
**Crop protection equipment — Spray
deposition test for field crop —**

**Part 1:
Measurement in a horizontal plane**

*Matériel de protection des cultures — Essais de dépôt de la
pulvérisation sur les grandes cultures —*

Partie 1: Mesurage dans un plan horizontal

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

ISO 24253 consists of the following parts, under the general title *Crop protection equipment — Spray deposition test for field crop*:

- *Part 1: Measurement in a horizontal plane*
- *Part 2: Measurement in a crop*

Introduction

Efficacy of plant protection products (PPP), their safety to the crop and the environment may be much influenced by spraying efficiency. The dose of the active ingredient and its variation that is retained on target surfaces in a downward directed (boom) spray application such as ground surface need to be measured in a manner that is both accurate and precise.

The location, numbers, and sampling structures used to monitor sprayed depositions need to be defined in a standard manner to enable results from different experiments to be compared.

A test can be set up to quantify or to describe the in-field situation or for machine comparison.

A spray system can be compared with a reference system.

This International Standard does not deal with the deposition of spray outside the treatment zone, in crop canopy nor that lost as airborne spray drift. However, the combination of this part of ISO 24253 with the protocol for field measurements of spray drift as given in ISO 22866^[5] when measured at the same time may result in a possible evaluation of spray mass balance. On the other hand, its combination with the measuring of sprayer boom movements in the field (see ISO 14131^[2]) can also be used to evaluate the spray deposition and its variation in the field as a result of the boom movement.

Spray deposition from horizontal boom sprayers with downward directed application is affected by nozzle parameters, boom height, boom steadiness, sprayer speed, meteorological conditions, and other sprayer additional devices such as air assistance. These dynamic factors can all be elements of a test to determine the quantity and the variation in spray deposition.

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Crop protection equipment — Spray deposition test for field crop —

Part 1: Measurement in a horizontal plane

1 Scope

This part of ISO 24253 specifies field measurements of spray deposition to determine the quantity and distribution of spray in a plane surface area, treated by horizontal boom sprayers with downward directed application.

This part of ISO 24253 allows flexibility in the arrangement of field tests, but specifies standardized measurement procedures that are useful to be able to compare the results from different field experiments or to compare with laboratory tests, such as that described in ISO 5682-2.^[1]

This part of ISO 24253 may not be appropriate for those spraying systems which rely on the presence of a crop canopy for efficient deposition (for example directed spraying, electrostatic charged spraying, very fine spraying, variable rate spraying).

This International Standard is not intended for use in or for a regulatory framework.

2 Terms and definitions

ISO 24253-1:2015

For the purposes of this document, the following terms and definitions apply.

2.1

spray dose

quantity of active ingredient (PPP or tracer) applied

Note 1 to entry: It is expressed in kg/ha (solids) or l/ha (liquids).

2.2

spray volume

quantity of sprayed liquid applied

Note 1 to entry: It is expressed in l/ha.

2.3

spray deposition

quantity of spray liquid that is deposited on the collector(s)

Note 1 to entry: It can be expressed as absolute amount of spray per unit of area ($\mu\text{l}/\text{cm}^2$, l/ha) as well as in relative terms as a % of theoretically applied spray volume or spray dose.

2.4

collector

artificial target to collect the sprayed liquid

Note 1 to entry: Examples of collectors for spray deposition measurements are listed in [Annex A](#).

2.5

tracer

traceable material representing a plant protection product to quantify spray deposition

[SOURCE: Adapted from ISO 22522.]

2.6

target area

area where it is intended to apply spray liquid

2.7

spray liquid

mixture of water, tracer and/or pesticide and/or additives which is sprayed

3 Test method

3.1 Principle

A spray deposition test comprises the measurement of spray deposition immediately available to the target area being the ground surface, represented by the collectors. This spray deposition measurement may utilize a dye, or other readily measurable tracer to simulate a plant protection product.

Spray depositions are assessed quantitatively. The variation in spray deposition is quantified.

Spray deposition values used to quantify mean deposition and deposition variation of the spray liquid applied by the tested sprayer is assessed using spray deposition collectors placed on a ground surface.

3.2 Test area

The test shall be performed on the ground surface (bare soil surface or short mowed grass of max. 8 cm height). Since there are influences from boom movement (boom ends) and other disturbances such as air turbulences around the tractor and the sprayer (centre of the machine), measurements shall be taken on both sides of the sprayer and at different distances along the spray boom (see 4.3).

The length of the test area shall ensure the output of the intended spray volume over the sampling area. The test area shall therefore have a track length before and after the sampling area assuring that the sprayer has reached even intended output flow considering sprayer size and forward speed.

NOTE With rate control in manual mode, a minimum track length of 10 m is suggested for travelling speeds of up to 2 m/s and 20 m for travelling speeds up to 4 m/s. With the rate control in automatic mode, the track length has to be adapted also considering the system reaction time.

Details of the spraying and sampling layout shall be fully reported with the test results, in accordance with Annex B (see also 4.3).

In identifying the place of the test area take notice of surrounding vegetation on the wind profile. The test area should be at least 10 times the height of the vegetation away from the surrounding vegetation or constructions.

Details of the test area and surroundings shall be specified in the test report.

3.3 Monitoring of meteorological conditions

Monitoring of the meteorological conditions shall be made at the time and the place of the test. The maximum error of measurements shall be

- for wind speed: 0,1 m/s for wind speed up to and including 1 m/s and 0,2 m/s for wind speed over 1 m/s,
- for temperature: 0,5 °C, recorded in the shade, and

- for humidity: 5 % of the relative humidity.

Measurements shall be made at $(2 \pm 0,1)$ m height above the ground surface. Measurements of wind (direction and velocity) shall be made at a frequency of at least 1 Hz (every 1 s) sampling rate. The instruments should be calibrated prior to their use according to instrument instructions.

3.4 Acceptable meteorological conditions for field measurement of spray deposition

Average wind speed during spraying shall not be higher than local recommendation or practice and preferably below 2 m/s at the measuring height specified in 3.3. The wind speed shall be stable during the test (the standard deviation shall not exceed ± 1 m/s).

For wind speeds above 2 m/s, the wind direction should be within $\pm 30^\circ$ of the mean wind direction.

Temperature shall be between 5 °C to 35 °C.

Temperature inversions affect deposition measurements and need to be reported (preferably by using of 3D anemometer alternatively by cloud cover or measurements of temperature at two heights).

3.5 Tracers

Tracers shall be safe for their intended use. See the environmental and operator safety data sheets for the suitability for this purpose.

NOTE Local Pesticide Regulatory Bodies ought to be able to comment on the use of suitable candidate products and their restrictions for this purpose.

The tracers shall be stable in field conditions and with a good recovery (at least >90 %; preferably >95 %) from all kind of collectors (see 3.6) used in the test. See e.g. Herbst, 2006^[4] and Stallinga et al., 2012.^[5]

Examples of usable tracers are the following:

- metal ions (recommended for several applications on the same target);
- food dyes:
 - tartrazine (E102);
- fluorescent dyes:
 - brilliant Sulfo Flavine;
 - sodium fluorescein.

3.6 Collectors

Collectors are used to sample spray deposition on the ground surface. The recovery of the sprayed tracer from the collectors shall be determined prior to the experiment.

The collectors used shall provide a good recovery (at least >90 %; preferably >95 %). Examples of collectors which can be used are given in Annex A. How to quantify tracer recovery from the collector is described in Annex C.

Background emission from the collectors is to be determined (see Annex C). The average reading of the blank collectors should not be higher than 0,1 % of the average reading of the sprayed collectors. Accuracy of the measuring device, artificial collector types, and background emission from artificial collectors shall be recorded and chosen to obtain a coefficient of variation of the background emission lower than 10 % (of at least 10 collectors; see Annex C).

Care shall be taken to ensure that the sampling collectors used to verify the applied dose and volume rate do not saturate. This shall be checked before the tests.

3.7 Spray liquid

The spray liquid shall be representative of liquids typically used in the application of plant protection products. Tap water or standard tank mix is often used in spray drift measurements (see ISO 22866[5]). A standard tank mix can be achieved by the addition of a water-soluble non-ionic surfactant at rates typically from 0,005 % to 0,5 % v/v, following manufacturers recommendation.

The type and concentration of additives shall be specified in the test report.

3.8 Soil surface roughness

When spraying a bare ground surface area, the ground surface roughness e.g. ploughed surface, seedbed prepared land, or roughness index from soil tillage studies shall be documented in the test report.

4 Test procedure

4.1 General

A test can be set up to quantify or to describe the in-field situation, or it can be a defined situation (specific track) for machine comparison. In a comparison test if mounted or trailed sprayers are used, preferably the same tractor configuration shall be used. Tractor type should be reported in the test report.

Each measurement shall involve sampling spray depositions on the ground surface (see [Figure B.1](#)). Make at least three measurements at the same collector positions or at different places after each other.

Place the collectors in a plane surface. A number of collectors shall be placed in a continuous line, both in the driving direction and in the cross direction (along the boom). The size of the collector shall be adapted to the resolution of interest; field level (m²), plant level (dm²), (disease/weed) spot level (cm²). This defines also the needed collector area to take a representative sample.

The sum of the total collector areas shall be at least: for the field level 1 m², for the plant level 0,5 m², and for the spot level 0,1 m².

Collector type, location, and size shall be specified in the test report.

Spray deposition result-presentation can be done in different ways. Either it is expressed on a relative basis, e.g. in percentage of spray volume, or on an absolute basis, e.g. $\mu\text{l}/\text{cm}^2$.

After the spraying, gather (as soon as possible following the tracer requirements and within 30 min after spraying) and code the artificial collectors and store them in a dark and dry and depending on substance, cool place. Extract the tracer from the collectors and determine the spray deposition, e.g. by fluorimetry as described in [Annex C](#).

The test shall be performed with the rate controller in manual mode unless the rate control in itself is being tested. Sprayer speed and nozzle output (l/min) over the test area shall be directly measured and recorded in the test report. Information from the rate controller (such as volume, speed, pressure) shall also be visually checked or recorded, and specified in the test report.

Preferably a laboratory spray distribution measurement of the sprayer should be done as described in ISO 5682-2[4] and presented in the report.

The results of all deposition measurements shall be statistically evaluated in accordance with the analysis of variance, ANOVA, 10 %.

Procedures for handling collectors prior to and post exposure to spray that minimize the risk of cross-contamination shall be established. The potential for cross-contamination and tracer degradation shall be monitored during a trial using clean collectors and those loaded with a measured volume of the tracer solution.

4.2 Comparison with a reference sprayer setup

For inter study comparisons of results, a reference sprayer setup should be included in the field measurement programme. The reference sprayer setup should be that typically used for the application of plant protection products in a certain region and crop, with defined application parameters. Good agricultural practice shall relate to the local conditions where the test is conducted.

Preferably collectors of same size and type should be used.

NOTE Reference sprayer setup can be according to ISO 22369-2.[4]

4.3 Sampling spray deposition on the ground surface

The test area for the deposition measurement is to be marked in the field. Spray deposition is to be measured on a bare ground surface in the field to quantify the amount and the variation of total spray deposition coming onto ground surface. The collectors are placed generally in the centre area at each side of the spray boom between 1,5 m from the end of the boom and the sprayer/tractor wheel (see [Figure 1](#)). Sampling spray deposition is done at least at three places according to [Figure B.1](#). For special purposes like sprayer boom movement effect place collectors underneath the tip of the boom (see [Figure B.2](#)), for the sprayer/tractor wake effect place collectors e.g. close to the sprayer. When placing collectors across the boom, the place of the collectors shall represent both the area “under” the nozzle positions and “between” the nozzle positions.

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