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Crop protection equipment — Traceability — Spray parameter recording

Matériel de protection des cultures — Traçabilité — Enregistrement des paramètres liés à la pulvérisation

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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.

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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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/TS 11356 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

Introduction

This Technical Specification presents a list of spray operation parameters that can be used for traceability in the food chain, for the health of livestock, operators and bystanders, for environmental regulations and contract policies, for policy control by authorities and other relevant areas.

Target plants or organisms, as well as non-target objects in the treated field or outside the field, can be relevant for traceability.

NOTE ISO 22005[1] gives related traceability principles and requirements.

Although the content of this Technical Specification received sufficient internal support to conclude that there is the future possibility of agreement on an International Standard, at the time of its publication there remained the need for

— more information on the parameters to be collected to cover local and regional requirements, such as the European Community Directive 2009/128/EC establishing a framework for Community action to achieve the sustainable use of pesticides,

— identification of the specific data to be recorded and the mode of collection for a number of the parameters, and

— results from technical developments within ISO/TC 23/SC 19 (*Agricultural electronics*) related to ISO 11783-10.

Crop protection equipment — Traceability — Spray parameter recording

1 Scope

This Technical Specification specifies the relevant spray operation parameters for recording information necessary for traceability, and provides a basis for the development of systems for automatically collecting and reporting agricultural production data. The parameters can also be valid for other records, such as those related to spraying in amenities.

Spray operation parameters for traceability can be required for different reasons, including approval, quality labelling, national or international directives, local regulations on food security, environmental protection or simply for identifying the treatment, machine or user. The extent to which these traceability parameters can be used will be dependent on the reasons and need for them identified by the intended users of this Technical Specification, who include machine manufacturers, farmers, the food industry and regulators.

2 Normative references

The following referenced documents are 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 11783-10:2009, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 10: Task controller and management information system data interchange*

3 Terms and definitions

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

3.1
buffer zone
distance between a **protected area** (3.4) and a **treated area** (3.8)

NOTE It is recorded in metres.

3.2
global navigation satellite system
GNSS
generic term for satellite navigation systems that provide autonomous geospatial positioning with global coverage

3.3
pre-harvest interval
time between the treatment and the harvesting of a crop

3.4
protected area
sensitive zone that can be adversely affected by spray treatment

3.5
spray operation
action made with a sprayer before, during and after treatment

3.6
spray record
data collected about the spray operation or information needed to qualify traceability

3.7
traceability
ability to trace the history, application or location of that which is under consideration

[ISO 9000:2005, definition 3.5.4][2]

3.8
treated area
specified zone of the field which was intentionally treated with a product by a spray operation

4 Spray operation parameters

4.1 General

Records of all the spray operations made by an individual sprayer for each field may be collected by the operator on paper or computer, or by sprayer computer — if possible, in the ISO BUS form defined by ISO 11783-10.

Spray operation parameters shall be recorded in accordance with 4.2 to 4.11, as applicable.

Parameters that are not applicable for the situation may be excluded.

Each recorded parameter shall be documented at least at the first of the following three levels:

— 1: required information (basic);

— 2: complementary information (optional);

— 3: more detailed information, generally collected automatically by computer (automatic/computer).

For each spray operation parameter recorded, the precision of measurement shall be considered and shall be proportionate to the importance, or relevance, of the particular parameter. If the recording of any spray operation parameter is required by legislation, for compliance with quality assurance schemes, etc., the precision of measurement required shall be specified and guidance shall be given on the means of measurement to achieve this.

An example of the structure of records is given in Annex A.

4.2 Field identification

4.2.1 Producer identity

The producer is responsible for spray operations on land or agricultural products that influence quality or the environment.

The data to be recorded and the mode of collection shall be in accordance with Table 1.

Table 1 — Producer's identity

Level	Data recorded	Mode of collection
1	Name of producer: farmer, company or organization Name of contact person Address Phone number	Manual
2	E-mail Web site	Manual
3	Identification number of farm EXAMPLE SIAN (*Sistema Informativo Agricolo Nazionale*), SIREN (*Système Informatique pour le Répertoire des Entreprises et des Établissements*), LPIS (Land Parcel Identification System) geographical coordinates	Manual/automatic
For the recording format of the parameter, see ISO 11783-10:2009, D.13, Customer (CTR), D.23, Farm (FRM).		

4.2.2 Field identity

The identity of the field is needed for environmental reasons (drift or leakages from the field) and for food traceability to ensure that previous treatments do not affect the present crop(s).

The data to be recorded and the mode of collection shall be in accordance with Table 2.

Table 2 — Field identity

Level	Data recorded	Mode of collection
1	Identification number or identification name of the field, given by the farmer	Manual
2	Field name with geographical coordinates LPIS	Manual
3	Boundary of the field, limited by coordinates Identification GNSS	Automatic
For the recording format of the parameter, see ISO 11783-10:2009, D.41, Treated zone (TZN).		

4.2.3 Treated area

The size of the treated area may be given as the unit area (e.g. m^2 or ha) or the number of treated rows or plants for bush and tree crops.

The data to be recorded and the mode of collection shall be in accordance with Table 3.

Table 3 — Treated area

Level	Data recorded	Mode of collection
1	Treated area: field size, non-treated area	Manual
2	Registration of the sprayed area	Automatic
3	Registration of sprayer passes on the treated area Graphically presented treated area (area recorded by GNSS)	Automatic
For the recording format of the parameter, see ISO 11783-10:2009, D.30 Partfield — PTN, D.41 Treatment zone — TZN.		

4.2.4 Protected areas

Protected areas can be in the treated field or outside it.

EXAMPLE Streams, wells, drainage wells, ditches, neighbouring crops downwind, greenhouses, kindergartens, residences, bees, bystanders.

Neighbouring crops can be sensitive to the product (e.g. organic crops) or there could be a risk of exceeding residue levels.

The data to be recorded and the mode of collection shall be in accordance with Table 4.

Table 4 — Protected area

Level	Data recorded	Mode of collection
1	Type of sensitive object (biological or environmental) and its location and distance to the treated area — defined by operator, farmer/producer in records or on a map	Manual
2	Aerial photo of the field and its protected area(s)	Manual
3	GNSS representation of the field and surroundings	Automatic
For the recording format of the parameter, see ISO 11783-10:2009, D.30 Partfield — PFD.		

4.2.5 Windbreaks

Vegetation or other objects can offer protection against spray drift. The presence of windbreaks can be relevant to determining the size of buffer zones and may be specified in local regulations.

The data to be recorded and the mode of collection shall be in accordance with Table 5.

Table 5 — Windbreaks

Level	Data recorded	Mode of collection
1	If present, location and vegetation type and height	Manual
2	Location registered via GIS (geographical information system)	Automatic
3	GNSS identification in spraying computer protocol to calculate buffer zones	Automatic
For the recording format of the parameter, see ISO 11783-10:2009, D.30 Partfield — PFD, D.33 Position — PTN.		

4.2.6 Buffer zones

Spray drift and surface run-off of plant protection products can cause unwanted effects in neighbouring crops or protected areas, such as crop damage, detectable levels of non-approved products or an excess of maximum residues levels. Depending on local conditions, it might be necessary to ensure safety distances from the treated zone to protected areas.

Required buffer zones can be specified by local regulations, on product labels or by demands in the grower's contract.

The size of buffer zones (as defined in 3.1) can be affected by weather conditions such as wind speed or wind direction. Applied buffer zones can therefore be wider than local regulations and may in practice be chosen with regard to the characteristics of the sprayer, e.g. boom section width. Other factors such as applied dosage and vegetation strips may also need to be considered.

The data to be recorded and the mode of collection shall be in accordance with Table 6.

Table 6 — Buffer zones

Level	Data recorded	Mode of collection
1	Size of required buffer zone(s) (see 3.1) Self-engagement in the respect of buffer zone(s)	Manual
2	Respect of buffer zone(s) ensured by GNSS system	Manual/automatic
3	Respect of buffer zone(s) by the sprayer controller system based on Table 2, level 3	Automatic
For the recording format of the parameter, see ISO 11783-10:2009, D.30 Partfield — PFD, D.33 Position — PTN.		

4.2.7 Soil type

Depending on the properties of the soil type, products can be absorbed or degraded in different ways. The product used could have an effect on crops grown in the soil and present a risk of leakage through the soil. Restrictions of use on specified soil types can be found on product labels.

The data to be recorded and the mode of collection shall be in accordance with Table 7.

Table 7 — Soil type

Level	Data recorded	Mode of collection
1	Soil parameters (sandy soil, clay soil, etc.) determined and expressed in accordance with good agricultural practices (GAP)	Manual
2	Results of soil analysis EXAMPLE Clay content, organic matter, pH.	Manual
3	Using GIS (geographical information system) database information	Automatic

4.2.8 Field surface geometry

Slope and other factors in the field can be relevant for protection against surface run-off according to good agricultural practices (GAP)[1)].

1) Food and Agriculture Organization of the United Nations (FAO)

The data to be recorded and the mode of collection shall be in accordance with Table 8.

Table 8 — Field surface geometry

Level	Data recorded	Mode of collection
1	Record e.g. the presence of slopes	Manual
2	Map indicating e.g. the location of slopes	Manual
3	Geographical information system (GIS) location	Automatic

4.3 Crop

4.3.1 Type

The crop type is relevant for ensuring that the product can be used according to its approval and for the relevant purpose, e.g. disease control.

The data to be recorded and the mode of collection shall be in accordance with Table 9.

Table 9 — Type

Level	Data recorded	Mode of collection
1	Crop type EXAMPLE Winter wheat, oil-seed rape, potatoes, apple trees.	Manual
2	Verification from certificate from seeds or plant	Manual
3	Automatic identification system, e.g. correlated to data mode of collection during planting, or automatic detection system	Automatic
For the recording format of the parameter, see ISO 11783-10:2009, D.10 Crop Type — CTP.		

4.3.2 Variety

The variety is relevant, as products can have different restrictions for use between varieties.

The data to be recorded and the mode of collection shall be in accordance with Table 10.

Table 10 — Variety

Level	Data recorded	Mode of collection
1	Brand name	Manual
2	Verification from certificate from seeds or plant	Manual
3	Automatic identification system, e.g. correlated to data mode of collection during planting, or automatic detection system	Automatic
For the recording format of the parameter, see ISO 11783-10:2009, D.11 CropVariety — CVT		

4.3.3 Growth stage or crop development stage

The growth stage or crop development stage at the time of treatment can be relevant, as weeds, diseases or insects can cause different levels of damage depending on the growth or crop development stage. Products can have limitations on earliest or latest use or dose recommendations related to the growth stage. Growth stages can be described or determined following (e.g. BBCH and Zadok scales) or days or years after planting for annual and perennial crops.

Special attention shall be given to tree and bush crops regarding relevant factors such as crop density, row spacing and crop height.

The data to be recorded and the mode of collection shall be in accordance with Table 11.

Table 11 — Growth stage or crop development stage

Level	Data recorded	Mode of collection
1	Self-determination of growth stage	Manual
2	Determination made by sensor technology EXAMPLE Infrared/ultrasonic system, LIDAR (light detection and ranging).	Manual
3	Determination made by sensor technology EXAMPLE Infrared/ultrasonic system, LIDAR or aerial imaging.	Automatic

4.4 Reason for treatment

4.4.1 Types of weed, disease or insect

The types of weed, disease or insect that are treated can be relevant for choosing the right product or dose and may be given as the name used in local GAPs or the Latin name.

The data to be recorded and the mode of collection shall be in accordance with Table 12.

Table 12 — Type or types of weed, disease or insect

Level	Data recorded	Mode of collection
1	Type(s) of weed, disease or insect	Manual
2		
3		

4.4.2 Frequency of weed, disease or insect

The frequency of a weed(s), disease(s) or insect(s) may be recorded as the number per unit area, per plant, per leaf, or per another unit used in local GAPs.

The data to be recorded and the mode of collection shall be in accordance with Table 13.

Table 13 — Frequency of weeds, diseases or insects

Level	Data recorded	Mode of collection
1	Frequency of weed(s), disease(s) or insect(s)	Manual
2		
3		

4.4.3 Other treatments

For any other treatments of the field, e.g. defoliants, growth-regulators and liquid nutrients, the data to be recorded and the mode of collection shall be in accordance with Table 14.

Table 14 — Other treatments

Level	Data recorded	Mode of collection
1	Reason for treatment	Manual
2		
3		

4.5 Spray liquid

4.5.1 Name and type of product for treatment by spraying

The product's trade name shall be recorded.

The type of product used, e.g. herbicide, fungicide, insecticide, growth-regulator, fertilizer, and the manner in which the product works, e.g. contact or systemic, may also be given.

When using plant protection products that are toxic to pollinating insects, record whether the plants are present in the flowering stage, including weeds.

The data to be recorded and the mode of collection shall be in accordance with Table 15.

Table 15 — Name and type of product

Level	Data recorded	Mode of collection
1	Trade name(s) of product(s)	Manual
2	Bar code registration	Manual/automatic
3		

4.5.2 Active ingredients

The standard names of active ingredients in the product used and their content may be given in percent, g/l or g/kg — information found on the product label.

The data to be recorded and the mode of collection shall be in accordance with Table 16.

Table 16 — Active ingredient(s)

Level	Data recorded	Mode of collection
1	Active ingredient(s) and content	Manual
2	Bar code registration	Manual
3		

4.5.3 Formulation

The formulation of the product may be given using generally accepted definitions, e.g. DF (dry flowable), SG (water soluble granules), EC (emulsifiable concentrate), SP (water soluble concentrate), EW (emulsion oil in water), T (tablet), FS (flowable concentrate), WG (water dispersible granules), FL (flowable), WP (wettable powder) and SC (suspension concentrate) — information found on the product label.

The data to be recorded and the mode of collection shall be in accordance with Table 17.

Table 17 — Formulation type

Level	Data recorded	Mode of collection
1	Formulation	Manual
2	Bar code registration	Manual
3		

4.5.4 Additives

Additives can have a significant influence on the properties of the spray liquid and performance of the product. An additive can be added to the spray liquid by the operator, e.g. surfactants, oil, drift retardants. Information is recorded as a brand name and dose or concentration.

The data to be recorded and the mode of collection shall be in accordance with Table 18.

Table 18 — Additives

Level	Data recorded	Mode of collection
1	Additive(s)	Manual
2		
3		

4.5.5 Water

The origin of water can be relevant as the presence of bacteria in water can have effects on health when sprayed on crops or products that are to be eaten. The quality of water can also influence the pre-harvest interval. The origin can be given as, e.g. stream water, from buffer tank or ground water. Other parameters can be relevant, for example temperature, and pH.

The data to be recorded and the mode of collection shall be in accordance with Table 19.

Table 19 — Water

Level	Data recorded	Mode of collection
1	Origin of water	Manual
2		
3		

4.6 Dose

4.6.1 Intended dose per unit area or volume or concentration of product

The dose may be recorded per unit area or volume unit, for example l/ha, g/ha, kg/ha, tablet/ha, g/m^3 or as a concentration. This might not be possible if dose variation is undertaken intentionally as a variable rate application.

The data to be recorded and the mode of collection shall be in accordance with Table 20.

Table 20 — Intended dose per unit area or volume or concentration of product

Level	Data recorded	Mode of collection
1	Intended dose	Manual
2		
3		

4.6.2 Total amount of product used

The total amount of each product used during the treatment may be recorded in, e.g. grams, kilograms, litres or number of tablets.

The data to be recorded and the mode of collection shall be in accordance with Table 21.

Table 21 — Total amount of product(s) used

Level	Data recorded	Mode of collection
1	Total amount of product(s) used	Manual
2		
3		

4.6.3 Pre-harvest interval

The pre-harvest interval might be relevant for the amount of residues in a harvested crop and is specified on the label of the product used.

The data to be recorded and the mode of collection shall be in accordance with Table 22.

Table 22 — Pre-harvest interval

Level	Data recorded	Mode of collection
1	Pre-harvest interval	Manual
2		
3		

4.7 Application technique

4.7.1 Sprayer

The sprayer used for the treatment may be recorded in respect of its type, e.g. boom-sprayer, band-sprayer, air-assisted sprayer, knapsack-sprayer, tunnel sprayer, and main technical features, e.g. boom width, nominal tank volume, type of fan.

The data to be recorded and the mode of collection shall be in accordance with Table 23.

Table 23 — Sprayer

Level	Data recorded	Mode of collection
1	Type of sprayer and main technical features	Manual
2		
3		

4.7.2 Sprayer adjustment

Sprayer adjustment can have a great influence on the effect of the treatment, residues in the treated crop and drift. Sprayer adjustment may be recorded as driving speed (km/h), boom height, nozzle type and size, number and position of nozzles, nozzle angle and liquid pressure and/or air pressure or air flow rate.

The data to be recorded and the mode of collection shall be in accordance with Table 24.

Table 24 — Sprayer adjustment

Level	Data recorded	Mode of collection
1	Nozzle type and size and liquid pressure and/or air pressure or air flow rate plus — for boom sprayers, boom height and driving speed, and — for air-assisted sprayers, number and position of nozzles used during the treatment	Manual
2		
3		

4.7.3 Liquid volume rate

The volume of spray liquid used may be recorded in litres per treated area or crop volume/leaf area.

The data to be recorded and the mode of collection shall be in accordance with Table 25.

Table 25 — Liquid volume rate

Level	Data recorded	Mode of collection
1	Liquid rate	Manual
2	Liquid rate	Manual, by sprayer computer
3	Liquid rate	Automatic, by sprayer computer

4.7.4 Spray quality (droplet size nominal value)

The spray quality can be relevant for the effect of the treatment and the environmental risk, particularly for spray drift, and is related to the nozzle type, size and liquid pressure. The droplet size may be recorded according to the nozzle/sprayer manufacturer's information, e.g. using the BCPC classification[3] as fine, medium, coarse or very coarse.

The data to be recorded and the mode of collection shall be in accordance with Table 26.

Table 26 — Spray quality

Level	Data recorded	Mode of collection
1	Spray quality	Manual
2		
3		

4.7.5 Drift reduction management

Record drift reduction management classified if possible according to local regulations and GAPs.

The data to be recorded and the mode of collection shall be in accordance with Table 27.

Table 27 — Drift reduction

Level	Data recorded	Mode of collection
1	Drift reduction management	Manual
2		
3		

4.7.6 Technical check and inspection

Regular technical checks and inspections of the sprayer, made by the operator or other parties, could be required by legislation and/or in quality assurance systems. The parts of the sprayer to be checked will be defined in legislation, standards or quality assurance schemes. Regular inspection of the complete sprayer, performed by authorized staff, can be required by legislation and/or quality assurance systems.

The data to be recorded and the mode of collection shall be in accordance with Table 28.

Table 28 — Technical check and inspection

Level	Data recorded	Mode of collection
1	Technical check by operator	Manual
2	Inspection of sprayer by certified body	Manual/automatic
3	Automatic check of sprayer functions	Automatic

4.8 Date and time of treatment

The date and time of the treatment can be necessary for identifying and verifying the recorded weather conditions, crop development stage and other relevant factors during the spraying operation.

The data to be recorded and the mode of collection shall be in accordance with Table 29.

Table 29 — Date and time for treatment

Level	Data recorded	Mode of collection
1	Date of treatment; times of start and completion of treatment	Manual
2	Times of start and completion of treatment of field	Manual
3	Times of start and completion of treatment of field	Automatic

4.9 Weather

4.9.1 Wind speed and wind direction

Wind speed and wind direction are relevant for reducing the risk of drift and are measured in the treated field. Measurements may be made at 2 m height for field crops or 1 m over the canopy for tree and bush crops, or other measurement methods given in local regulations or GAPs may be used.

The data to be recorded and the mode of collection shall be in accordance with Table 30.

Table 30 — Wind speed and wind direction

Level	Data recorded	Mode of collection
1	Wind speed and direction	Manual
2	Wind speed and direction	Automatic collection and manual recording
3	Wind speed and direction	Automatic collection and registration of data by meteorological station

4.9.2 Temperature and relative humidity

The temperature and relative humidity during the spraying operation are relevant for the effect of the treatment and the risk of drift, and are measured in the shade in the treated field. Other methods of measurement given in local regulations or demanded in contracts may be used.

The data to be recorded and the mode of collection shall be in accordance with Table 31.

Table 31 — Wind speed and wind direction

Level	Data recorded	Mode of collection
1	Temperature and relative humidity	Manual
2	Temperature and relative humidity	Automatic collection and manual recording
3	Temperature and relative humidity	Automatic collection and registration of data by meteorological station