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Equipment for crop protection — Method for measurement of potential drift from horizontal boom sprayer systems by the use of a test bench

Matériel de protection des cultures — Classification de la dérive des matériels de pulvérisation

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22401 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

Introduction

In recent years spray drift control has become more and more relevant and buffer zones have been widely introduced.

Normally, the determination of buffer zones widths or other regulations take into account also the type of spraying equipment used for pesticide application and its drift or potential drift.

This Standard is aimed at defining a test procedure to assess spray potential drift from horizontal boom sprayers, using an ad-hoc test bench, in order to get a quick and simple assessment of this spraying equipment.

This test procedure can be used as an alternative method for the drift assessment to the field drift measurement, or to the laboratory measurement of spray drift from nozzles (ISO 22866, ISO 22856).

The application of this Standard may support advisory services for farmers, product development and certification and classification schemes.

Equipment for crop protection – Method for measurement of potential drift from horizontal boom sprayer systems by the use of a test bench

1 Scope

This Standard provides a test method to measure spray sedimentation from horizontal boom sprayer systems using a test bench. The sedimentation measure gives a value for potential drift that can be used to compare different sprayer setups.

This Standard is applicable to mounted, trailed and self-propelled field crop sprayers used in arable crops and horizontal boom sprayers used for weed control in orchards/vineyards and for spray application on horticultural crops.

This Standard is intended for booms using a uniform set of spray generators. If intended for drift classification of the sprayer system the comparison is limited to nozzle type, pressure and boom height.

NOTE Further investigations and tests are on-going to extend the possibility to consider other parameters for classification aims (e.g. air assisted system, forward speed, nozzle spacing and orientation).

2 Normative references

The following referenced document is indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5681, *Equipment for crop protection – Vocabulary*

ISO 10625:2005, *Equipment for crop protection – Sprayer nozzles – Colour coding for identification*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO 5681 and the following apply.

3.1
sprayer setup
combination of nozzle and boom parameters and sprayer adjustment on a specific sprayer model

Note 1 to entry: Examples of setting parameters to be considered are spray generator type, spacing, orientation and size, boom height, nozzle spacing, forward speed, spray pressure, spray deposition assistance (e.g. air assistance).

3.2
potential spray drift
percentage of initial spray volume that remains suspended in the air after the sprayer passage and which represents the fraction of spray liquid susceptible to drift out of the treated area by the action of air currents during the application process

3.3
realised spray deposit (RSD)
calculated amount of the expected spray deposit in the treated area based on measured forward speed and nozzle flow rate assuming an even distribution under the boom

Note 1 to entry: For example, applying a volume of 100 l/ha the realised spray deposit RSD corresponds to 1 µl/cm^2.

4 Principles

The method is aimed at determining the potential spray drift generated by horizontal boom sprayer setups, by collecting the spray droplets sedimenting after the boom has passed over the entire length of the test bench. The total amount of collected sediment is compared to the realised spray deposit (*RSD*) to obtain the Drift Potential Value (DPV, see 7.2).

To allow comparison of results between facilities/laboratories, one measurement shall be done with the sprayer system setup indicated in Annex A.

5 Test materials and equipment

5.1 Test liquid

Where possible, all measurements shall use a tracer of low toxicity that can be safely applied to the treated area with no associated risks of environmental contamination (e.g. yellow Tartrazine E102). Tracer concentration and analytical sensitivity shall be appropriate to guarantee the detection of at least 0,01 µl/cm^2 of spray on the deposit collector.

The spray liquid shall have physical properties representative of liquids typically used in the application of plant protection products. This can normally be achieved by the addition of a water-soluble surfactant at typical usage rates (for example, 0,1 %).

NOTE The formulation of some tracers can include a surfactant component.

5.2 Test bench to assess potential spray drift

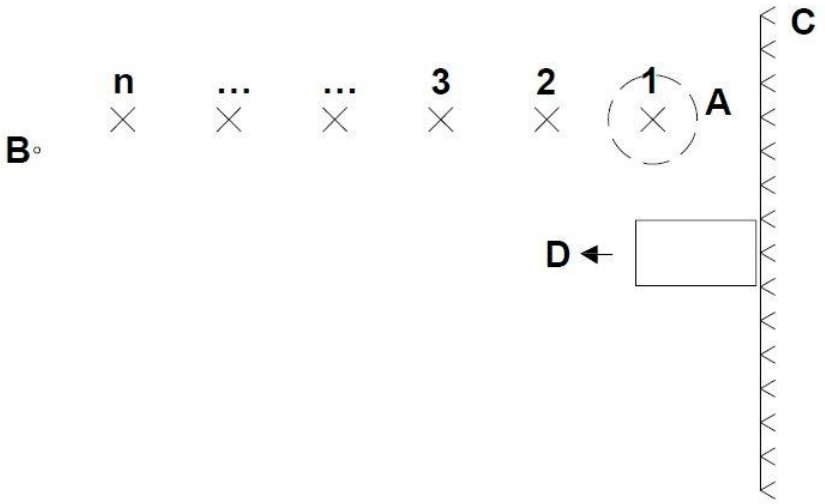
The test bench consists of a frame track provided with aligned slots in which are situated the deposit collectors (e.g. Petri dishes) and with sliding covers linked together and able to ensure the complete covering to avoid any unintended entry of droplets on the artificial collectors slots (see Figure C.1).

Two slots, one at the beginning and one at the end of the test bench, shall be maintained permanently uncovered in order to collect the whole spray deposit under the boom.

Spacing between slots shall be (500 ± 2) mm. The test bench shall be equipped with at least 20 covered slots for deposit collectors, numbered from 1 to n according to the sprayer travel direction. The area of the deposit collector in each slot shall be a minimum of 100 cm^2.

The sliding covers shall be linked to a control device enabling covering and/or uncovering of the deposit collectors by the boom passing.

The control device enabling to uncover the deposit collectors shall be activated automatically when the boom passes point B (see Figure 1). Point B shall be positioned so that the deposit collectors are uncovered when the spray hits the ground at (2 ± 0,1) m distance beyond the middle of collector n. This should prevent the nozzles from spraying directly onto the deposit collectors.



Key

1, 2, 3, n collectors
A slot for artificial collector
B starting point for uncovering collectors positioned so that the collectors are uncovered when the nozzle spray hits the ground at (2 ± 0,1) m distance beyond the middle of collector n
C horizontal boom sprayer
D travel direction

Figure 1 — Scheme of the test bench

NOTE See also Annex D showing an example of test bench.

6 Test conditions

6.1 Environmental conditions

Tests shall be operated, preferably indoor, with an average wind velocity < 0,5 m/s and a maximum wind velocity < 1,0 m/s, with air temperature between 5 °C and 35 °C and relative humidity between 40 % and 95 %. Wind velocity measurements shall be reported and carried out at least at 1 Hz frequency and at 2 m height. In the test report the environmental average temperature, the average relative humidity, the maximum, minimum and average wind velocity and the average wind direction (with respect to the test bench direction) during the test shall be recorded (see Annex C).

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

When operating indoor, the length of the testing hall shall be at least equal to the test boom length plus 20 m before and after the test bench, the height shall be a minimum of 7 m and the width shall be at least equal to the boom width plus 4 m.

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

The temperature difference between ground surface and ambient air shall not be large enough to create turbulence.

If comparison tests between sprayer setups are undertaken then the replicates of the same test shall be carried out in similar conditions and always under the following limits: differences between average wind velocities shall not exceed 0,2 m/s, differences between air temperature shall not exceed 10°C and differences between air relative humidity shall not exceed 20%. Maximum and minimum wind velocity shall also be recorded in all tests.

6.2 Test bench positioning

When operating indoor the test bench shall be positioned on artificial grass or on a bare soil flat surface. When operating outdoor the test bench shall be positioned in an open field on a flat surface with grass, with the height of vegetation between 50 mm and 100 mm in order to stabilize the environmental conditions. Do not operate tests on concrete or hard surfaces. Always verify the horizontality of the test bench and preferably position it so that the deposit collectors are placed at a maximum height of 300 mm from the ground, parallel to the sprayer travel direction, corresponding to the nozzle closest to the centre of the right or left half-boom (see Figure 1).

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

When comparing different sprayer setups take care to operate with the test bench collectors positioned at the same height from the ground and report this height in the test report.

NOTE Assessment of transverse distribution under the boom can be made to define the exact position of the test bench under the boom. Details can be reported in the test report.

6.3 Forward speed

Measure the forward speed of the tested sprayer with a maximum error of 0,1 km/h, measuring the time needed to cover a distance of at least 50 m.

When comparison of different sprayer setups is undertaken the forward speed of the sprayers shall be the same (± 0,2 km/h) and at least one comparison test shall be made at a forward speed of (7 ± 0,2) km/h.

6.4 Vehicle travel track

The sprayer/tractor travel track shall be a level surface to minimize boom movement. Other surface types can be used to assess the effect of boom stability on potential spray drift.

7 Test procedure

7.1 Method

7.1.1 Adjust sprayer parameters (forward speed, operating pressure, boom height), select the nozzle parameters (e.g. type, spacing, size and orientation) to be used in the test and calculate the realised spray deposit under the boom (RSD). Boom height shall be measured from the nozzle tip to the deposit collectors.

7.1.2 Insert the deposit collectors in the test bench slots and activate the control device in order to cover them.

