles at the end of spraybooms with a working width of 10 m or more shall be protected against damage by ground contact (e. g. by protection distance holder).												
0 0 0 0 5 0 0	2.23.1	Should the occasion arise that a container for plant protection products belongs to the machine its capacity shall be big enough for at least 1 h of seed treatment.												

Type of equipment	No.	text of the legal requirement or feature
0 0 0 0 0 0 7	2.23.2	The capacity of the petrol tank shall be big enough to fog out the whole capacity of the chemical tank.
0 0 0 0 0 6 0	2.24.1	The deposit installation shall have a fixation.
0 0 0 0 0 6 0	2.25.1	If the granules have to be put into the soil, security shall be provided that no granules remain uncovered on soil, even if the machine is put up at the end of the field.
1 2 0 0 0 0 0	2.26.1	Cleaning gadgets for containers of plant protection products attached to the equipment shall be in accordance with DIN 11 218 from October 1995.
1 0 0 0 0 0 0	2.3.1	One person shall be able to adjust the spray boom to the height of the crop with a force of less than 50 daN.
1 0 0 0 0 0 0	2.4.1	The height of the liquid atomisers above the ground shall be adjustable within a range of at least 1.0 m. The minimum distance between the atomisers and the target area shall correspond with the atomisers outfit. For equipment that is to be used in cultures higher than 1.0 m the height of the liquid atomisers above the ground shall be adjustable within a range of 1.2 m. Explanation: For three-point-linked machines an average lifting height of 0,5 m should be assumed.
1 2 0 0 0 0 0	2.5.1	In all positions of height above the ground the sprayed liquid shall not get in contact with parts of the equipment, with the exception that it is required for special functions, however dripping shall be avoided.
1 2 3 4 0 0 7	2.6.1	Number, position and size of the liquid atomisers have to be chosen in such a way, that the spray liquid can be applied at the quantity required.
1 2 3 4 0 0 0	2.7.1	The liquid output of the pump shall correspond with the quantity of liquid needed by the equipment. Explanation: The liquid output of the pump is to measure with a maximum allowable error of 2.5 %.
0 0 3 0 0 0 0	2.7.2	Pressure waving shall be small. Explanation: Pressure waving is small, if it does not deviate more than 25 % from the mean pressure.
1 2 0 0 0 0 0	2.8.1	It shall be possible to switch off the blower separately from other driven parts of the machine. Explanation: This can be obtained by a clutch, a belt-drive cocking-handle or turning away the air-flow.
0 2 0 0 0 0 0	2.9.1	The liquid- and air-jets shall be adjustable by one person to the respective cultivation type and height of the crop.
1 2 3 4 5 6 7	3.0.0	Plant protection equipment must have a quality so that plant protection products can be dosed and distributed sufficiently accurate.
1 2 0 0 0 0 0	3.1.1	During spraying and continuously decreasing liquid level in the tank the application rate (l/ha) shall not deviate more than 10 % from the mean.
0 0 3 4 0 0 0	3.1.2	During the whole time of emptying the tank the output of spray-liquid in l/min shall not deviate more than 10 % from the mean.

Type of equipment	No.	text of the legal requirement or feature
0 0 0 0 0 0 7	3.1.3	It shall be possible to fog out a determined amount of liquid with an accuracy of 10 %, independent of the filling height in the tank.
0 0 0 0 5 0 0	3.10.1	At the outlet of the seed treatment machine the plant protection product shall adhere to the seed with a maximum allowable tolerance of not more than 7 % of the mean value. The mean value shall not deviate more than 10 % from the target dose. Explanation: To determine the target dose use guide-line 4-1.1.3 of BBA - guide-lines part II.
0 0 0 0 5 0 0	3.11.1	The applied plant protection product amount on at least 80 % of single seeds shall not deviate more than 50 % from the mean value. Explanation: Determine uniformity of distribution according to BBA - guide-line 4-1.1.3 part II with barley.
0 0 0 0 0 6 0	3.12.1	For the distribution in longitudinal axis the applied granule masses in 25 consecutive sections of 20 cm length each shall not deviate more than 30 % from the mean value of the 25 sections.
0 0 0 0 0 6 0	3.13.1	During use on a 10 % slope in working direction and cross to it the output shall not deviate more than 10 % from the nominal value, even when the container is emptied to the minimum level appointed by the manufacturer. Explanation: Determine the output by collecting granules for at least 60 s with a maximum allowable error of 1 %. The nominal output is to be measured with the machine in horizontal position and with half filled container.
0 0 0 0 0 6 0	3.14.1	The output of the single hoppers, each adjusted to the same dose, shall not deviate more than ± 10 % from the mean value of all hoppers. Explanation: Determine the output by collecting granules for at least 60 s with a maximum allowable error of 1 %.
0 0 0 0 5 6 0	3.15.1	It shall be possible to adjust the appointed amount in such a way, that a maximum tolerance of ± 10 % will be kept.
0 0 0 0 0 6 0	3.16.1	During emptying the container the output and distribution of granules shall be uniform. Explanation: This requirement is applicable for levels between 10 and 100 % of the nominal container capacity.
0 0 0 0 5 0 0	3.16.2	During emptying the container the output of the plant protection product shall be uniform. Explanation: This requirement is applicable for levels between 10 and 100 % of the nominal container capacity.

Type of equipment	No.	text of the legal requirement or feature
1 0 3 4 0 0 0	3.2.1	<p>If nozzles are used on a boom to form a uniform spray the transverse volume distribution will be measured on a 10 cm groove patternator and for a given pressure and nozzle height the coefficient of variation shall not exceed 7 %, for other specified ranges of pressure and height it shall not exceed 9 %. The range of height shall be at least 20 cm. The maximum tolerable height is 90 cm.</p> <p>Explanation: The coefficient of variation is calculated by the formula:</p> $C_v = \frac{\sqrt{\frac{\sum (X_i - \bar{X})^2}{n-1}}}{\bar{X}} \cdot 100\% \quad \text{with} \quad \bar{X} = \frac{\sum X_i}{n}$ <p>With nozzles with overlapping spray patterns, this requirement holds only for the fully overlapped areas.</p>
1 2 0 0 0 0 0	3.3.1	<p>Tanks shall be equipped with agitators which prevent more than 15 % deviations in concentration of a 1 % OB 21 (Cupravit) suspension.</p> <p>Explanation: For this test follow BBA - guide-line 1-1.2.1 part VII.</p>
1 2 0 0 0 0 0	3.3.2	<p>Feature 3.3.1 shall also be fulfilled after a standstill of 15 h followed by 10 min of agitating with nominal revolutions per minute.</p>
1 2 0 0 0 0 0	3.3.3	<p>Also during emptying of the tank in the nozzles' supply line deviations in concentration shall not exceed 15 %.</p>
0 0 0 4 0 0 0	3.3.4	<p>It shall be provided that the concentration of the liquid does not change essentially during emptying the tank. Explanation: This feature will be fulfilled if there is no more than 15 % deviation of a 1 % OB 21 (Cupravit) suspension during operation.</p>
1 0 0 0 0 0 0	3.4.1	<p>The output of adjacent nozzles of the same type on spray booms shall not deviate more than 5 % from their mean output.</p>
0 2 3 4 0 0 0	3.4.2	<p>The output of adjacent nozzles of the same type on spray booms shall not deviate more than 10 % from their mean output.</p>
0 0 0 0 0 0 7	3.4.3	<p>If there is more than one atomiser the output rate of each single atomiser with the same characteristic shall be within 10 % deviation of the common mean value.</p>
1 0 0 0 0 0 0	3.5.1	<p>Spray booms with more than 10 m working width shall allow movements independent of the sprayer(e.g. pendulum) to keep its position parallel to the ground.</p>
1 2 3 4 0 0 0	3.6.1	<p>During correct use in correspondence to its purpose the pressure pulsation at the pressure side of the pump shall not exceed more than 25 % from the wanted spraying pressure.</p>
0 2 0 0 0 0 0	3.7.1	<p>The nominal output of the blower shall not deviate more than 10 % from the real output. Explanation: The nominal output has to be measured with a maximum allowable error of 5 %.</p>
0 0 0 4 0 0 0	3.8.1	<p>The at a time adjusted output with constant revolutions of the engine shall not exceed 10 % of the mean output also for all by the instruction manual allowed directions and differences in height between nozzle and tank.</p>

Type of equipment	No.	text of the legal requirement or feature										
0 0 0 0 5 0 0	3.9.1	During seed treatment the seed and the plant protection product shall always be in correct relation.										
0 0 0 0 5 0 0	3.9.2	With continuously working seed treatment machines the dosing of the plant protection product shall be interrupted automatically when the flow of seed stops.										
0 0 0 0 5 0 0	3.9.3	The flow of seed shall be interrupted automatically when the flow of plant protection product stops.										
1 2 3 4 5 6 7	4.0.0	Plant protection equipment must have a quality so that if it is used properly to its intended purpose, the plant protection product is deposited sufficiently on the target object.										
1 0 0 0 0 0 0	4.1.1	The 10 % volumetric droplet diameter of nozzles mounted in a spray boom shall not be smaller than 115 µm if there is no drift reducing equipment in use. Explanation: For the measurement follow Guideline 1-1.2.4 of Part VII of the Guidelines for Plant Protection Equipment Tests of the Federal Biological Research Centre (BBA). For comparable measurements nozzles of the size 02 with a 10 % volumetric droplet diameter of 115 µm at 2.5 bar are deposited at the BBA. These nozzles can be used for comparable measurements with different droplet size analysing systems as e. g. image analysing and Malvern. These nozzles are available at the BBA.										
1 2 3 4 5 6 7	5.0.0	Plant protection equipment must have a quality so that parts of it which heat up during operation cannot come into contact with plant protection products during filling or draining of the tank.										
1 2 3 4 5 6 7	6.0.0	Plant protection equipment must have a quality so that it can be filled safelyr.										
1 2 3 4 0 0 0	6.1.1	Tank filling devices shall work in such a way that the liquid does not flow back.										
1 2 3 4 0 0 7	6.2.1	Strainers in filling openings shall allow filling of tanks with a nominal capacity up to 100 l within 1 min, bigger tanks with a flow rate of at least 100 l/min.										
1 2 0 0 0 0 0	6.2.2	The filling openings of tanks shall have the following minimum diameters: <table border="1"> <thead> <tr> <th><u>nominal tank capacity [l]</u></th> <th><u>ø of filling opening [mm]</u></th> </tr> </thead> <tbody> <tr> <td>up to 150</td> <td>150</td> </tr> <tr> <td>150 to 600</td> <td>200</td> </tr> <tr> <td>more than 600</td> <td>300</td> </tr> </tbody> </table>	<u>nominal tank capacity [l]</u>	<u>ø of filling opening [mm]</u>	up to 150	150	150 to 600	200	more than 600	300		
<u>nominal tank capacity [l]</u>	<u>ø of filling opening [mm]</u>											
up to 150	150											
150 to 600	200											
more than 600	300											
1 2 0 0 0 0 0	6.2.3	Tank filling strainers shall have the following minimum depths: <table border="1"> <thead> <tr> <th><u>nominal tank capacity [l]</u></th> <th><u>depth of strainer[mm]</u></th> </tr> </thead> <tbody> <tr> <td>up to 150</td> <td>60</td> </tr> <tr> <td>150 to 400</td> <td>100</td> </tr> <tr> <td>400 to 600</td> <td>200</td> </tr> <tr> <td>more than 600</td> <td>250</td> </tr> </tbody> </table> <p>Explanation: The depth will be measured from the upper edge of the strainer down to its bottom.</p>	<u>nominal tank capacity [l]</u>	<u>depth of strainer[mm]</u>	up to 150	60	150 to 400	100	400 to 600	200	more than 600	250
<u>nominal tank capacity [l]</u>	<u>depth of strainer[mm]</u>											
up to 150	60											
150 to 400	100											
400 to 600	200											
more than 600	250											

Type of equipment	No.	text of the legal requirement or feature
0 0 3 4 5 0 0	6.2.4	The filling openings of non pressure tanks shall have minimum diameters of at least 100 mm.
0 0 3 4 0 0 0	6.2.5	For pressure tanks it shall be made sure by suitable shape or an additional feeding hopper that the upper diameter of the filling opening has at least 100 mm.
0 0 0 0 5 6 0	6.2.6	The filling openings of containers for dry used plant protection products shall have minimum diameters of at least 200 mm.
0 0 0 0 0 0 7	6.2.7	For tanks it shall be made sure by suitable shape or an additional feeding hopper that the upper diameter of the filling opening has at least 100 mm.
0 0 3 4 0 0 7	6.3.1	Regardless of the amount filled into the machines, they shall not tip over when put on a 8.5° inclined plane.
0 0 0 0 5 0 0	6.4.1	With appropriate filling the seed treatment liquid shall not splash back.
1 2 3 4 5 6 7	7.0.0	Plant protection equipment must have a quality so that it is protected against dirt so as not to be impaired in its functions.
1 2 0 0 0 0 0	7.1.1	Plant protection equipment shall have a sucking filter with a maximum mesh width of 0.5 mm.
1 2 3 4 0 0 0	7.2.1	The liquid going to the atomisers shall be filtered central on the pressure side. Explanation: Central filters may also be those in pipes. For equipment with manual handled atomisers these may be nozzle strainers. For pedestrian motor powered sprayers and blowers, working without a pump, central filtering is not necessary.
1 2 3 4 0 0 7	7.2.2	Their mesh width shall be smaller than the smallest diameter of the smallest size of nozzle to be used.
1 2 0 0 0 0 0	7.2.3	Plugging of central pressure filters shall be recognisable from the operators place.
1 2 0 0 0 0 0	7.2.4	If there are filters in lines and additional directly in front of the nozzles the meshwidth of the linefilters shall be equal or smaller then those of the nozzlefilters.
1 2 3 4 0 0 0	7.2.5	At the maximum required flowrate the pressure drop at each filter shall not exceed 5 %.
1 2 3 4 5 0 0	7.3.1	With exception of compression sprayers strainers shall be installed in filling openings and shall have a mesh width between 0.5 and 2 mm. Explanation: For compression sprayers it shall be possible to put on filling strainers. Appropriate filling strainers have to be offered by the manufacturer.
1 2 3 4 0 0 0	7.3.2	The maximum force required to remove the strainer shall not exceed 4 daN.
1 2 3 4 0 0 7	7.3.3	Spaces between tank filling opening and strainer shall not exceed 2 mm.

Type of equipment	No.	text of the legal requirement or feature
0 0 0 0 0 0 7	7.3.4	There shall be a strainer in the filling opening or in the additional feeding hopper with a mesh width between 0.5 and 2 mm.
1 2 0 0 0 0 0	7.5.1	Chemical introduction bowls shall be equipped with a strainer (guarding sieve) with a maximum mesh width of 2 cm.
0 0 0 0 5 0 0	7.6.1	Continuously working seed treatment machines shall have a dust - sucking - off - installation. Explanation: A joining for a dust - sucking - off - installation is sufficient, if an appropriate installation is in the setting up place and if it can be connected to the equipment.
0 0 3 4 0 0 0	7.7.1	After 1999-01-01 the nozzles shall be protected against pollution even if the equipment is parked for filling up. Explanation: This feature is fulfilled if the spray gun is fixed to the equipment in a way that pollution is impossible.
1 2 3 4 5 6 7	8.0.0	Plant protection equipment must have a quality so that filling levels of tanks (full and low) are easily visible.
1 2 3 4 5 6 7	9.0.0	Plant protection equipment must have a quality so that there is a sufficient difference between nominal and total capacity of the tank.
1 2 3 4 0 0 0	9.1.1	Non pressurized tanks shall have an additional capacity of at least 5 % of the nominal capacity.
0 0 0 0 5 0 7	9.2.1	Tanks and containers shall have an additional capacity of at least 5 % of the nominal capacity. Explanation: This is not applicable for the original chemical tanks and containers.
1 2 3 4 5 6 7	10.0.0	Plant protection equipment must have a quality so that plant protection products cannot leak.
1 2 3 4 5 6 7	10.1.1	Tank lids shall seal well.
1 2 3 4 0 0 7	10.1.2	Sealings shall fit well and shall be fixed tightly in their position.
1 2 0 0 0 0 0	10.2.1	Dripping of more than 2.0 ml (on average) per nozzle shall be avoided by suitable devices. Explanation: Beginning of dripping is taken from the moment of break down of the spray jet.
0 0 0 0 0 0 7	10.2.3	With equipment for stationary use the plant protection product flow shall be interrupted automatically when the machine stops during use.
0 0 0 0 0 0 7	10.2.4	Dripping of more than 2.0 ml per nozzle shall be avoided by suitable devices. Explanation: Beginning of dripping is taken from the moment of closing the shut-off valve.
0 0 0 0 5 0 0	10.3.1	Installations for sucking off the dust shall be constructed in such a way, that no dust enters the environment.
0 0 0 0 0 6 0	10.4.1	After switching off the granules metering system it shall be sure, that no more granules than unavoidable come out of the applicator.
0 0 3 4 0 0 0	10.5.1	After 1999-01-01 hose nipples at the tank have to be protected against fracture.

Type of equipment								No.	text of the legal requirement or feature
1	2	3	4	5	6	7	11.0.0	Plant protection equipment must have a quality so that the supply of plant protection products can be easily known.	
1	2	0	0	0	0	0	11.1.1	Tanks shall have durable volume scale according to DIN 11219 from June 1977 which is well visible from the operator's place. Explanation: If the volume scale is not well visible from the operator's place there shall be an additional easily visible level indicator system. With trailed air-assisted sprayers this feature is fulfilled if there is a volume scale on the left and right side of the tank.	
1	2	0	0	0	0	0	11.1.2	The tolerances of the volume scales and the level indication systems are: a) Up to 20 % of the nominal tank capacity 7.5 % of the respective graduation mark of the scale. b) In case of more than 20 % of the nominal tank capacity 5 % of the respective graduation mark of the scale. Explanation: Determination has to be done with a maximum allowable error of 1 %.	
0	0	3	4	0	0	7	11.2.1	The determination of the level in the tank shall be possible by a scale (following DIN 11219 from June 1977) with a maximum allowable error of 10 %. Explanation: The determination of level also is given, if the content can be measured indirectly, e.g. by using a level finder with markings.	
0	0	0	0	5	6	0	11.3.1	The determination of the level shall be possible by a scale. Explanation: Determination is also ensured by an inside scale.	
1	2	3	4	5	6	7	12.0.0	Plant protection equipment must have a quality so that adjustment is simple, accurate and reproducible.	
1	2	0	0	0	0	0	12.1.1	Pressure adjustment devices shall keep the working pressure unchanged at constant revolutions of the pump. Explanation: That also means, that after switching off and on the working pressure shall return to its original value. This applies also if in the meantime different pressures were adjusted. The deviations shall not exceed 5 %.	
0	0	3	4	0	0	0	12.2.1	Easy and supervisible adjustment of the output shall be given during use, too. Explanation: With motor powered equipment the easy adjustment of the output during use can be achieved by adjusting the revolutions of the engine or with manual powered equipment by using a pressure regulator at the handle or by changing the pumping frequency. For equipment which atomises with pressure supervisibility is given if it has a pressure gauge.	
1	2	0	0	0	0	0	12.3.1	Devices intended to produce a constant application rate shall meet the features 12.3.2 to 12.3.6 . Explanation: The tests are carried out according to the BBA - guide-line 1-1.2.3 part VII.	
1	2	0	0	0	0	0	12.3.2	Deviation from the mean application rate at a constant stage shall not exceed 10 % within 5 s after variations of operating conditions. Variations in working conditions for instance can be switching off nozzles, speed variations (also those between switching off and on nozzles) and the switching of sprayboom - sections.	

Type of equipment	No.	text of the legal requirement or feature
1 2 0 0 0 0 0	12.3.3	Variations in the application rate (l/ha) following variations in speed shall reach a constant stage within 5 s.
1 2 0 0 0 0 0	12.3.4	During repeated adjustments of the same application rate (l/ha) the coefficient of variation calculated from 7 measurements shall not exceed 3 %.
1 2 0 0 0 0 0	12.3.5	Whilst spraying with constant p.t.o.-revolutions and with constant speed the maximum deviations from the mean application rate (l/ha) shall not exceed 5 %.
1 2 0 0 0 0 0	12.3.6	For the deviation of the measured application rate (l/ha) or respective output (l/min) from the values required the following limits are fixed: 1. for the medium deviation 6 % and 2. for the coefficient of variation 3 %.
0 0 0 0 5 0 0	12.4.1	With repeated and uniform adjustments the output of seed and plant protection product shall not deviate more than 10 % from the output of the first adjustment. Explanation: Five repetitions will be done with the same seed and the same plant protection product.
0 0 0 0 5 0 0	12.5.1	The dose of seed plant protection product shall be adjustable at an easily accessible place.
0 0 0 0 5 0 0	12.5.2	For measuring the dose of plant protection product it shall be possible to collect it totally before reaching the seed.
0 0 0 0 0 6 0	12.6.1	The drive shall make sure, that the revolutions respectively the moving of the granule metering mechanism do not deviate more than 10 % from the adjusted nominal value.
0 0 0 0 0 6 7	12.7.1	With repeated and uniform adjustments the output shall not deviate more than 10 % from the output of the first adjustment. Explanation: Five repetitions are required.
0 0 0 0 5 6 7	12.8.1	The adjustment of metering mechanism shall be clearly visible.
1 2 3 4 5 6 7	13.0.0	Plant protection equipment must have a quality so that it is fitted with the necessary and sufficiently accurate measuring devices.
1 2 0 0 0 0 0	13.1.1	The error of measuring systems for dosing measure shall not exceed 5 % of the real data.
1 2 0 0 0 0 0	13.2.1	Equipment with hydraulic pressure atomisers shall have a pressure gauge suited for the spray pressure to be adjusted by following the dose instruction. After 1993-12-31 the reading of the spray pressure adjusted by following the dose instruction shall be possible even if central pressure filters are plugged.
1 2 0 0 0 0 0	13.2.2	It shall at least meet classification 2.5 according to DIN 16005 from February 1989.
1 2 3 4 0 0 0	13.2.3	A definite reading shall be possible. Explanation: If the liquid flow pulsates at more than 5 Hz the pressure gauge shall be damped.

Type of equipment	No.	text of the legal requirement or feature
1 2 0 0 0 0 0	13.2.4	Pressure gauges with a non linear scale or pointers, which circulate more than one time shall meet at least classification 2.5 according to DIN 16005 from February 1989 within the spray pressure range.
1 2 0 0 0 0 0	13.2.5	Up to 5 bar the scale of the pressure gauge shall be graduated each 0.2 bar and between 5 and 20 bar each 1 bar.
1 2 0 0 0 0 0	13.2.7	The minimum diameter of manometers housings is 60 mm.
0 0 3 4 0 0 0	13.2.8	Equipment with pressure atomisers shall have a pressure gauge.
0 0 3 4 0 0 0	13.2.9	The pressure gauge shall show the pressure with at least 0.25 bar accuracy.
1 2 3 4 5 6 7	14.0.0	Plant protection equipment must have a quality so that it can be safely operated, controlled and immediately stopped from the operator's place.
1 2 3 4 5 6 7	14.1.1	Adjusting devices shall be in reach of the operator. Explanation: Stretching out of the arms, with tractor powered equipment also backwards, is tolerable.
1 2 3 4 5 6 7	14.2.1	The adjusting device shall allow easy handling and shall not hinder. Explanation: Easy handling of the adjustment devices normally means that it is freely accessible and that it is positioned and constructed according to its function. That for instance means for tractor mounted equipment that the armature shall be adaptable to the respective tractor model. The operator's free movement shall not be restricted by the adjustment devices.
1 2 0 0 0 0 0	14.3.1	The working pressure, if necessary the application rate (l/ha), the adjustment at the armature and the actual volume in the tank shall be clearly readable from the operator's place. Explanation: Turning of the head and the upper body is tolerable
0 0 3 4 0 0 7	14.4.1	Important armatures for the work shall be positioned in the field of vision. Explanation: Turning of the head and the upper body is tolerable. Important armatures are e.g.: shut off valves, adjustable pressure regulators, pressure gauges and flow rate indicators.
1 2 3 4 0 0 7	14.5.1	Pressure lines shall be equipped with quick-acting shut-off valves (e.g. tip-over lever valves).
1 2 3 4 5 6 7	15.0.0	Plant protection equipment must have a quality so that it can be drained safely, easily and completely.
1 2 3 4 0 0 7	15.1.1	For tanks up to 400 l the technical rest volume of liquid shall not exceed 4 % of the nominal tank capacity and for bigger tanks it shall not exceed 3 %. Explanation: The technical rest volume is the remaining liquid in the equipment, which cannot be applied properly. The measurement has to follow BBA - guide-line 1 - 1.2.2 of part VII.

Type of equipment	No.	text of the legal requirement or feature
1 2 0 0 0 0 0	15.1.2	If the equipment is to be used on slopes then - up to a described maximum degree of slope - the rest volume remaining in the tank on slopes shall not exceed the limits stated in feature 15.1.1 in all directions of slopes. Explanation: The rest volume on the slope is the remaining liquid in the equipment, which cannot be applied properly. The measurement has to follow BBA - guide-line 1 - 1.2.2 of part VII.
0 0 0 0 5 0 0	15.1.4	The content of the mixing tank shall be applicable in a proper way down to a remnant of not more than 1 % of the nominal tank capacity.
0 0 3 4 0 0 0	15.1.5	For tanks up to 17 l the technical rest volume of liquid shall not exceed 250 ml and for bigger tanks it shall not exceed 1.5 % of the nominal tank capacity Explanation: The technical rest volume is the remaining liquid in the equipment, which cannot be applied properly. The measurement has to follow BBA - guide-line 1 - 1.2.2 of part VII.
1 2 0 0 0 0 0	15.2.1	In horizontal position tanks shall be able to drain totally.
1 2 0 0 0 0 0	15.2.2	There shall be an easily accessible and sufficiently dimensioned tank outlet which allows quick and total emptying. Explanation: The outlet shall be free accessible from one side. The technical rest volume in the tank shall drain within 5 min. Total emptying is accomplished if there are no visible puddles at the bottom of the tank.
1 2 0 0 0 0 0	15.2.3	It shall be possible to collect the draining liquid at the outlet without contaminating the operator or equipment parts, as for instance stays.
0 0 3 4 0 0 7	15.2.4	In a definite position the equipment shall be able to drain totally.
0 0 0 0 0 6 0	15.2.5	In a definite position tanks shall be able to drain totally.
0 0 0 4 5 6 7	15.2.6	It shall be possible to collect the draining liquid without contaminating the operator or equipment parts, as for instance stays.
0 0 0 0 5 6 7	15.3.1	Total emptying of the tank shall be possible by one person.
0 0 0 0 5 0 0	15.4.1	It shall be possible to empty the mixing device.
1 2 3 4 5 6 7	16.0.0	Plant protection equipment must have a quality so that it can be cleaned easily and thoroughly.
1 2 3 4 0 0 7	16.1.1	Filters shall be installed at a freely accessible place.
1 2 3 4 0 0 7	16.1.2	Filter insets shall be removable.
1 2 3 4 0 0 7	16.1.3	For quick cleaning the filter tissue of the inset shall be freely accessible.
1 2 0 0 0 0 0	16.1.4	At a nominal tank capacity of more than 200 l it shall be possible - also with a full tank - to clean the sucking filter without wasting more liquid than the volume in the filter-housing and in case, in the sucking hose.
1 2 3 4 5 6 7	16.2.1	Depth of roughness Rz, in accordance with ISO 4287-1, of inner and outer walls of the tanks shall be less than 0.1 mm.

Type of equipment	No.	text of the legal requirement or feature
1 0 0 0 0 0 0	16.3.1	An additional clean water tank shall be present and its capacity shall be at least 10 % of the nominal tank capacity or 10 times the dilutable part of the technical rest volume. Explanation: If need be the dilutable part of the technical rest volume shall be reported in the instruction manual.
1 2 0 0 0 0 0	16.3.2	The additional clean water tank shall make possible - rinsing of the pipes even with filled up spray tank, - the inner cleaning and - the outer cleaning of the equipment. Explanation: Methods for cleaning and examples for connection are published in " AID-Heft 1314".
0 2 0 0 0 0 0	16.3.3	Equipment with a nominal tank capacity of more than 400 l shall have an additional clean water tank and its capacity shall be at least 10 % of the nominal tank capacity or 10 times the dilutable part of the technical rest volume. Explanation: If need be the dilutable part of the technical rest volume shall be reported in the instruction manual.
1 0 0 0 0 0 0	16.4.1	Equipment shall have a system for inner tank cleaning.
0 2 0 0 0 0 0	16.4.2	Equipment with a nominal tank capacity of more than 400 l shall have a system for inner cleaning
1 2 0 0 0 0 0	16.4.3	The equipment shall have a connection for its outer cleaning.
1 2 3 4 5 6 7	17.0.0	Plant protection equipment must have a quality so that wear-and-tear parts can be exchanged.
1 2 3 4 5 6 7	17.1.1	Wearing parts shall be accessible and changeable in an easy way. Explanation: Wearing parts are for instance atomisers, filter insets, antidrip valves, pumpvalves, diaphragms and piston sealings.
1 2 3 4 5 6 7	18.0.0	Plant protection equipment must have a quality so that measuring devices can be connected for inspection and test purposes.
1 2 0 0 0 0 0	18.1.1	For the test of the equipment's pressure gauge there shall be a connection with a 1/4 " thread. Explanation: Otherwise the declarer has to provide a suitable adapter.
1 2 0 0 0 0 0	18.1.2	Between the pump and the pressure regulator it shall be possible to connect a flowmeter without disconnecting any hoses on the machine. Explanation: Suitable adapters with 1" hose socket have to be provided by the declarer.
0 2 0 0 0 0 0	18.1.3	It shall be possible to catch up the liquid output of each single nozzle. If it is not possible to connect a 3/4" hose directly, the declarer has to provide sealing adapters.
1 2 0 0 0 0 0	18.1.4	If a flowmeter for dosing is used in the equipment a coupling shall be present which allows to connect test facilities without demounting the flowmeter.

Type of equipment							No.	text of the legal requirement or feature
1	2	3	4	5	6	7	19.0.0	Sufficient and easy readable dosage tables or diagrams must be permanently fitted to the equipment or, if this is not possible, must be delivered with the equipment in a durable form.
1	2	3	4	0	0	0	19.1.1	The flow rate of the nozzles shall not deviate more than 10 % from the data of the dosing tables. Explanation: The maximum tolerable error for measuring the flow rate is 2.5 %.
0	0	0	0	5	0	0	19.2.1	Dosing instructions as standard values based on water shall at least give information about the adjusting of seed and plant protection product flow rate (if need be in relation to the seed and its hectoliter weight). Changeable dose mechanism are to be taken in consideration
1	2	3	4	5	6	7	20.0.0	The designation of type of equipment as well as the year of construction must be identifiable on the plant protection equipment.
1	2	3	4	5	6	7	21.0.0	Nozzles must be labelled so as to show the design, size and important operating data. Explanation: Identification must be performed by codes (e.g. type number, symbols, colours etc.) which can be decoded by the aid of tables to supply the information required.

**Federal Biological Research Centre
for Agriculture and Forestry
Messeweg 11/12
3300 Braunschweig
Federal Republic of Germany**

Explanations on the Procedure of Declaration

**Description of the equipment type pursuant to article 6 paragraph 3 of the
Regulatory Ordinance on Plant Protection Products and article 25 paragraph 3 of the
Plant Protection Act**

and

**Hints for the description of equipment types and description of the structure of
combination tables**

Preamble

Under the Plant Protection Act, the manufacturer, the marketing firm or the importer of plant protection equipment has to declare to the Federal Biological Research Centre for Agriculture and Forestry (BBA) in Braunschweig that the equipment type fulfils the requirements set out in article 24 of the Act before the equipment is marketed for the first time.

This declaration must be accompanied by all pieces of documentation required under article 25 paragraphs 2 and 3 of the Plant Protection Act (see section C of this form), otherwise the declaration cannot be accepted.

Every equipment type for which a declaration and the accompanying documents have been submitted will be registered in the plant protection equipment list by BBA and can be marketed.

If the documentation lodged with a declaration is incomplete, the equipment type will not be registered in the list. **Equipment of this type must not be marketed.**

The equipment type is only registered in the list and may only be marketed after all required documentation has been submitted.

Registrations in the plant protection equipment list are announced in the Federal Gazette (Bundesanzeiger) and the BBA bulletins every two months.

The requirements set out in article 24 of the Plant Protection Act have been detailed by the following BBA guidelines:

- Features of field sprayers
- Features of air-assisted sprayers for orchards, vineyards and hops
- Features of pedestrian, manual-powered sprayers
- Features of pedestrian, motor-powered sprayers
- Features of seed dressing equipment
- Features of granules applicators
- Features of fogging machines

The guidelines are available from:
Saphir Verlag, Gutsstraße 15, D-38551 Ribbesbüttel, Germany.

A Definitions

A.1 Equipment type -

stands for plant protection equipment of one manufacturer, marketing firm or importer which do not differ essentially as to design and facilities, which are of the same kind (see B.1) and which shall be marketed under a uniform type name and on the basis of the same declaration.

A.2 Version -

stands for plant protection equipment of one equipment type, which do not differ essentially in design and specification.

A.3 Option -

Comprises different construction features and specifications of plant protection equipment of one equipment type that influence application of the plant protection products but are not criteria demarcating an equipment type or version.

A.4 Kinds of equipment

1. Field sprayers
Plant protection equipment equipped with a horizontal spray boom such as mainly used on field crops (e. g. tractor mounted sprayers, trailed sprayers, self-propelled sprayers).
2. Air-assisted sprayers
Equipment mainly used in orchards, vineyards and hops (e. g. tractor-mounted, trailed, self-propelled sprayers).
3. Pedestrian, manual-powered sprayers
All pedestrian sprayers which are not powered by motors, mainly used in horticulture, orchards, vineyards, storage protection and forestry.
4. Pedestrian, motor-powered sprayers
All pedestrian motor-powered sprayers, mainly used in horticulture, vineyards, storage protection and forestry.
5. Seed dressing equipment
Equipment to apply plant protection products to seeds.
6. Granules applicators
Equipment to apply granular plant protection products.
7. Fogging machines
Equipment for fogging liquid plant protection products.

If a piece cannot be clearly classified under one of these kinds of equipment, the BBA shall be consulted.

B Demarcation of types of equipment, versions and options

B.1 Demarcation of types of equipment

B.1.1 Manufacturer (not manufacturing site/workshop)

B.1.2 Kinds of equipment

- a) Field sprayers
- b) Air-assisted sprayers
- c) Pedestrian, manual-powered sprayers
- d) Pedestrian, motor-powered sprayers
- e) Seed dressing equipment
- f) Granules applicators
- g) Fogging machines

B.1.3 Obvious and fundamental differences with regard to the mode of operation

- attached
- trailed
- mounted
- self-propelled
- hand-held
- shoulder-/back-portable
- continuous (only with B.1.2 e)
- discontinuous (only with B.1.2 e)

B.1.4 Disproportionately great number of addenda to one type of equipment

B.1.5 Disproportionately great number of versions of one type of equipment

B.2 Demarcation of versions

B.2.1 Nominal capacity of tank (B.1.2 a, b, c, d, f, g)

B.2.2 Design and flow rate at nominal pump pressure (B.1.2 a, b, c, d, e, g, if existing)

B.2.3 Design and working width of spray/spreader boom (B.1.2 a, c, d, if existing)

B.2.4 Design and flow rate at nominal number of revolutions of fan (B.1.2 a, b, d, f, g, if existing)

B.2.5 Dosage facility/-ies, controller (B.1.2 a, b, c, d, e, f, g)

B.2.6 Flowrate per hour (B.1.2 e)

B.2.7 Number of dosage facilities (B.1.2 f)

B.2.8 Agitation (B.1.2 e)

C Description of the equipment type

All pieces of documentation listed in the following have to be submitted together with the declaration. If documents are missing, the declaration cannot be accepted, meaning that the equipment type cannot be registered in the plant protection equipment list for the time being and therefore must not be marketed!

C.1 The description of the equipment type must contain:

1. a total representation including data on technique and functions:
 - a) total representation
 - b) data on the intended outfit of the equipment type (combination table, see C.2)
 - c) description form sheet
 - d) operation scheme and description of function
2. sufficient pictorial representations of the machine: photos, charts or leaflets shall show the equipment type with all its versions and complete optional equipment.
3. individual representation of all parts important for the application of plant protection products, in particular of the dosage and distribution facilities (if existing):

a) agitator	g) strainers, filters
b) pump	h) spray boom
c) tank filling and measuring device for plant protection products	i) fan/spray device
d) drain device	j) application rate regulator
e) atomizer	k) dosage device
f) controller	l) mixing device

C.2 Standard equipment of the equipment type (combination table)

The components of a type of equipment must be unambiguously classed with the version(s) they belong to.

All versions of an equipment type which have to be demarcated from each other on the basis of the criteria listed under B.2 are registered with their names.

It is recommended to do this in the form of a combination table.

Examples of combination tables for the different kinds of equipment have been appended.

That way of representation is recommended also for types of equipment which are presently manufactured as one version only, bearing in mind that there may be several versions in future. All possible optional devices have to be attached to the versions.

C.3 Description form sheets

Form sheets for the description of kinds of equipment can be requested from BBA. The sheets provide for descriptions of all parts of the equipment type including optional equipment which influences the application of the plant protection product. For some kinds of equipment, there are code lists to be used when filling in the form sheet. Where a code list applies, the square in the form sheet is filled in with either the relevant code number or the text belonging to it. If none of the descriptions given by the code list apply, code number 99 is entered together with a detailed description of the facts.

As the description form sheets have been designed to cover all plant protection equipment of one kind, some points may not apply in some cases. This must be indicated by entering "not applicable". If some points require several entries, such as with equipment with tanks of different designs and sizes, the information may be entered all together under the respective points or on separate copies of the same points. Information which needs more space than provided for by the form sheet has to be entered on a separate sheet. At any rate, it must be clear to which point the information refers.

C.4 Instructions for use

C.4.1 Under article 29 of the Plant Protection Act, the instructions for use must contain:

1. name and address of the manufacturer, marketing firm or importer,
2. name of the equipment type and
3. its field of use (as marked on the form sheet pertaining to the declaration).

C.4.2 In addition under annex 2 of article 6 (2) of the Regulatory Ordinance on Plant Protection Products the instructions for use must contain:

1. Information on the outfit of the plant protection equipment in correspondence to its purpose.
The combination table or another unambiguous list of possible combinations of equipment must be included in the instructions for use.
2. Information on the filling of the tank and necessary safety precautions.
The tank filling and the precautions for safety of the user and the environment must be described clearly. If applicable, the AID leaflet "Filling of Plant Protection Devices" (leaflet no 2079) should be used and amended according to the particular device.
3. Ranges of operations and settings.
Name the ranges of operations and settings which are covered by the declaration given under article 25 of the Plant Protection Act. This includes data on the performance of the pump/fan according to the speed of the PTO, on steps to adjust the air flow and on

the maximum slope with which the permitted amount of remaining chemical is not exceeded.

4. Remaining amount of substance which cannot be applied by the device as intended.
If the description form sheet demands such data, these have to be included in the instructions for use. The data should differentiate between that part of substance which can be diluted and that which cannot. If not, give the amount of plant protection substance which cannot be applied as intended.
5. Emptying and cleaning of equipment.
The procedure must be described clearly, including precautions for users' and environmental safety.
6. How to check dosage.
Indicate a practicable method and explain it with the help of an example.
7. Mesh width of strainers.
Indicate the largest inside mesh width.
8. Intervals between checks of equipment for proper functioning and accuracy of dosage and distribution.
The intervals need not necessarily be time intervals.
9. Limitations concerning the use of certain plant protection products.
The instructions for use have to contain a list of either plant protection products which are permitted or such which are not permitted with the equipment. If negative effects of combinations of registered plant protection products are known, these have to be included in the list.
10. Adjustment of the plant protection equipment to other operations.
Explain the settings for the different operations. The instructions for use should, for instance, explain adjustment of a combined sprayer and atomizer or of a field sprayer to band spraying.
11. Possible combinations with other machines and equipment.
Name safety precautions.
12. Checking of the plant protection equipment.
The instructions for use must describe the connections according to features 18.1.1 and 18.1.2 and name the sources and correct designations of adapter pieces, if needed.

C.5 Other hints

Documentation which has been tabled at the Federal Biological Research Centre before does not have to be submitted anew if modifications are made, but has to be clearly referred to in a new declaration.

If a declaration refers to documentation which has been submitted to BBA by another party, that party's consent is needed.

The pieces of documentation mentioned under C.1 need not be submitted separately. Reference may be made to other documentation submitted in the framework of the same declaration.

Information which is subject to secrecy and not to be published in the descriptive list of plant protection equipment is to be marked as such.

D Modifications

For modifications of the equipment type which influence the application of the plant protection products, the documentation describing the equipment type must be submitted anew, or supplemented. All modifications of the declared equipment type and, if there are, corrections of the former descriptions shall be submitted collectively.

If plant protection equipment is later equipped with parts which have not been subject of the declaration before, the following conditions must be met for the equipment to continue to fulfil the requirements of article 24 of the Plant Protection Act and be marketed:

1. If

- atomizers
- pressure gauges
- strainers
- pipes
- pumps
- electronic monitors and
- electronic controls

in plant protection equipment are to be replaced by others, all parameters of the new parts must be within the ranges of the parameters of those parts which are described by the declaration and which are now to be replaced.

This has to be proven by expert opinion or by official BBA approval.

Explanations:

a) pumps

- Type of pump (old and new), manufacturer and workshop have to be included in the information on the outfit of the plant protection equipment (e. g. in combination table).
- Instructions for use must be delivered to the buyer.

b) electronic monitors

- The flow meter type planned by the manufacturer must be used.
- Instructions for use must be delivered to the buyer.

c) electronically measuring and controlling device

- The manufacturer's original controls with flow meter, pressure controls, electric by-pass and shut-off valves and electric operation unit have to be used unless the manufacturer agrees to another interlace.

Note: The standardized interlace (interlace - board computer) may be used later.

- Instructions for use must be delivered to buyer.

2. Procedure of "supplementary declaration"

- controls
- monitors with flow meter component
- electronic measuring and controlling devices with modified control panel by the manufacturer or with controls by other manufacturers
- field spray booms
- twin fluid nozzles and their accessories and
- recycling facilities for sprayers and air assisted sprayers

may be modified if the respective parts do have the official BBA approval and a supplementary declaration was made to BBA by the manufacturer (importer) of the parts.

Explanations on the "supplementary declaration" procedure

- a) The manufacturer (importer) of the respective item of equipment applies for testing through BBA of the item in combination with one or several equipment types.
- b) After successful testing by BBA, the manufacturer of the item of equipment makes a supplementary declaration to BBA. That supplementary declaration has to be accompanied by:
 - a description of the item and reference to BBA testing of the item,
 - a list of equipment types (including manufacturer, types and versions of the equipment) on which the item can be mounted,
 - instructions for mounting and use of the item in combination with each equipment type.
- c) The manufacturer delivers together with the equipment item:
 - instructions for mounting and use
 - written statement concerning the recognition of warranty and liability arising from the modification or re-equipment
- d) The BBA announces
 - the supplementary declarations like "normal" declarations in the Federal Gazette (Bundesanzeiger)
 - the supplementary declarations as such in the BBA information bulletin.

3. A new declaration is required in all other cases.

The information concerning modification of an equipment type must make clear whether a new version is added to the equipment type by the modification or whether a version is cancelled. The following structure will be useful:

Corrections:

Modifications:

Additions:

Cancelled:

The pages of the description form which are concerned by the modification are replaced. Other pieces of documentation concerned are either supplemented or replaced.

A new declaration is required if a modification of an equipment type affects a demarcation as under B.1. This kind of modification leads to a **new equipment type** and cannot be covered by a supplement to an existing declaration.

Example of Combination Table for Field Sprayers

Version				Option													
Name of version	tank	pump	field spray boom	con-troller		band-sprayind device	agitator shut-off	electrical remote controller	electronical regulator	yaw compensator	boom extension	dobble nozzle carrier	flat spray nozzles*				
				for 3 boom sections (C 1)	for 5 boom sections (C 2)								120°	110°	80°		
1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

* Name manufacturer, size and material of nozzle

Example of Combination Table for Air-assisted Sprayers

Name of version	Version							Option													
	tank			pump		fan		con- troller										nozzle inserts*			
	tank 400 l (T 400)	tank 600 l (T 600)	tank 800 l (T 800)	diaphragm pump 100 l/min (DP 100)	piston pump 100 l/min (PP 100)	piston pump 180 l/min (PP 180)	axial 70 000 m ³ /h (AF 7)	axial 100 000 m ³ /h (AF 10)	tangential 20 000 m ³ /h (TF 2)	controller 1 (C 1)	controller 2 (C 2)	remote control	injector filler	flushing device	lift for hop growing	hose reel and spray gun	jet adjustment nozzle	twin quick-change nozzle	diameter 1.5 mm	diameter 2.0 mm	diameter 2.5 mm
1	X			X			X		X						X	X	X	X	X	X	X
2	X			X			X			X	X				X	X	X	X	X	X	X
3	X			X				X	X						X	X	X	X	X	X	X
4	X			X			X			X	X				X	X	X	X	X	X	X
5	X				X		X		X						X	X	X	X	X	X	X
6	X				X		X			X	X				X	X	X	X	X	X	X
7	X				X			X							X	X	X	X	X	X	X
8	X				X		X			X	X				X	X	X	X	X	X	X
9		X			X		X		X			X	X		X	X	X	X	X	X	X
10		X			X		X			X	X	X	X		X	X	X	X	X	X	X
11		X			X		X		X			X	X		X	X	X	X	X	X	X
12			X			X	X			X	X	X	X		X	X	X	X	X	X	X
13			X			X		X		X	X	X	X		X	X	X	X	X	X	X

* Name manufacturer, size and material of nozzle

Example of Combination Table for portable, manual-powered Sprayers

Name of version	Version								Option											
	tank		pump		spray-boom		fan		con-troller		standard nozzles *									
	tank 10 l (T 10)	tank 15 l (T 15)	piston pump (PP)		spray pipe 1 nozzle	radial 340 m ³ /h	radial 720 m ³ /h	shut-off valve	pipe extension 40 cm	pipe extension 100 cm	dovetail nozzle*	diameter 0.8 mm	diameter 1.0 mm	diameter 1.5 mm	adjustable nozzle *	atomizing nozzle*	hollow cone nozzle*			
1	X		X		X		X	X	X	X	X									
2	X		X		X	X		X	X	X										
3	X			X	X		X	X	X	X	X	X	X	X	X	X				
4	X			X	X	X		X	X	X	X	X	X	X	X	X				
5		X	X		X		X		X											
6		X	X		X		X		X			X								
7		X		X	X		X		X			X	X	X	X	X	X			
8		X		X	X		X		X			X	X	X	X	X	X			
9		X	X		X		X	X	X	X	X	X								
10		X	X		X	X		X	X	X	X	X								
11		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X			
12		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X			

* Name manufacturer, size and material of nozzle

Example of Combination Table for portable, motor-powered Sprayers

Name of version	Version							Option											
	tank		pump		spray-boom		fan	con-troller											
	tank 10 l (T 10)	tank 15 l (T 15)	piston pump (PP)		spray pipe 1 nozzle	radial 340 m ³ /h	radial 720 m ³ /h	shut-off valve	pipe extension 40 cm	pipe extension 100 cm	dovetail nozzle*	standard nozzles *			adjustable nozzle *	atomizing nozzle*	hollow cone nozzle*		
1	X		X		X		X	X	X	X	X	X	X	X	X	X	X		
2	X		X		X	X		X	X	X	X	X	X	X	X	X	X		
3	X			X	X		X	X	X	X	X	X	X	X	X	X	X		
4	X			X	X		X	X	X	X	X	X	X	X	X	X	X		
5		X	X		X		X		X			X	X	X					
6		X	X		X			X				X	X	X					
7		X		X	X		X		X			X	X	X					
8		X		X	X		X		X			X	X	X					
9		X	X		X		X	X	X	X	X	X	X	X	X	X	X		
10		X	X		X	X		X	X	X	X	X	X	X	X	X	X		
11		X		X	X		X	X	X	X	X	X	X	X	X	X	X		
12		X		X	X		X	X	X	X	X	X	X	X	X	X	X		

* Name manufacturer, size and material of nozzle

Example of Combination Table for seed dressing equipment

V e r s i o n

Name of version	V e r s i o n						O p t i o n				
	dosage device		flow per hour			mixing device		aspiration device	dust filter	bagging device	automatic capacity control
	dosage device 1	dosage device 2	4 t/h	10 t/h	20 t/h	drum 120 mm	drum 200 mm				
1	X		X			X		X	X	X	
2	X					X		X	X	X	X
3	X			X			X	X	X	X	X
4	X			X	X		X	X	X	X	X
5		X	X			X		X	X	X	
6		X		X		X		X	X	X	X
7		X		X			X	X	X	X	X
8		X			X		X	X	X	X	X

* Name manufacturer, size and material of nozzle

Example of Combination Table for Granules Applicators

Name of version	Version					Option							
	con- tainer		dosage device										
			kind	number									
	container 15 l	container 20 l	cam wheel	cell wheel	1	2	3	4	5	tail wheel drive	1-side fold	2-side fold	
1	X		X		X					X	X		
2	X		X			X				X	X		
3	X		X				X			X	X	X	
4	X			X	X					X	X		
5	X			X		X				X	X		
6	X			X			X			X	X	X	
7		X	X		X					X	X		
8		X	X			X				X	X		
9		X	X				X			X	X	X	
10		X		X	X					X	X		
11		X		X		X				X	X		
12		X		X			X			X	X	X	
13		X		X				X		X	X		X
14		X		X					X	X	X		X

° Name manufacturer, size and material of nozzle

SECTION II

Voluntary Testing of Plant Protection Equipment

A. BBA-Approval

B. Loss Reducing Technique

Preliminary Remarks to the Voluntary Testing of Plant Protection Equipment (§ 33 of Plant Protection Act)

A. BBA-Approval

Testing of plant protection equipment on a voluntary basis has developed over several decades and remains an important part of the tasks of the Federal Biological Research Centre for Agriculture and Forestry (BBA) after the compulsory procedure of declaration was introduced. The voluntary testing differs from the declaration procedure in so far as it is carried out on the actual equipment and -in conformity with article 33, paragraph 3, No. 3 of the Plant Protection Act- also on equipment and devices which are used in plant protection but which are not plant protection equipment (e. g. equipment for weed control by heat). It is carried out together by the BBA and the examination authorities of the Laender. The BBA carries out the technical examination on modern and efficient test facilities (see page 197 and following), producing exact and verifiable results, while the examination authorities of the Laender take over field tests in field cropping, viticulture, fruit, hop and vegetables growing and forests to test the practical performance of the equipment. The BBA co-operates with a total of 18 examination authorities, some of which have their own large testing facilities.

The voluntary tests are based on the Plant Protection Act, the Regulatory Ordinance and on the later following BBA-publications.

As the equipment is examined under both technical and practical aspects, its suitability can be safely evaluated. The test results of BBA and of the authorities which tested the practical use are discussed with the examination authorities involved in the framework of the expert group on the equipment registration procedure (formerly working and evaluation committee). If the equipment performs well in the tests, it is recognized for a five-year period and may be marked with a "sticker of approval" (figure 1). Apart from complete plant protection equipment tests are also carried out for equipment parts such as nozzles, controls etc.

The tests include examination of safety aspects by the Federal Association of Agricultural Professional Associations. Official test reports are published for approved equipment and equipment parts. The approved equipment and equipment parts are published annually.



Figure 1: BBA sticker of approval which is awarded for a five-year period if equipment or equipment parts are found to be suitable for their purpose in voluntary official tests

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

March 1999

1-2.3.1

**Regulations for Testing
Plant Protection Equipment**

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

Published by:

Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

German version obtainable from:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbüttel

English version obtainable from:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

Use of common names or trade names in this regulation does not mean these can be used by anyone. They may be registered, legally protected trademarks, even when this is not evident. No warranty for possible mistakes in the text..

All rights reserved, including rights of translation, reprint, photo-copying and copying by electronic media.

No liability for errors in text.

Regulations for Testing Plant Protection Equipment

Article 1

This regulation concerns the testing of suitability of equipment for plant protection according to article 33 (2) no. 5 and paragraph (3) no. 3 of the Plant Protection Act as published on 14 May 1998 (Federal Law Gazette (BGBl) I p. 971, 1527, 3512), in conjunction with articles 4 to 6 of the Regulation on Plant Protection Products as published on 17 August 1998 (BGBl I p. 2162).

Article 2

Plant protection equipment is such which is designed to directly or indirectly protect plants and plant products (stored products) from noxious organisms and diseases.

Article 3

- (1) The BBA acts and tests upon application.
- (2) The testing can be applied for by the:
 1. manufacturer;
 2. distributor;
 3. importer;
 4. owner.
- (3) Those who have neither residence nor an office in a member country of the European Community can apply for testing only if they have ordered an agent with residence or office in the area of validity of the German Plant Protection Act. The agent is empowered to act on behalf of the applicant in the procedure of testing.
- (4) The application must be made by a form (see page 63/64) published by the BBA.
- (5) An application for testing according to article 33 (2) no. 5 of the Plant Protection Act and the expert opinion for approval (in the following in short "approval") do not free the applicant from the obligation to make a declaration about the equipment according to article 25 of the Plant Protection Act.
- (6) Documents which are not in German must be translated by an official translator. The BBA may allow exceptions.

Article 4

- (1) The BBA tests plant protection equipment in cooperation with the plant protection services of the *Laender*.
- (2) Other institutions may be involved in the testing.

Article 5

Two copies of the use instructions in German must be sent in with the equipment to be tested. More documents, such as spare parts lists and drawings, must be supplied to the inspection office upon request. The inspection office may ask for personal instructions about operation of the equipment by the applicant or his agent.

Article 6

- (1) Testing is based on the legal requirements and on the features published by the BBA according to article 4 (2) of the Regulation on Plant Protection Products as well as on other specific guidelines published by the BBA for various kinds of equipment.
- (2) The suitability of the equipment is tested with the help of special testing facilities and in practical operation. The BBA may allow exceptions in special cases.
- (3) Testing with the help of special test facilities serves to verify technical data, observance of legal requirements and service life, if necessary.
- (4) Operation tests also include testing the functions before actually operating sprayers in practice. Operation tests are carried out for every intended area of use at an inspection office of the *Laender*-based plant protection service. The BBA may allow exceptions.

Article 7

The BBA may order a new test when

1. observance of the conditions tied to the approval must be monitored;
2. the equipment has been modified in a way concerning its function as plant protection equipment, or when such a modification is planned;
3. facts substantiate the suspicion that the equipment is no longer suitable;
4. prolongation of the approval has been applied for, but new criteria have become valid for the equipment concerned.

Article 8

- (1) Plant protection equipment is approved by the BBA if testing has shown that the equipment fulfils the legal requirements and, proceeding from the current state of technology, is suitable for the intended purpose.
- (2) The BBA establishes features and other guidelines for the different kinds of equipment as a basis for testing. If there are no special features and guidelines for some kind of equipment and legal requirements are met, the equipment is judged by the technical data and test results, the functionality of construction and in practical use.

- (3) The BBA evaluates the suitability of equipment and techniques together with the *Laender*-based plant protection service.
- (4) Before granting approval, the BBA hears a panel of plant protection equipment experts appointed from the offices taking part in the testing according to article 4 of this regulation.
- (5) The BBA may impose conditions, in particular with regard to the use of certain information and labels.

Article 9

The applicant may place the BBA sticker of approval (black print on white fond) on his equipment if the equipment is approved. He is entitled to advertise the approval. It is allowed to list more than one test number (Nr. G + four-digit number) under the sticker of approval. In that case, each number must be followed by the full name of the machine or piece concerned. The sticker of approval and the numbers and names of recognised equipment shall appear together.



Nr. G

Article 10

- (1) Approval ends five years after the end of the year it was granted. It can be renewed upon application. A shorter period of approval may be defined in particular cases.
- (2) Approval shall be withdrawn if a requirement is not fulfilled by the time approval is granted.
- (3) Approval shall be withdrawn if a requirement ceases to exist. It may be withdrawn when the holder of the approval applies for that, or when he does not adhere to a condition imposed by the BBA.

Article 11

The BBA raises costs (fees and expenses) for the official testing on the basis of the BBA Cost Regulation.

Article 12

This testing regulation takes effect on 1 April 1999.

At the same time, the Regulation on the Testing of Plant Protection Equipment of July 1973 becomes ineffective.

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

March 1999

1-2.3.2

Explanations for the Testing of
Plant Protection Equipment

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

Published by:

Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

German version obtainable from:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbüttel

English version obtainable from:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

Use of common names or trade names in this regulation does not mean these can be used by anyone. They may be registered, legally protected trademarks, even when this is not evident. No warranty for possible mistakes in the text..

All rights reserved, including rights of translation, reprint, photo-copying and copying by electronic media.

No liability for errors in text.

Explanations for the Testing of Plant Protection Equipment

These explanations hold for the testing of plant protection equipment according to article 33 (2) no. 5 and paragraph (3) no. 3 of the Plant Protection Act (PflSchG) as published on 14 May 1998 in the *Bundesgesetzblatt* (Federal Law Gazette - BGBl. I p. 971, 1527, 3512), in conjunction with articles 4 to 6 of the Regulation on Plant Protection Products as published on 17 August 1998 (BGBl I p. 2162). Testing is required if the equipment is to be entered in the "List of loss-reducing equipment".

- (1) In the course of testing, the suitability of plant protection equipment is evaluated on the basis of uniform criteria. Requirements and features for the testing have been published by the *Biologische Bundesanstalt für Land- und Forstwirtschaft* (BBA) in guidelines for the testing of plant protection products and plant protection equipment, part VII. The application for testing does not free the applicant from submitting a declaration according to article 25 Plant Protection Act.

Labour safety tests are carried out by

Bundesverband der landwirtschaftlichen Berufsgenossenschaften
- Hauptstelle für Sicherheit und Gesundheitsschutz -
Weißensteinstraße 70 - 72, 34131 Kassel.

- (2) The test results are discussed by a machinery evaluation committee (Fachbeirat Geräte – Anerkennungsverfahren).

The committee consists of the head of the BBA Department for Plant Protection Products and Application Techniques as chairman, the head of the Application Techniques Division as deputy chairman, and technical experts of the test stations of the plant protection services of the federal *Laender*. Other members may be appointed by the president of the BBA.

Members' names are published in *Nachrichtenblatt des Deutschen Pflanzenschutzdienstes* (Bulletin of the German Plant Protection Service).

- (3) If there is a fundamental obstacle to approval of an equipment, the BBA will inform the applicant of that before the beginning of testing.
- (4) The minimum test period in practice is one season.
The BBA decides upon the test stations for the test in practice and informs the applicant about its decision. Applicants' proposals may be considered if disadvantages (such as far distance to the inspection place) are avoided, also with a view to future presentations or inspections.
If a machine of the type to be tested is present on a suitable farm, the machine can be tested on that farm, if the applicant wishes so.
- (5) If the applicant lists several areas of use of the machine and a test station can carry out tests in several areas of use, the BBA may order to carry out the tests there in order to reduce the number of machines needed for testing. However, the period of testing per area of use must not be shorter than the regular minimum test period.

- (6) With big machines to be tested, the BBA may order, upon the applicant's justified request, fewer machines for testing than would be necessary going by the number of testing stations. Together with the test station, it will make a schedule of delivery of the machines. The applicant has to make sure that the machines are delivered to the testing stations in due time.
- (7) Apart from complete equipment, equipment parts will be tested too. In these cases, the applicant has to deliver fitting pipe connections and power shafts, and upon request by the BBA or another testing station, also the machine on which the parts in question are fitted. The testing stations can allow exceptions according to their own discretion.
- (8) Applicants are advised to insure machines against any kind of damage for the time of testing and transport. In cases of damage, settlement between the parties concerned should be sought.
- (9) The BBA may ask for material samples and information about the materials used for pesticide-carrying parts of the equipment to test their resistance to plant protection products.
- (10) Testing is stopped if operation tests reveal any deficiencies which speak against the use of the equipment in practice. Tests may be continued if the applicant is able to remove the defects early enough to allow tests to be finished within the period provided for by the guidelines.
- (11) Applicants may inform themselves about the course and level of testing at the testing stations and to inspect their equipment during tests, after contacting the testing station about that request. – If requested so, the BBA informs the applicant about the state of affairs of the approval procedure.
- (12) The evaluation of the equipment is supported by reproducible data and test methods, as far as possible.
- (13) The approval holds only for the tested type of equipment. Varying versions of approved equipment types are only considered as approved if they have been tested by the BBA or presented at the BBA to good effect.
- (14) Approval may be restricted to certain areas of use, techniques or plant protection products.
- (15) Conditions imposed by the BBA shall not obstruct technological progress. Technical feasibility is considered in the evaluation of deficiencies and their possible removal.

Advice on how to meet certain conditions remove deficiencies are given by the BBA or the test stations of the Plant Protection Service only upon request by the applicant and without liability.

- (16) With the approval, the applicant may receive, without obligation, recommendations for improval of the equipment. These recommendations exceed what is required for approval and are intended to serve the improvement of the equipment.
- (17) When an application for prolonging the approval of certain equipment is made, the equipment must be presented to a test station named by the BBA. The BBA announces relevant dates. It may release such presentation in exceptional cases.

The BBA starts new testing if a presentation of equipment cannot affirm that this equipment is equal to the equipment type tested.

The testing stations decide where they want to inspect or test the equipment.

- (18) If equipment is to be marketed by another distributor and under another name, the distributor may apply for transference of the approval. For this purpose, both the old and the new applicant have to declare in writing that the equipment is technically the same. The new applicant has to present the machine at a test station named by the BBA.

A approval is transferred by the BBA without prior hearing of the Commission on Plant Protection Equipment. Transference of approval is not possible if equipment has been ammended in a way concerning its function as plant protection equipment.

A transference of approval does not affect the period of approval or deadlines for fulfilling certain conditions imposed.

- (19) Before an approval is withdrawn, the applicant can be granted an adequate period of time to clarify the problem in question. This period is usually 6 weeks.
- (20) The BBA publishes test reports about approved equipment. Before print, it sends draft reports to the applicant concerned for comment. The BBA also publishes an annual list of authorised plant protection products, part six of which lists the approved equipment ("Pflanzenschutzmittelverzeichnis Teil 6, Anerkannte Pflanzenschutzgeräte"). The list comprises all approved equipment and optional equipment parts with basic technical data and information about the equipment's suitability for certain techniques and places of use.

The BBA can make more publications about the equipment.

- (21) Test reports may be distributed and used only in unabridged form.
- (22) Requirements for plant protection equipment and guidelines for equipment testing can be obtained from:

Saphir Verlag
38551 Ribbesbüttel
Phone: 0 53 74/6576 fax: 0 53 74/65 77

- (23) The BBA strives for permanent contact with applicants. To form a technically objective, generally valid opinion, the BBA calls conferences with the Committee on Plant Protection Equipment and with the VDMA Farm Machinery Association, if necessary also with the agrochemical industry (represented by Industrieverband Agrar e. V.) and research institutes dealing with plant protection machinery.

- (24) The BBA supports the establishment of European and internationally valid requirements and testing methods for plant protection equipment.

This guideline replaces leaflet no. 39 of July 1973 by the Biologischen Bundesanstalt für Land- und Forstwirtschaft.

APPLICATION FORM

Applicant:

Place, date:

Official in charge:

Phone:

Biologische Bundesanstalt
für Land- und Forstwirtschaft (BBA)
Abteilung für Pflanzenschutzmittel
und Anwendungstechnik
Messeweg 11/12
28104 Braunschweig

Application

for testing renewed approval transfer of approval 1)
and/or
for registration in the list of loss-reducing equipment 2)
of the following plant protection equipment:

Manufacturer: _____

Designation of equipment 3): _____

Version 4) _____

For registered equipment 5), E-no.: _____

Type of equipment 6): _____

Design 7) _____

Use intended in the following areas 8): _____

Enclosures:

- Instruction manual (3 copies)
- Description of the type of equipment
- Picture of the machine
- Certificate about the technical safety of the machine with regard to prevention of accidents 9)
- Certificate of adherence to Road Licencing Regulations
- List of equipment versions to be registered as loss-reducing techniques 10)

The applicant has the right of disposal of the equipment. With the delivery of the equipment, he assumes legal liability for any damage which may occur during the transport and testing of the equipment and which has not been caused by the BBA or persons empowered by it by intention or gross neglect. The applicant acknowledges the BBA's provisions and current fees for the testing of plant protection equipment.

Firm's stamp

Signature

Please note remarks on the backpage.

BBA-FA 61-01/1 (08.96)

Notes

- 1) If acknowledgement (of some plant protection equipment) is to be transferred, a statement by the holder of the recognition saying that he agrees to the transfer must be enclosed.
- 2) Registration of plant protection equipment in the list of loss-reducing equipment:
Upon consultation with the BBA, the applicant has to supply certain test results proving that drift during spraying is reduced. With equipment registered in that list, smaller buffer zones must be kept while spraying.
- 3) Please name the type of equipment as written on the type plaque, or as entered in the official plant protection equipment list, if it is plant protection equipment in the letter of the law.
- 4) If there is a matrix of the equipment type in question, please enter only the name of the particular version, if not, please describe the equipment in detail. If equipment parts are the matter in question, no information is required.
- 5) Before plant protection equipment - except minor equipment - is placed on the market, the distributor has to make a statement to the BBA saying that the equipment meets the legal demands. That statement is not replaced by the present application. The BBA enters equipment for which such a statement was made into the official plant protection equipment list under an 'E'-number. The E-number has to be cited here. The space need not be filled if the application is about minor equipment, equipment parts or equipment, which is not plant protection equipment in the meaning of the law.
- 6) Please choose from the following list:

Field crop sprayers	Pump
Vineyard, orchard and hop sprayers	Nozzles
Portable, manual-powered sprayer	Sprayer boom
Portable, motor-powered sprayer	Hose
Seed dressing machine	Pressure gauge
Granules applicator	Recycling facility
Fogger	Vine spray boom
Fumigator	Devices for rodent control
Brushing equipment	Forest protection equipment
Other sprayer	Warning device/recorder
Other plant protection equipment	Spraying monitor
Horizontal distribution controls	Constant flow control
Pressure controls	
Flow controls	
Controls of horizontal distribution, pressure and flow	
- 7) Please choose (information on) the design/version from the following two lists (one term from either list):

Design/version:	Technique:
Attached equipment	Broadcast treatment
Mounted equipment	Band/row treatment
Trailed equipment	Punctual treatment
Self-propelled machine	Continuous
Knapsack equipment	Stepwise
Shoulder-portable equipment	Wet seed-dressing machine
Hand-held equipment	Dry seed-dressing machine
Stationary	Seed coater
Cart sprayer	Hot fogger
Other equipment	Cold fogger
	Other technique
- 8) Please choose area(s) of use from the following list:

Field crops	Grassland
Tree nurseries	Specialty crops
Forests	Storage protection
Vegetable crops	Wine-growing
Hop-growing	Glasshouse crops
Non-cultured land	Ornamentals
Fruit-growing	
- 9) Such a certificate is issued by a competent body under the Act on Technical Instruments of Labour (usually, Bundesverband der landwirtschaftlichen Berufsgenossenschaften, Hauptstelle für Unfallverhütung, Postfach 41 03 56, 341 114 Kassel).
- 10) All versions equipped with a proven loss-reducing facility may be entered, even when the complete equipment was not tested, but only the loss-reducing facility in question. The eventual decision about entry in the register lies with the BBA.

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

April 1999

1-2.1

Supplementary Requirements and Recommendations for Plant Protection Equipment to be tested in compliance with Article 33 of the Plant Protection Act

Published by the Department of Plant Protection Products and Application Techniques of the Biologische Bundesanstalt Braunschweig

Names and Addresses of authors:

Siegfried Rietz
Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik
Messeweg 11/12
D - 38104 Braunschweig

Lothar Knott
Landwirtschaftskammer Westfalen-Lippe (IPSAB)
Nevinghoff 40
D - 48147 Münster

German version obtainable from:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbüttel

English version obtainable from:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

Use of common names or trade names in this regulation does not mean these can be used by anyone. They may be registered, legally protected trademarks, even when this is not evident. No warranty for possible mistakes in the text..

All rights reserved, including rights of translation, reprint, photo-copying and copying by electronic media.

No liability for errors in text.

Contents

	Page
Field sprayers and air-assisted sprayers (equipment type 1)	
Additional requirements	73 - 74
Recommendations	75 - 76
Sprayers and air-assisted sprayers for orchards, vineyards and hops (equipment type 2)	
Additional requirements	77 - 79
Recommendations	79 - 80
Pedestrian manual powered sprayers (equipment type 3)	
Additional requirements	81 - 82
Recommendations	82
Pedestrian motor powered sprayers (equipment type 4)	
Additional requirements	83 - 84
Recommendations	85
Seed treatment machines (equipment type 5)	
Additional requirements	86 - 87
Recommendations	87
Granules applicators (equipment type 6)	
Additional requirements	88
Recommendations	89

This guideline document supersedes the following publications of the Federal Biological Research Centre for Agriculture and Forestry:

- Leaflet No. 43: Requirements for Seed Treatment Machines
(Equipment Type 5)
- Leaflet No. 46: Requirements for Field Sprayers
(Equipment Type 1)
- Leaflet No. 47: Requirements for Plant Protection Equipment for
Application of Plant Treatment Granules
(Equipment Type 6)
- Leaflet No. 52: Requirements for Mobile Sprayers and Air-Assisted
Sprayers for Orchards, Vineyards and Hops
(Equipment Type 2)
- Leaflet No. 53: Requirements for Pedestrian, Hand-held Sprayers
(Equipment Type 3)
- Leaflet No. 54: Requirements for Pedestrian Motor Powered Sprayers,
Air-assisted Sprayers and Dusting Equipment
(Equipment Type 4)

Section A of the guideline document lists additional requirements for equipment types 1-6 that must be met in addition to the legal requirements in order to pass testing according to Article 33 of the Plant Protection Act.

Section B provides recommendations for each equipment type. If the tested equipment fulfils these recommendations, this will be recorded in the equipment test report after the positive test decision has been made.

Field sprayers and air-assisted sprayers (Equipment type 1)

A Additional Requirements for Voluntary Equipment Testing

1. Mode of operation

- 1.1 The equipment must not damage the crop when in operation.
- 1.2 The uniformity of cross distribution is measured by a 10 cm groove patternator. Measured values may not deviate by more than ± 5 % (corresponding to a coefficient of variation $C_v=7$ %) from the mean in the pressure range specified by the applicant. With overlapping nozzles, this requirement holds only for the fully overlapped area.

2. Equipment

- 2.1 In trailed and self-propelled equipment, the track width and regulation devices must be adapted to meet the current standards for tractors and agricultural machinery. A minimum ground clearance of 35 cm must be maintained.

3. Application rate

- 3.1 The application rate depends on what is labelled for the specific plant protection product to be used (§ 15 (1) no. 3 together with § 15 (2) no. 2a Plant Protection Act).
- 3.2 Test measurements will be made at a travelling speed of 6 km/h, whereby either the power take-off speed or the engine speed (motorized equipment) specified in the instruction manual will be used, as applicable.

4. Equipment parts

4.1 Pumps

- 4.1.1 The pump output must comply with the values specified in the dosage table for the equipment in question, and a minimum capacity of 5 l/min must be maintained for each meter of working width. Hydraulic agitation systems must also meet the conditions specified in items 3.3.1 to 3.3.3.

4.2 Spray tank

- 4.2.1 Protective coating or varnish should not dissolve or detach.
- 4.2.2 The tank filling strainer should be easy to remove.
- 4.2.3 Driving safety and spraying quality must not be impaired by sloshing tank liquid.

4.3 Spray boom

- 4.3.1 Vertical and horizontal vibration must be kept to a minimum when travelling across uneven terrain.

4.4 Controls

- 4.4.1 The display range and scale division of the spray pressure gauge must ensure proper display of the optimum pressure range for the utilized nozzle types. More than one spray pressure gauge must be installed, if necessary.

5. Instructions for use

- 5.1 The optimum distance between the spray boom and the target area and the optimum pressure range must be indicated.
- 5.2 Must provide instructions for nozzle use and dosage tables or diagrams indicating the spray application rate (l/ha) as a function of the pressure indicated on the pressure gauge and as a function of the travelling speed for the specified nozzle types.
- 5.3 The number, configuration and size of nozzles should ensure that the spray mixture is applied at the rate specified in the dosage table. The pressure in each nozzle must not exceed or fall below the optimum pressure range (cf. item 1.2).
- 5.4 Must explain how to clean and flush pumps, pipes, controls and nozzles while there is still spray in the tank.
- 5.5 For equipment with tank volumes of 200 litres or more, the manual must describe how to clean and/or flush the pumps and pipes and control gauges and nozzles whilst spray mixture is still present in the tank.
- 5.6 The manual must explain how inspections according to guideline 1-3.2.1 of part vii of the BBA Guidelines for the Testing of Plant Protection Products and Plant Protection Equipment shall be carried out, and in particular, where measuring devices shall be connected, if necessary.
- 5.7 If pipe filters are used, the manual must state how often they are to be cleaned.
- 5.8 All documents and instruction labels on the sprayer must be in German.
- 5.9 Symbols for operation and setting instructions and colour labels on the machine must be explained.

Field sprayers and air-assisted sprayers (Equipment type 1)

B Recommendations for Voluntary Equipment Testing

1. Operability

- 1.1 Operation and maintenance should be simple.
- 1.2 Maintenance points must be easily accessible and clearly marked.

2. Outfit

- 2.1 Sprayers should be designed for one-man operation.
- 2.2 Nozzle-to-ground distance should be adjustable up to 2.5 m.
- 2.3 Sprayers without mixing device should have a chemical introduction bowl which facilitates preparation of the spray mixture, enhances operator protection and is equipped with a device to wash pesticide containers.

3. Application rate

- 3.1 Ensure application rate of at least 200 to 600 l/ha.
- 3.2 Spray application rates should be variable to a certain degree by adjusting the travelling speed (5 to 8 km/h) or, better, by using different nozzles or nozzle tips, while keeping pressure constant.

4. Equipment parts

4.1 General remarks

- 4.1.1 Parts subject to wear should be easily accessible and exchangeable.

4.2 Pumps

- 4.2.1 The pressure accumulator should be pre-pressurized for pulsation damping and should be equipped with a pressure gauge.

4.3 Spray tank

- 4.3.1 Sprayers without a chemical introduction bowl should have a mixing device that facilitates the preparation of spray mixture.

4.4 Spray boom

- 4.4.1 Booms with a working width of more than 10 m should have both vertical and horizontal vibration compensation devices in order to keep horizontal vibration to a minimum.

4.5 Controls

- 4.5.1 Dosing device should be dependent on power take-off shaft speed.
- 4.5.2 It should be possible to reroute the return flow to the suction intake line in order to minimize the amount of residual mixture that can no longer be properly applied.
- 4.5.3 Should be positioned so as to be operated in front or to the side of the driver, and control gauges should be readable in the front or lateral field of vision.

4.6 Filters

- 4.6.1 Central pressure filters in the controls should allow self-cleaning mode.

5. Instructions for use

- 5.1 Should include information on the droplet size spectrum generated by the nozzles.

Sprayers and air-assisted sprayers for orchards, vineyards and hops (Equipment type 2)

A Additional Requirements for Voluntary Testing

1. Mode of operation

- 1.1 The equipment must not damage the crop when in operation.
- 1.2 With the data specified in item 2.3, the sprayers should achieve at least one of the following working width and height specifications, regardless of the number of lines or rows, when spraying to both sides:

Orchards

Working width ≤ 3 m and working height ≤ 3 m

Working width ≤ 4 m and working height ≤ 4 m

Working width ≤ 6 m and working height ≤ 6 m

Working width ≤ 8 m and working height > 6 m

Vineyards

Working width ≤ 1.6 m and working height ≤ 1.8 m

Working width ≤ 1.8 m and working height ≤ 2.2 m

Working width ≤ 2.0 m and working height ≤ 2.2 m

Working width ≤ 2.5 m and working height ≤ 2.2 m

Hops

Working width ≤ 3.2 m and working height ≥ 8.5 m

Working width ≤ 6.4 m and working height ≥ 8.5 m

Working width ≤ 9.6 m and working height ≥ 8.5 m

Working width ≤ 10.5 m and working height ≥ 8.5 m

2. Application rate

- 2.1 The application rate depends on what is labelled for specific plant protection product to be used (§ 15 (1) no. 3 together with § 15 (2) no. 2a of the Plant Protection Act).
- 2.2 Measurements for test purposes will be made at a travelling speed of up to 6 km/h in vineyards and orchards, and up to 2 km/h in hops, whereby the nominal power take-off shaft speed or the engine speed (motorized equipment) specified in the instruction manual will be used, as applicable.
- 2.3 Under the mentioned conditions, the following application rate should be achieved:

Orchards

400 to 2000 l/ha without air assistance

300 to 1000 l/ha for air-assisted spraying

Vineyards
400 to 2000 l/ha without air assistance
300 to 1000 l/ha for air-assisted spraying

Hops
500 to 5000 l/ha without air assistance
300 to 3500 l/ha for air-assisted spraying

3. Equipment parts

3.1 Pumps

3.1.1 The operating pressure of equipment with hydraulic atomising must lie within the following limits:

	WITHOUT AIR ASSISTANCE	WITH AIR ASSISTANCE
Orchards	40-60 bar	≤ 40 bar
Vineyards	20-60 bar	≤ 20 bar
Hops	50-60 bar	≤ 40 bar

3.2 Spray tank

3.2.1 Protective coating or varnish should not dissolve or detach.

3.2.2 The tank filling strainer should be easy to remove.

3.3 Nozzles

3.3.1 The number, configuration, size and spraying angle (and swirl plates) of nozzles should ensure that the spray mixture can be applied at any rate specified in the dosage table.

3.3.2 The output of nozzles of the same size must not deviate by more than 10 %.

3.4 Controls

3.4.1 The display range and scale division of the spraying pressure gauge must ensure proper display of the optimum operating pressure range; more than one pressure gauge must be installed, if necessary.

4. Instructions for use

4.1 Should indicate how inspection according to guideline 1-3.2.2 of part VII of the BBA Guidelines for the Testing of Plant Protection Productis and Plant Protection Equipment are to be performed and, in particular, where measuring devices are to be attached, if necessary.

4.2 The manufacturer must provide examples showing instrument settings that ensure good spray distribution.

4.3 If pipe filters are used, the manual must specify how often they are to be cleaned.

- 4.4 For equipment with tank volumes of 400 litres or more, the manual must describe how to clean and flush the pumps and pipes and control gauges and nozzles whilst spray mixture is still present in the tank.
- 4.5 For equipment with tank volumes of up to 200 l, the manual must describe how to clean the suction filter whilst spray mixture is still present in the tank.
- 4.6 All documents and instruction labels on the machine must be in German.
- 4.7 Symbols for operation and adjustment instructions as well as colour labels must be explained.

Sprayers and air-assisted sprayers for orchards, vineyards and hops (Equipment type 2)

B Recommendations for Voluntary Equipment Testing

1. Operability

- 1.1 Operation and maintenance should be simple.
- 1.2 Maintenance points should be easily accessible and clearly marked.

2. Outfit

- 2.1 Sprayers should be designed for one-man operation.
- 2.2 Hop sprayers should have ground clearance of not less than 300 mm.
- 2.3 Endangered equipment parts should be protected from ground contact. Equipment used in orchards should also be protected from bulky pieces of wood.
- 2.4 If there is no separate mixing device, sprayers should have a chemical introduction bowl which facilitates preparation of spray mixture, enhances operator protection and is equipped with a device for washing pesticide containers.

3. Application rate

- 3.1 Spray application rate should be varied by using different nozzles or nozzle tips, while the pressure should remain constant.

4. Equipment parts

- 4.1 Pumps
 - 4.1.1 The pressure accumulator should be pre-pressurized for pulsation damping and should be equipped with a pressure gauge.

4.2 Spray tank

- 4.2.1 With sprayers used on sloping terrain, it should be possible to empty the tank with the pump when the tank holds up to 1000 l and slopes have a gradient of over 20% or when the tank is bigger and slopes have a gradient of over 10%.
- 4.2.2 If there is no chemical introduction bowl, sprayers should be equipped with mixing devices facilitating the preparation of spray mixture.

4.3 Swinging spray pole

- 4.3.1 Movements of swinging spray poles while travelling across uneven terrain should be kept within narrow limits.

4.4 Fan

- 4.4.1 The airstream generated by the sprayer should be symmetrical with respect to its flow volume and velocity left and right of the sprayer. Fluctuations in flow volume and maximum velocity should not deviate from the mean value by more than 7.5 %.
- 4.4.2 Fans should be prevented from sucking in drops of spray, plant debris or dirt, etc.

5. Instructions for use

- 5.1 Should indicate the flow volume required for the hydraulic agitator to maintain uniform dispersion during spraying.
- 5.2 Should give data on the droplet size spectrum generated by the nozzles.

Pedestrian manual-powered sprayers (Equipment type 3)

A Additional requirements for voluntary equipment testing

1. Operation

1.1 The equipment must permit quick, plant-protective operation.

2. Outfit

2.1 With tanks filled, the equipment must not weigh more than 25 kg.

2.2 If filled equipment weighs more than 10 kg, it must be easy for a second person to help take the equipment up and put it down.

2.3 Carrying straps must not pinch.

2.4 Carrying straps must be adjustable in length.

2.5 Handles which are held in hand during operation must not impair the worker, for instance by any pressing or sharp edges.

2.6 Sprayers must have suitable devices to prevent dripping as far as possible.

3. Equipment parts

3.1. Pumps

3.1.1 Liquid pumps (piston and diaphragm pumps) must be adapted to the nozzles in output and pressure.

3.1.2 The power required for pumping should be within tolerable limits.

3.1.3 Air pumps for equipment where the tank must be put under pressure have to allow pumping-up in about three minutes. The piston cross section has to be so as to signal exceeding of the maximum working pressure by stiffness.

3.2 Tank

3.2.1 It must be possible to spray the tank empty in horizontal position.

3.2.2 Varnish or any other coatings must not dissolve or detach.

3.3 Controls

3.3.1 Apart from in equipment with a filling volume of less than 5 l, there must be some device to keep the spraying pressure within a deviation of +/-15 % throughout the time the tank is emptied.

3.4 Nozzles

- 3.4.1 The number, arrangement and assortment of nozzles must fit the intended use.
- 3.4.2 The output of flat-jet nozzles may deviate, with constant pressure, by a maximum of +/- 5 % from the tabular value.

3.5 Hoses and spray lances

- 3.5.1 Hose lines on the equipment must be long and flexible enough to allow working without unusual fatigue even with the arm stretched.
- 3.5.2 Hose lines must remain flexible down to a temperature of 0° C.

4. Instructions for use

- 4.1 All documents and instruction labels on the machine must be written in German.
- 4.2 Symbols for operation and machine adjustment and colour labels must be explained.
- 4.3 Must contain information about nozzle use and a calibration table showing the nozzle output as a function of pressure.

Pedestrian manual-powered sprayers (Equipment type 3)

B Recommendations for voluntary equipment testing

1. Outfit

- 1.1 The weight of the basic equipment should be limited as follows:

Equipment weight (kg)		
Usable tank contents (l)	Pressure accumulator sprayers (automatic)	Others
3	-	0.8
5	4.5	1.2
10	6.5	4
15	8	6

- 1.2 Carrying straps should be padded.
- 1.3 Handles which are held in hand during operation should be comfortably shaped.

Pedestrian motor-powered sprayers (Equipment type 4)

A Additional requirements for voluntary equipment testing

1. Operation

1.1 The equipment must permit quick, plant-protective operation.

2. Outfit

2.1 When adjustable nozzles are used, adjustment of the jet pattern must be easy and reproducible.

2.2 The equipment must not weigh more than 25 kg with full tanks.

2.3 If filled equipment weighs more than 10 kg, it must be easy for a second person to help take the equipment up and put it down.

2.4 Carrying straps must not pinch.

2.5 Carrying straps must be adjustable in length.

2.6 Handles which are held in hand during operation must not impair the worker, for instance by any pressing or sharp edges.

2.7 Combination equipment must be easily re-equipped.

3. Equipment parts

3.1 Pumps

3.1.1 The pumps must be adapted in pressure to the specified nozzle equipment.

3.2 Spray tank

3.2.1 It must be possible to spray tanks empty in horizontal position.

3.2.2 Varnish or any other coatings must not dissolve or detach.

3.3 Controls

3.3.1 Air-assisted sprayers must have a gauge showing the spray mixture flow.

3.3.2 Sprayers without air-assistance must have a controlling device keeping the spray pressure within a +/-15 % deviation throughout the time the tank is emptied.

3.4 Nozzles

3.4.1 Output and drop size must be variable in air-assisted sprayers.

- 3.4.2 In sprayers without air-assistance, the number, arrangement and size assortment of nozzles must allow adjustment to the crop.
- 3.4.3 The output of flat-jet nozzles may deviate, with constant pressure, by a maximum of +/-5 % from the tabular value.

3.5 Hoses and spray lances

- 3.5.1 Hose lines on the equipment must be long and flexible enough as to allow working without unusual fatigue even with the arm stretched.
- 3.5.2 Hose lines must remain flexible down to a temperature of 0° C.

3.6 Fans

- 3.6.1 Fans of air-assisted sprayers and dusters must be adapted to the specified purpose in air output and velocity.

3.7 Motor

- 3.7.1 The motor must be easy to start and run reliably.

4. Instructions for use

- 4.1 All documents and instruction labels on the machine must be in German.
- 4.2 Symbols for operating and adjustment instructions and colour labels on the machine must be explained.
- 4.3 Must contain a calibration table showing output as a function of pressure or motor speed.

Pedestrian motor-powered sprayers (Equipment type 4)

B Recommendations for voluntary equipment testing

1. Outfit

- 1.1 Carrying straps should be padded.
- 1.2 Handles which are held in hand during treatment should be comfortably shaped.
- 1.3 Maintenance points should be easily accessible and clearly marked.
- 1.4 The equipment should permit liquid output of up to 3.2 l/min.

2. Equipment parts

2.1 Pumps

- 2.1.1 Air-assisted sprayers should have pumps to ensure even flow of liquid.

Seed treatment equipment (Equipment type 5)

A Additional requirements for voluntary equipment testing

1. Mode of operation

- 1.1 The equipment must permit quick and seed-protective operation.
- 1.2 Wet seed protection products must stick to the seed with a +/-5 % deviation from the index value at the outlet of the seed treatment equipment.
- 1.3 There must be no blockages of the equipment.

2. Operability

- 2.1 A single person must be able to easily operate shut-off and stop devices and control measuring and regulating devices of the equipment.
- 2.2 Seed treatment equipment must permit easy and quick adjustment to the seed to be treated and the seed protection product used.

3. Outfit

- 3.1 Thorough cleaning of equipment parts which come into contact with seed and seed protection product must be possible and easy to do.
- 3.2 Any inaintenance points must be easily accessible and clearly marked.
- 3.3 If the equipment is designed for the treatment of different sorts of seed, any alterations must be easily made.

4. Seed protection product supply

- 4.1 A single person must be able to completely empty or exchange seed protecting product containers within a few minutes.
- 4.2 The operator must be able to see from his place when the minimum filling level is reached.

5. Dosage device

- 5.1 Dosage devices of combination equipment must permit easy and quick adjustment to the various seed treatment methods by one person.

6. Instructions for use

- 6.1 Must contain tables giving index values for setting the dosage devices for various kinds of seed and protection products.
- 6.2 All documents and instruction labels on the machine must be in German language.

6.3 Symbols for operating and adjustment instructions and colour labels on the machine must be explained.

6.4 Proper ways of cleaning should be specified.

Seed treatment equipment (Equipment type 5)

B Recommendations for voluntary equipment testing

1. Outfit

1.1 Combination equipment should be designed so as to allow treatment against seed-borne diseases first, and against other diseases later.

1.2 It should be guaranteed that the equipment can apply the most usual seed protecting products and product combinations.

1.3 Bagging should fit the seed stream.

2. Dosage device

2.1 Should have manual start.

Granules applicators (Equipment type 6)

A Additional requirements for voluntary testing

1. Mode of operation

- 1.1 Equipment must allow efficient, plant-protective operation.
- 1.2 Application of the granules must comply with the specifications in the product use instructions.
- 1.3 The granules application rate must be adjustable depending on the developmental stage of the treated crop and is set in accordance with the label instructions for the product used (§ 15 (1) no. 3 together with § 15 (2) no. 2a of the Plant Protection Act.

2. Operability

- 2.1 Equipment parts for instrument adjustment must have clearly devided scales.

3. Outfit

- 3.1 If the equipment is designed for use in different crops, it must be easily adaptable to the different conditions.
- 3.2 Equipment which is to be used in combination with sowing or planting machines or any other machines specified by the applicant, must permit easy attachment to these machines through the operator or a professional repair shop, if necessary, with the help of enclosed assembly instructions.

4. Containers

- 4.1 Protective coating or varnish must not dissolve or detach.
- 4.2 It must be possible to quickly and completely empty them.

5. Instructions for use

- 5.1 Must show how to achieve trouble-free flow of granules from the equipment to the place of application.
- 5.2 All documents and instruction labels on the machine must be in German.
- 5.3 Symbols for operating and adjustment instructions and colour labels on the machine must be explained.

Granules applicators (equipment type 6)

B Recommendations for voluntary testing

1. Outfit

- 1.1 Equipment should be designed for one-man operation.
- 1.2 Operator working place should be designed for controllability.
- 1.3 Maintenance points should be readily accessible and clearly marked.
- 1.4 Parts subject to wear and not influencing the dosing should be readily accessible and exchangeable.

2. Dosing mechanisms

- 2.1 Should permit stepless dose adjustment.

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

1952

PHYSICS 551

LECTURE NOTES

BY

ROBERT H. DICKINSON

1952

1952

PHYSICS DEPARTMENT

Testing of Plant Protection Equipment

Requirements for Nozzles

Based on:

1. **BBA-Features** of field sprayers and of air assisted sprayers in orchards, vineyards and hops and
2. **Supplementary requirements** for the testing of plant protection equipment under Article 33 of the Plant Protection Act (BBA guideline for the testing of plant protection equipment, part VII, 1-2.1).

Notes:

- 2.12.1 e. g. means the number of the feature to be tested according to the BBA Guideline.
F means that requirements hold for field sprayers.
R means that requirements hold for orchard, vineyard and hop sprayers.

2.12.1 F + R

Each nozzle must form a uniform spray jet, the pattern of which must not change unintentionally during operation.

2.12.2 F + R

The jet direction and, if applicable, jet pattern of the nozzles must be adjustable in a reproducible manner by suitable technical aids.

Explanation: Suitable aids are, e. g., fixed marks, locking devices, or adjusting gauges.

3.2.1 F

If nozzles are used on a boom to form a uniform spray the cross volume distribution will be measured on a 10 cm groove patternator and for a given pressure and nozzle height the coefficient of variation must not exceed 7 %, for other specified ranges of pressure and height it must not exceed 9 %. The range of height must be at least 20 cm. The maximum tolerable height is 90 cm.

Explanation: The coefficient of variation is calculated by the formula:

$$C_v = \frac{\sqrt{\frac{\sum (X_i - \bar{X})^2}{n-1}}}{\bar{X}} \cdot 100\% \quad \text{with} \quad \bar{X} = \frac{\sum X_i}{n}$$

With nozzles with overlapping spray patterns, this requirement holds only for the fully overlapped areas.

Supplementary requirement under 2.

F

The uniformity of cross distribution is measured by a 10 cm groove patternator. Measured values may not deviate by more than ± 5 % from the mean in the pressure range specified by the applicant. With overlapping nozzles, this requirement holds only for the fully overlapped area.

Explanation: If the variation coefficient V_k is used in evaluating the uniformity of cross distribution, V_k must be ≤ 7 %.

3.4.1 F

The output of adjacent nozzles of the same type on spray booms must not deviate more than 5 % from their mean output.

3.4.2 R

The output of adjacent nozzles of the same type on spray booms must not deviate more than 10 % from their mean output.

Supplementary requirement under 2.

R

The output of nozzles of the same size must not deviate by more than 10 %.

4.1.1 F

The 10 % volumetric droplet diameter of nozzles mounted in a spray boom must not be smaller than 115 μm if there are no drift reducing equipment in use like for example air-assistance.

Explanation: For the measurement follow Guideline 1-1.2.4 of Part VII of the Guidelines for Plant Protection Equipment Tests of the Federal Biological Research Centre (BBA). For comparable measurements nozzles of the size 02 with a 10 % volumetric droplet diameter of 115 μm at 2.5 bar are deposited at the BBA. These nozzles can be used for comparable measurements with different droplet size analysing systems as e. g. image analysing and Malvern. These nozzles are available at the BBA.

19.1.1 F + R

The flow rate of the nozzles must not deviate more than 10 % from the data of the dosing tables.

Explanation: The maximum tolerable error for measuring the flow rate is 2.5 %.

21.0.0 F + R

On atomisers data as type, size and important data for spraying must be indicated.

Explanation: Identification must be performed by codes (e.g. type number, symbols, colours etc.) which can be decoded by the aid of tables to supply the information required.

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

January 1988

1-1.2.1

**Guideline for the
Test of Tank Agitators**

by
Dirk Rautmann
Siegfried Rietz

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

names and addresses of authors:

Dirk Rautmann and Siegfried Rietz
Biologische Bundesanstalt
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

German version available by:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbuetel

English version available by:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

All rights reserved, including translation, reprint and photocopying of the guideline, or parts of it.

The use of common, trade and product names in this guideline does not mean they may be used by anyone. They may be legally protected, registered trademarks even if not marked as such.

No liability for errors in text.

Guideline for the test of tank agitators

Agitators are tested with the help of a one-per cent suspension of OB-21 (Cupravit). One suspension can be used for testing several devices to save OB-21 and reduce the problem of disposal. When filling the next tank, the deposit in the first is flushed with the original spray liquid.

Containers shall be closed because of water evaporation. A suspension can be used for at least six weeks, according to studies by the BBA division for application techniques.

At the beginning of a test, fill tank up to nominal capacity while the agitators are running. Stir the one-per cent suspension until it is homogeneous. At the same time take two basis samples (≥ 30 ml) each at three points (5 cm below the liquid level, middle of the liquid column, 5 cm above the tank ground). Then stop agitation and allow the suspension to stand still in the tank for 15 hours. Switch on agitators again and stir the tank content at maximum intensity. After ten minutes agitating take two samples each at three different levels as for the basis samples, with the agitators running.

Next, simulate empty-spraying of the tank by opening one of the spray boom feeders and connecting it to a valve which lets out the same amount of liquid as is applied by all nozzles together during normal spraying. Close all other feeders. Set pressure at three bar overpressure for flat fan nozzles and at the middle between minimum and maximum operating pressure for vineyard and orchard sprayers. If there are several nozzle sets, use the one which applies the greatest amount of spray liquid.

At the outlet of the opened nozzle feeder, take two samples each at the beginning of spraying and after every 50 l with sprayers of up to 400 l of nominal tank capacity, after every 100 l with sprayers of nominal tank volume between 400 and 1,000 l, and after every 200 l with sprayers of more than 1,000 l nominal tank volume, until spraying is finished. The last sample is to be taken from the residue of the tank content.

The concentration of the samples is stated by determining their contents of solid matter. Shake samples and fill 20 ml of each into evaporating pans. Weigh empty and filled pans accurately to 1 mg. Dry samples in the pans at 105° to 110°C in a hot air cabinet, suck off the air. Cool samples down in the desiccator and weigh them again accurately to 1 mg.

Take the mean of each pair of samples. The three mean values of the basis samples must be between 0.950 and 1.050 %. If they are, their average is the reference value, if not the basis sampling has to be repeated. Calculate the relative deviations of the mean values of the other samples from the reference value.

Standard Report

Effect of agitators with OB-21 suspension

1. Concentration in the tank after filling (basis sample):

top:..... % middle:..... % bottom:..... %

reference value:..... %
(mean of top/middle/bottom values)

2. Concentration in the tank after 15 hours standstill and 10 minutes agitation

top:..... % middle:..... % bottom:..... %

relative deviation from the reference value:

top:..... % middle:..... % bottom:..... %

3. Effect of agitators after 15 h standstill and 10 min agitation
(measured at spray boom section feeder)

type of nozzle: type of valve/strainer:

overpressure: bar

sampling at filling level of the tank: [1]	relative deviation of the OB-21 concentration with reference to the basis sample [%]

Notes on sediment of OB-21 after emptying of tank:

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

January 1988

1-1.2.2

**Determination of the
Rest Volume of Liquid**

by
Dirk Rautmann
Siegfried Rietz

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

names and addresses of authors:

Dirk Rautmann and Siegfried Rietz
Biologische Bundesanstalt
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

German version available by:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbuettel

English version available by:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

All rights reserved, including translation, reprint and photocopying of the guideline, or parts of it.

The use of common, trade and product names in this guideline does not mean they may be used by anyone. They may be legally protected, registered trademarks even if not marked as such.

No liability for errors in text.

Guideline for the determination of the rest volume of liquid

1. Field crop and orchard sprayers

a) Technical rest volume

The equipment shall run in a fixed and horizontally position at the nominal speed of the pump.

The field spray boom or nozzle carrier must be switched on.

Pressure is set so as to achieve

- a single nozzle output of 2 l/min for field crop and vineyard sprayers,
- a single nozzle output of 4 l/min for orchard sprayers,
- a single nozzle output of 6 l/min for hop sprayers.

The single nozzle output must be adjusted with an accuracy of 0.1 l/min. The machine is to be stopped immediately when the gauge shows the first significant pressure drop.

The volume of spray liquid which is left in the equipment at that point of time is determined accurately to 0.1 % of the nominal tank volume.

b) Rest volume of liquid on slope

In correspondence to its purpose - which is provided by the instruction manual - the machine is put into a slope position towards the left, right, front and back. In these positions, the rest volumes on slope are determined in the same way as the technical rest volume of liquid.

2. Pedestrian sprayers

Technical rest volume

The equipment is operated as usual but in a fixed position.

The equipment is switched off immediately when the nozzle begins to put out spray liquid mixed with air. The volume of liquid left in the equipment is determined accurately to 0.1 % of the nominal tank capacity.

All measurements are to be repeated twice, and an average is calculated from the results.

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

January 1988

1-1.2.3

**Examination of Flow Control Devices on
Field Crop and
Orchard Sprayers**

by
Dirk Rautmann
Siegfried Rietz

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

names and addresses of authors:

Dirk Rautmann and Siegfried Rietz
Biologische Bundesanstalt
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

German version available by:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbuettel

English version available by:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

All rights reserved, including translation, reprint and photocopying of the guideline, or parts of it.

The use of common, trade and product names in this guideline does not mean they may be used by anyone. They may be legally protected, registered trademarks even if not marked as such.

No liability for errors in text.

1 - 1.2.3

All measurements of the flow rate (or application rate) are carried out at the spray boom or nozzle carrier. The results are recorded. Measuring and recording continues until a state of inertia is reached again. At a nominal p.t.o. shaft speed of 1,000 RPM, for instance, the speeds analogous to 540 RPM are valid.

The measurements under points 1 to 3 are made under the following test conditions:

The driving speed is 2 m/s, the p.t.o. shaft speed 400 RPM and the standard application rate 300 l/ha.

1 Changing of spray condition by switching on and off the nozzle feeders

- 1.1 Switch off - switch on, measure simultaneously.
- 1.2 Switch off at 2 m/s -- lower speed to 1.5 m/s, slow down p.t.o to 300 RPM -- switch on, measure simultaneously.
- 1.3 Switch off at 2 m/s -- raise speed to 2.5 m/s, raise p.t.o. to 500 RPM -- switch on, measure simultaneously.

2 Changes in speed

- 2.1 within one gear:
Change p.t.o. shaft speed from at least 300 RPM to 400 RPM and 500 RPM and then from 500 RPM to 400 RPM and 300 RPM for five seconds each, carrying out measurements simultaneously.
- 2.2 Changing gears at p.t.o. 400 RPM
Set speed to at least 1.5 m/s; 2; 2.5; 2; 1.5 m/s, measure simultaneously.

3 Switching off/on boom sections

Successively switch off boom sections except one, then switch them on again. Measure simultaneously.

4 Setting the same flow rate anew

The equipment is operated at p.t.o. 500 RPM and a driving speed of 2 m/s. Two rows of measurements are repeated seven times ($n=7$). For the measuring rows, set and operate the equipment at a flow rate of 100 (or the nearest possible value), then successively set it to 200, 300 and 400 l/ha (1st measuring row: ascending) and to 500 l/ha (or the nearest possible value), then set it to 400, 300 and 200 l/ha (2nd row: descending). Measure at flow rates 200, 300 and 400 and 400, 300 and 200 l/ha, respectively. When setting the flow rates, be careful not to exceed the value to be set (and to have to turn down the flow rate later). If tables, diagrams or the directions of use, for a driving speed of 2 m/s, provide for a flow rate of more than 50 l/ha below 200 or above 400, the two series of measurements have to be extended accordingly, the first settings (100 l/ha and 500 l/ha, resp.) being shifted accordingly.

To establish the time during which the equipment exceeds the flow rate tolerance of $\pm 10\%$, add up the individual times during which that tolerance is exceeded.

Evaluation

The coefficient of variation V_k is calculated as follows:

$$\bar{x} = \frac{\sum x_i}{n}; \quad s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

$$i = 1, 2, \dots, 7 \quad V_k = \frac{s}{\bar{x}} \cdot 100[\%]$$

The largest deviations δ are calculated:

$$\delta_{\max} = \frac{x_{\max} - \bar{x}}{\bar{x}} \cdot 100[\%]; \quad \delta_{\min} = \frac{x_{\min} - \bar{x}}{\bar{x}} \cdot 100[\%]$$

The mean deviation between mean flow rate \bar{x} and standard flow rate \tilde{x} is calculated:

$$\Delta = \frac{\bar{x} - \tilde{x}}{\tilde{x}} \cdot 100[\%]$$

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

December 1993

1-1.2.4

**Determination of Droplet Size
Characteristics of Spray Nozzles
for Plant Protection Equipment**

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

Name and Address of authors:

H. Ganzelmeier, C. Ludewig, D. Rautmann and H.-J. Wehmann
Biologische Bundesanstalt
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

German version available by:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbueffel

English version available by:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D-38104 Braunschweig

All rights reserved, including translation, reprint and photocopying of the guideline, or parts of it.

The use of common, trade and product names in this guideline does not mean they may be used by anyone. They may be legally protected, registered trademarks even if not marked as such.

No liability for errors in text.

Preliminary remark

Nozzles in crop protection equipment are assessed with regard to their drop size distribution, among other criteria. Different measuring techniques have in the past measured different drop size characteristics in the same nozzles. It is the aim of this guideline to standardize the measuring technique and thus make results comparable.

This guideline describes a standard measuring technique developed in the Federal Biological Research Centre for Agriculture and Forestry and agreed with nozzle manufacturers.

1. Measuring device

The drop size is measured with a Phase-Doppler-Particle-Analyzer (PDPA).

2. Arrangement

The nozzle is moved on a level 500 mm above the measuring volume of the PDPA so that the whole width of the spray jet is included. Five passages are needed in the depth of the spray jet. One passage comes in the middle of the jet depth, and two each on both sides at distances of one sixth and two sixths from the middle (see Figure).

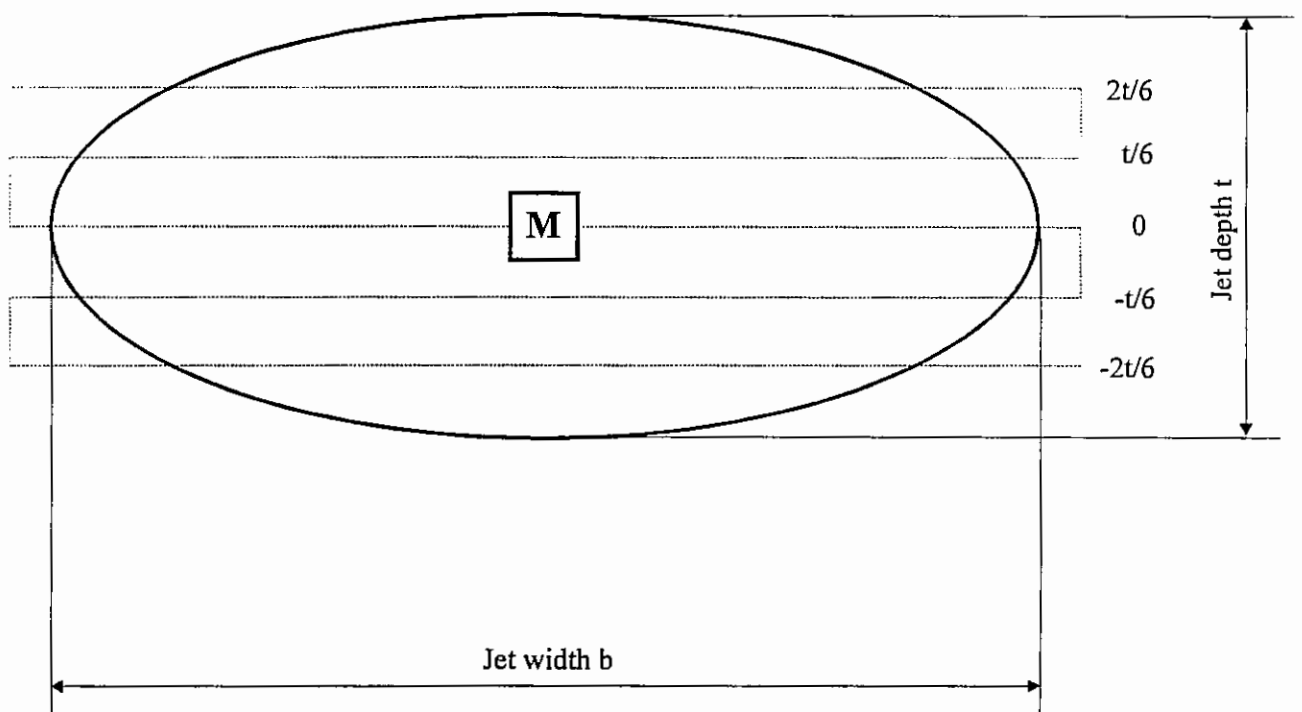
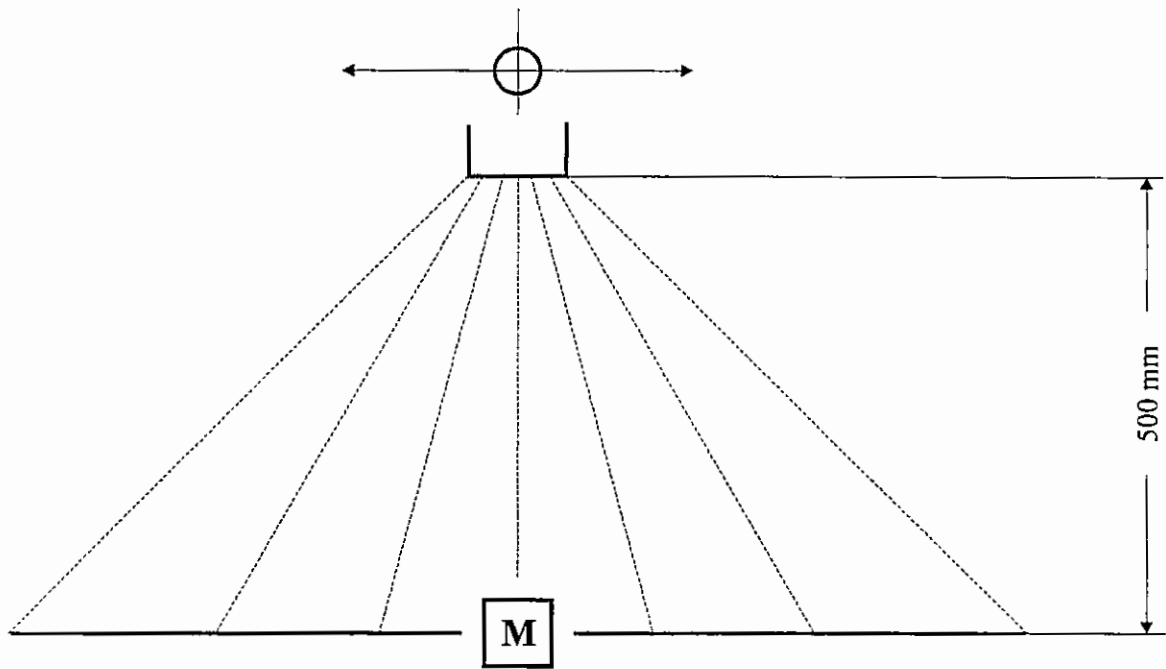
3. Execution of measurement

Measurements are carried out with five single nozzles of the same type and size, and with tap water. The nozzle moves with constant velocity.

4. Assessment

Each measurement must be based on a minimum of 5000 drops. The aim is to define the 10-per cent (50-per cent, 90-per cent, resp.,) volumetric diameter in each measurement (*i.e.*, the $D_{10\%}$, $D_{50\%}$, and $D_{90\%}$). The $D_{10\%}$ ($D_{50\%}$, $D_{90\%}$) is the drop size at which 10 % (50 %, 90 %) of the spray liquid volume is sprayed so that the drops are of that size in diameter, or smaller. The $D_{10\%}$, $D_{50\%}$, and $D_{90\%}$ values of the five nozzles are then averaged.

Measuring arrangement



M = Measuring volume of the PDPA

SECTION II

Voluntary Testing of Plant Protection Equipment

B. Loss Reducing Technique

**Preliminary Remarks to the
Voluntary Testing of Plant Protection Equipment
(§ 33 of Plant Protection Act)**

B. Loss Reducing Technique

Official list of drift reducing technique

Dirk Rautmann, Biologische Bundesanstalt für Land- und Forstwirtschaft, Braunschweig, Germany

Spray technique is an important tool in risk mitigation. In Germany often the authorization of plant protection products cannot be granted or wide buffer zones to surface waters are necessary because of the risks to surface waters. A measure to make the authorization feasible or to reduce the width of the buffer zones is to use a spray technique which reduces the amount of drifted material.

In comparison to the basic drift values which have been determined with common spray techniques the so called "loss reducing equipment" must reduce spray drift fallout significantly. In Germany this has to be proved by field trials. Each successfully tested equipment will then be listed in the official list of drift reducing technique which is published in the federal gazette ("Bundesanzeiger").

If buffer zones are specified in the instruction of the plant protection product a reduced buffer zone width can be specified for applications with loss reducing equipment that is referenced by the official list. Therefor the list offers the opportunity to make use of the benefits of loss reducing equipment in a way that applications are either possible now or that the buffer zone is smaller and a greater part of the field can be treated.

In 1993 the register "loss reducing equipment" has been introduced in Germany. At that time a minimum drift reduction of 90% had been fixed for equipment to be included in this register. Since then the BBA-approval that proves the suitability of the equipment for the designated purpose is a prerequisite. A declaration according to article 25 of the German Plant Protection Act and an entry in the plant protection equipment list is of course essential, too. Normally field trials have to be done to prove the drift reduction in all measured distances. In some cases the determination of the drift potential index (DIX) in a wind tunnel will be sufficient.

If all this is fulfilled the equipment is registered as a loss reducing equipment.

A new classification system has been introduced in 1999. Classes of 90%, 75% and 50% drift reduction allow more differentiated buffer zones. The benefits of new techniques which save plant protection products and reduce the drift will be available to more farmers and will solve a lot of problems concerning the application near surface waters. Field sprayers with air induction nozzles that have been tested in field trials obtained a drift reduction up to 80%.

Within this process discussions with the European partners are necessary to obtain harmonised regulations.

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

February 2000

1-2.3.3

**Procedure for the entry of plant protection
equipment in the chapter drift of the list of
loss reducing equipment**

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

Published by:

Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

German version obtainable from:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbüttel

English version obtainable from:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

Use of common names or trade names in this regulation does not mean these can be used by anyone. They may be registered, legally protected trademarks, even when this is not evident. No warranty for possible mistakes in the text..

All rights reserved, including rights of translation, reprint, photo-copying and copying by electronic media.

No liability for errors in text.

Procedure for the entry of plant protection equipment in the chapter drift of the list of loss reducing equipment

Article 1 Testing

An application (form BBA-FA 61-01) can be made to the Federal Biological Research Centre for Agriculture and Forestry for checking equipment and facilities with regard to their drift reducing properties. This examination is an extension of the test of plant protection equipment in accordance with article 33 (2) No 5 and (3) No 3 of the Plant Protection Act (PflSchG) as amended in the notification of 14 May 1998 (BGBl. [= Federal Gazette] I p. 971, 1527, 3512). The regulations for testing plant protection equipment are applicable (guidelines for the testing of plant protection products and plant protection equipment, Part VII, 1-2.3.1, March 1999).

Article 2 Prerequisites

A prerequisite for entry in the list of loss reducing equipment is that the equipment or the drift reducing facility of the equipment is tested and approved by the BBA in accordance with article 33 (2) No 5. For complete equipment an additional declaration in accordance with article 25 PflSchG is necessary.

Article 3 Nature and extent of the testing

The applicant must supply the trial results necessary for the evaluation. The extent of the examination on the drift reducing properties depends on the respective equipment or the drift reducing facility.

As a rule, an adequate amount of drift trials must be performed. The trials must be performed in accordance with guideline VII 2-1.1 "measuring direct drift when applying liquid plant protection products outdoors" out of the guidelines for testing plant protection products and plant protection equipment from the Federal Biological Research Centre for Agriculture and Forestry. Wind speed must be at least 2 m/s. The ground sediment must be measured in distances of 5 m, 10 m, 20 m, 30 m and 50 m, as well as in field crops at 1 m distance and in bush and tree crops at 3 m.

Article 4 Execution and assessment of the trials

The assessment is made using one of the following alternative procedures.

1. Comparison with reference equipment corresponding to table 1 (appendix 1). At least 3 trials are to be performed with the equipment to be examined as well as with the reference equipment. For each distance, at least 30 measured values are necessary in total per equipment. From the mean values of each distance, a power function each is calculated as a regression line in accordance with the method of minimal quadratic deviations, both for the equipment to be examined and the reference equipment. The limits for the classes

drift reduction 50 %
drift reduction 75 %
drift reduction 90 %.

are calculated from the regression line of the reference equipment and are listed in a drift diagram together with the regression line of the equipment to be tested. Classification is in the

class whose regression line is not exceeded within the total measured distance range by the regression line of the equipment to be examined. (s. example in appendix 3)

2. Comparison with the basic drift values. At least 6 drift trials are to be performed as described above with the equipment to be tested. For each distance, at least 60 measured values in total must be derived. The 95th percentiles in accordance with the calculation regulation of the guideline stated above are derived from these. The classes stated above are calculated from the data table of the drift reduction classes (s. appendix 2, table 2). Classification is as described above. (s. example in appendix 4)
3. If possible and asked for by the applicant for nozzles for field crops, through a comparison measurement with a reference nozzle, type XR 110 03, LU 120 03 or similar in the wind tunnel in accordance with guideline VII - 1-2.2.1 (currently in preparation). Classification is performed with the help of the DIX analogue to the classification for the outdoor drift trials.

Article 5 Decision

(1) The plant protection equipment is entered by the BBA into the list of loss reducing equipment if the examination has proved that the equipment possesses the drift reducing properties necessary for the classification in one of the drift reducing classes.

(2) Should drift reducing facilities be offered as extensions for upgrading existing plant protection equipment, then this extension must include instructions for use and if necessary mounting instructions. The instructions for use must describe the conditions for use and respective limits of use as well as how to adjust the equipment to be used as drift reducing equipment. This information will be included in the provisions for use in the list. The mounting instructions of the extension must also include a list of the equipment types suitable for the latter, unless all equipment *types* of a kind can be used for equipping (e. g. flat spray nozzles for field sprayers). All equipment types with this drift reducing facility are then entered into the list.

(3) The BBA hears the panel of plant protection equipment before entry (s. regulations for testing plant protection equipment article 8 (4)).

(4) When approval expires, entry in the list is deleted. If an approval is renewed before the previous one expires, and the presence of drift reducing properties is confirmed as applied for, the entry is not deleted.

(5) Should it not be possible to renew the approval because the equipment or facility is no longer manufactured, the entry is not deleted as long as drift reducing properties are present.

Article 6 Notification

The BBA announces entries and deletions in the list of loss reducing equipment in the Federal Gazette.

Article 7 Entry into force

This procedure applies as from 1 November 1999.

Table 1: reference equipment

Field crops	Grapevine	Fruit crops	Hops
mounted field sprayer with 15 m working width, flat fan nozzle XR 11003, LU 12003 or comparable, nozzle distance 50 cm, distance to the target area 50 cm, spray pressure 3 bar, travelling speed 6 km/h	mounted air blast sprayer with axial fan, 15000 m ³ /h, hollow cone nozzles ATR yellow, spray pressure 8 bar, travelling speed 6 km/h, adjustment corresponding to good agricultural practise (see instructions for adjustment of the BBA)	trailed air blast sprayer with axial fan, 30000 m ³ /h, hollow cone nozzles ATR yellow, spray pressure 10 bar, travelling speed 6 km/h, adjustment corresponding to good agricultural practise (see instructions for adjustment of the BBA)	trailed air blast sprayer with axial fan, at least 70000 m ³ /h, liquid application rate 2500 l/ha, spray pressure 25 bar, travelling speed 1,2 km/h, adjustment corresponding to good agricultural practise

Table 2: Drift reduction classes

**Data table of the drift reduction classes
(as of 2000-01-05)**

Distance (m)	Field crops			Fruit crops			Grapevine			Hops		
	50%	75%	90%	50%	75%	90%	50%	75%	90%	50%	75%	90%
1	1,70	0,85	0,34									
3				12,99	6,49	2,60	3,39	1,70	0,68	10,04	5,02	2,01
5	0,35	0,18	0,07	9,37	4,69	1,87	1,71	0,86	0,34	7,11	3,56	1,42
10	0,18	0,09	0,04	6,02	3,01	1,20	0,68	0,34	0,14	3,82	1,91	0,76
15	0,12	0,06	0,02	2,94	1,47	0,59	0,40	0,20	0,08	1,69	0,85	0,34
20	0,09	0,05	0,02	1,44	0,72	0,29	0,27	0,13	0,05	0,95	0,47	0,19
30	0,06	0,03	0,01	0,53	0,26	0,11	0,16	0,08	0,03	0,42	0,21	0,08
40	0,05	0,02	0,01	0,26	0,13	0,05	0,11	0,05	0,02	0,24	0,12	0,05
50	0,04	0,02	0,01	0,15	0,07	0,03	0,08	0,04	0,02	0,15	0,08	0,03
75	0,02	0,01	0,00									
100	0,02	0,01	0,00									

Remarks: Drift values in %, relative to the application rate in l/ha or kg/ha

**Drift classes and classification of a tested equipment
in comparison to a reference equipment
basis: mean values**

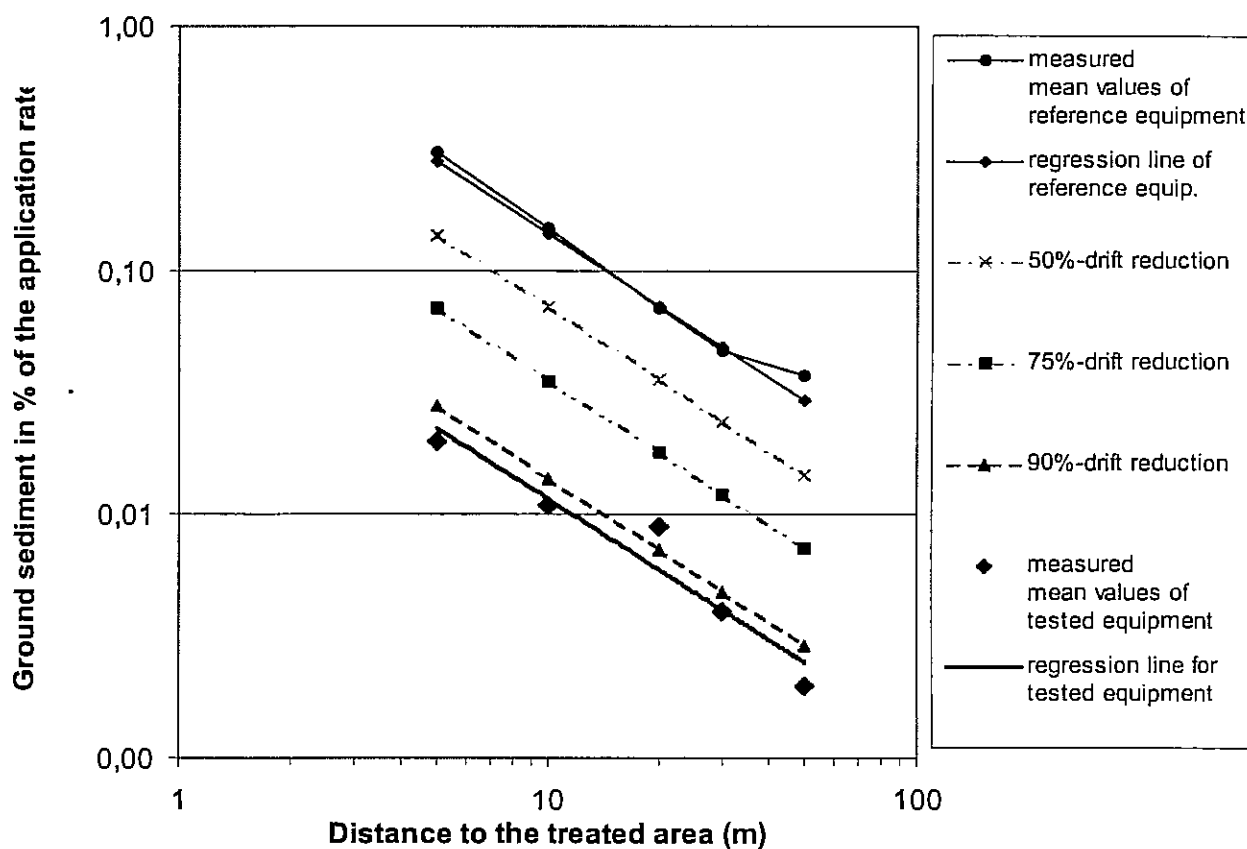


Diagram 1: Example of the classification of a tested equipment in comparison to a reference equipment. As the limiting line of the 90 % drift reduction class is not exceeded the tested equipment is graded to this class.

**Drift classes and classification of a tested equipment in comparison to the basic drift values (here: field crops)
basis: 95th percentile**

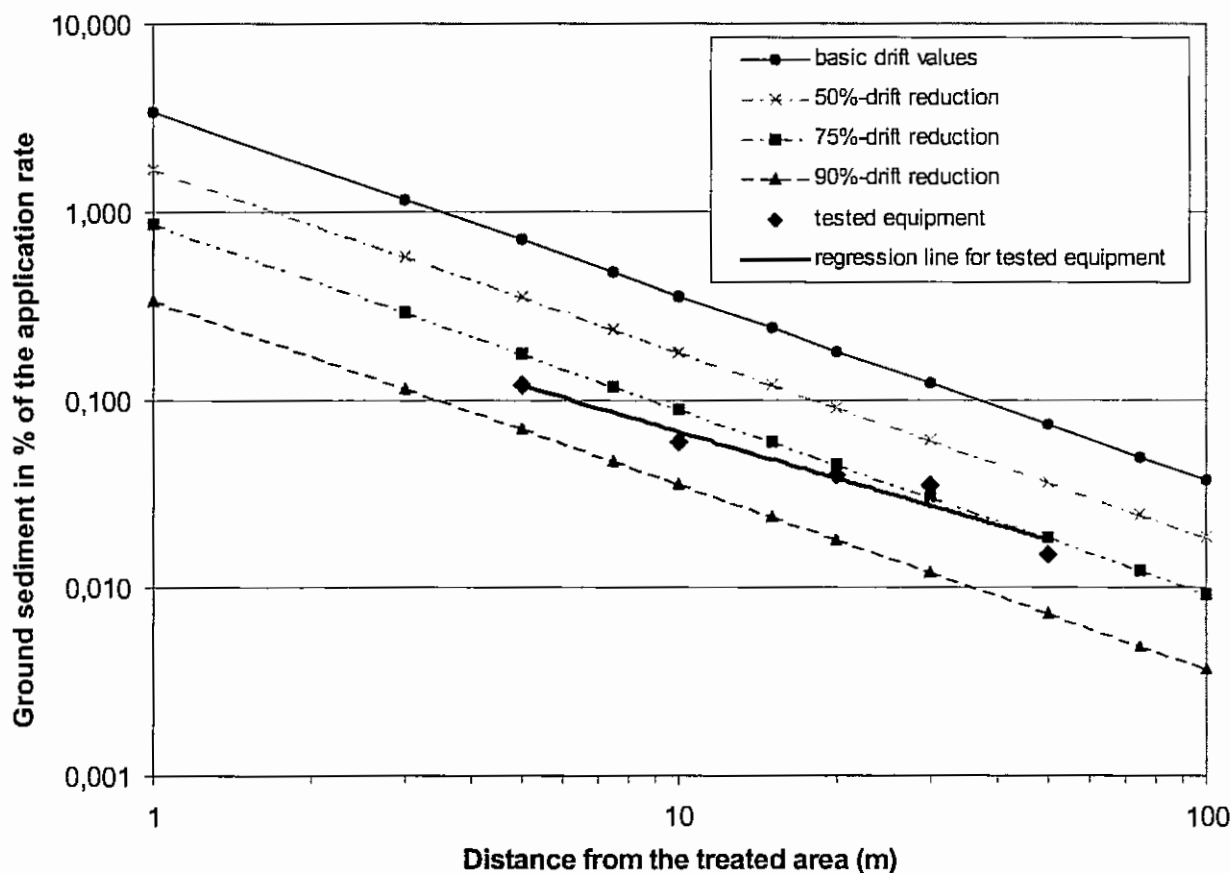


Diagram 2: Example of the classification of a tested equipment in comparison to the basic drift values. As the limiting line of the 75 % drift reduction class is not exceeded the tested equipment is graded to this class.

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

September 1992

2-1.1

**Measuring direct Drift
when applying
liquid Plant Protection Products
outdoors**

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

names and addresses of authors:

Heinz Ganzelmeier Dirk Rautmann	Biologische Bundesanstalt für Land- und Forstwirtschaft Fachgruppe Anwendungstechnik Messeweg 11/12 D-38104 Braunschweig
Gerhard Bäcker	Forschungsanstalt Geisenheim E.-v.-Lade-Str. 1 D-6222 Geisenheim/Rhein
K. W. Eichhorn Roland Ipach	Staatliche Lehr- und Forschungsanstalt für Landwirtschaft Breitenweg 71 D-67435 Neustadt/W.
Elmar Kersting	Bayer AG Pflanzenschutzzentrum Monheim Alfred-Nobel-Straße 50 D-40789 Monheim
Heribert Koch	Landesanstalt für Pflanzenbau und Pflanzenschutz Essenheimer Str. 144 D-55128 Mainz
F.-O. Ripke	Landwirtschaftskammer Hannover Pflanzenschutzamt Wunstorfer Landstraße 9 D-30453 Hannover
Klaus Schmidt	Landesanstalt für Pflanzenschutz Reinsburgstraße 107 D-70197 Stuttgart

German version available by:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbuettel

English version available by:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

All rights reserved, including translation, reprint and photocopying of the guideline, or parts of it.

The use of common, trade and product names in this guideline does not mean they may be used by anyone. They may be legally protected, registered trademarks even if not marked as such.

No liability for errors in text.

Introduction

The present Guidelines help to assess plant protection equipment in view of direct drift problems to make a high comparability of outdoor drift values possible. Many outdoor trial parameters cannot freely be chosen as it is possible with a test stand and do not remain constant throughout the trial. In keeping with the limits stipulated in these Guidelines, different research workers, for some parameters, have shown to reach highly identical results. For the evaluation of the drift trials, various possible ways have been discussed. The method described in paragraph 6 of these Guidelines has already been used for other evaluations (e.g. residue trials) and has stood the test. As far as the clarification of details is concerned, deviations from the Guidelines are permitted. However, it should be taken into consideration that these results do not always lend themselves for absolute statements as they only permit relative comparisons.

1. Definition

A direct drift is that part of the amount of active ingredient applied which, during the application process, due to atmospheric currents, is borne beyond the treated area. Whatever amount gets lost due to evaporation or leaching cannot be considered as a direct drift.

2. Trial area

The trial area is part of a larger location. In wind direction, next to the trial area, there should be a free site serving as an area for drift measurements. The size of the trial area cannot be fixed. Its width depends upon crop, growth stage, kind of equipment, etc. and it should be so that the tour which is farthest away from the area for drift measurements does not contribute to the direct drift. (Pragmatical values: crop areas 20 m; orchards 5 rows; vineyards 10 rows). The length of the trial area is best chosen if direct drifts can still reach the neighbouring area of measurement even if winds, within the permissible values, will change direction.

3. Carrying out of trials

The entire trial area is treated with a liquid. For demonstration purposes this liquid can contain both a plant protection product (copper preparation) or a colouring agent. Each trial shall be repeated at least three times. During the trial the following weather data shall be constantly recorded (see annex 1):

- wind direction
- wind speed
- air temperature
- relative atmospheric humidity
- amounts of cloud

Weather data shall be recorded in the centre of the measuring area, within five metres from the trial area, at the following heights (see annex 2): in

- fields 1 m
- vineyards 3 m
- orchards 4 m
- hop-growing areas 10 m

Air temperature, throughout the entire trial, must not exceed 25 °C and wind speed not 5 m/s.

The mean wind direction shall not deviate more than 30° from the main one. The main wind direction is the average one ascertained over the whole duration of trials carried out on one trial site and one trial day and should be at right angles to the direction of the tour. All the trial parameters shall be completely recorded according to annex 1.

4. Method of measurement

Direct drifts are measured

- in suspension:
passive, ball-shaped drift collectors (see annex 3) are fixed onto poles;
- as ground sediments:
object carriers with a surface area of at least 100 cm² (see annex 3) are horizontally placed on the ground.

The amount of collected product is measured by fluorimetric or atomic absorption spectrometric methods.

5. Points of measurement

The suspended part of the direct drift is measured by drift collectors at a vertical distance of 1 m; further subdivisions are possible. The distance from the trial area is

- 5 m in fields;
- 10 m in fruit-, vine- and hop-growing areas.

In fields, measurements shall be carried out up to a height of 4 m while for the other crop heights it must be adapted to the crop height and the equipment.

The drift collectors are placed at least at three different times.

It depends upon the task of the trial how the object carriers for measuring the ground sediment will be arranged.

From the following distances at least five must be selected in order to grant the comparability of trials:

1; 2; 3; 4; 5; 7.5; 10; 15; 20; 30; 40; 50; 75 and 100 m.

The object carriers are placed at distances of 2 – 3 m and measurements are carried out five times.

Starting points for fixing the distances from the trial area are

- in fields: 1 nozzle distance from the outermost nozzle
- in fruit-, vine- and hop-growing areas:
 - - the centre of the equipment if the spraying is done only from one outer side;
 - - the width of half a lane from the outermost row if the first tour is carried out in the first lane.

All arrangements are depicted in annex 2.

6. Evaluation and representation of results

The measured amounts of drifted product are indicated according to annexes 4 and 5. In addition the mean values are to be calculated for each distance.

As the normal distribution of results from drift trials is not very likely, a distribution-free index is used for quantification. A quantile of 95 of the individual values is chosen as an index to take, in the evaluation, the optimum values into account.

The following calculating method is suggested:

$$A(0.95) = (1 - G) * A(J) + G * A(J+1)$$

with

$$(n + 1) * P = J + G$$

n = Number of values

P = T/100, here 0.95

T = percentile value, here 95 %

J = integral part of $(n + 1) * P$

G = fraction of $(n + 1) * P$

A(J) = drift value in place J

A(J + 1) = drift value in place J + 1

A(0.95) = required quantile value

A(n) = drift values arranged according to their size

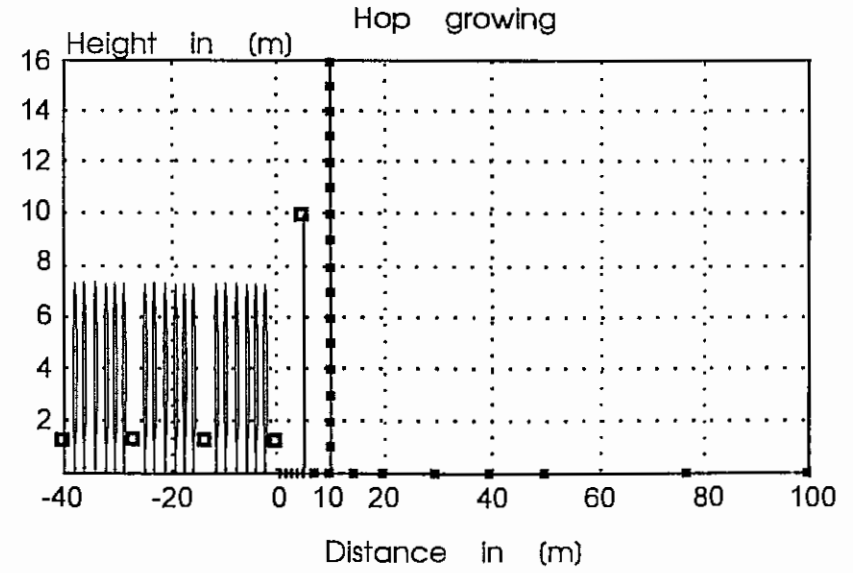
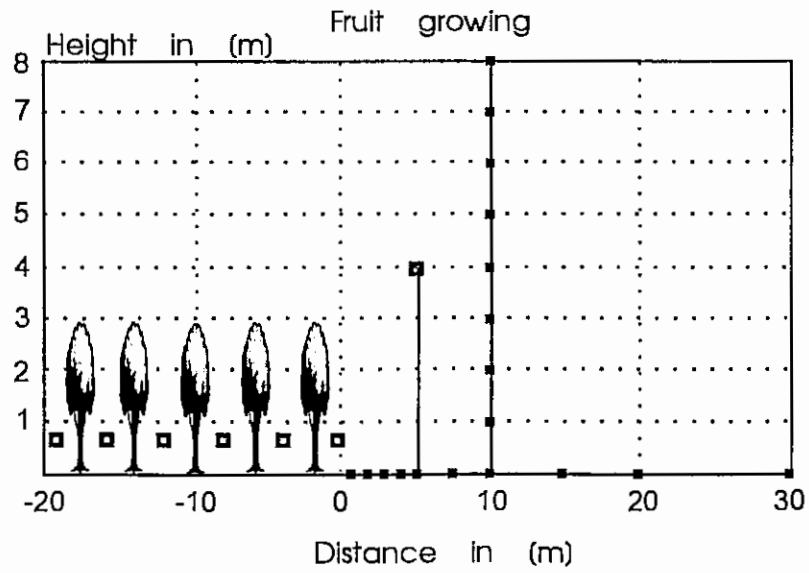
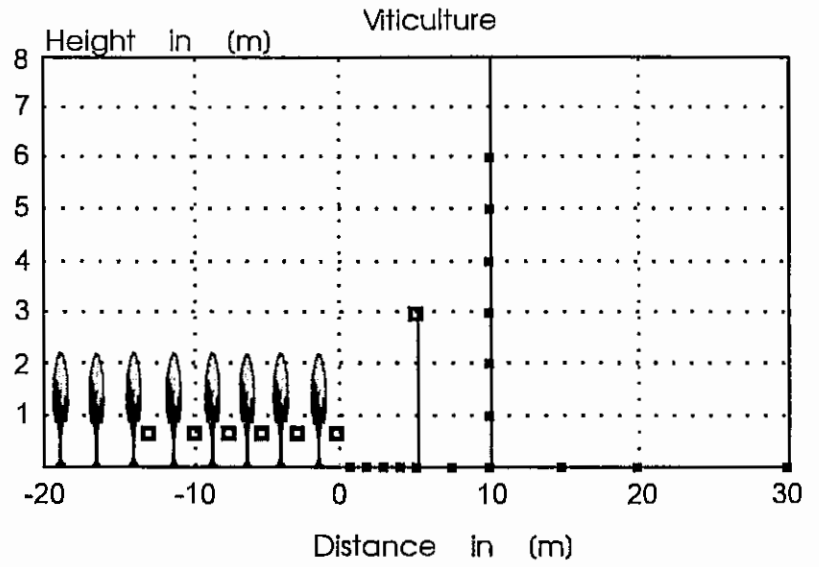
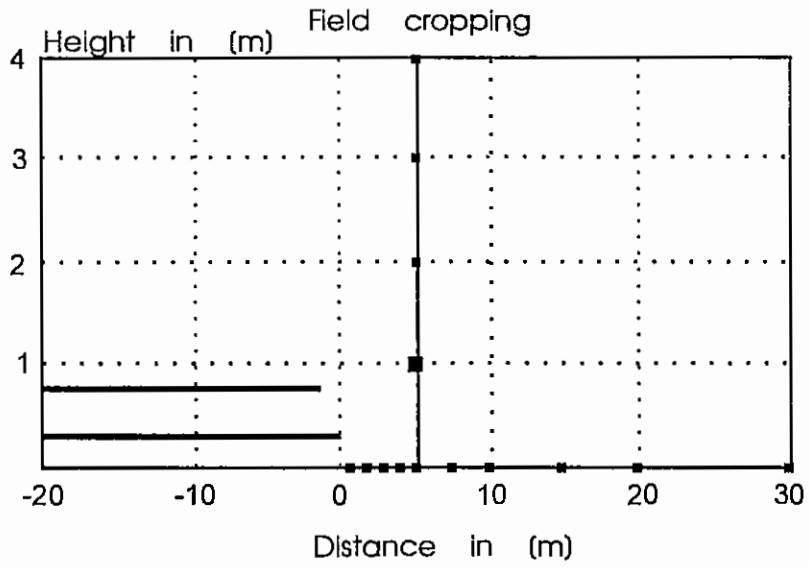
Annex 1

Trial carried out by		Trial No.:			
Trial area:		Farm:			
Where:		Where:			
Detailed location:		Street:			
Slope:					
Crop		Crop:			
Variety:		Root stock:			
Age:		Site:			
Form of crapping:		Density of stand:			
Growth stage:		Vigour:			
Height of stand: cm		Upper limit: cm			
		Lower limit: cm			
Liquid of treatment		Remarks:			
Amount of liquid: l		Liquid application rate: l/ha			
Substance used:		Concentration: %			
Amount of substance: g		Substance application rate: g/ha			
Auxiliary substances:		Concentration: %			
Amount of aux. substances: g		Appl. rate of aux. substances: g/ha			
Plant protection equipment		Remarks:			
Manufacturer:		Typ:			
Attached equipment: () Trailed: ()		Mounted: () Self-drive: ()			
Working width: m		Speed: km/h			
Height of connecting rod: cm		Distance of first nozzle from the ground: cm			
Type of nozzles:		Spraying pressure: bar			
Spraying angle: () forwards () backwards					
Nozzle position:					
		No.			
		Size		Angle	
		Size		Angle	
		Size		Angle	
		Size		Angle	
		Size		Angle	
		Size		Angle	
		Size		Angle	
		Size		Angle	
		Size		Angle	
Position of guide vanes:					
left below: right below: left top: right top:					
All angles measured from the horizontal; marked upwards with (+) and downwards with (-)					
Type of fan:		Sense of rotation:			
Step:		Speed in rpm:			

Annex 1

Trial arrangement						Remarks:
Standard arrangement:						
Field cropping: () Viticulture: () Fruit growing: () Hop growing: ()						
Changes:						
Ground sediment measurement:			Kind of collector:			
Collector size:			Number per distance:			
Measur 0)						
Suspended part measurement:			Kind of collector:			
Height bottom:			Number per height:			
Height top:			Vertical distance:			
Carrying out of trail						Remarks:
Description/sketch:						
Weather data						
Row/tour	Time	Temp. (°C)	Rel. humidity (%)	Wind direction	Wind speed (m/s)	Clouds
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Miscellaneous:



□ Weather data ● S

■ G

Annex 3

Materials for drift measurement

Ground sediment

Filter paper M&N No. 615
Width 30 mm, rolls of 100 m each
Art. No. 100 615 003

Manufacturer:
Macherey & Nagel
Postfach 307
5160 Düren

Petri dishes
145 cm²
Order No. 639 160

Manufacturer:
Grteiner & Söhne
Postfach 1320
72622 Nuertingen
(Tel. 07022/5010)

Suspended parts:

"Drift collectors"
(ball shaped plastic detergents)

Specifications:
Art. No. 0140
Diameter: 80 mm
Colour: white
Weight: 15 g
Knitted fabric width: 110 mm
Thread size: 0.38 mm
(pressed)

Manufacturer:

Siral A. Siebauer
Postfach 29
Niedermauer Str. 8-10

91187 Roettenbach
(Tel. 09172/454)

washable glasses

Boiling glasses 230 ml
with neutral screw-on lid
Art. No. 17 016

Manufacturer:

SIA Handels GmbH
Am Bahnhof
Postfach 31 11 74

38239 Salzgitter
(Tel. 09172/454)

Annex 4

Ground sediment measurement

Trial number:

Distance [m]	Replication	Deposited drift material	
		[$\mu\text{g}/\text{cm}^2$]	rel. to application rate [%]

Annex 5

Suspended part measurement

Trial number:

Distance from the trial area:m

Height [m]	Replication	Deposited drift material	
		per collector [µg]	rel. to application rate [%]

SECTION III

INSPECTION OF PLANT PROTECTION EQUIPMENT - Already in Use

Preliminary Remarks to the Testing of Plant Protection Equipment Already in Use (Inspection)

Voluntary testing of field sprayers has 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 this country has gathered plenty of experience with the inspection of plant protection equipment.

Since not all crop protection equipment is accessible with voluntary programmes, compulsory inspection for field sprayers was introduced in mid-1993 by way of a statutory regulation. The same will obtain for air assisted sprayers for orchards, vineyards and hops in the near future.

Insufficient participation by farmers, and certainly the high percentage of faulty field sprayers as well, occasioned the Federal Minister of Nutrition, Agriculture and Forestry to initiate compulsory testing for in-use plant protection equipment for field crops (field sprayers). The Regulation on Plant Protection Products and Plant Protection Equipment of 11 June 1992 (amended in 1998, see pages 13 to 17) states that the above-mentioned equipment must be tested by official authorities or officially licensed inspection stations once every two calendar years. The obligation to have these tests done went into effect on 30 June 1993. It applies for crop protection equipment in-use and new sprayers after their first use.

The order also stipulates that the equipment owner must indicate the section of the calendar year in which the crop protection equipment in question must be inspected by a certification label on the equipment issued by the responsible authority. The labels are also issued if the equipment has only minor faults which the owner is obligated to eliminate without delay.

According to the order, field sprayers in use as of 1 January 1994 must bear a valid inspection label. Following this date, the office stipulated by state law is required to prohibit use of field sprayers until they bear such an inspection label. Fines are defined for contravention.

The federal order also contains a devolution of power upon the states to undertake further action as may be required to check compliance with the compulsory regulations by means of state orders or administrative regulations.

On the basis of BBA drafts aiming at the greatest possible level of national uniformity in this inspection system, the states have issued licensing and inspection orders referring to the two BBA guidelines defining in detail the requirements governing the inspection equipment (1-3.1.1) and the requirements/features for in-use field sprayers (1 – 3.2.1) and air blast sprayers for bushes and trees (1-3.2.2). In spite of many years of experience in the field of equipment inspection, well-established testing procedures and mature testing technology, many regulations had to be set out in more detail for reasons of legal security. For instance, requirements for testing equipment have been more stringently defined and specified. Alterations were also required in the requirements/features for in-use field sprayers in relation to determination of horizontal distribution quality. The former practice of visual reading of the levels in the collectors and determination of compliance with the $\pm 15\%$ deviation clause no longer seems appropriate within the framework of the updated requirements. Nowadays most of the Federal *Laender* evaluate horizontal distribution according to the coefficient of variation. This led to a predominant use of test stands with electronic filling gauges. Several new items of test equipment which measures step by step beneath the spray booms, are now on the market. These products already have BBA approval. Conventional test stands (groove patternators) in some *Laender* are still in use. For these a BBA approved automatic filling level measuring device is available on the market.

It is stipulated that the water used in inspection has to be collected and pumped back into the sprayers tank to prevent water contamination.

The total amount of field sprayers in use in Germany is estimated roughly to 150 000 and in the average nearly 50 % are inspected in a year.

As to the inspection of air assisted sprayers used in tall growing crops (orchards, vineyards and hops) up to now it was disputed whether evaluation of the distribution quality should depend on measurements on a vertical distribution patternator or not. To clarify this dispute a number of countries have carried out measurements by vertical patternators with the aim to optimise the spray distribution in tall growing crops [Gracia et al., 1996; Kaul et al., 1995; KümmeI et al., 1991; Schmidt et al., 1995]. As a result, some countries question the use of vertical patternators for inspection purposes, while others are using it already [Knoll, 1992; Lindt, 1993]. With a view to the European regulations aimed for, this question still needs to be clarified to be able to guarantee perfect operation of the sprayer while using reasonable, not excessive inspection techniques.

In Germany instructions for an optimum adjustment of the vertical distribution of air assisted sprayers for orchards (s. page 173 - 176) and for vineyards (s. page 177 - 180) have been developed on the base of numerous field trials. Farmers following these instructions can adjust their sprayers in the plantation to be treated and will get a good application effect with reduced environmental pollution.

Proposal for Uniform Enforcement of Plant Protection Equipment Inspections in the Federal States (Laender)

(Draft)

Regulation under Article 30 (2) of the Plant Protection Act of 15 September 1986 (BGBl¹ I p. 1505)
on the approval of inspection workshops

Article 1 Approval

Upon application, commercial enterprises are approved by <the authority competent at the seat of the enterprise>² as inspection workshops for inspections of crop protection equipment if

1. the enterprise guarantees to accurately and reliably carry out the inspections and acknowledges the inspection regulation,
2. the enterprise employs sufficient personnel who are especially qualified for inspection of crop protection equipment,
3. the enterprise has the necessary facilities to carry out the inspections, and
4. the enterprise guarantees readiness for inspection together with <the competent authority>.

Details on the conditions for approval are given in Appendix 1.

Inspections under this regulation are tests according to Article 7 (2) or (3) of the Regulation Plant Protection Products of 28 July 1987 (BGBl. I p. 1754) amended by Article 1 (1) of the regulation of 11 June 1992 (BGBl. I p. 1049).

Article 2 Powers of the Inspection Workshops

Approved inspection workshops are entitled to

1. carry out inspections according to the document of approval,
2. award inspection stickers as shown in Appendix 2,
3. use a plaque of approval as shown in Appendix 3.

Article 3 Obligations of the Inspection Workshops

The inspection workshops undertake to

1. allow officials of <the competent authority> access to the inspection facilities and ongoing work during customary business hours,
2. give information, upon request, concerning the inspection procedure,
3. treat the inspection reports confidentially,
4. notify <the competent authority> of changes in the inspection personnel, and

¹ BGBl.: Bundesgesetzblatt - Federal Law Gazette

² The administrative procedural laws of the respective land are valid.

5. notify the respective competent authority, before inspections, if inspections are to be carried out in another land.

Article 4
Termination of Approval

Apart from cases as under Article 49 (2) sentence 1 of the Administrative Procedural Law³, approval of an inspection workshop may be withdrawn if this is sought by the inspection workshop.

Article 5
Fees

A fee is raised on the approval of an inspection workshop⁴.

³ The administrative procedural laws of the respective land are valid.

⁴ The fee regulations of the respective land are valid.

Conditions for Approval as Inspection Workshop

1. Inspection personnel

For the inspection of plant protection equipment, the inspection workshop must employ personnel who have completed relevant vocational training, who are reliable and who have proved the necessary technical knowledge and skills regarding the technical requirements of crop protection equipment, its operation and calibration, and who have a minimum of job experience.

2. Place of inspection

A suitable shed or test field is required. Suitable in particular means providing protection from weather influences. It is to be ensured that only clean equipment, filled with clean water, is allowed for inspection, and that the water used is collected and returned. The provisions of the Water Balance Law must be observed; liquid residues must be legally disposed of.

3. Inspection equipment

Facilities according to Article 1 (3) include, as far as necessary for the inspection work that may be carried out according to the document of approval,

- a patternator to measure the horizontal distribution according to BBA Guideline 1-3.1.1 of Part VII of the BBA Guidelines for Testing Plant Protection Equipment,
- devices to measure the pump volume flow rate and to test flowmeters according to Guideline 1-3.1.1 of Part VII of the BBA Guidelines for the Testing of Plant Protection Equipment,
- a pressure testing device according to Guideline 1-3.1.1 of Part VII of the BBA Guidelines for Testing Plant Protection Equipment,
- at least two gauging cylinders according to Guideline 1-3.1.1 of Part VII of the BBA Guidelines for Testing Plant Protection Equipment,
- a revolution counter,
- a stopwatch,
- technical aids to check nozzle spacing and angles, and
- a computer.

To ensure the necessary accuracy of measurement, the inspection equipment must be checked by experts at least every two years. The measuring instruments used for these checks must have an even greater accuracy than the inspection equipment. Check results are recorded in an instrument book. [Inspection equipment which has undergone the check should be labelled with a sticker.]

Sample of inspection sticker:

Cf. Appendix 4 of the Regulation on Plant Protection Products of 28 July 1987 (BGBl. I p. 1754) amended by Article 1 (5) of the regulation of 11 June 1992 (BGBl. I p. 1049).

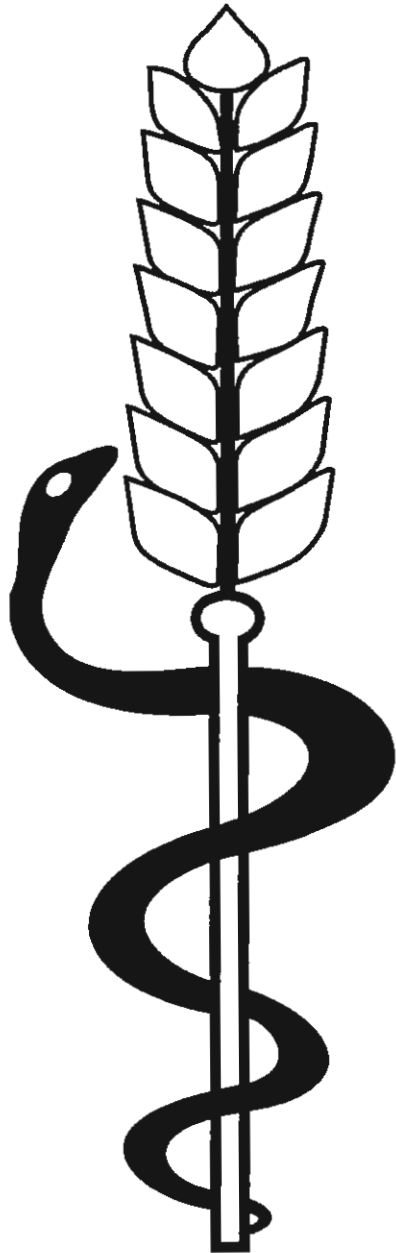
Material: self-adhesive foil
Size: 75 mm in diameter
Colours:

Year	Colour	RAL (Standardized) No.
1995	Orange	2000
1996	Blue	5015
1997	Yellow	1012
1998	Brown	8004
1999	Pink	3015
2000	Green	6018

In the following years, the colours are returning in the same order. The writing is any time black. Size of the inspection workshop's address field: 60 mm wide, 25 mm high. The address of the inspection workshop, written in black, may be either directly printed on the sticker or is stuck separately on the address field in the inspection sticker with self-adhesive transparent foil.

[Appendix 3
(to Article 2 (3))]

Plaque of approval:
Approved Workshop for Inspection of Plant Protection Equipment



**Approved
Workshop
for
Plant Protection
Equipment**

**Proposal for Administrative Regulations in the Federal States (Bundesländer)
(Inspection Regulation for crop protection equipment)**

(Draft)

Administrative rule according to Article 30 (2) of the Plant Protection Act of 15 September 1986 (BGBl¹. I p. 1505) for an inspection regulation and for adequate training of the inspecting personnel.

Contents

- I. Definitions of terms
- II. Inspection regulation for plant protection equipment for field crops
 - 1. Inspection procedure
 - 2. Inspection report
 - 3. Procurement of inspection stickers
 - 4. Inspection fee
- III. Regulations regarding the training of inspection personnel

I. Definition of terms

1. Inspection:

Testing according to Article 7 (1) to (3) of the Regulation on Plant Protection Products of 28 July 1987 (BGBl. I p. 1754), amended by regulation of 11 June 1992 (BGBl. I p. 1049).

2. Appropriate vocational training:

Vocational training in the field of farm machinery, such as agricultural mechanic /*to be supplemented by the Land authorities*/.

3. Plant protection equipment for field crops:

Plant protection equipment according to Article 7 (2) sentence 2 of the Regulation on Plant Protection Products of 28 July 1987 (BGBl. I p. 1754), amended by regulation of 11 June 1992 (BGBl. I p. 1049).

¹ BGBl. Bundesgesetzblatt -- Federal Law Gazette

II. Inspection regulation for plant protection equipment for field crops

1. Procedure of inspections

Inspections shall be carried out according to Guideline 1-3.2.1 of Part VII of the BBA Guidelines for the Testing of Plant Protection Equipment.

2. Inspection report

The result of inspection is to be reported for every item of plant protection equipment in writing, in at least three copies, following Guideline 1-3.2.1 of Part VII of the BBA Guidelines for the Testing of Plant Protection Equipment. Calibration values such as nozzle throughput and spray pressure should be checked and recorded.

One copy of the inspection report is sent to the owner of the equipment and one to the competent Land's crop protection service. The inspection workshops keep their own copies for ten years.

3. Procurement of inspection stickers

The crop protection service and other authorities empowered by it are entitled to procure inspection stickers. These authorities keep records about the stickers they have issued. The inspection workshops obtain the stickers at their expense from the crop protection service or an authority empowered by it. They keep records about the use of the stickers. These records have to be submitted to the crop protection service upon request.

4. Inspection fee

A fee is raised on the inspection.

III. Training of inspection personnel

Following is a list of subjects to be treated during special training of inspection personnel. The subjects are based on the Plant Protection Act, the Regulation on Plant Protection Products, the Regulation on the Approval of Inspection Workshops, and sections I and II of the present regulation.

1. Introduction

- Importance and necessity of the inspection

2. Legal bases of the inspection

- Plant Protection Act
- Regulation on Plant Protection Products
- Regulation on the Approval of Inspection Workshops
- Administrative Regulations

3. Regulation of the inspection of plant protection equipment

- Conditions for approval of the inspection workshop:
 - inspection personnel
 - place of inspection
 - testing devices
- Powers of the inspection workshop
- Duties of the inspection workshop

4. General notes regarding the inspection

- Requirements to be met by crop protection equipment
- Criteria to assess fulfilment of the requirements
- Identification of the equipment type and version
- Correct operation of the item of equipment
- Correct operation of the testing devices
- Procurement of inspection reports (forms) and stickers
- Records about the use of the stickers

5. Execution of inspection

- Mechanic prepares equipment for inspection
- Inspector clears equipment for inspection
- Fitting of testing devices
- Execution of measurements
- Location and elimination of faults
- Writing of inspection report
- Assessment of the equipment
- Decision on award of sticker

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

December 1996

1-3.1.1

**Requirements for
Facilities to Test
Plant Protection
Equipment Already in Use**

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

names and addresses of authors:

H. Ganzelmeier and D. Rautmann
Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

K. Schmidt
Landesanstalt für Pflanzenschutz
Reinsburgstrasse 107
D-70197 Stuttgart 1

L. Knott
Landwirtschaftskammer Westfalen-Lippe
Nevinghoff 40
D 48147 Muenster

German version available by:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbuettel

English version available by:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

All rights reserved, including translation, reprint and photocopying of the guideline, or parts of it.

The use of common, trade and product names in this guideline does not mean they may be used by anyone. They may be legally protected, registered trademarks even if not marked as such.

No liability for errors in text.

Preliminary remark: Facilities used by official or officially recognized stations to test plant protection equipment already in use shall meet the requirements listed in the present Guideline.

For the approval by the BBA these requirements are taken as a basis for the tests.

1. Test facility to measure the uniformity of the cross distribution of plant protection equipment for field crops

A test stand with 100-mm-wide and at least 80-mm-deep grooves measured between the upper edge and the bottom end shall be used to measure the uniformity of the cross distribution. The test of a 12-m-wide spray boom must be possible in one passage.

- Groove test stands shall be at least 1.5 m deep. The groove width shall be adhered to with a tolerance of + 2.5 mm. Prior to the start of the control, the grooves being ready for use shall be checked by suitable means such as a pattern to see whether the above tolerance limits are adhered to. The graduated cylinders shall be of the same type and size and have a capacity of at least 500 ml. Scale graduation should be 10 ml at a maximum. The error should not be greater than 10 ml or 2 % of the measured value.
- The groove width of test stands working with groove scanners and electronic data sampling shall be adhered to with a tolerance of ± 1 mm. The positioning of the single steps of the scanner shall be adhered to with an accuracy of ± 20 mm. The measuring error of the flow volume of the single grooves at a flow volume of 300 ml/min shall be less than 4 %. The instruction manual shall give information how to adjust the test stand.
- Test stands of different design can be used if they reach at least the same measuring accuracy.

2. Test facility to measure liquid flows

The measuring range shall be appropriate for the measuring task. The display must be adjustable. Connecting pieces for various makes of plant protection equipment shall be on hand.

2.1 Test facility to measure pump capacities

For pump testing, the error of flowmeters should not exceed 2 % of the measured value or 2 l/min.

2.2 Test facility to check flowmeters

The error of measuring instruments for testing flowmeters, which are in use for accurate dosing, should not be greater than 1.5 % of the measured value.

3. Facilities for testing manometers

Manometers used for testing shall have a minimum diameter of 100 mm and they shall be officially calibrated. If, for measuring purposes, they are directly connected to the plant protection equipment, they will have to be damped and be provided with a pressure-relief device.

Measuring range, scale graduation and accuracy depend on the range of the spraying pressure for which the pressure gauge to be tested normally is in use and can be gathered from the following table:

Range of spraying pressure [bar]	Minimum requirements for manometers used for testing			
	Scale graduation max. [bar]	Accuracy [bar]	Grade required following DIN 16005	With a measuring range of up to [bar]
0 - 6	0.1	0.1	1.6	6
			1.0	10
			0.6	16
6 - 16	0.2	0.25	1.6	16
			1.0	25
> 16	1.0	1.0	2.5	40
			1.6	60
			1.0	100

4. Test facilities to measure the single nozzle output of sprayers and air-assisted sprayers for high crops

For the loss-free collection of the liquid output of all nozzles, measuring cylinders, having a measuring range of up to 2 l, a scale graduation of 20 ml at a maximum and an error of 20 ml at a maximum shall be used.

The number of measuring cylinders shall depend upon the plant protection equipment to be tested. For air-assisted vineyard sprayers, ten cylinders often suffice; for sprayers in hops, twenty cylinders can be required.

Test stands of different design can be used if they reach at least the same measuring accuracy.

5. Measuring cylinders for calibration

For the testing and calibration of volume measuring instruments measuring cylinders shall have a certification of accuracy and their specification can be gathered from the following table:

Volume	Scale graduation	error at a maximum
2000 ml	20 ml	± 10 ml
1000 ml	10 ml	± 5 ml
500 ml	5 ml	± 2.5 ml
100 ml	1 ml	± 0.5 ml

Explanation: If measuring cylinders with a certification of accuracy are kept ready for calibration it is not necessary to use officially calibrated or accuracy certificated measuring cylinders with the test stands No. 1 and No. 4 of this guideline.

6. Auxiliary devices for testing the preset spray angle of nozzles used for sprayers and air-assisted sprayers for field crops, having an accuracy of at least 2°.

7. Auxiliary devices for testing the nozzle inclination for sprayers and air-assisted sprayers for high crops, having an accuracy of at least 2°.

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

December 1996

1-3.2.1

**Features for Testing Field
Sprayers Already in Use**

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

names and addresses of authors:

D. Rautmann, S. Rietz and H. Ganzelmeier
Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

German version available by:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbüttel

English version available by:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

All rights reserved, including translation, reprint and photocopying of the guideline, or parts of it.

The use of common, trade and product names in this guideline does not mean they may be used by anyone. They may be legally protected, registered trademarks even if not marked as such.

No liability for errors in text.

Preliminary remark

During the test of equipment already in use the fulfilling of requirements according to § 24 of the Plant Protection Act is checked on the basis of the following features.

These features are arranged by design groups of plant protection equipment and are numbered correspondingly. Following each feature instructions and/or examples pertaining to minor failures are given. The listing of minor failures need not necessarily be complete but it provides a framework for discretionary powers. The statement "Minor failures: none" means that no minor failures exist for this feature.

If the failures are of minor importance, a control badge (sticker) may be issued if the owner engages himself to remedy the failures **immediately**.

For testing used equipment (within six months from its putting into use) according to § 7, section 3, of the Regulation for Plant Protection Products and Plant Protection Equipment, only the features pertaining to

- 2. pump
- 6. pipe system
- 9. nozzles

shall be applied. However, for new equipment with a spray boom which has been approved by the BBA as a single part or which is part of a complete approved equipment (nozzles may also have been exchanged by other ones approved by the BBA according to the equipment matrix) and if the manufacturer also supplies a certificate showing all the important data of the equipment, the measuring of the cross distribution according to feature K.9.3 can be dropped.

The result of the test shall be described in a control report to be written according to the sample in Appendix 1. If the above prerequisites are met and if the testing is done according to § 7, section 3, of the Regulation for Plant Protection Products and Plant Protection Equipment without measuring the cross distribution, then the result of the test shall be stated in the control report which is an integral part of the equipment certificate according to the sample given in Appendix 2.

1. Drive

- K.1.1 The drive shall not be affected in its function by wear or any other defect.
Explanation: Drive elements such as p.t.o. shaft, chain, sprocket wheels, V-belt, gear, etc. are to be tested.
Minor failures: slight wear of the drive elements, poor chain greasing, slight damaging of V-belt, too low V-belt tension.

2. Pump

- K.2.1 The volume flow of those pumps, which supply the nozzles with liquid, should be adapted to the needs of the equipment.
Explanation: The measurement is to be done with a measuring device according to Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. The needs of the equipment can be taken from the maximum nozzle output and an additional volume flow for the hydraulic agitator if existing. The additional volume flow is to take from the following table:

nominal tank capacity	additional flow rate
up to 1000 l	5 % of the nominal tank capacity
between 1000 and 2000 l	60 l/min
more than 2000 l	3 % of the nominal tank capacity

Minor failures: none

- K.2.2 Pulsation caused by the pump must be damped.
Minor failures: none
- K.2.3 The pressure-relief device shall work reliably.
Explanation: The functioning of the pressure-relief device must also be granted if a subsequent installed pressure-filter is plugged up with foreign particles.
Minor failures: none
- K.2.4 The pump shall not leak.
Explanation: She may not drip.
Minor failures: none

3. Agitator

- K.3.1 A clearly visible agitation inside the tank should be reached during spraying, with half filling and at the rated p.t.o. shaft speed.
Explanation: Attention should be paid to the correct insertion of the parts of the agitator. If the latter is hydraulic, there should be an additional volume flow according to feature K.2.1.
Minor failures: none

4. Spray liquid tank

- K.4.1 The tank and the screw-caps must not leak.
Minor failures: none
- K.4.2 If the filling is done at the tank dome, there should be a filler sieve available.
Minor failures: none
- K.4.3 Pressure compensation must be ensured.
Minor failures: none
- K.4.4 A clearly readable liquid level gauge has to be available.
Minor failures: The hose used to determine the tank level is opaque and only little transparent, the float is hardly visible, the scale is partly hid by the hoses.
- K.4.5 It must be possible to collect the spray liquid properly when the drainage is done.
Minor failures: The drain-cock is difficult to operate, the collection of liquid is hindered by a badly positioned hose.
- K.4.6 As far as tank filling devices are concerned, it must be ensured that the spray liquid cannot flow back.
Minor failures: none
- K.4.7 Gate-type fillers of sprayers made after 1 January 1989 shall have a protective grating with a maximum mesh width of 2 cm.
Minor failures: none
- K.4.8 Gate-type fillers must work reliably.
Minor failures: none
- K.4.9 Container cleaning device must work reliably.
Minor failures: none

5. Controls

- K.5.1 All devices for measuring, switching and adjusting pressure shall not leak and function well.
Minor failures: All switching or adjustment devices are lacking ease but are not impaired in their functions.
- K.5.2 All devices for adjusting pressure have to keep the working pressure at a normal constant speed.
Explanation: This includes also that they reach the same working pressure after the equipment has been switched off and on again.
Minor failures: Changes of the working pressure by up to 5 %.

1 - 3.2.1

K.5.3 The controls required for a perfect dosing as well as the switching devices have to be mounted such that the operator can read and operate them without difficulty during work; it is still considered reasonable that the operator turns his head or his upper body in doing so.

Minor failures: Switches for boom sections are unfavourably positioned and cannot be easily reached, minor vibrations of the manometer indicator.

K.5.4 As to their scale range, pressure gauges shall correspond to their purpose.

Minor failures: none

K.5.5 In the range of spraying pressure the pressure gauges shall at least meet the requirements of grade 2.5 (DIN 16005).

Explanation: The accuracy of the pressure gauges shall be tested by means of the test facility for manometers according to Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. Grade 2.5 (DIN 16005) corresponds to the following error limits:

range of spraying pressure up to [bar]	Max. error [bar]
5	0.125
6	0.15
10	0.25
16	0.4

Minor failures: Indication errors up to 3 % of the end of the range of spraying pressure.

K.5.6 The manometer casing shall have a minimum diameter of 60 mm.

Minor failures: none

K.5.7 The scale graduation of the pressure gauges, up to 5 bar, shall be 0.2 bar at the maximum.

Minor failures: none

K.5.8 Other measuring devices, especially flowmeters used for dosing, can deviate from the measured value by 5 % at the maximum within the customary measuring range.

Explanation: Flowmeters, if any, shall be tested when being fitted already by means of a test equipment according to those described in Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. In doing so, controls connected before in series, consisting of separate return flow, a feed line leading to the controls of the plant protection equipment, a valve for adjusting pressure, a manometer, a flowmeter and a pressure- relief device can be useful.

Minor failures: indication errors up to 7.5 % at range limits.

K.5.9 There shall be a main control valve which works reliable.

Minor failures: none

6. Pipe system

- K.6.1 The pipe system must not leak and be designed such that all nozzles are uniformly and sufficiently provided with liquid.
Explanation: Pipelines and connections shall be tested at the maximum possible working pressure however with 10 bar at the most. They shall not drip.
Minor failures: none
- K.6.2 Hoses should not have any marks of kinking or abrasion.
Minor failures: negligible abrasion having not yet reached the woven fabric of the hose.
- K.6.3 Hoses in working condition must not be suspended in the range of the jet.
Minor failures: none

7. Filtering

- K.7.1 At least one filter each has to be inserted into the suction and pressure pipelines. It shall be possible - also with a full tank - to clean the filter without wasting more liquid than the volume in the filter housing and in the sucking hose respectively.
Explanation: Nozzle filters, if any are in this case not regarded as filters in pressure pipelines. The filter elements shall be checked as to their state of sealing and damages.
Minor failures: minor damage to the sealing though no dropping.
- K.7.2 The filter elements have to be replaceable.
Minor failures: none

8. Spray boom

- K.8.1 In all directions it must be of stable design, i.e. during spraying there should be no major unwanted bouncing, no mechanical deformation or deflection in its joints.
Minor failures: negligible deformations of the boom which do not affect the direction of nozzles.
- K.8.2 There have to be obstacle-avoiding devices with an automatic resetting.
Minor failures: Slow automatic resetting because of poor greasing, for example.
- K.8.3 Nozzles must have uniform spacing between each other and from the target area.
Explanation: During the folding of the boom, the nozzle heads should not be twisted or shifted. The distances of nozzles from the target area may vary up to 10 cm.
Minor failures: none
- K.8.4 Parts of equipment shall not be sprayed.
Minor failures: none
- K.8.5 In case of working widths equal 10 m or more, the atomizers at the boom ends have to be protected from being damaged because of soil contact, e.g. by spacers.
Minor failures: Spacer is deformed.

K.8.6 For spray booms with more than 6 m working width, it must be possible to switch the spray boom on or off in at least two sections.

Minor failures: none

K.8.7 Height adjustment devices must be in working order.

Minor failures: none

K.8.8 Devices to compensate bouncing and slope positions must be in working order.

Minor failures: none

9. Nozzles

K.9.1 Types and sizes of all nozzles used at the same time, including the relevant drop stop valves and filters, if any, have to be alike.

Explanation: Nozzles should be used which are approved by the BBA. With multiple-nozzle-bodies each nozzle type is to be tested.

Minor failures: none

K.9.2 Nozzles should not drip after being switched off.

Explanation: It shall be checked, by repeatedly operating the on/off switches, whether the nozzles do not drip for more than five seconds after the spray jet collapsed.

Minor failures: none

K.9.3 The cross distribution, within the fully overlapping range, shall be uniform. The cross distribution will be evaluated on the basis of the coefficient of variation which shall not exceed 10 %. Until 31 December 1997 an equal criterion is, that not more than 8 % of the measured values, within the fully overlapping range, shall deviate more than 15 % from the total mean value.

Explanation: The cross distribution test is to be done by means of the test equipment described in Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. Prior to the start of the cross distribution measurement, attention should be given to the perfect functioning of the spraying and correct adjustment of all nozzles. The measurement of the fitted sets of nozzles shall be made at the working pressure indicated by the owner of the sprayer. The distance from the measuring area should be the one normally used in practice; for nozzles with a spray angle of 110°/120°, the distance, as a rule, is 50 cm. If for remedying failures new nozzle tips approved by the BBA are installed no additional cross distribution test is to be done provided that at least one cross distribution test has been done before.

Minor failures: Up to 12 % of the measured values deviate more than 15 % from the mean value.

Control test station

Control Report No.
for plant protection equipment for field crops

- Test acc. to § 7, sect. 2 of PflSchMVO* Test acc. to § 7, sect. 3 of PflSchMVO Recheck
 Safety regulation test

Owner's address

Make or manufacturer acc. to BBA code list:
Type:
Year of manuf. 19 Machine No.:
 rear mounted surface mounted trailed self-propelled
 private hired jointly used

Remarks, recommendations, replaced parts, repairs

Test result		Date and signature of the inspector		
sticker	<input type="checkbox"/> yes <input type="checkbox"/> no			
	Equipment	minor failure *if any	failure or missing	O.K. or failure remedied
1. Drive		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Pump	<input type="checkbox"/> piston <input type="checkbox"/> diaphragm } Type <input type="text"/> <input type="checkbox"/> <input type="text"/> <input type="text"/> l/min at <input type="text"/> bar	K.1.1 Function <input type="checkbox"/>	K.2.1 flow volume K.2.3 pressure relief device <input type="checkbox"/>	K.2.2 pulsations K.2.4 no leakage <input type="checkbox"/>
3. Agitator	<input type="checkbox"/> mechanic <input type="checkbox"/> hydraulic	K.3.1 recirculation <input type="checkbox"/>		
4. Tank	nominal capacity <input type="text"/> l	K.4.1 no leakage K.4.3 pressure compens. K.4.5 drainage K.4.7 filler sluice K.4.9 cont. cleanng. * <input type="checkbox"/>	K.4.2 filler sieve K.4.4 scale K.4.6 filler device K.4.8 gate-type filler * <input type="checkbox"/>	<input type="checkbox"/>
5. Controls		K.5.1 function K.5.3 operation K.5.5 accuracy K.5.7 spacing K.5.9 switch off dev. <input type="checkbox"/>	K.5.2 pressure K.5.4 measur. range K.5.6 casing K.5.8 flowmeter * <input type="checkbox"/>	<input type="checkbox"/>
6. Pipe system		K.6.1 no leakage K.6.3 suspension <input type="checkbox"/>	K.6.2 no kinking <input type="checkbox"/>	<input type="checkbox"/>
7. Filtering		K.7.1 installed <input type="checkbox"/>	K.7.2 inserts <input type="checkbox"/>	<input type="checkbox"/>
8. Spray boom	working width <input type="text"/> m nozzle distance <input type="text"/> cm no. of sections <input type="checkbox"/>	K.8.1 stability K.8.3 distance K.8.5 spacer K.8.7 height adjustm. <input type="checkbox"/>	K.8.2 evading K.8.4 in spray jet K.8.6 sections K.8.8 anti-swing * <input type="checkbox"/>	<input type="checkbox"/>
9. Nozzles	no. of pieces <input type="text"/> marking <input type="text"/> manufacturer <input type="text"/> no. of measured data with > 15% deviation <input type="text"/> or coefficient of variation <input type="text"/>	K.9.1 type, size K.9.3 cross distribution <input type="checkbox"/>	K.9.2 anti dip <input type="checkbox"/>	<input type="checkbox"/>

Land / competent office

Location of control (area code, town)

Sample Equipment Certificate

Appendix 2

To be completed by the manufacturer

Manufacturer Type: D-No.:

Designs (Matrix) Machine-Nr.:

Year of manuf. 19 Approved (BBA), Test No. G-

rear-mounted surface-mounted trailed self-propelled

private hired jointly used

Additional accessories:

Nominal tank capacity l

Type of pump

Pump design

Type of controls

No. of sections

possible spray booms

To be completed by the control test station

Control test station **Control Report No.**

for plant protection equipment for field crops
Test according to § 7, sect. 3 of the PflSchMVO

Owners address

Remarks, subsequent changes

Test result		Date and signature of the inspector		
sticker	<input type="checkbox"/> yes <input type="checkbox"/> no	minor failure	failure or missing	O.K. or failure remedied
2. Pump	Capacity: <input style="width: 60px;" type="text"/> l/min at <input style="width: 60px;" type="text"/> bar	K.2.1 flow volume K.2.3 pressure relief device	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
6. Pipe system		K.6.1 no leakage K.6.3 suspension	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
8. Spray boom	marking <input style="width: 60px;" type="text"/> working width <input style="width: 60px;" type="text"/> m nozzle spacing <input style="width: 60px;" type="text"/> cm			
9. Nozzles	No. of pieces <input style="width: 60px;" type="text"/> nozzle marking <input style="width: 60px;" type="text"/> manufacturer <input style="width: 60px;" type="text"/> * no. of measured data with > 15% deviation or coefficient of variation <input style="width: 60px;" type="text"/>	K.9.1 type, size K.9.3 * cross distribution * if not approved by the BBA	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

Land / competent office Location of control (area code, town)

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



Guidelines for the testing
of plant protection products
and plant protection equipment

Part VII

June 1997

1-3.2.2

**Features for Testing Air-Assisted
Sprayers for Bush and Tree Crops
Already in Use**

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

names and addresses of authors:

H. Koch
Landesanstalt für Pflanzenbau und Pflanzenschutz
Essenheimer Straße 144
D-55128 Mainz

K. Schmidt
Landesanstalt für Pflanzenschutz
Reinsburgstraße 107
D-70197 Stuttgart 1

H. Ganzelmeier, D. Rautmann and S. Rietz
Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

Additionally the elaboration of these features were assisted by the plant protection offices of the Federal States.

German version available by:

Saphir-Verlag
Gutsstrasse 15,
D 38551 Ribbesbüttel

English version available by:

**Biologische Bundesanstalt für
Land- und Forstwirtschaft**
-Fachgruppe Anwendungstechnik-
Messeweg 11/12
D 38104 Braunschweig

All rights reserved, including translation, reprint and photocopying of the guideline, or parts of it.

The use of common, trade and product names in this guideline does not mean they may be used by anyone. They may be legally protected, registered trademarks even if not marked as such.

No liability for errors in text.

Preliminary remark

During the test of plant protection equipment for bush and tree crops already in use the fulfilling of requirements according to § 24 of the Plant Protection Act is checked on the basis of the following features. The fulfilling of these features also applies to the fulfilment of the requirements coming from § 24 of the Plant Protection Act. Thus plant protection equipment already in use can be marketed again if these features are fulfilled.

These features are arranged by design groups of plant protection equipment and are numbered correspondingly. Following each feature instructions and/or examples pertaining to minor failures are given. The listing of minor failures need not necessarily be complete but it provides a framework for discretionary powers. The statement "Minor failures: none" means that no minor failures exist for this feature.

If the failures are of minor importance, a control badge (sticker) may be issued if the owner engages himself to remedy the failures **immediately**.

For testing used equipment (within six months from its putting into use) according to § 7, section 3, of the Ordinance for Plant Protection Products and Plant Protection Equipment, only the features pertaining to

- 2. pump
- 6. pipe system
- 9. nozzles

shall be applied.

The result of the test shall be described in a control report to be written according to the sample in Appendix 1.

1. Drive

- K.1.1 The drive shall not be affected in its function by wear or any other defect.
Explanation: Drive elements such as p.t.o. shaft, chain, sprocket wheels, V-belt, gear, etc. are to be tested.
Minor failures: slight wear of the drive elements, poor chain greasing, slight damaging of V-belt, too low V-belt tension.

2. Pump

- K.2.5 The volume flow of those pumps, which supply the nozzles with liquid, should be adapted to the needs of the equipment.
Explanation: The measurement is to be done with a measuring device according to Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. The needs of the equipment can be taken from the maximum nozzle output and an additional volume flow for the hydraulic agitator if existing. The additional volume flow is to take from the following table:

nominal tank capacity	additional flow rate
up to 1000 l	5 % of the nominal tank capacity
between 1000 and 2000 l	60 l/min
more than 2000 l	3 % of the nominal tank capacity but at the most 100 l/min

Minor failures: none

- K.2.2 Pulsation caused by the pump must be damped.
Minor failures: none
- K.2.3 The pressure-relief device shall work reliably.
Explanation: The functioning of the pressure-relief device must also be granted if a subsequent installed pressure-filter is plugged up with foreign particles.
Minor failures: none
- K.2.4 The pump shall not leak.
Explanation: She may not drip.
Minor failures: none

3. Agitator

- K.3.2 A clearly visible agitation inside the tank should be reached during spraying, with half filling and at the rated p.t.o. shaft speed.
Explanation: Attention should be paid to the correct insertion of the parts of the agitator. If the latter is hydraulic, there should be an additional volume flow according to feature K.2.5.
Minor failures: none

4. Spray liquid tank

- K.4.1 The tank and the screw-caps must not leak.
Minor failures: none
- K.4.2 If the filling is done at the tank dome, there should be a filler sieve available.
Minor failures: none
- K.4.3 Pressure compensation must be ensured.
Minor failures: none
- K.4.4 A clearly readable liquid level gauge has to be available.
Minor failures: The hose used to determine the tank level is opaque and only little transparent, the float is hardly visible, the scale is partly hid by the hoses.
- K.4.5 It must be possible to collect the spray liquid properly when the drainage is done.
Minor failures: The drain-cock is difficult to operate, the collection of liquid is hindered by a badly positioned hose.
- K.4.6 As far as tank filling devices are concerned, it must be ensured that the spray liquid cannot flow back.
Minor failures: none
- K.4.7 Gate-type fillers of sprayers made after 1 January 1989 shall have a protective grating with a maximum mesh width of 2 cm.
Minor failures: none
- K.4.8 Gate-type fillers must work reliably.
Minor failures: none
- K.4.9 Container cleaning device must work reliably.
Minor failures: none

5. Controls

- K.5.1 All devices for measuring, switching and adjusting pressure shall not leak and function well.
Minor failures: All switching or adjustment devices are lacking ease but are not impaired in their functions.
- K.5.2 All devices for adjusting pressure have to keep the working pressure at a normal constant speed.
Explanation: This includes also that they reach the same working pressure after the equipment has been switched off and on again.
Minor failures: Changes of the working pressure by up to 5 %.

1 - 3.2.2

K.5.10 The controls required for a perfect dosing as well as the switching devices have to be mounted such that the operator can read and operate them without difficulty during work; it is still considered reasonable that the operator turns his head or his upper body in doing so.

Minor failures: Minor vibrations of the manometer indicator.

K.5.11 The application to one side only shall be possible by switching off the other.

Minor failures: none

K.5.4 As to their scale range, pressure gauges shall correspond to their purpose.

Minor failures: none

K.5.13 In the range of spraying pressure the pressure gauges shall at least meet the requirements of grade 2.5 (DIN 16005).

Explanation: The accuracy of the pressure gauges shall be tested by means of the test facility for manometers according to Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. Grade 2.5 (DIN 16005) corresponds to the following error limits:

range of spraying pressure up to [bar]	Max. error [bar]
10	0.25
16	0.4
25	0.625
60	1.5

Minor failures: Indication errors up to 3 % of the end of the range of spraying pressure.

K.5.6 The manometer casing shall have a minimum diameter of 60 mm.

Minor failures: none

K.5.12 The scale graduation of the pressure gauges, up to 20 bar, shall be 1 bar at the maximum and 2 bar at the maximum for more than 20 bar.

Minor failures: none

K.5.8 Other measuring devices, especially flowmeters used for dosing, can deviate from the measured value by 5 % at the maximum within the customary measuring range.

Explanation: Flowmeters, if any, shall be tested when being fitted already by means of a test equipment according to those described in Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. In doing so, controls connected before in series, consisting of separate return flow, a feed line leading to the controls of the plant protection equipment, a valve for adjusting pressure, a manometer, a flowmeter and a pressure-relief device can be useful.

Minor failures: indication errors up to 7.5 % at range limits.

- K.5.9 There shall be a main control valve which works reliable.
Minor failures: none

6. Pipe system

- K.6.4 The pipe system must not leak and be designed such that all nozzles are uniformly and sufficiently provided with liquid.
Explanation: Pipelines and connections shall be tested at the maximum possible working pressure however with 25 bar at the most. They shall not drip.
Minor failures: none
- K.6.2 Hoses should not have any marks of kinking or abrasion.
Minor failures: negligible abrasion having not yet reached the woven fabric of the hose.
- K.6.3 Hoses in working condition must not be suspended in the range of the jet.
Minor failures: none

7. Filtering

- K.7.1 At least one filter each has to be inserted into the suction and pressure pipelines. It shall be possible - also with a full tank - to clean the filter without wasting more liquid than the volume in the filter housing and in the sucking hose respectively.
Explanation: Nozzle filters, if any are in this case not regarded as filters in pressure pipelines. The filter elements shall be checked as to their state of sealing and damages.
Minor failures: minor damage to the sealing though no dropping.
- K.7.2 The filter elements have to be replaceable.
Minor failures: none

9. Nozzles

- K.9.2 Nozzles should not drip after being switched off.
Explanation: It shall be checked, by repeatedly operating the on/off switches, whether the nozzles do not drip for more than five seconds after the spray jet collapsed.
Minor failures: none
- K.9.4 The nozzle equipment shall be adapted to an appropriate application of the plant protection products as directed.
Minor failures: none
- K.9.5 The nozzle equipment of the left and right side shall be symmetrical.
Explanation: At comparable vertical nozzle positions the nozzles inclusive their anti drip device and filters shall be uniform as to their size and type.
Minor failures: none
- K.9.6 It shall be possible to switch off each nozzle.
Explanation: For nozzle bodys without any switching off device suitable stopper plates shall be available in a sufficient number.
Minor failures: Hard to operate.

- K.9.7 Nozzles shall be adjustable (output, spray angle, direction of spray, nozzle spacing) in a reproducible manner.
Minor failures: Hard to operate, poor visible marks.
- K.9.8 The nozzles shall form a uniform spray jet.
Explanation: Test by sight with switched off blower.
Minor failures: none
- K.9.9 The output of nozzles with the same marking shall not deviate more than 10 % from their mean output.
Explanation: The test of the single nozzle output is to be done by means of the test equipment described in Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. Prior to the start of the output measurement, attention should be given to the perfect functioning of the spraying of all nozzles. The measurement of the fitted sets of nozzles shall be made at the working pressure indicated by the owner of the sprayer, if not known at a normal spray pressure. The liquid output of the equipment can be used to calculate the application rate (l/ha).
Minor failures: Deviation of the nozzle output up to 15 % from the mean value.

10. Blower

- K.10.1 The nominal rotation speed of the blower shall be reached at the nominal speed of the p. t. o.
Minor failures: Up to 10 % deviation from the nominal speed.
- K.10.2 The blower (fan, casing, air deflectors) shall be in a proper condition.
Explanation: The equipment parts shall be tested with regard to mechanical deformation, wear and tear, corrosion and vibrations.
Minor failures: Minor deformation of adjustable air deflectors.
- K.10.3 It shall be possible to switch off the blower separately from other driven parts of the machine.
Explanation: The proper function of the clutch, the device for the belt tension or the air deflecting plates shall be tested.
Minor failures: Hard to operate.
- K.10.4 Adjustable air guide plates on the blower and on an additional blower casing shall function well.
Minor failures: Hard to operate.
- K.10.5 Parts of equipment may not be sprayed, with the exception that this is necessary for the functioning of the blower and don't cause dripping.
Minor failures: none

Control test station

Control Report No.

for plant protection equipment for bush and tree crops

- Test acc. to BBA-Guideline Part VII, 1-3.2.2 Safety regulation test

Make or manufacturer acc. to BBA code list:

Type:

Year of manuf. 19 Machine No.:

- rear mounted surface mounted trailed self-propelled

- private hired jointly used

Tank capacity Pump, type

Pump, make

Control, type

Owners' address

Remarks, recommendations, replaced parts, repairs

Test result Date and signature of the inspector

Sticker yes no

	Equipment		minor failure			failure or missing			failure remedied			
			*if any									
1. Drive		K.1.1 function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
2. Pump	<input type="text"/> l/min at <input type="text"/> bar	K.2.5 flow volume K.2.3 pressure relief device		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	K.2.2 pulsations K.2.4 no leakage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Agitator	<input type="checkbox"/> mechanic <input type="checkbox"/> hydraulic	K.3.1 recirculation			<input type="checkbox"/>							
4. Tank		K.4.1 no leakage K.4.3 pressure compens. K.4.5 drainage K.4.7 filler sluice K.4.9 cont. cleang.		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	K.4.2 filler sieve K.4.4 scale K.4.6 filler device K.4.8 gale-type filler	*	<input type="checkbox"/>	<input type="checkbox"/>
5. Controls		K.5.1 function K.5.10 operation K.5.4 measur. range K.5.6 casing K.5.8 flowmeter		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	K.5.2 pressure K.5.11 regulation K.5.13 grade K.5.12 spacing		<input type="checkbox"/>	<input type="checkbox"/>
6. Pipe system		K.6.4 no leakage K.6.3 suspension			<input type="checkbox"/>		<input type="checkbox"/>		K.6.2 no kinking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Filtering		K.7.1 installed		<input type="checkbox"/>	<input type="checkbox"/>				K.7.2 inserts		<input type="checkbox"/>	<input type="checkbox"/>
9. Nozzles	no. of pieces <input type="text"/> marking <input type="text"/> manufacturer <input type="text"/>	K.9.2 anti drip K.9.5 symmetric K.9.7 adjustable K.9.9 output			<input type="checkbox"/>		<input type="checkbox"/>		K.9.4 outfit K.9.6 switch off K.9.8 spray jet		<input type="checkbox"/>	<input type="checkbox"/>
9. Blower		K.10.1 rotation speed K.10.3 switching off K.10.5 parts shall not be sprayed		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		K.10.2 proper condition K.10.4 air guide plates		<input type="checkbox"/>	<input type="checkbox"/>

Land / competent office

Location of control (area code, town)



Optimum adjustment of the vertical distribution of air assisted sprayers for orchards



The best vertical distribution of air-assisted sprayers is adjusted to the highest orchard trees with the help of simple auxiliary means in the farmyard. The adaption to lower orchard trees is done by switching off nozzles in pairs.

1. Auxiliary means

Measuring pole, 4 m long

Metric tape measure, 2 m long

Pole for adjustment of nozzles, 2 m long

Marker tape(splicing tape)

Long ribbon of fabric, 2 cm width and 2 m long

2 x short ribbon of fabric, 2 cm width and 0,5 m long

2. Definition of the range to be treated in height (Fig. 1)

- Lower limit of treatment: usually 20 cm or to be measured in the orchard
- Upper limit of treatment: highest tree of the orchard+growth+30 cm addition

3. Adjustment of the air deflectorsⁱ (Fig. 1)

- Set up sprayer and measuring pole in a sheltered place in the farmyard
- Mark lower and upper limits of treatment on the measuring pole
- Set air stream symmetricallyⁱⁱ to lower and upper limit of treatment:
 - Set maximum speed of ventilator
 - Make air stream limits visible with the help of the long fabric ribbon tied to the poleⁱⁱⁱ
 - Adjust^{iv} air stream limits to the limits of treatment by adjusting the air deflectors
- Mark limits of treatment, as adjusted, on the sprayer, or note them down
- Mark direction of air deflectors on the sprayer, or measure and note down angles^v

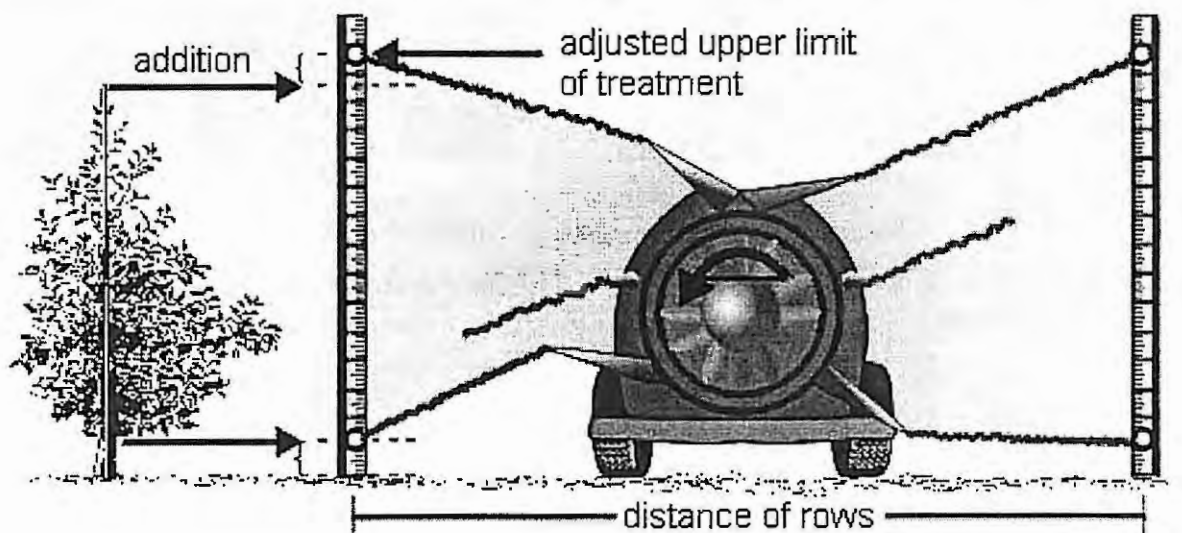


Fig. 1: Adjustment of the air deflectors to the limits of treatment and test of the blowers twist

4. Test of the air twist of the blower (Fig. 1)

- With asymmetry of air deflectors: sprayer with air twist
- With symmetry of air deflectors: test symmetry in the middle of the air outlet
 - Attach the short fabric ribbons to the left and right of the middle nozzles
 - Switch on the blower
 - With asymmetric direction of ribbons: blower with air twist
 - With symmetric direction of ribbons: blower without air twist

5. Adjustment of nozzles^{vi} (Fig. 2a or 3a)

- Divide range between treatment limits into equal sections on the measuring pole
- Mark these sections on the measuring pole with splicing tapes
- Note down the size of these sections
- Adjust nozzles to the marked points on the measuring pole:
 - Slip the aligning pole on the nozzles and direct it towards the points marked on the measuring
 - With sprayers with air twist: adjust nozzles asymmetrically (Fig. 2a)
 - With sprayers without air twist: adjust nozzles symmetrically (Fig. 3a)
 - Check spray jet of opened nozzles^{vii}
 - Prevent spraying on equipment parts^{viii}
- Mark direction of nozzles on the sprayer, or measure and note down angles^{ix}

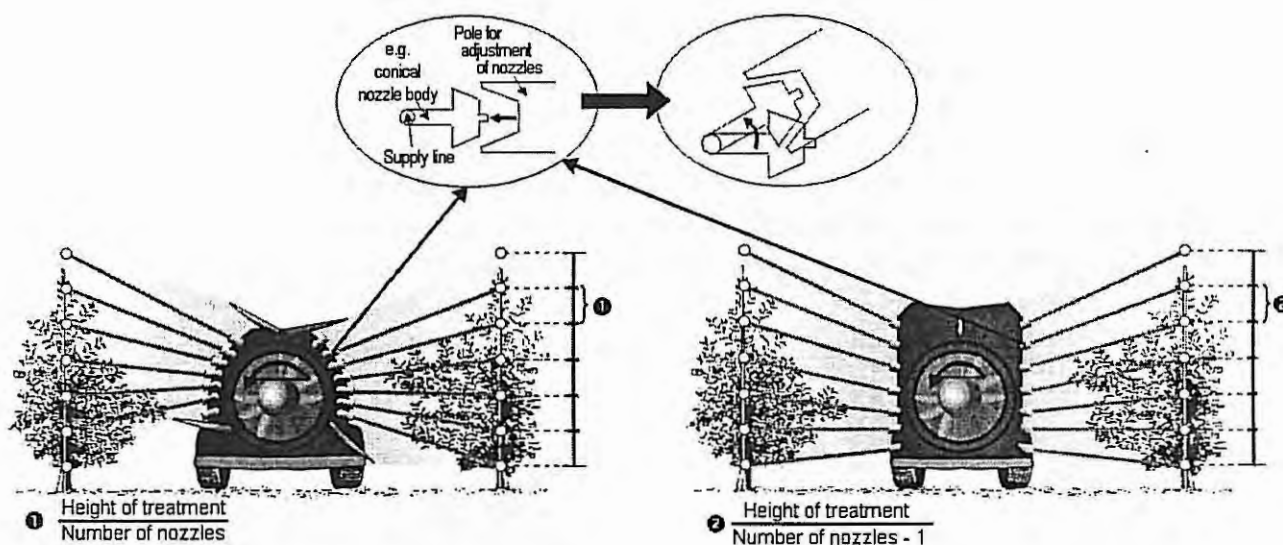


Fig. 2a: Adjustment of nozzles on sprayers with air twist

Fig. 3a: Adjustment of nozzles on sprayers without air twist

6. Visual check and adjustment to changed limits of treatment (Fig. 2b or 3b)

- Drive sprayer into the orchard with the highest trees
- Visual check of the spray jet
- Drive sprayer into the orchard with low trees Switch off nozzles in pairs to adjust the spraying range to upper and lower limits of treatment
- Visual inspection of the spray jet

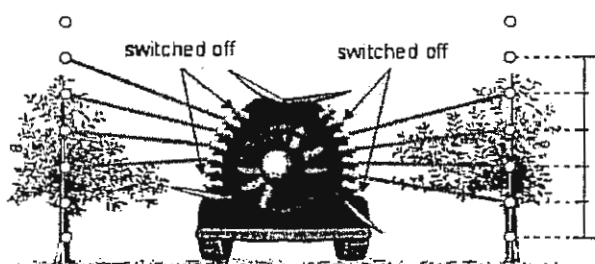


Fig. 2b: Adjustment to tree height by switching off nozzles (with air twist)

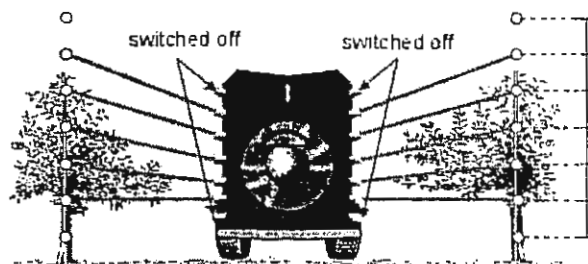


Fig. 3b: Adjustment to tree height by switching off nozzles (without air twist)

-
- If air deflectors are missing and if the air flow on both sides is not symmetric, optimum adjustment is not possible. It is recommended to touch up the sprayer. If the bottom deflector is set downwards and the air stream does not reach the lower limit of treatment, the sprayer cannot be correctly adjusted for treatment of leaves near the ground. If the top air deflector is set upwards and the air stream does not reach the wanted upper limit of treatment, the sprayer cannot be correctly adjusted for treatment of trees with this height. If the topmost air deflector is set downwards and the air stream reaches higher than the wanted limit of treatment, the sprayer is adjusted to the wanted height of treatment by switching off nozzle pairs.
 - If the air deflectors not adjustable and the limits of treatment are not hit or are exceeded by the air stream, optimum adjustment of the sprayer is not possible.
 - Tie the long ribbon to the pole and hold it to the air deflector to be adjusted.
 - With ventilators rotating leftwards, start with the left side of the ventilator, and with ventilators rotating rightwards, vice versa.
 - This defines the sprayer's range of treatment.
 - The adjustment of nozzles depends on whether or not the sprayer has an air twist. For sprayers with air twist, the asymmetry of the air stream is compensated by an oppositely directed asymmetry of the nozzles. The respective figure is the basis for further adjustment. The formula for calculating the size of sections on the measuring pole is to be taken from the figure.
 - Twisted nozzles may have partly been switched off.
 - As much nozzles as possible should be switched on. Where it is necessary to switch off nozzles pairs, the section on the measuring pole would have to be defined anew.
 - This basic adjustment is not changed again. Adjustment to the height of the trees in the orchards is only done by switching off nozzle pairs at the top or at the bottom of the sprayer.



Optimal adjustment and handling of air assisted sprayers in vineyards

LWG
Würzburg

LVWO
Weinsberg

SLFA
Neustadt/W.

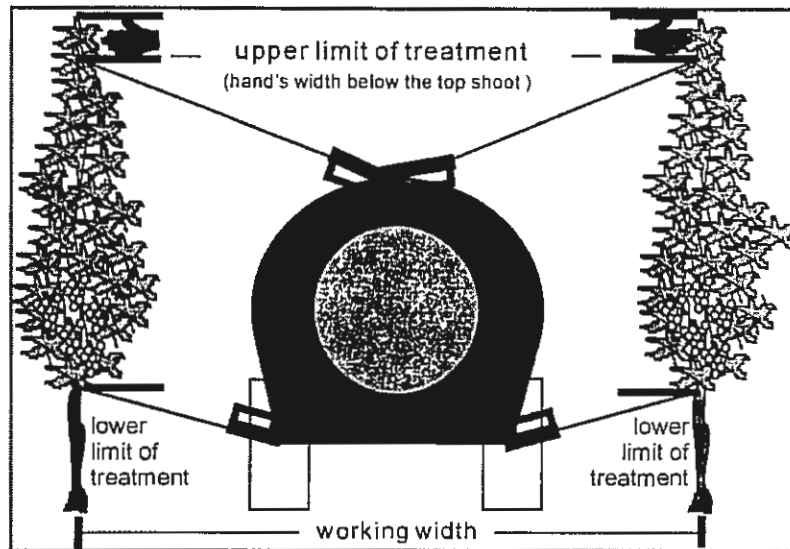
FA
Geisenheim

The correct adjusting of equipment is a vital basis for improving the wetting of vines with plant protection products and consequently for optimising the impact of vine protection measures. At the same time, environmental stress through drift and soil contamination is reduced. The vine sprayers are adjusted exactly to the growth of the vines. This takes place principally in the vineyards. The air deflectors are adjusted to the vine height by adjusting them to the corresponding growth stage and further nozzle pairs are switched on. For practical reasons, a trial spray is performed with water.

1. Adjustment of the air deflectors

This step is only relevant for equipment with axial blowers. If there are no air deflectors for this type of blower, an optimal adjustment of the sprayer is not possible.

- **Assembly of the equipment in working position in the vineyard**
- **Determination of lower and upper limit of treatment**
 - lower limit of treatment = lower vine limit
 - upper limit of treatment = one hand's width below the respective upper vine limit
- **Direction of the air flow on lower and upper limits of treatment**
 - adjust the blower speed to the growth stage
 - make the spraying area visible by switching on the nozzles
 - adjust the spraying area to the vine height using the air deflectors (they should be adjusted separately for each side; depending on the influence of the rotation direction, different angles of incidence may be necessary on both sides)



Adjustment of the air deflectors

2. Direction of the nozzles

a. Equipment with upwardly directed air current ¹

- **Determination of the number of nozzles corresponding to the vine height**
- **Direct the lowest and highest of the necessary nozzles on the limit of treatment**
This adjustment is performed for practical reasons together with the adjustment of the air deflectors.
- **Direct intermediate nozzles on the remaining vine zone**
- **Check the spray jet of the opened nozzles**
To avoid uneven distribution on the surfaces, particularly when the rows are close together, it is vital to ensure that the spray jets overlap sufficiently. If necessary, nozzles with a wider spray angle should be used.

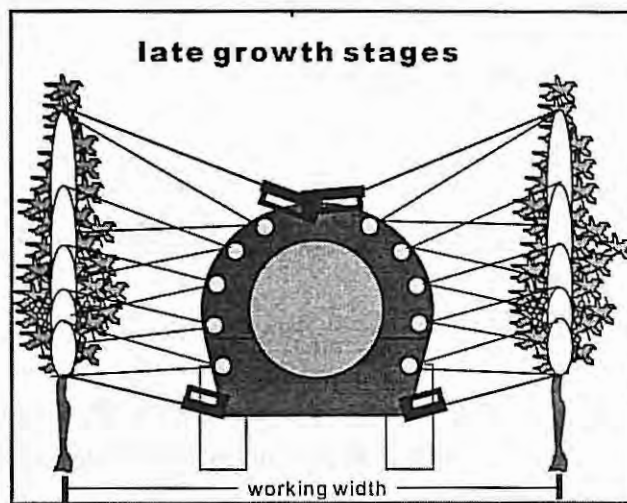
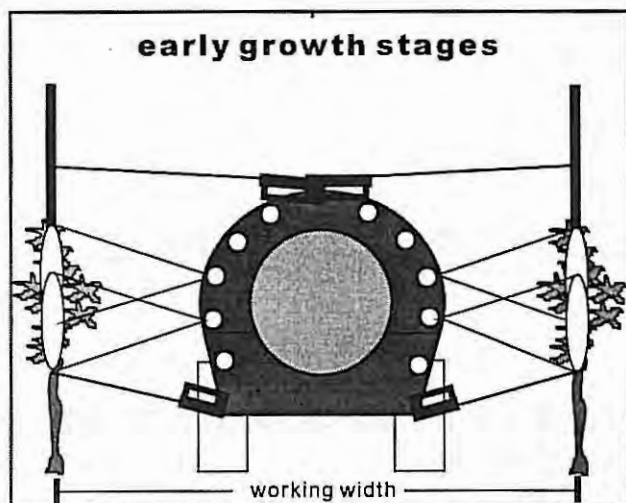
b. Equipment with extensively horizontal air current ²

- **Determination of the number of nozzles corresponding to the vine height**
- **Direct the lowest and highest of the necessary nozzles on the limit of treatment**

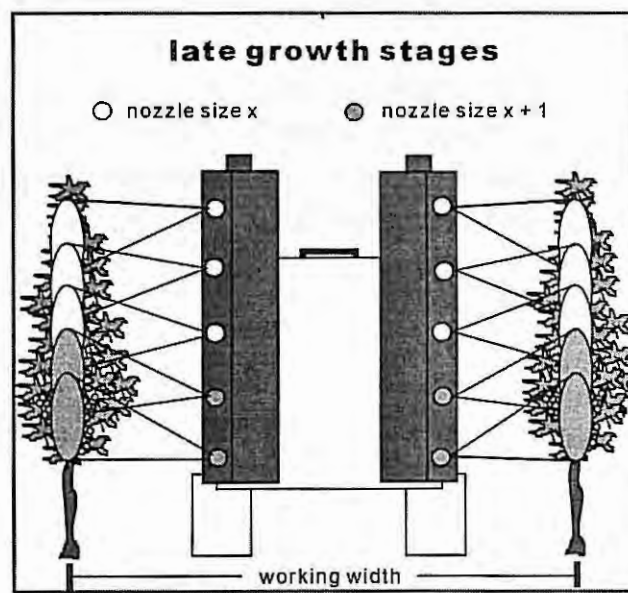
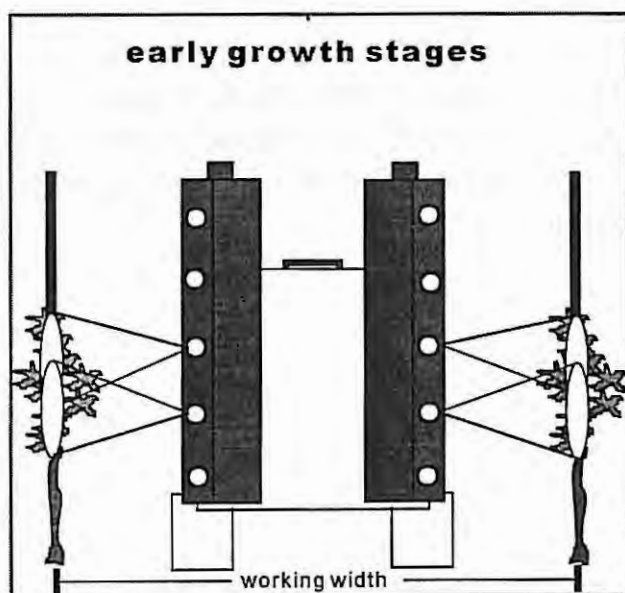
¹ Axial blower, reversal axial blower, radial blower with strong vertical air current

² Tangential blower, axial blower and radial blower with extensively horizontal air current

- **Direct intermediate nozzles horizontally**
- **Check the spray jet of the opened nozzles**
To avoid uneven distribution on the surfaces, particularly when the rows are close together, it is vital to ensure that the spray jets overlap sufficiently. If necessary, nozzles with a wider spray angle should be used.



Nozzle direction for equipment with upwardly directed air current



Nozzle direction for equipment with a horizontal air current

3. Visual check

The visual check should be performed for practical reasons by a second person during operation.

- **Visual check of the spray area**
To avoid drift and soil losses it is vital that the spray jet is directed exactly on the upper and lower limit of treatment.
- **If necessary, adjustments should be corrected**
- **Final visual check**

4. Further recommendations for "Good Professional Practice"

- **Speed should not exceed 6 km/h.**
- **The vine rows should generally be treated from both sides. Treatment from one side is only acceptable in exceptional cases.**
- **The recommended pressure range for a standard nozzle combination lies between 6 and 12 bar.**
- **It is sometimes advisable to use nozzles for equipment with a horizontal air flow which are closer together or a combination of nozzles of the same type but the next size up around the grape zone.**
- **For reducing drift, complete or partial equipping with injector nozzles has proven successful. To reduce drift on waters and non-vine growing land, application on the relevant peripheral rows should only be from one side, in the direction of the area to be treated.**

Authors :	H. Ganzelmaier, Biol. Bundesanstalt f. Land- u. Forstwirtschaft, Braunschweig W. Uhl, Bayerische Landesanstalt f. Weinbau und Gartenbau, Würzburg-Veitshöchheim R. Hauser, Lehr- u. Versuchsanstalt f. Weinbau u. Obstbau, Weinsberg R. Ipach, Staatl. Lehr- u. Forschungsanstalt f. Landwirtschaft, Weinbau u. Gartenbau, Neustadt/W. G. Bäcker, Forschungsanstalt f. Weinbau, Gartenbau, Getränketechnologie u. Landespflege, Geisenheim
-----------	--

SECTION IV

APPENDICES

Appendix A

Guidelines for the Application of Plant Protection Products with the Use of Aircraft.

Appendix B

A Historical Survey of the Development of Plant Protection Testing in the Federal Republic of Germany

Appendix C

Description of Test Facilities Used in the Application Techniques Division

Non-official translation

German text is legally binding

**Federal Biological Research Centre for Agriculture and Forestry
Federal Republic of Germany**



**Guidelines
for the application of
Plant Protection Products
with the use of aircraft.**

2nd edition

April 1991

Published by the Department of Plant Protection Products and
Application Techniques of the Biologische Bundesanstalt
Braunschweig

names and addresses of authors:

Heinz Ganzelmeier
Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Anwendungstechnik
Messeweg 11/12
D-38104 Braunschweig

Helmut Lyre
Biologische Bundesanstalt für Land- und Forstwirtschaft
Fachgruppe Biologische Mittelprüfung
Messeweg 11/12
D-38104 Braunschweig

At the time of up-dating the version accepted by the Legislative Authority and editorially revised from the guidelines of December 1972, and from the leaflet „Setting up the applications groups“ to these Guidelines from January 1973. A „special issue“ leaflet no longer existing.

1. Introduction

The guidelines for the application of plant protection products with the use of aircraft should help in reducing and avoiding the various harmful effects threatening the environment and should be used as basis for the official measures.

The air-traffic rules and the other relevant regulations remain untouched.

The competent Agricultural Government Authorities of the federal districts can derive diverging regulations from these guidelines.

2. Compulsory Announcement

Each intended output of plant protection products with use of aircraft must be notified by the contractor a minimum of 14 days before the beginning of the operation to the relevant Agricultural Government Authority of the federal districts. The form presented as enclosure 1. should be used for this purpose. When a danger suddenly occurs a shorter period of time can also apply.

Additionally, it is necessary to inform at least per telephone in due time, the relevant Agricultural Authority of the federal districts and this no later than 48 hours before the beginning of the operation.

3. Conditions of Contract

A written contract has to be made between the contractor and the flying enterprise.

The guidelines for the output of plant protection products have to be made as part of the contract.

The contractor and the flying enterprise have the obligation to conclude the necessary adequate liability on third-party insurance. Further particulars are to be agreed-upon in the contract.

4. Aeronautical Map for Operation

It is necessary that the competent Agricultural Government Authorities, that every pilot and that the operation manager have a map established at the minimum scale of 1:25000 or at a bigger scale (for example 1:10000) on which the following items have to be marked :

- a) the fields to be treated
- b) the operating airfields (take-off and landing runways as well as the refilling place for the plant protection products).
- c) all the properties running a risk, for example : blocks of flats and gardens, water surfaces, protected water areas from the zones I and II, and other protected areas.
- d) certain neighbouring cultivated grounds.
- e) all flight obstacles on the fields to be treated.

A specimen of the aeronautical map has to be presented together with the Notification Form number 2 to the competent agricultural federal district authorities. Any change occurring in the registration of the beginning of the operation has to be notified to the relevant Agricultural Authority in due time and no later than 48 hours before.

5. Requirements for the Personnel and the Equipment of the Task Groups

5.1 Pilots only can be employed who can show evidence of their required reliability and the required specialised professional knowledge and dexterity according to Paragraph 10 from the Code of Protection for Cultivated Plants brought into effect on 15th September 1986 (PflSchG).

5.2 The instruments set up on the flying equipment for bringing out the plant protection products as well as the refuelling installation on the ground (vehicles, mixing installation, scald container, measuring instruments for liquid measurements, hose lines) have to meet the requirements specified in Article 4 under Section 1 from the Regulations for Plant Protection Products and Plant Protection Equipment brought out on 28th July 1987. In particular, results from it :

5.2.1 Minimum requirements for the aircraft

5.2.1.1 To control the pre-adjusted working pressure, a fluid dampened (Glycerine) gauge has to be fitted in the spray system. The range of this gauge should be within the limits of the working pressure.

5.2.1.2 Front end mounting of the spray system is to be preferred, if the kind of application and the liquid distribution allows it.

5.2.1.3 It must be made sure that the nozzles do not drip after being switched-off.

5.2.1.4 The spray tank is to be equipped with an agitator.

5.2.1.5 In case of an hydraulic agitator in the spray tank, the main pump has to have sufficient output to ensure adequate spray mixing effect with fully opened spray nozzles. (ground level testing with water).

5.2.1.6 The pump's suction line has to be properly installed to secure the in-flight emptying of the tank.

5.2.1.7 To completely drain the spray tank a drainage valve has to be installed in such a manner, that the spray fluid can be safely recovered without endangering operating personnel or any other part of the machinery getting in contact with it, for example struts.

5.2.1.8 The filling hole of the spray container must be provided with a leak proof closing lid. The container must have a pressure compensator through which the spray liquid cannot overflow.

5.2.1.9 The spray tank as well as suction or pressure piping have to be equipped with non reverse safety valves (couplers) which allow removal of same without loss of fluid.

5.2.1.10 Within the range of the pilots visibility the following read-out devices are to be installed:

a) Pressure Gauge for the working pressure if possible for the pump end and the spray boom ends.

b) Control lights indicating the position of the valve, either open or closed.

c) Fluid volume indicator.

5.2.2 Minimum requirements for ground level refilling installations.

5.2.2.1 To ensure the proper composition of the spray fluid the tank vehicle has to be equipped with the proper balance, calibrated measuring devices, etc...

5.2.2.2 The mixing unit's chemical tank, used to refill the aircraft's spray tank, has to have an accurate and clearly visible calibrating device. To be accurate, the mixing unit has to be levelled out properly.

5.2.2.3 The design of this mixing tank has to be so that no leakage or swapping over can occur while mixing.

5.2.2.4 The mixing tank's volume should not exceed approx. 1500 litres and be equipped with a mixer capable of reconditioning a suspension which has been settled over a period of time¹.

5.2.2.5 The spray tank also has to have a draining device, which allows a total draining of the fluid without spilling over personnel or equipment.

5.2.2.6 Further more the tank has to have a pressure compensator and a tight, leak proof, filling cap which avoid spilling while moving.

5.2.2.7 All individual valves of the mixing unit, like the tank, hoses, etc. have to be provided with a leak proof shut-off device.

5.3 All airfields, used as filling stations, are to be equipped with a wind sock and operational measuring devices for wind speed, temperature and humidity.

5.4 To operate and maintain the spraying - and the mixing/filling equipment, a qualified operator, especially trained on crop spraying equipment, has to stand by at the location being used.

¹ The efficiency of the agitator must not exceed $\pm 15\%$ deviation of concentration of a one percentage OB 21 suspension (copperoxychloride) within the tank. Explanation : Follow BBA guidelines VII, 1-1.2.1.

6. Location of airfields and their restricted use.

Airfields, in use for crop spraying operations, are not to be located within restricted areas where drinking water is withdrawn from. Airfields can only be set up with the permission of the landowner. Plant grown for animal feed in areas set up as refilling sites are to be harvested prior to the site being used. These areas have to be left idle for a minimum of 6 weeks. Soil, which has been contaminated by a major chemical spill are to be left unused until regenerated. The owner or user of the area concerned is to be informed accordingly.

7. Public Information

The contractor has to make a public notice at the latest 48 hours before the crop spraying starts. He is to stipulate the beginning and the end of the operations.

8. Restriction of Access and Marking

The contractor has to restrict the access to the area to be treated and, if necessary, mark the areas to be treated. Human being, domestic animals and endangered objects should not come into contact with the plant protection product.

9. Plant Protection Products

Only approved plant protection products in legalised amounts are to be used. The use of reduced amounts is also possible.

Additional regulations according to Paragraph 8 from the Plant Protection Act made by the regional authorities remain unchanged.

10. Operating Flight Conditions

10.1 Plant protection products shall not be sprayed from aircraft if:

- a) horizontal wind speed exceeds 5m/sec. and if strong gusts of wind do not allow proper spraying operation.
- b) thermal winds exist or if the air temperature is above +25°C in shaded areas.
- c) within a safe range of 50 m from endangered objects. In order to operate within the 50 m area a written approval from the persons concerned is required. In case of wind drifts the safety range has to be increased.
- d) derived from c) plant protection products dangerous to bees are not allowed to be used inside a circle of 60 m from the beehives without permission from the bee-keeper and then outside their daily time of flying-swarming. (Paragraph 2 Division 3 from the Bees' Protection Regulations against Plant Protection Products from 19.12.1972).

10.2. A flight log book is to be kept according to attachment No. 2.

11. Wind Drift

Should, in spite of all precautionary measures, the plant protection products drift onto endangered objects, the persons concerned must immediately be informed and begin counter measures. The same applies if other unmarked objects were directly hit by the plant protection products.

12. Handling and Storage of Plant Protection Products as well as empty packing Material.

The contractor is liable for the safe storage of plant protection products, of the rests of these products and for the legal disposal of packing material.

Legal Basic laws are :

- Regulations on waste reduction and waste disposal from 27.08.1986 („Abfallgesetz - AfG) which are the basis for the
- Decree on waste regulations according to Paragraph 2 Division 2 („Abfallbestimmungs Verordnung - AbfBestV“) from 03.04.1990 (Plant Protection Products see under Waste classification 53103, Page 623) ; according to Paragraph 4 Division 5 Waste Regulations is the
- 2nd general administrative regulations for Waste Decree („TA-Abfall“) from 10.04.1990. Here are the regulations for waste disposal (Plant Protection Products - see Attachment C, Page 32).

13. Precautions when dealing with Plant Protection Products

Please consult the leaflet AID No. 1042 „Vorsicht beim Umgang mit Pflanzenschutz- und Schädlingsbekämpfungsmitteln“ = Precautions when dealing with plant protection products and fighting it's harmful effects, 1991 (or new version).

Attachment No. 1

Announcement of intended Application of Plant Protection Products with Use of Aircraft ²

1. Company respectively Name and address of orderer:
2. Company respectively Name and address of flying service:
3. Operational area (District respectively County):
4. Type of plants, type of pest (infection) and number of treatments:
5. Type of plant protection product and amount of in kg/ha or l/ha:
6. Proposed additives in kg/ha or l/ha:
7. Proposed mixtures with other additives (i.e. fertilisers) in kg/ha or l/ha:
8. Amount of water or other soluble (i.e. oil) in l/ha:
9. Type of aircraft, models and identifications:
10. Name of provided pilots:
11. Description of installation and type of equipment used on aircraft (crop spraying equipment):
12. Description of the filling equipment:
13. Proposed dates of treatment (beginning and end):
14. Remarks :

.....the ..(date)... 19..

..... the .. (date)... 19..

Flying Services

Contractor/Company

Note to the contractor :

With this announcement please enclose the aeronautical map made according to Point 4 of the Guidelines for the Plant Protection equipment with the use of aircraft.

² according to regulations.....(Indication of the applied laws).

Appendix A

Attachment No. 2

Flight Log Book

Sheet No.	Date	Pilot	Helicopter/plane	Company
-----------	------	-------	------------------	---------

Air Field No.	Location	Time		Flight Nr.	Safe load kg/l	Plant Protection Products Additives and other Products	Treated Area ha	Duration of Flight		Remarks
		Begin	End					Minute	Second	

..... the 19....
 place date Pilot Contractor

Appendix A

Appendix B

A Historical Survey of the Development of Plant Protection Testing in the Federal Republic of Germany

A Historical Survey of the Development of Plant Protection Testing in the Federal Republic of Germany

The Plant Protection Act of 1937 specified the testing of plant protection products and plant protection equipment. Until 1945, such equipment was examined under technical and practical aspects by the "Biologische Reichsanstalt". Another office involved was the Technology Branch of the Potato Beetle Control Service. With the end of World War Two, that service ceased to exist as so many others in the public sector, and a new beginning had to be made in the official testing of plant protection equipment in the following years.

In February 1946, a working group for the official examination of plant protection equipment was set up, with the head of the Plant Protection Products Examination Office of the "Biologische Zentralanstalt" in Braunschweig as chairman. An Institute for the Examination of Plant Protection Equipment was built up in Darmstadt and was moved to Braunschweig, now seat of the "Biologische Bundesanstalt für Land- und Forstwirtschaft"-BBA- (Federal Biological Research Centre for Agriculture and Forestry), in 1950. A testing hall was built there in 1964, and most of the testing activities moved indoors.

As plant protection equipment became ever larger and technical demands on test facilities increased, a new, much larger testing hall was soon planned. In autumn 1988, the Application Techniques Division of the Braunschweig Department for Plant Protection Products and Application Techniques moved into a modern testing hall with offices and laboratories of its own (figure 1). The new hall is equipped with new facilities, such as an air-conditioned wind channel and test benches to test oscillation, cross distribution and fans. For a description of the test facilities used in the Application Techniques Division see section IV, appendix C.

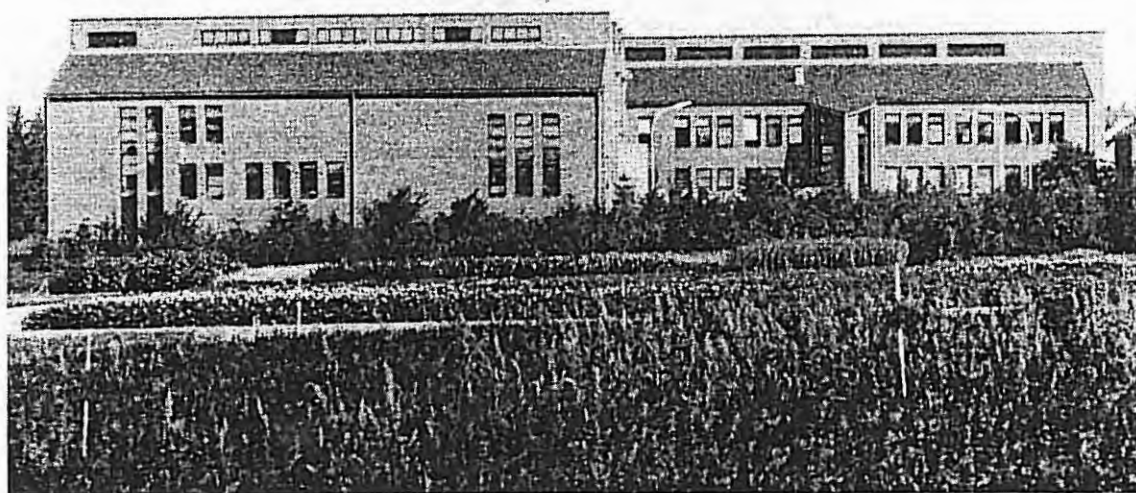


Figure 1: Southern aspect of the new test hall with offices and laboratories of the Division for Application Techniques in Braunschweig; the hall was built in 1988.

The Act on the Protection of Crop Plants (Plant Protection Act) of 15th September 1986 significantly widened the official testing of plant protection equipment. From 1st July 1988, a procedure of declaration which regulates the placing of plant protection equipment on the market became legally binding. Voluntary tests of plant protection equipment for suitability continue. The Act also regulates the examination (monitoring) of used equipment.

Appendix C

Description of Test Facilities Used in the Application Techniques Division

AIR-CONDITIONED WIND CHANNEL

Task/Purpose

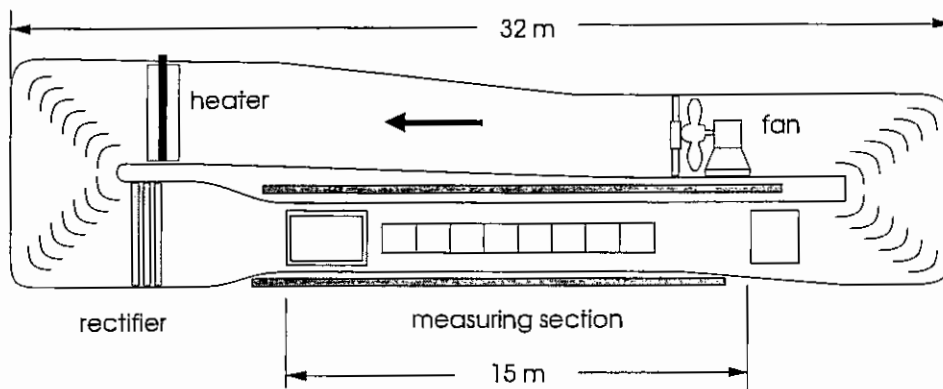
Evaluation of the direct drift of nozzles and plant protection equipment with the aspect to find application techniques which are more convenient for the environment.

The advantage of this wind channel is that tests can be carried out under constant and reproducible climatic conditions.

Arrangement and Function

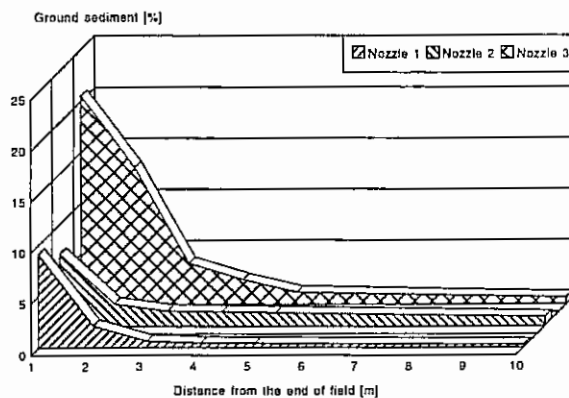
Closed wind channel (Goettingen design). Measuring section made of stainless steel (length up to 15 m; width up to 2.4 m; height 1.6 m). Continuously adjustment of air speed up to 15 m/s; of temperature from 10 to 30°C; and of relative humidity from 40 to 80%.

At the beginning of the measuring section individual atomizers or sprayer boom segments are installed. Research on drift can be done by using tracers or plant protection products. The ground sediment in wind direction is determined by using glass plates. For determining the air carried drift different collectors are used which are arranged inside the measuring section wherever it may be suitable.



Results

Ground sediment in relation to the distance
Drift measurements in crops



AIR DISTRIBUTION TEST STAND

Task/Purpose

Determination of the air velocity and direction of fans attached to air-assisted sprayers at several fixed points from the fan centre.

Evaluation of the air distribution as to the fulfilling of requirements and features.

- The air speed shall not exceed the values of the following table:

Crops	Air velocity	Measuring point
vineyards	30 m/s	0.60 m from the fan centre
orchards	40 m/s	0.75 m from the fan centre
Hops	40 m/s	1.00 m from the fan centre

-The air flow produced by the device must be symmetrical on the right and left side as to their maximum speeds. At comparable measuring points deviations shall not exceed 10 % from the mean value .

Arrangement and Function

The air-assisted sprayer is correctly positioned and operated at a rated p.t.o. speed while standing. The measuring probe (five-hole ball-shaped impact tube) passes vertically through the air currents, with levels of distances being 0.6 m (vineyards), 0.75 m (orchards) or 1.0 m (hops) from the fan centre and the maximum spacing in height being 0.25 cm starting with 0.25 cm and finishing with the maximum working height of the device.

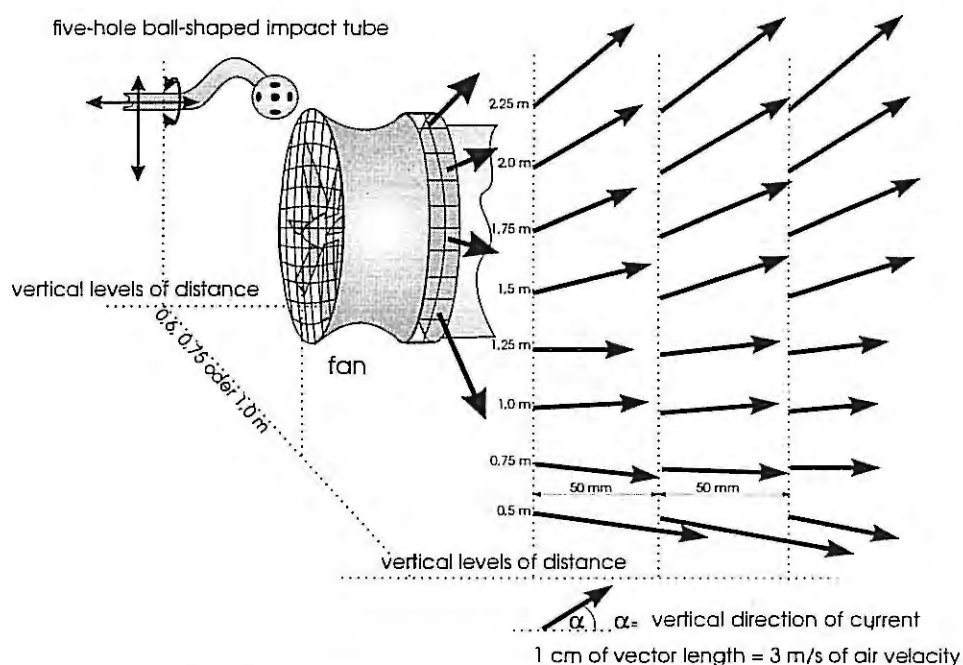
The probe is constantly set into the direction of the air current by a servo motor; this action is computer-assisted.

Thus it becomes possible to measure the air speed as well as the direction of the air on the horizontal and vertical levels.

The measured values thus obtained are stored by a PC and composed to form an air speed profile chart.

The test stand because of its probe which can be continuously moved in three directions has a measuring range of 1.6 m (length) by 3.84 m (height) and 2.0 m (width).

Results



APPLICATION LABORATORY

Task/Purpose

Laboratory for application tests with plant protection products.
 Research on the penetration and application behaviours of droplets in crops under reproducible conditions.

Measurement of droplet sizes of nozzles at different pressures and with different plant protection products.
 Measurements of the uniformity of distribution of granules applicators.

All tests are done at speeds normally used in practice and serve, on the one hand, to evaluate the fulfilling of legal requirements during equipment tests and, on the other hand, to gain basic knowledge in order to optimize the distribution and deposition of plant protection products.

Arrangement and Function

Laboratory with waste air treatment by air wash and activated carbon filter. Soil drainage in collecting tanks.
 Computer-controlled trolley-car on a rail for application tests.

The rail is fastened to hinged brackets. If the room has to be used for other purposes, the rail with the trolley-car can be moved to the wall. It can be suspended at an optional height of 2.2 or 3.2 m above ground. The car is servo-motor driven and has a vertically adjustable adapter, e.g. for the spray booms, individual nozzles or granule applicators. The lower end of the adapter is adjustable to a height between 30 cm and 290 cm above ground. The rail is eight metres long (at least 3 m thereof for constant velocity). The velocity is continuously adjustable up to 4.3 m/s (15 km/h). The maximum spraying pressure at the nozzles is 10 bar. Digital displays and data outputs are available at the switchboard panel for spraying pressure, velocity, sprayer position, room temperature and humidity as well as barometric pressure.

Results

Example of a droplet size distribution

To produce an image of the droplet sedimentation the spray boom will be moved across silicon oil filled petri dishes.
 Droplet size will be measured with an automatically image analysing system.

For measuring sizes of droplets in flight a "Phase Doppler Particle Analyser" (PDPA) is used.

Häufigkeitsverteilung Volumen			Akkum. Bilder		
Klassenzahl: 36			Dichte = 1.0000 g/cm **3		
Durchmesser	Summen	Verteilung	Volumen	Anteil	Diff.
mm			summiert	summiert	norm.
			mm**3	%	%
0.000	0.020	*	0.000000	0.00	-1.5
0.020	0.040	*	0.001354	0.1	-3.6
0.040	0.060	*	0.018978	0.4	-8.3
0.060	0.080	*	0.055079	1.5	-9.6
0.080	0.100	*	0.130350	3.4	-1.7
0.100	0.120	X*	0.254463	6.0	-1.84
0.120	0.140	X*	0.401887	10.1	-2.24
0.140	0.160	X*	0.573794	14.2	-2.83
0.160	0.180	XX*	0.769487	18.8	-2.81
0.180	0.200	XX*	0.989811	24.3	-2.95
0.200	0.220	XXX*	1.234844	30.3	-2.21
0.220	0.240	XXXX*	1.601380	39.6	-1.69
0.240	0.260	XXXX*	2.089497	51.4	-5.1
0.260	0.280	XXXX*	2.711856	66.9	8.6
0.280	0.300	XXXX*	3.474084	85.2	7.5
0.300	0.320	XXXX*	4.373357	107.6	1.18
0.320	0.340	XXXX*	5.416364	133.7	2.03
0.340	0.360	XXXX*	6.601493	163.6	2.54
0.360	0.380	XXXX*	7.928664	197.4	0.3
0.380	0.400	XXXX*	9.407186	235.2	-8.1
0.400	0.420	XXXX*	11.038081	277.0	-2.47
0.420	0.440	XXXX*	12.821821	322.8	-2.18
0.440	0.460	XXXX*	14.759480	372.7	-3.35
0.460	0.480	XXXX*	16.851844	426.7	-3.19
0.480	0.500	XXXX*	19.099314	484.7	-4.15
0.500	0.520	XXXX*	21.501685	546.7	-4.07
0.520	0.540	XXXX*	24.059810	612.7	-2.69
0.540	0.560	XXXX*	26.774712	682.6	-1.17
0.560	0.580	XXXX*	29.646422	756.4	-2.91
0.580	0.600	XXXX*	32.675810	834.2	-1.81
0.600	0.620	XXXX*	35.863916	916.0	-1.68
0.620	0.640	XXXX*	39.209848	1001.8	-1.25
0.640	0.660	XXXX*	42.724653	1091.6	-1.80
0.660	0.680	XXXX*	46.408236	1185.4	-3.7
0.680	0.700	XXXX*	50.261862	1283.2	-1.08
0.700	0.720	XXXX*	54.285516	1385.0	0.00

CROSS DISTRIBUTION TEST STAND

Task/Purpose

1. Determination of the uniformity of cross distribution of field sprayers.
2. Determination of the flow rate of the individual nozzles of a field sprayer boom.

Evaluation of the cross distribution and the output of the individual nozzles as to the fulfilling of requirements and features.

Ref.to 1:

For one pressure and distance indicated for the atomizer by the declarer, the coefficient of variation should not exceed 7% while for all other indicated pressures and distances it should not exceed 9%.

Ref.to 2:

Deviations of the flow rate of each individual nozzle from the common mean should not exceed 5%.

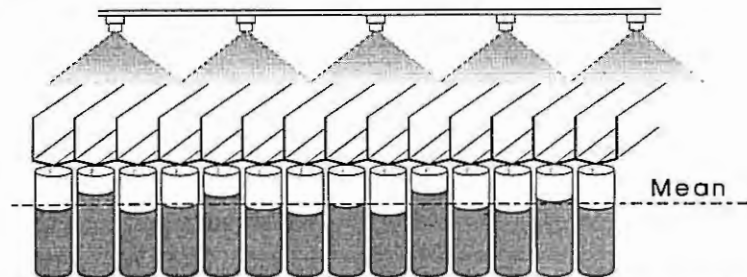
Arrangement and Function

The tests are made with the sprayers in standing position as follows:

Collecting the liquid from the boom into 100-mm-wide grooves, passing on the liquid from the grooves into collecting cylinders for a certain time, determining the liquid in the cylinders by ultrasonic sensor measurements followed by electronic processing of the data obtained. The whole process is program-controlled from the PC.

For data evaluation purposes, the PC calculates the average value, the individual deviations therefrom and the coefficient of variation on the basis of all the levels of spray liquid measured in the cylinders.

The test stand has a working width of 12 m and can be moved horizontally in such a way that field sprayer booms up to a working width of 24 m can be tested within two measuring steps.



The distance of the nozzles from the collecting level can be continuously adapted to heights between 0.30 and 1.50 m.

Results

Protocol prints

of a horizontal distribution

of the single nozzle output

TEST STAND FOR SINGLE NOZZLES

Task/Purpose

Measuring the liquid distribution of single nozzles to evaluate and compare the quality of distribution. Measuring the spray angle.

For band spraying nozzles, if possible, the distribution profile should be rectangular, i.e. it should have a sharply defined spray pattern, and the cross distribution should meet the requirement that the measured values do not deviate more than 30 % from the average of all values measured between the lateral edges of the spray pattern.

In all nozzle tests, the geometry of the nozzle tip is documented by means of its distribution profile. In case of repeated tests, it may be concluded from comparisons of distribution profiles that the geometry of the nozzle tip must have changed.

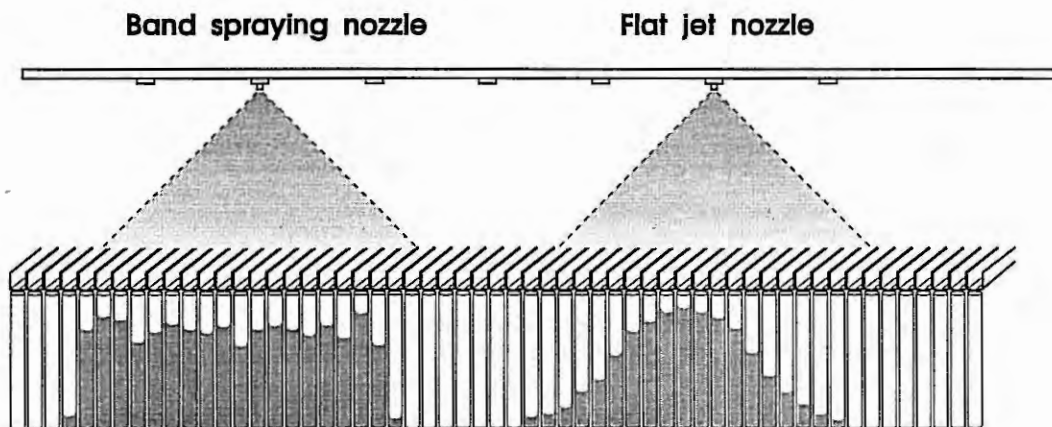
Arrangement and Function

The liquid distributed by a nozzle is collected in 25-mm-wide grooves, passed on to collecting cylinders for a certain time followed by a determination of the liquid volumes by ultrasonic sensor and the input of the measured values into an EDP system. The whole process is program-controlled by a PC. The tests are made in standstill.

A graphic representation is made from the measured values by support of electronic data evaluation.

The test stand has a working width of 2475 mm (99 grooves) and a groove length of 2500 mm. Spraying pressures up to 10 bar can be continuously adjusted. The spray boom is movable both vertically and horizontally. The distance between nozzles and collecting level can be continuously adapted between 0.10 m and 1.10 m of height.

Results



FAN TEST STAND

Task/Purpose

Measurement of air flow rate of air-assisted sprayers for use in orchards, vineyards and hops.

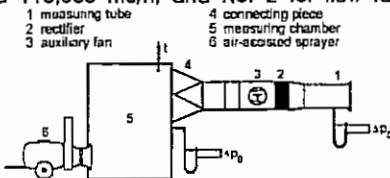
Evaluation of fan output: The nominal air flow rates should not deviate more than 10 % from the actual ones.

Arrangement and Function

The air-assisted sprayer sucks the air from the measuring chamber (5). To prevent any differential pressure in the measuring chamber, the same amount of air has to be fed to it through a set of measuring and control units consisting of measuring tube (1), rectifier(2), controllable auxiliary fan (3) and connecting piece (4). As the characteristic line of the measuring tube was determined by the manufacturer before it was fitted into the test stand, the air flow rate can easily be determined by measuring the differential pressure within the measuring tube.

The various options for installing the air-assisted sprayers do not only permit to measure the total air flow rate of the fan but also to measure partial streams, e.g. on the left and right hand side of the fan. The fitted wall of the measuring chamber has such dimensions that measurements are possible at a maximum differential pressure of 200 Pa.

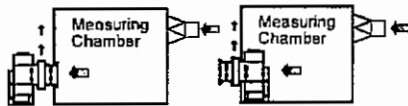
The test stand has two different measuring and control sets. No. 1 is for measurements of flow rate between 20,000 and 110,000 m³/h, and No. 2 for flow rates between 2,000 and 20,000 m³/h.



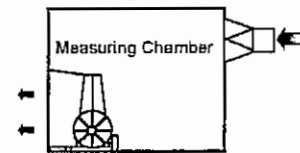
Basic arrangement of the chamber test stand



Arrangement for an one way sucking air-assisted sprayer in the measuring chamber



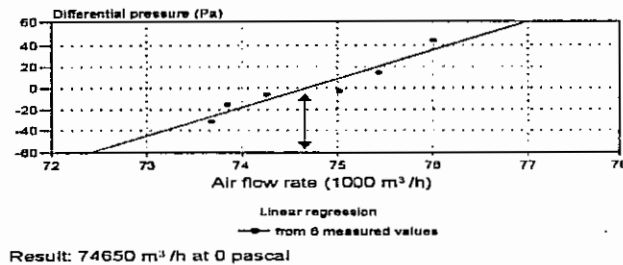
Arrangement for a two way sucking air-assisted sprayer in the measuring chamber



Arrangement to measure the half side air flow rate of an air-assisted sprayer

Results

Measurement of air flow rates Air-assisted sprayer in hops



FAN TEST STAND

Task/Purpose

Air flow-rate measurements on engine-driven pedestrian sprayers.

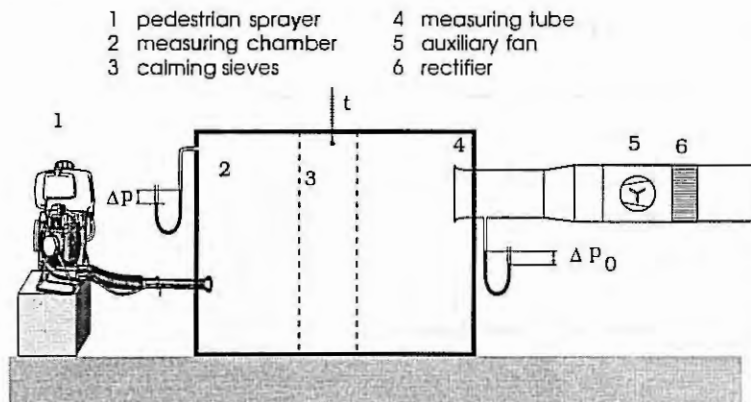
Evaluation of fan output: the air flow rate of the fan has to be at least 400 m³/h.

Arrangement and Function

As far as engine-driven pedestrian sprayers are concerned, a separate measurement of the air flow rate on the intake side is not possible because of the fan providing the engine with cooling air. It is no solution either to put the sprayer inside the measuring chamber, so that the air flow cooling the engine is not measured; firstly, due to the exhaust gases, the result would be falsified and secondly the engine would peter out for lack of oxygen. Therefore, the air flow rate must be measured on the pressure side. To this end, the sprayer (1) is put outside the measuring chamber (2) and the spray lance is led into the measuring chamber. The measuring chamber is provided with stabilizing screens (3) to prevent the jet of air from directly hitting the intake measuring nozzle (4). The auxiliary fan is controlled such that inside the measuring chamber there will be no differential pressure.

The air flow rate of the fan can be determined by help of the characteristic line of the measuring tube and the differential pressure measured in it.

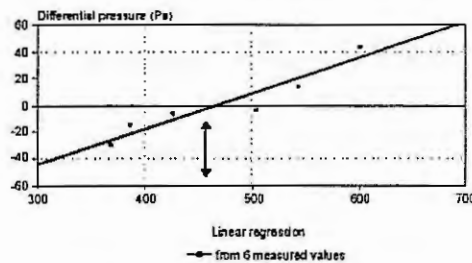
The test stand corresponds to DIN standard 24163 and is suited for measuring air flow rates between 200 and 2000 m³/h by various optional measuring tubes.



General arrangement of the test stand

Results

Air flow-rate measurements (engine-driven pedestrian sprayer)



Result: 465 m³/h at 0 Pascal

PUMP TEST STAND

Task/Purpose

1. Determination of the characteristic lines of pumps for plant protection equipment.
2. Testing of control devices for plant protection equipment.

Judgement on the fulfilling of requirements and features. Determination of the present state of the art on the basis of comparative investigations of, for example, electronic control devices. To this end, measurements shall be made according to the Guideline 1-1.2.3, part VII, of the Guidelines for the official testing of plant protection products.

Elaboration of test specifications and features.

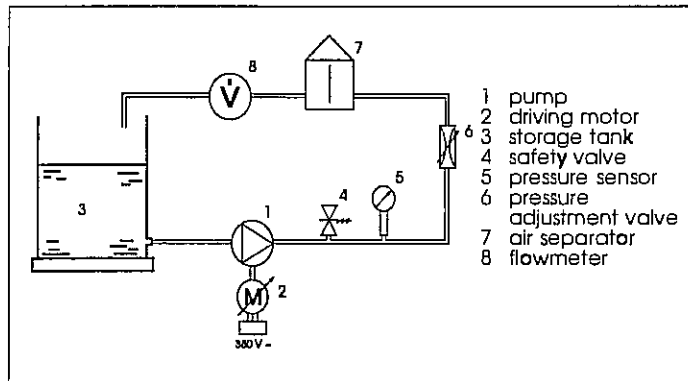
The flow rate of the pump must be adapted to the liquid- consuming parts of the equipment (for field sprayers, e.g. 5 l/ min per metre of working width plus, if required, the necessary flow rate for the hydraulic agitator).

Arrangement and Function

The pumps to be tested are installed into the fluid circuit of the test stand and their flow rates are determined as a function of the working pressure.

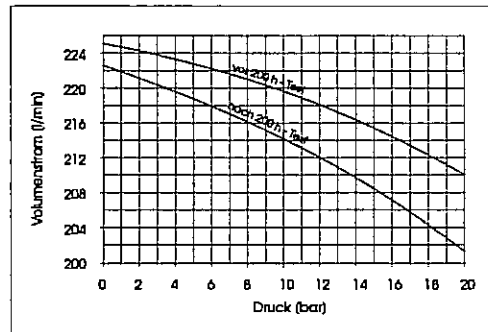
Characteristic values of the test stand:

Driving speed:	continuously adjustable up to 1,000 1/min
Maximum working pressure:	60 bar
Maximum flow rate:	300 l/min
Acceptance of measuring signals:	by XY recorder or EDP



Results

Characteristic line of a six-chamber diaphragm pump



PUMP TEST STAND (DURABILITY TEST)

Task/Purpose

Tests to determine the wear of pumps and nozzles.

Evaluation of the reliability of function and wear resistance. The flow rate should not be changed considerably by the durability test.

Arrangement and Function

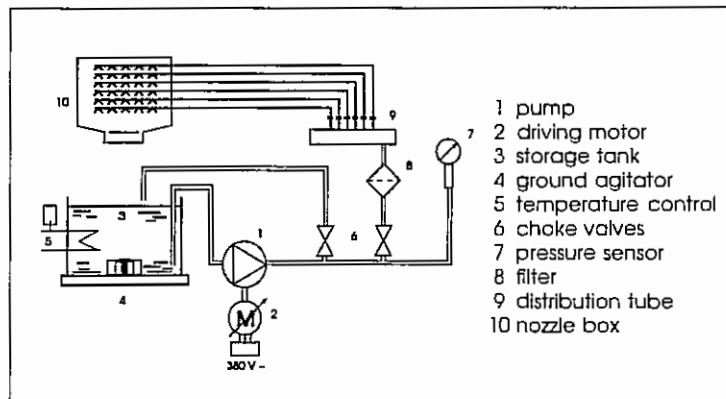
The parts to be tested are installed into the fluid circuit of the test stand and operated throughout the duration of the test under load.

Conditions of testing:

Duration of test: 200 h for pumps, 1,000 h for nozzles.
 Pressure during test: 50 % of the nominal pressure for pumps,
 medium spraying pressure for nozzles.
 Driving speed: Nominal rotational speed (540 min⁻¹)
 Test liquid: OB21, 0.5%
 Test temperature: 20°C ±2°C

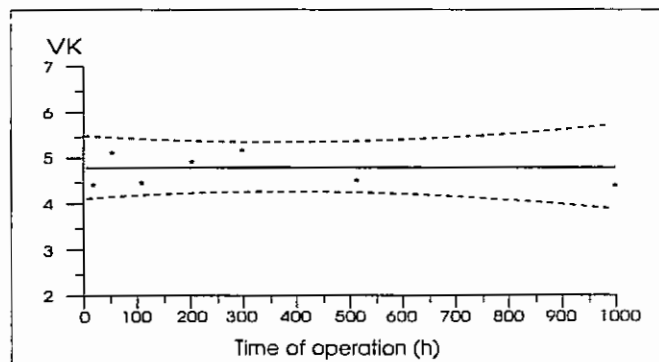
Storage tank: 1,000 l

For nozzles, at the beginning of the test and after 15, 50, 100, 200, 500, 750 and 1,000 hours, the coefficient of variation for the cross distribution and the individual nozzle output are determined.



Results

Coefficients of variation of the cross distribution of a stainless steel nozzle during a 1,000 h wear test



SPRAY BOOM TEST STAND

Task/Purpose

Determination of the uniformity of distribution of field sprayers taking into account their boom movements as they occur in practice.

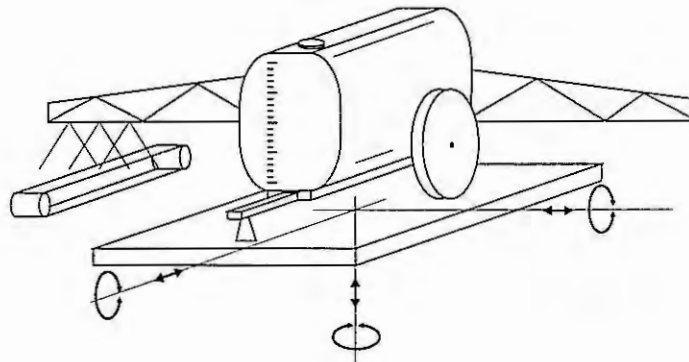
The oscillation test stand allows a simulation of field sprayer movements with 6 degrees of freedom under standardized reproducible conditions.

Elaboration of requirements and features to evaluate the movement behaviour of the boom and the quality of distribution.

Arrangement and Function

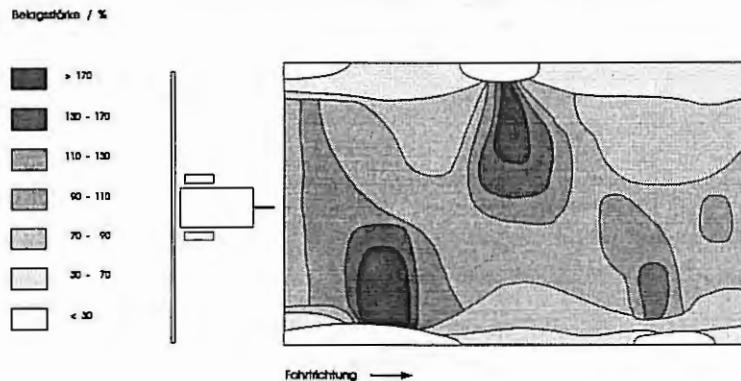
The vibrating table of the test stand (3.5 by 2.5 m) is moved by hydraulic cylinders. At a maximum stroke of 200 mm, its maximum acceleration is up to 2 g. This corresponds to a nominal load of 1.5 t at a stroke frequency of about 2 Hz. Thus it is possible to simulate, at a high rate of accuracy, the movements of a field sprayer which were measured before during field application. The use of standardized "test areas" permits to ensure reproducible test conditions at the test stand.

While the field sprayer is moving at the test stand, the spray distribution and the respective deposition is measured under the boom. Water is given onto an endless moving band and the spray quantity applied in each vertical section is measured capacitywise. Vertical distribution can repeatedly be measured in different sections of the boom thus permitting a judgement of the spray distribution.



Results

Example for spray distribution when moving over uneven field



TECHNICAL REST VOLUME

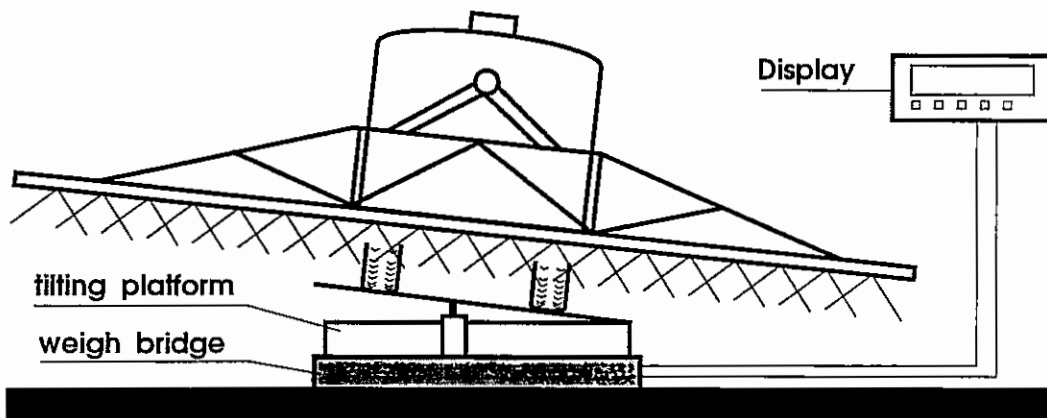
Task/Purpose

Measurements of the technical rest volume and the rest volume on slopes. Technical rest volumes are any spray liquids which cannot be applied according to the defined use.

For tanks up to 400 l the technical rest volume and the rest volume on the maximum slope according to the defined use must not exceed 4 % and for bigger tanks it must not exceed 3 %. Measurements shall be made according to guide-line 1-1.2.2. of part VII of the guide-lines issued for the testing of plant protection equipment.

Arrangement and Function

The plant protection equipment is mounted on a tilting platform. Both is positioned on a weigh-bridge. The dry weight of the equipment is determined before filling. Then the liquid is filled in and the equipment operated according to the above guide-line. When air is sucked in for the first time, the equipment is switched off and a second weighing follows. The difference between the two weighings presents the rest volume. In the case of air-assisted sprayers for high-growing crops, the measurement shall be made horizontally and, in the case of slopes, left and right side down. For field sprayers on slopes, an additional measurement shall be made up- and downwards.



Results

Nominal Tank capacity (l)	Field Sprayers			Air assisted Sprayers		
	Minimum Rest Volume (l)	Maximum Rest Volume (l)	Number of Variations	Minimum Rest Volume (l)	Maximum Rest Volume (l)	Number of Variations
400	2	15	525	2	9,3	98
600	2	21,8	1005	1	12,4	88
800	2,6	27	1196	0,4	16	36
1000	2,6	33	1176	1	21,1	96
1200	9,5	23,2	252			
1400	14,6	40	210	10,2	10,2	8
1500	5,6	45	522	1	25	26
2000	5	46,5	894	2,2	40	25
2800	5,5	29,5	288			
3000	25	63	168	2,3	60	10
3500	19,9	35	33			
4000	33,5	80	83			

Table indicating rest volumes originating from the procedure of declaration for plant protection equipment. For every class of litres, the minimum and maximum rest volumes as well as the number of variations of types are indicated.

TESTSTAND FOR ELECTRONIC CONTROL UNITS

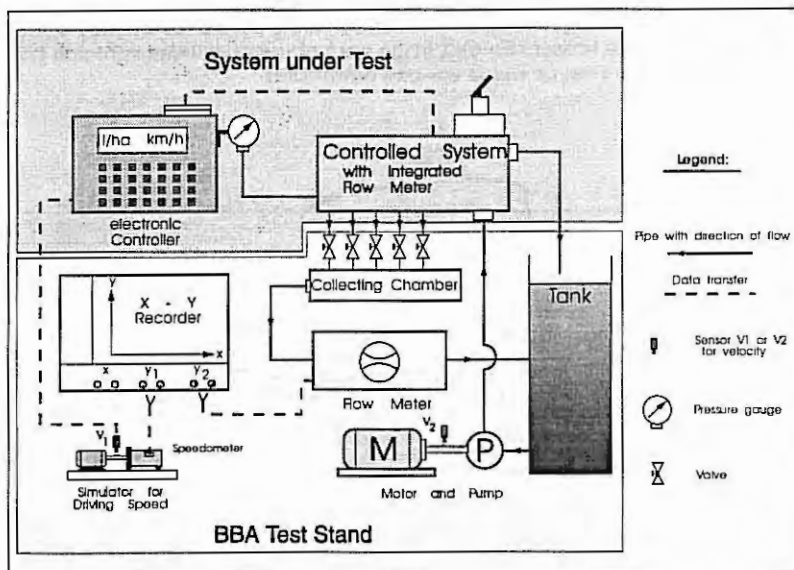
Test/Purpose

Test of equipment for controlling the output of sprayers and air blast sprayers for field crops, orchards, vineyards and hops.
Judgement on the fulfilling of requirements and features.

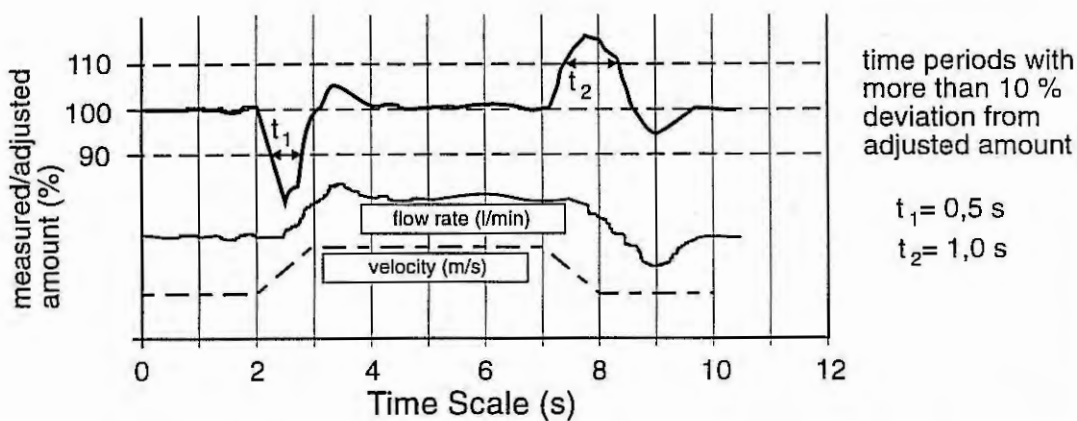
Arrangement and Function

The system under test consists of the electronic controller and the controlled system, both together will be integrated in the test stand.

When simulating working conditions -as variation of velocity, switching of boom sections ,variation of output or switching on and off the spray boom- the nozzle flow rate and the velocity are recorded and from this will be calculated the momentary deviation from the adjusted amount (l/ha).



Results



VERTICAL DISTRIBUTION TEST STAND

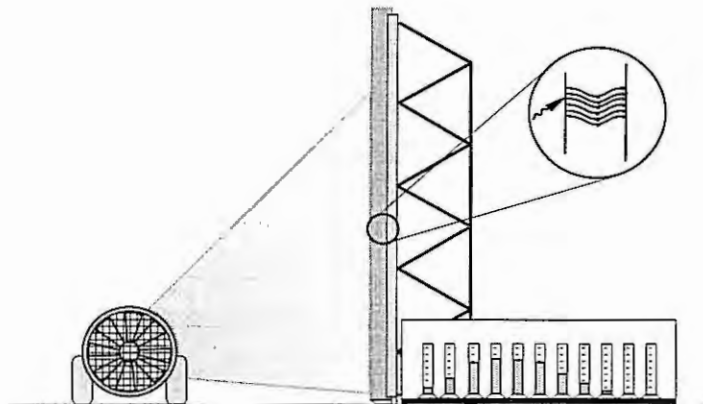
Task/Purpose

Determination of the liquid distribution of air-assisted orchard and vineyard sprayers.

Elaboration of requirements as to the distribution characteristics of air-assisted sprayers, with results of measurement from field tests being included. Testing of the sprayer settings indicated by the manufacturer to ensure favourable vertical distributions, low drift and low soil contamination.

Arrangement and Function

Collecting the droplets produced by the nozzles in separating elements (200 cm long, 25 cm high, distance between the laminae 25 to 35 mm). The water separated from the carrier air stream in 18 separating elements is collected sectionwise and flows into graduated cylinders through plastic tubes. The constant determination by an ultrasonic sensor of the contents of the graduated cylinders guarantees a permanent control of the momentary liquid flow rate per sector. As soon as the stationary working condition is reached, the measured values are taken over by an EDP system. This data collecting is program-controlled by PC. The tests are carried out while the sprayer is standing. The test stand has a height of 4.5 m and a width of 2.0 m permitting vertical distribution measurements for fruit tree heights of up to 4.0 m. The distance between the central axis of the air-assisted sprayers and the test stand is half the width of the lane, generally 2m.



Results

Vertical Distribution

Air assisted sprayer:

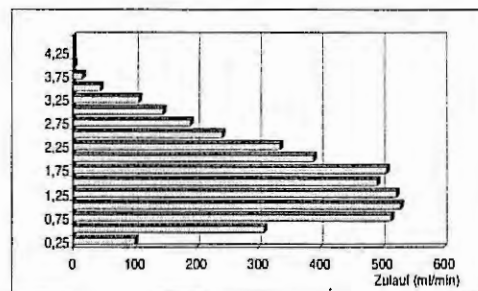
Hersteller: Nicolca
Gerät: SCR 1000
Type: Anhängesprüngerät
G-Nr.:
Gepr. Seite: Rechts
Abstand: 2,0 m

Fan:

Type: Axial
Rotor Durchmesser: 700 mm
Drehzahl: 540 U/min
Gang: 0
Drehricht.: Links
Druck: 10,0 bar

Diagonale und Winkel

Links			Rechts		
Nr.	Größe	Winkel	Nr.	Größe	Winkel
8	3	62	8	3	64
7	3	52	7	3	53
6	3	48	6	3	49
5	3	28	5	3	32
4	3	20	4	3	22
3	3	13	3	3	15
2	3	-1	2	3	3
1	3	-21	1	3	-13



Berichte aus der Biologischen Bundesanstalt für Land- und Forstwirtschaft
erscheinen seit 1995 in **zwangloser Folge**.

- Heft 36, 1997: Rechtliche Regelungen der Europäischen Union zu Pflanzenschutzmitteln und deren Wirkstoffen (Band B: Richtlinien, Verordnungen, Entscheidungen und Protokolle zur Wirkstoffprüfung) Stand: 1. November 1997, 3. Auflage. Bearbeitet von Dr. Jörg-Rainer Lunde, 148 S.
- Heft 37, 1997: Zuständigkeiten bei der Prüfung und Zulassung von Pflanzenschutzmitteln und bei der EU-Wirkstoffprüfung. (Stand: Dezember 1997). Bearbeitet von Edelgard Adam, 58 S.
- Heft 38, 1997: Inhaltsverzeichnis Amtliche Pflanzenschutzbestimmungen N.F. Band 1, Heft 1 bis Band 63, Heft 5. Bearbeitet von Sigrd von Norsinski, Elke Vogt-Arndt, Richard Voigt, 74 S.
- Heft 39, 1998: Wirkstoffdatenblätter zur arbeitsmedizinischen Vorsorgeuntersuchung - Pflanzenschutzmittel -, 1. Folge, Stand: Dezember 1996. Bearbeitet von Dr. Hans-Hermann Schmidt, Dr. Eberhard Hoernicke, Dr. Marion Fathi, Dr. Rudolf Pfeil, 241 S.
- Heft 40, 1998: Liste der zugelassenen Pflanzenschutzmittel (Stand: 1. Januar 1998). Bearbeitet von Dr. Achim Holzmann und Andreas Spinti, 69 S.
- Heft 41, 1998: 100 Jahre Biologische Bundesanstalt für Land- und Forstwirtschaft – Entwicklung und Organisation des Pflanzenschutzes in Deutschland. Bearbeitet von Dr. Heinrich Brammeier, 296 S.
- Heft 42, 1998: 2. BBA-Notifizierer-Konferenz (15./16. Januar 1998). Bearbeitet von Dr. Hartmut Kula und Dr. Jörg-Rainer Lunde, 193 S.
- Heft 43, 1998: Leitlinie: Rückstandsanalysemethoden für die Überwachung, Stand: 21. Juli 1998. Bearbeitet von Dr. Ralf Hänel und Dr. Johannes Siebers.
- Heft 44, 1998: Tagungsband zur Antragstellerkonferenz Braunschweig, 10. Juni 1998. Bearbeitet von Edelgard Adam, 176 S.
- Heft 45, 1998: Europäische und nationale Regelungen für gentechnisch veränderte Organismen (GVO) (Richtlinien, Entscheidungen, Empfehlungen, Gesetze, Verordnungen und Bekanntmachungen) Stand: 1. Juli 1998. Bearbeitet von Prof. Dr. Günther Deml, Dr. Joachim Schiemann, Dr. Jörg Landsmann, 306 S.
- Heft 46, 1998: Einführung in die Biometrie unter Berücksichtigung der Software SAS. Teil 3: Die Varianzanalyse im Feldversuchswesen. Dr. Eckard Moll, 172 S.
- Heft 47, 1998: Zuständigkeiten bei der Prüfung und Zulassung von Pflanzenschutzmitteln und bei der EU-Wirkstoffprüfung. (Stand: September 1998). Bearbeitet von Edelgard Adam, 59 S.
- Heft 48, 1999: Tropischer und subtropischer Pflanzenbau. Seine Entwicklung als Teil der Landbauwissenschaften – am Beispiel der Kagera-Region in Tansania/Ostafrika – eine Kurzdarstellung der tansanischen Landwirtschaft. Dr. Heinrich Brammeier, 82 S.
- Heft 49, 1999: Art und Menge der in der Bundesrepublik Deutschland abgegebenen und der exportierten Wirkstoffe in Pflanzenschutzmitteln (1987 – 1997). Ergebnisse aus dem Meldeverfahren nach § 19 des Pflanzenschutzgesetzes. Bearbeitet von Dr. Hans-Hermann Schmidt, Dr. Achim Holzmann, Edeltraut Alisch, 77 S.
- Heft 50, 1999: Pflanzenschutzmittel im ökologischen Landbau – Probleme und Lösungsansätze. Erstes Fachgespräch am 18. Juni 1998 in Kleinmachnow - Pflanzenstärkungsmittel – Elektronenbehandlung - . Bearbeitet von Dr. Holger Beer und Dr. Marga Jahn, 76 S.
- Heft 51, 1999: Wirkstoffdatenblätter zur arbeitsmedizinischen Vorsorgeuntersuchung - Pflanzenschutzmittel - . 2. Folge, Stand: Dezember 1998. Bearbeitet von Dr. Hans-Hermann Schmidt, Dr. Eberhard Hoernicke, Dr. Marion Fathi, Dr. Rudolf Pfeil, 239 S.
- Heft 52, 1999: Liste der zugelassenen Pflanzenschutzmittel (Stand: 1. Januar 1999). Bearbeitet von Dr. Achim Holzmann und Andreas Spinti, 63 S.
- Heft 53, 1999: Pflanzenschutz im ökologischen Landbau – Probleme und Lösungsansätze. Zweites Fachgespräch am 5. November 1998 in Darmstadt. Die Anwendung kupferhaltiger Pflanzenschutzmittel, ihre Auswirkungen auf den Naturhaushalt und Erörterung der Möglichkeiten, unerwünschte Auswirkungen zu begrenzen. Bearbeitet von Dr. Marga Jahn und Dr. Holger Beer, 85 S.
- Heft 54, 1999: Verzeichnis der Wirkstoffe in zugelassenen Pflanzenschutzmitteln (ehemals Merkblatt Nr. 20). Stand: Juli 1999. Bearbeitet von Dr. Walter Dobrat, 265 S.
- Heft 55, 2000: Liste der zugelassenen Pflanzenschutzmittel (Stand: 1. Januar 2000). Bearbeitet von Dr. Achim Holzmann, 88 S.
- Heft 56, 2000: Einführung in die Biometrie unter Berücksichtigung der Software SAS. Teil 4: Korrelationsanalyse, Regressionsanalyse und Kovarianzanalyse. Zur Nutzung von SAS/INSIGHT® und der Analyst Application. Bearbeitet von Dr. Eckard Moll, 94 S.