

ORIGINAL ARTICLE

THE PROSPECT OF EUROPEAN HARMONISATION - PLANT PROTECTION EQUIPMENT UNDER TEST

GANZELMEIER H.

ABSTRACT

The voluntary testing of plant protection equipment by the Federal Biological Research Centre for Agriculture and Forestry covers not only the technical examination but also extended field tests. An agreement amongst national testing stations in the European Network for Testing of Agricultural Machinery (ENTAM) is an important basis for joint tests in the future. Until recently, obligate testing of plant protection equipment was only established in Germany. Standardisation at European and international level has been strongly intensified over the last few years. Therefore a multitude of EU-/ISO-standards are now available.

The paper describes the ways of testing plant protection equipment in Germany in connection with the latest efforts to harmonise the relevant regulations at EU level.

KEY WORDS: testing, examination, inspection, EN/ISO standards

DETAILED ABSTRACT

The voluntary testing of plant protection equipment by the Federal Biological Research Centre for Agriculture and Forestry covers not only the technical examination but also extended field tests. A successful test is finalised by the BBA approval which means that the equipment is highly suitable for plant protection purposes. An agreement amongst national testing stations in the European Network for Testing of Agricultural Machinery (ENTAM) is an important basis for joint tests in the future. Until recently, obligate testing of plant protection equipment was only established in Germany. The farmers are obliged to have their boom sprayers inspected once every two years. For air-assisted sprayers, an obligatory inspection was introduced in May 2002. Only a few EU-Member States have already established an obligatory inspection procedure. Standardisation at European and international level has been strongly intensified over the last few years. Therefore a multitude of EU-/ISO-standards are now available. The regulatory framework however represents only one part of future security in plant protection. Just as important are research, innovation and information.

INTRODUCTION

In Germany the reliability of plant protection equipment has always been of immense significance, due to plant protection and environmental reasons. It is the task of the Federal Biological Research Centre for Agriculture and Forestry (BBA) in Germany

to test such equipment [1]. Prof. Dr.-Ing. Heinz Ganzelmeier (BBA Braunschweig) describes plant protection equipment testing in Germany in connection with the latest efforts to harmonise the relevant regulations at EU level.

THE APPROVAL PROCEDURE

Voluntary plant protection equipment testing, so-called testing for approval, is carried out directly on the equipment. Its significance for new developments in equipment and for equipment parts,

e. g. nozzles, has remained. Such testing is carried out together with the plant protection services of the Federal States; the BBA carries out the technical tests using its test facilities, whilst the practical testing is managed by the testing authorities of the Laender. Figure 1 shows a look at the test hall for plant protection equipment which is used by the Application Techniques Division, responsible for it, at the BBA. The test hall is equipped with numerous modern testing facilities.

As is well known, if testing is successful, BBA approval is granted and a test report for the equipment is issued. In the case of technical faults, testing can continue on an improved piece of equipment. At the moment, there are 73 items of plant protection equipment and 129 equipment parts approved by the BBA. Approval is limited to five years and can be extended on application.

Figure 1: View in the testing hall of the Application Techniques Division at the Federal Biological Research Centre for Agriculture and Forestry (BBA).



THE DECLARATION PROCEDURE







The obligatory testing of plant protection equipment was introduced with the amendment of the Plant Protection Act in 1986. This was to ensure that particularly those manufacturers and dealers who

had been able to place their equipment on the market without having to observe BBA requirements now also had to keep to these standards. However, according to law, a successful BBA test of approval is not necessary as evidence of observing legal requirements, but merely a declaration made by the

manufacturer or the distributor, in which in addition to extensive documents, the outfit and function of his type of equipment are documented and the observance of legal requirements confirmed in writing. These documents are to be submitted to the BBA before the type of equipment is placed on the market for the first time. The declaration and the enclosed documents are examined by the BBA. If the legal requirements are fulfilled, the equipment type is registered in the list of plant protection equipment. This is proof of the requirements for placing the equipment on the market are fulfilled,

and plant protection equipment of this type may be sold. This declaration procedure applies to foreign companies in exactly the same manner. If it is suspected that the legal requirements are not being observed, the BBA can demand further information or the equipment for testing. A breach of the legal requirements can lead to deletion of the entry in the plant protection equipment list, meaning that this type of plant protection equipment is no longer allowed to be sold. A survey of different sprayer types for field crops registered in the plant protection equipment list is shown in Figure 2.

Figure 2: Review of boom sprayers registered in the plant protection equipment list.

Sprayers and air assisted sprayers for field crops						
	3-point hitch	mounted	trailed	self propelled	line spraying	among all: air assisted
total available sprayer types	73 (38%)	25 (13%)	70 (37%)	19 (10%)	4 (2%)	14 (7%)
tank (l)	200 - 1500	600 - 5000	600 - 8000	300 - 5000	100 - 1000	600 - 4000
spray boom (m)	7 - 24	8 - 36	12 - 45	4,5 - 45	4 - 12-reihig	12 - 36
pump (l/min)	58 - 240	94 - 2x225	94 - 3x250	138 - 1400	18 - 225	100 - 344
tech. rest volume (% of tank capacity)	1,6 - 2,8	1,9 - 3,0	1,2 - 3,0	0,8 - 2,1	1,2 - 3,1	1,6 - 3,0

© Hans Peter 2002

A similar extensive legal regulation for plant protection equipment such as in Germany which stipulate that plant protection equipment must meet minimum requirements has not yet been introduced by any other Member State. The present activities of the Member States concerning the harmonisation of technical requirements for new plant protection equipment and in the area of inspecting plant protection equipment already in use (CEN / ISO standardisation) make it clear that there is a need for action in other countries in the EU as far as legal regulations for plant protection equipment are

concerned. The declaration procedure in Germany, which limits the amount of work required for technical testing (examination of documents) and integrates the manufacturer as well as the dealer with regard to his responsibility for the equipment (declaration of the manufacturer) is generally consistent with the modules of conformity assessment of the EU and can certainly be seen as a future-oriented European evaluation procedure for plant protection equipment.

DRIFT CLASSIFICATION OF PLANT PROTECTION EQUIPMENT

The responsibility of the BBA both for the authorisation of plant protection products as well as for testing plant protection equipment is deliberate, and once again proved very beneficial last year especially with regard to the differentiation of buffer zone requirements for surface water and the drift classification of plant protection equipment ([2, 3]). In the case of authorising plant protection products where it is necessary to maintain minimum buffer zones to surface waters, drift reducing plant protection equipment is also referred to. There are allocated reduced minimum buffer zones for the drift reducing classes 50 %, 75 % and 90 %, which are distinctly less than standard buffer zones allocated for conventional applications. In this way, the aim of improving the adjustment of buffer zones to the various local conditions, whilst maintaining the same high level of protection, has been achieved.

The evaluation of the plant protection equipment with regard to its drift reduction is carried on application by the manufacturer/distributor by the Division of Application Techniques. One precondition is that the equipment/equipment parts have proved suitable by successfully passing the test of approval mentioned above. The applicant must in addition provide evidence of drift reduction by submitting field drift measurements in accordance with the BBA drift guideline.

The drift reduction test is voluntary and represents an extension of the BBA testing for approval. The procedure for assessing the drift results and the classification of drift reducing equipment into drift reducing classes is published in a BBA guideline ([4]). Moreover, the plant protection equipment allocated a drift reduction class (50 %, 75 % and 90 %) is published in the register of "Loss reducing equipment" which is an important prerequisite for the transparency and the smooth administrative handling of the procedure.

EUROPEAN NETWORK FOR TESTING AGRICULTURAL MACHINERY

The voluntary suitability testing (Approval Procedure) of plant protection equipment is similar to plant protection equipment testing in other EU Member States. Up to now, this testing has not been

co-ordinated between the national testing authorities. Future co-operation on a voluntary basis has been arranged in the context of an agreement between the national test centres in Europe ([5]).

The beginning of this co-operation goes back to the year 1997 when Germany, Austria and Italy agreed to co-operate on voluntary equipment testing in an association of European test centres, in the so-called "European Network for Testing of Agricultural Machinery" (ENTAM). In the meantime, other test centres have joined the ENTAM or have expressed their interest. ENTAM's target is to work with harmonised European requirements to achieve the mutual recognition of test results, making multiple tests superfluous, and thus saving time and costs, and providing a wider choice of tested equipment in Europe.

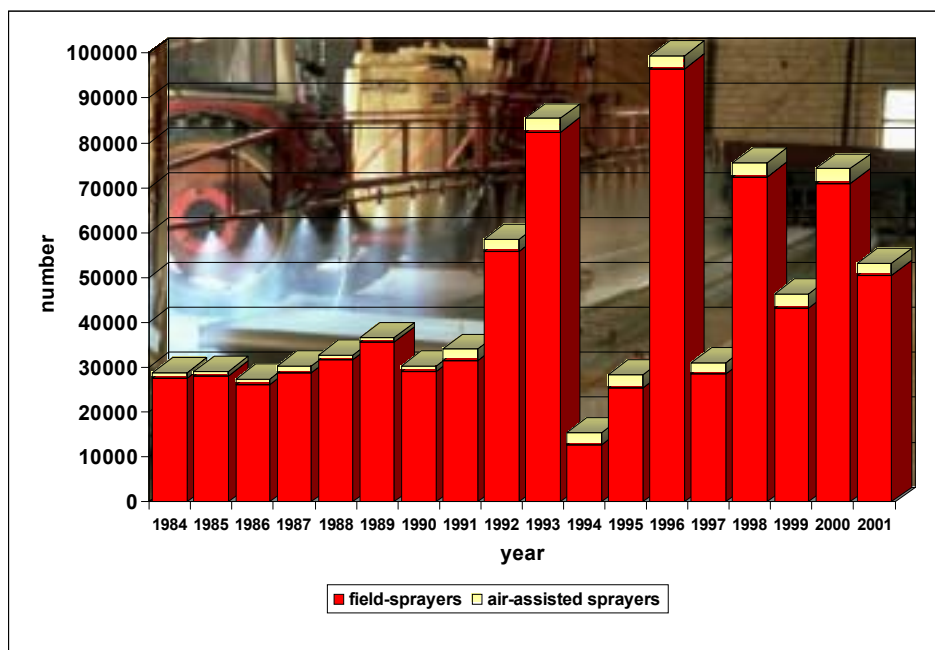
In order to make German plant protection equipment testing possible in the context of ENTAM too, an agreement had to be made with the DLG, which up to this point had acted as the sole German test centre in ENTAM. Work sharing with the DLG, which has proven reliable for decades, is therefore also put into practice at European level. This has created another European platform with new challenges and opportunities to help shape European equipment testing.

PLANT PROTECTION EQUIPMENT INSPECTIONS IN GERMANY

Until recently, the inspection regulation for plant protection equipment in Germany used to be different for boom sprayers and air-assisted sprayers. Since the middle of 1993, boom sprayers have to be inspected by recognised inspection workshops once every two years (four calendar half years); for air-assisted sprayers, such an obligatory inspection has only existed since 1 May 2002, following the amendment of the Plant Protection Product Ordinance.

Due to present estimations, there are around 144,000 boom sprayers and 66,000 air-assisted sprayers for fruit, vine and hop growing already in use in Germany. Around 70,000 of the boom sprayers are inspected annually. In spite of efforts to increase the annual number of inspections over the past few years, the number of air-assisted sprayers inspected each year has remained low, see Figure 3.

Figure 3: Number of boom sprayers and air-assisted sprayers inspected from 1984 to 2001 in Germany.



The procedure of technical inspection, i.e. whether a test stand for measuring vertical distribution should be made obligatory, has not only been clarified in Germany, but also throughout Europe in the meantime. Accordingly, a vertical distribution test stand can be used as an additional option at any time but is not to be used as part of the official air-assisted sprayer inspection procedure.

Together with the authorities in Stuttgart, Mainz, Jork, Neustadt, Veitshöchheim, Weinsberg and the research institute in Geisenheim, the BBA has developed and published setting recommendations for viticulture- and orchard sprayers. This allows much more precise adjustments to air-assisted sprayers than measurements with test stands for measuring vertical distribution would ever allow because the adjustments in the vineyard or orchard can be made by the farmer himself ([6, 7]).

INSPECTION SITUATION IN EUROPE

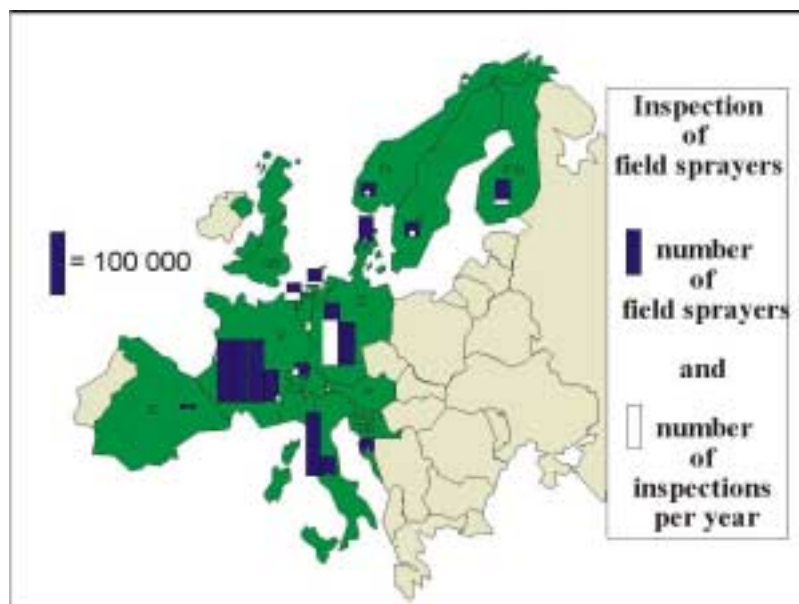
As far as the inspection of plant protection equipment already in use in Europe is concerned, Germany's position is relatively favourable with respect to boom sprayers. The results in Figure 4 from a survey from 1996 and 1997 give an overall

impression of inspection activities in Europe.

In order to review the current introduction and use of equipment inspections in Europe, the BBA sent a written survey to 27 institutes in 24 European countries. The survey was answered by 18 countries and amongst other things provided the information that 13 of them, offer boom sprayer inspection while 11 countries provide the possibility of inspecting air-assisted sprayers. Summarising, the survey shows that in all countries awareness of the environment is increasing and that most countries believe that the regular inspection of plant protection equipment in use is necessary in the interest of efficient and environmentally friendly plant protection. For those countries which do not offer plant protection equipment inspections at the moment, these survey results can be very helpful with regard to future decisions.

The Application Techniques Division of the BBA currently has several bilateral co-operations running with European countries (Spain, Poland, Hungary) in the field of agricultural research. The aim of such co-operations is to support the introduction of equipment inspections and to encourage the exchange of experience which in the medium term will enable the mutual recognition of inspections.

Figure 4: Survey results from the inspection of plant protection equipment in Europe.



The Application Techniques Division of the BBA currently has several bilateral co-operations running with European countries (Spain, Poland, Hungary) in the field of agricultural research. The aim of such co-operations is to support the introduction of equipment inspections and to encourage the exchange of experience which in the medium term will enable the mutual recognition of inspections.

PROGRESS IN EN/ISO STANDARDISATION

The European (EN) and international (ISO) standardisation of plant protection equipment has made great progress in the past few years [8]. The harmonisation of the technical rules and regulations in the Member States is seen as one of the main prerequisites for the free trade. Up to now

paramount for ISO were standards for test methods/regulations whilst CEN preferentially set standards for performance requirements for machines and equipment.

In the meantime, many CEN/ISO standards for plant protection equipment are available, DIN standards are subordinate in their significance, see Table 1. The following are now particularly significant: EN 12761 (already published) – 'Requirements concerning Plant Protection Equipment' (boom and air-assisted sprayers) - and prEN 13790 (not yet completed) – 'Requirements concerning Plant Protection Equipment already in Use' (boom sprayers and air-assisted sprayers). Tables 2 and 3 review both these standards. However, technical details cannot be illustrated at this point.

Table 1: Current list of German (DIN), European (EN) and international (ISO) standards for plant protection equipment.

DIN 11210	Connection dimensions of nozzle holders of band sprayers
DIN 11215	Connection dimensions of nozzles
DIN 11218	Rinsing device for plant protection product cans
DIN 11219	Nominal tank volume
EN 907	Safety requirements for sprayers
EN 12761-1 ¹⁾	Environmental protection - General
EN 12761-2 ¹⁾	Environmental protection – Field crop sprayers
EN 12761-3 ¹⁾	Environmental protection – Air-assisted sprayers for bush and tree crops
PrEN 13790-1	Inspection of sprayers in use - Field crop sprayers
PrEN 13790-2	Inspection of sprayers in use - Air-assisted sprayers for bush and tree crops

Table 2a): First European standard BBA-features for environmental protection for brand new plant protection equipment – Part 2: boom sprayers.

<p>Measuring systems *clearly readable (turning tolerable) *max. error 5 % *pressure gauge accuracy</p> <p>Controls / Flow control devices *quick-acting-cut-off-valve *constant spray pressure *dynamic behavior (within 7 s: ± 10 % / ISO 5682-3) *pressure drop ± 10 % *calibration aids *deviation of appl. rate ± 10 %</p> <p>Distribution/Control of spray drift *transverse volume distribution: c_{α} ± 7 or 9 % (ISO 5682-2) *deviation of nominal flowrate ± 10 % (nozzles mounted)</p>	<p>*deviation of mean flowrate ± 5 % (nozzles mounted) *10 % vol. droplet dia. : minimum value (11002)</p> <p>Rinsing water tank *separately (not combined with other tanks) *volume ± 10 % spray tank vol. or 10 times of dilutable residue *rinsing of tank and pipes</p> <p>Test adapters for *pressure gauge (1/4" inner thread or adapters) *pump capacity (adapters)</p>	<p>Marking according to EN 12761/1</p> <p>Introduction handbook according to EN 12761/1</p> <p>Cleaning devices for empty cans (if applicable) *performance: residue after cleaning : 0,01 % *rinsing water: return to the tank</p> <p>Requirements for boom sprayers</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Additional BBA features: *cleaning device for tank inside required *connection for external cleaning device required</p> </div>
---	--	---

Table 2b): First European standard BBA-features for environmental protection for brand new plant protection equipment – Part 3: air-assisted sprayers.

<p>Spray tank *roughness (ISO 4287/4288) *filling (avoiding return-flow) *filling orifice/diameter/no leakage *extra volume *strainer / minimum depth mesh size filling capacity *emptying / techn. residue (ISO 13440) *tank outlet / complete emptying complete collecting without contamination protected against opening *tank content indicator (ISO 9357) durable visible from operating + filling pos. accuracy *mixing even concentration</p>	<p>Hoses and pipes *no deformation</p> <p>Filters *suction filter (pos. displacement pump) *filter on pressure side *adequate mesh size *blockages detectable *easily accessible *filter inserts removable *cleaning at any tank filling level</p> <p>Nozzles *spray direction / defined adjusting and fixing *dripping stop *deviation of nominal flowrate ± 5% (ISO 5682-1) *swivel nuts (ISO 14710) *measuring of single nozzle flowrate *switching of each nozzle</p>	<p>Measuring systems *clearly readable (turning tolerable) *max. error 5 % *pressure gauge accuracy</p> <p>Controls / Flow control devices *constant spray pressure *dynamic behavior (within 7 s: ± 10 % / ISO 5682-3) *pressure drop ± 10 % *calibration aids *deviation of appl. rate ± 10 %</p> <p>Fan *switching independently *reproducible adjustment</p>
--	--	---

Table 3a): Draft of European standard for environmental protection for plant protection equipment already in use - Part 1: boom sprayers

pr EN 13790		
Agricultural machinery - Sprayers - Inspection of sprayers in use - Part 1: Field crop sprayers		
Inspection / Function test		Measurement
Power transmission parts Pump <ul style="list-style-type: none"> • Pulsations • Leakages Agitation Spray liquid tank <ul style="list-style-type: none"> • Leakages • Strainer/Grating • Pressure compensation • Level indicator • Emptying • Flow back • Chemical introduction container • Cleaning device^{*)} 	Controls/Regulation system <ul style="list-style-type: none"> • Reliability/Leakages • Operation • Pressure gauge Pipes, Hoses, Filters Spray boom <ul style="list-style-type: none"> • Stable/straight • Automatic resetting • Safely lockable • Nozzle spacing/orientation/height • Prevention of nozzle damage • Boom section control • Height adjustment • Damping, Slope compensation • Pressure variation Nozzles <ul style="list-style-type: none"> • Identical • Dipping 	Pump <ul style="list-style-type: none"> • Capacity Pressure gauge <ul style="list-style-type: none"> • Accuracy Other measuring devices <ul style="list-style-type: none"> • Accuracy Spray boom <ul style="list-style-type: none"> • Spacing/Height Nozzles/transverse distribution <ul style="list-style-type: none"> • Measurement on patternator alternative • Flow rate measurement • Pressure drop measurement
^{*) if applicable}		^{*) introducing new inspection procedures patternator should be preferred}

Table 3b): Draft of European standard for environmental protection for plant protection equipment already in use - Part 2: air-assisted sprayers

pr EN 13790		
Agricultural machinery - Sprayers - Inspection of sprayers in use - Part 2: Air-assisted sprayers for bush and tree crops		
Inspection / Function test		Measurement
Power transmission parts and blowers Pump <ul style="list-style-type: none"> • Pulsations • Leakages Agitation Spray liquid tank <ul style="list-style-type: none"> • Leakages • Strainer/Grating • Pressure compensation • Level indicator • Emptying • Flow back • Chemical introduction container^{*)} • Cleaning device^{*)} 	Controls/Regulation system <ul style="list-style-type: none"> • Reliability/Leakages • Operation • Pressure gauge Pipes, Hoses, Filters Nozzles <ul style="list-style-type: none"> • Suitability • Symmetrical • Dripping • Switching off • Adjustment • Uniformity of spray jet Blower <ul style="list-style-type: none"> • Switching off • Guide plates • Dripping 	Pump <ul style="list-style-type: none"> • Capacity Pressure gauge <ul style="list-style-type: none"> • Accuracy Other measuring devices <ul style="list-style-type: none"> • Accuracy Blower <ul style="list-style-type: none"> • Rotational speed Nozzles/Distribution <ul style="list-style-type: none"> • Nozzles output • Pressure difference optional • Patternator measurement
^{*) if applicable}		^{*) in order to provide further information a section of patternator test bench may be used}

Nevertheless, one issue in prEN 13790 in the part on boom sprayers, which refers to the assessment of nozzles, should briefly be pointed out. For assessing the nozzles, the present draft for standardisation states first of all the measurement of cross distribution and secondly however allows the procedure favoured by Belgium of single nozzle output measurements. A note has been added to the standardisation draft referring to the fact that when an equipment inspection is introduced for the first time method 1 (measurement of cross distribution) is preferential. Therefore, one can be optimistic about the fact that future plant protection equipment inspections in accordance with European standards will not result in any major changes to the inspection procedure currently applied in Germany.

Germany plays a very active roll in the CEN/ISO standardisation of plant protection equipment. It chairs three ISO/TC/23/SC 6 working groups (equipment cleaning, drift classification and test tracks for field sprayers) which must submit an initial harmonised working paper about tasks assigned in a resolution to the super-ordinate

committee (SC : subcommittee 6). Several rounds of discussions and comments are required which are processed before the standard is accepted by all Member States. After a period of about three, sometimes up to five years, it is subsequently published.

CONCLUSION

The harmonisation of the testing of new plant protection equipment and the inspection of plant protection equipment already in use in the EU has the aim of aligning aspects of the environment and competition law within the European Economic Area. This will happen all the quicker the sooner it is possible, in plant protection too, to fully establish the European authorisation procedure for plant protection products and the sooner uniform EN/ISO standards for plant protection equipment in the Member States are available. The regulatory framework however represents only one part of future security in plant protection. Just as important are research, innovation and information.

REFERENCES

- [1] GANZELMEIER, H. (2001): Pflanzenschutztechnik und Pflanzenschutzgeräteprüfung im Wandel der Zeit. Nachrichtenbl. Deut. Pflanzenschutzd. 53 (10), p. 242 - 262.
- [2] RAUTMANN, D. (2001): Die Verzahnung der Prüfung der Pflanzenschutzgeräte mit der Zulassung der Pflanzenschutzmittel. Nachrichtenbl. Deut. Pflanzenschutzd. 53 (10), p. 270 - 273.
- [3] GANZELMEIER, H. (2000): Drift studies and drift reducing sprayers - A German approach. ASAE Paper No. 001024, Milwaukee, USA, July 9 to 12.
- [4] ANONYMOUS (APRIL 2000): Verfahren zur Eintragung von Pflanzenschutzgeräten in den Abschnitt "Abtrift" des Verzeichnisses "Verlustmindernde Geräte". Richtlinien für die Prüfung von Pflanzenschutzmitteln und Pflanzenschutzgeräten, Teil VII, 1 - 2.3.3.
- [5] GANZELMEIER, H. (1999): Europäische Prüfstellen für Landmaschinen tagten in der BBA in Braunschweig. Nachrichtenbl. Deut. Pflanzenschutzd. 51 (9), p. 242 - 243.
- [6] GANZELMEIER, H. BÄCKER, G., HAUSER, R., IPACH, R., UHL, W. (2001): Sachgerechte Einstellung und Handhabung von Sprühgeräten im Weinbau. Deutsches Weinbau-Jahrbuch, 52. Jahrgang, p. 141 - 144.
- [7] KAUL, P., KOCH, H., KNEWITZ, H., MOJE, A., SCHMIDT, K., GANZELMEIER, H. (1998): Einstellung von Sprühgeräten im Obstbau 23 (5), p. 251 - 254.
- [8] GANZELMEIER, H. (1997): Stand der Europäischen Normung für Pflanzenschutzgeräte. Nachrichtenbl. Deut. Pflanzenschutzd. 49 (3) p. 51 - 56.

Heinz Ganzelmeier,
Federal Biological Research Centre for Agriculture and Forestry Braunschweig,
Messeweg 11/12, D-38104 Braunschweig,
Austria

