International Standard ISO 5690/1

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Equipment for distributing fertilizers — Test methods — Part 1: Full width fertilizer distributors

Matériels de distribution des fertilisants — Méthodes d'essai — Partie 1: Distributeurs d'engrais en nappe

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 5690/1 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

This second edition cancels and replaces the first edition (ISO 5690/1-1982) annex A of which has been revised technically.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Contents

Equipment for distributing fertilizers — Test methods — Part 1: Full width fertilizer distributors

0 Introduction

The aim of this part of ISO 5690 is to harmonize the testing of full width solid fertilizer distributors, first to fix the variable conditions of laboratory testing, and second to give guidance for field test conditions.

The laboratory tests determine the influence of forward speed, flow rate, fertilizer level in hoppers, bumps and transverse tilting.

Optional field tests (see annex B) will complete the laboratory tests by describing the influence of slope, the condition of the ground and of the wind.

1 Scope and field of application

This part of ISO 5690 specifies a test method for equipment for full width distribution of solid fertilizers; it applies to agricultural full width fertilizer distributors.

NOTE — Equipment designed for distributing microgranular pesticides or herbicides is excluded. Part 2 of ISO 5690 deals with distributors of fertilizers in lines. (See ISO 3339/0 for the classification.)

2 References

ISO 500, *Agricultural tractors — Power take-off and drawbar — Specification.*

ISO 565, *Test sieves — Woven metal wire cloth, perforated plate and electroformed sheet — Nominal sizes of openings.*

ISO 3339/0, *Tractors and machinery for agriculture and forestry — Classification and terminology — Part 0 : Classification system and classification.*

ISO 3534, *Statistics — Vocabulary and symbols.*

ISO 3789, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Location and method of operation of operator's controls —*

Part 1: Common controls.

Part 2: Controls for agricultural tractors and machinery.

ISO 3944, *Fertilizers — Determination of bulk density (loose).*

ISO 5698, *Agricultural machinery — Hoppers — Manual loading height.*

ISO 5699, *Agricultural machines, implements and equipment — Dimensions for mechanical loading with bulk goods.*

3 Definitions

The definitions relating to the distribution of fertilizers will be covered in ISO 3339/5.

For the purpose of this part of ISO 5690, the following definition applies.

application rate (of fertilizer): The quantity, expressed as mass or volume, of fertilizer distributed per unit length or unit area.

4 General test conditions

NOTE — The manufacturer or his representative shall be entitled to be present at the tests.

4.1 Fertilizer distributor

4.1.1 Selection

The fertilizer distributor to be submitted to testing may be selected by the representative of the test station in agreement with the manufacturer.

The fertilizer distributor shall, in every regard, be strictly in accordance with the specifications which the manufacturer is required to send to the test station in writing.

The test report (see annex C) shall specify how the distributor to be tested has been selected.

4.1.2 Manufacturer's instructions

The distributor shall be used in accordance with the instructions given in the manufacturer's user's handbook, to avoid in particular the use of fertilizers which are specified as not suitable for the machine. Any restrictions of this kind should be specified in the test report.

4.1.3 Checking of specifications

During the checking of specifications, the distributor shall rest on a solid horizontal surface.

4.2 Fertilizer

4.2.1 Types of fertilizer used for the tests

Carry out, unless indicated otherwise by the manufacturer of the machine (comment in the test report), each of the performance tests with the following types of fertilizer :

— type a: a powdered fertilizer;

— type b: a granular fertilizer;

— type c: a crystalline or prilled fertilizer;

— type d: optionally, any other fertilizer which the test station considers of sufficient importance and the physical properties of which differ from those of the fertilizers indicated above.

4.2.2 Physical properties of the fertilizer

Determine the physical properties of the fertilizer used in the tests (see annex A) : particle size, (loose) bulk density, moisture content, angle of repose. (The last two are under study.) These values shall be noted in the test report.

4.3 Filling of distributor

Fill the hopper with the fertilizer in accordance with the specifications of the manufacturer of the distributor immediately prior to testing so that there is no time for settling or consolidation.

4.4 Test procedure

The tests shall be carried out on an even, horizontal and hard surface, either indoors or outdoors. In the case of outdoor testing, for mandatory tests, the wind speed shall not exceed 2 m/s; for optional tests, the wind speed shall not exceed 7 m/s.

If the tests are carried out on concrete or on the ground, precautions shall be taken to avoid ricochet.

The p.t.o. rotational frequency shall be that for which the distributor is designed. The p.t.o. rotational frequency on the tractor shall be in accordance with ISO 500.

If the manufacturer provides different instructions, the rotational frequency used shall be quoted in the test report. Prior to testing, check the p.t.o. rotational frequency.

The forward speed at which runs are made shall be constant. The forward speeds for testing are 8 km/h or 15 km/h by choice of the manufacturer, except for tests on the effect of forward speeds. The distributing mechanism shall be at the same height above the fertilizer-collecting receptacles (for example the upper edge of the containers) as that recommended by the manufacturer for work above ground or crop.

4.5 Distribution application rates

The planned distribution quantities are as follows :

a) **powdered fertilizers**: 600 kg/ha and maximum and minimum quantities currently used in agricultural practice for this type of fertilizer;

b) **granular fertilizer**: 400 kg/ha and maximum and minimum quantities currently used in agricultural practice for this type of fertilizer;

c) **crystalline or prilled fertilizer**: 150 kg/ha and maximum and minimum quantities currently used in agricultural practice for this type of fertilizer.

The transverse tests for evenness shall be carried out at rates a), b), c), and with the maximum quantity and the minimum quantity as shown by the manufacturer in the features of the equipment.

The longitudinal tests shall also be carried out with rates a), b) and c).

4.6 Devices for receiving fertilizer

The collecting containers shall have external dimensions of either 1 000 mm × 250 mm, or 500 mm × 500 mm and shall have a minimum depth of 150 mm. However, for full-width distributors, only containers of 1 000 mm × 250 mm shall be used.

Measures shall be taken to avoid spillage by ricochet out of the containers, such as

— interlocking inserts for dividing the containers into cells of dimensions 50 mm × 50 mm, with a height not exceeding half the height of the container (see figure 1);

— unstretched net (see figure 2) draped over the containers.

5 Mandatory tests [1)]

5.1 Evenness of transverse distribution

5.1.1 Arrangement of containers

Containers (see 4.6) placed side by side with their edges parallel to the ground surface shall cover the total distributing width so that their longitudinal axis is parallel to the forward axis of the distributor.

If it is necessary to allow spaces between the containers for the passage of tractor wheels, these shall be as small as possible and shall be a multiple of the width of a container.

5.1.2 Procedure

Carry out the test at 8 km/h or 15 km/h with a half-full hopper but with a quantity of fertilizer not exceeding 2 t.

1) For the optional tests, see annex B.

Distribute each quantity envisaged (see 4.5) in at least two runs without intervening weighing so as to eliminate the influence of lengthwise distribution unevenness. The number of runs shall be sufficient to ensure that the amount collected by a container allows weighing with a minimum accuracy of 1 % (0,1 g per 10 g).

Successive runs shall be perfectly coincident with each other. The number of runs and the quantities distributed shall be quoted in the test report.

Weigh the fertilizer collected in each container.

5.1.3 Tilt (to simulate transverse imbalance)

Repeat the previous test

— in the case of trailed equipment by driving one of the wheels of the distributor on to moving rollers raised 100 mm;

— in the case of mounted equipment, by driving one of the wheels of the tractor on to moving rollers in order to give a lateral inclination of 7 % (in the case of adjustable track widths, use the maximum width setting).

5.2 Evenness of longitudinal distribution

5.2.1 Arrangement of containers

5.2.1.1 Case of full-width distributors

Arrange the containers side by side in five rows 10 m long so that their longitudinal axis is perpendicular to the forward axis of the distributor.

These five rows are arranged as follows:

— one on the axis of the distributor;

— two to the right and two to the left of the axis so that the outer edge of the outer row is located at the end of the theoretical working width given by the manufacturer and the middle row is at the same distance from the outside row as from the centre row.

In order to limit the number of containers to be used, each side may be tested in succession. The centre row can be dispensed with for trailed distributors with a small space between wheels. The two intermediate rows are then placed as close as possible to the run of the outer edges of the tyres.

5.2.1.2 Case of centrifugal distributors

A single row of containers is necessary.

This row is located between the wheels of the distributor and/or of the tractor, or, in the case of a narrow-tracked trailed distributor, on the outside of the wheels but as near as possible to the run of the outer edges of the tyre.

5.2.2 Procedure

Distribute each quantity envisaged (see 4.5) in a single run.

5.2.3 Effect of forward speed

Carry out this test for distributors fitted with a dispersing mechanism which is land-wheel driven. Perform the test at 8 km/h or 15 km/h, and at the maximum speed shown by the manufacturer, using the opening adjusted to the quantities envisaged (see 5.5) and a half-filled hopper but with the quantity of fertilizer not exceeding 2 t.

5.2.4 Effect of bumps (mandatory for trailed distributors and optional for mounted distributors)

Repeat the test conditions (see 5.2.3) with only the speeds of 8 km/h or 15 km/h and maximum.

Place in the path of the trailer, or of the tractor if the equipment is mounted, and perpendicular to the axis of displacement, an obstacle 200 mm long and 80 mm high, preceded by a ramp of 250 mm minimum length and having a width greater than that of the tyres, allowing the machine to rise 80 mm above ground level.

In the case of a trailer, the wheels of the distributor shall pass over the obstacle but those of the tractor shall not.

5.3 Programming of mobile tests

In order to avoid unnecessary duplication of tests, certain tests can be eliminated as being of no interest and for others one run can be used for two tests (see the table).

Table — Programming of mobile tests

Test		Speed	Application rate	Type of fertilizer
Type	No.	km/h (see 4.4)	kg/ha (see 4.5)	(see 4.2.1)
a) **Transverse regularity**	101	8 or 15	min.	a or c
	102	8 or 15	600 or 150	a or c
1) horizontal distributor	103	8 or 15	max.	a or c
	104	8 or 15	min.	b
	105	8 or 15	400	b
	106	8 or 15	max.	b
	107	8 or 15	min.	d[1]
	108	8 or 15	max.	d[1]
2) inclined distributor	109	8 or 15	min.	a or c
	110	8 or 15	max.	a or c
	111	8 or 15	min.	b
	112	8 or 15	max.	b
	113	8 or 15	min.	d[1]
	114	8 or 15	max.	d[1]
b) **Longitudinal regularity**	201	8 or 15	600	a
	202	8 or 15	400	b
1) without bumps	203	8 or 15	150	c
	204	optimal	600	a
	205	optimal	400	b
	206	optimal	150	c
	207	max.	600	a
	208	max.	400	b
	209	max.	150	c
2) with bumps	210	8 or 15	600	a
	211	8 or 15	400	b
	212	8 or 15	150	c
	213	max.	600	a
	214	max.	400	b
	215	max.	150	c

1) Optional.

5.4 Rate tests

Measures shall be taken to collect all the fertilizer.

Carry out the tests with the types of fertilizer envisaged (see 4.2.1) with the hopper half full but the quantity of fertilizer not exceeding 2 t.

5.4.1 Effect of flow adjustment

Use a sufficient number of adjustments to establish the approximate shape of the curve representing the flow in relation to the position of the control lever (five tests per type of fertilizer) by covering the range of flow shown by the manufacturer.

The duration of each test shall be such that a quantity of fertilizer sufficient to be weighed can be obtained. It should not be less than 30 s. In order to convert flows expressed in kilograms per second into quantities expressed in kilograms per hectare, use the optimum working width as previously established in 5.1.

5.4.2 Effect of the level of fertilizer in the hopper

Adjust the feed setting so as to obtain a flow as near as possible to 0,1 kg/s per metre of distribution width.

Fill the hopper, unless its capacity is in excess of 2 t, in which case use 2 t.

Start up the feed mechanism.

Take samples over a period of 1 min at regular intervals during emptying until complete emptying is achieved.

This test will be limited to fertilizer type a.

6 Results

6.1 Transverse distribution

6.1.1 Weighing

Weigh the quantities collected in each container separately. Divide each of these values by the number of runs in order to determine the mean quantity distributed per run, and illustrate using a histogram.

For ease of comparison of the results, the following scales are recommended:

— horizontal axis : 1 cm per 1 m;

— vertical axis : 1 cm per 20 %.

(See the graph in figure 3.)

6.1.2 Degree of unevenness of transverse distribution

The degree of unevenness shall be shown by the coefficient of variation (see ISO 3534), a, given by the equation

$$a = \frac{s}{\bar{x}}$$

where

s, the standard deviation, is given by the equation

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

in which

n is the number of containers;

x_i is the amount collected in each container;

$\bar{x}$, the absolute mean, is given by the equation

$$\bar{x} = \frac{1}{n}\sum x_i$$

6.1.3 Working width

6.1.3.1 Full-width distributors

The optimum width of work of full-width distributors shall be that stated by the manufacturer.

6.1.3.2 Centrifugal distributors

The test station shall determine the optimum width by using the histogram (see 6.1.1). This shall be established by using the methods described in the two following cases:

a) for circular distribution, superposition by translation of the histogram,

b) for to-and-fro distribution, superposition by translation of the histogram with its mirror image,

to plot the graph of the coefficients of variation.

In agreement with the manufacturer, the lowest coefficient of variation corresponding to a working width compatible with the way of using the fertilizer shall be taken.

6.1.4 Irregularities of transverse distribution on sloping ground

Establish the results in accordance with the principles specified in 6.1.2 and 6.1.3.

6.2 Longitudinal distribution

6.2.1 Forward speed index

Evenness of longitudinal distribution shall be recorded and a graph shall be prepared for each row of containers. Should no particular unevenness be found in the longitudinal distribution, show the standard deviations on the test length by summarizing the extent of the variations. If significant cyclic variations occur, show their origin and amplitude, if necessary after taking careful measurements.

6.2.2 Effects of bumps

Follow the same procedure as in 6.2.1.

6.3 Rate testing

6.3.1 Flow adjustment effects

Prepare a graph showing the correlation between the control lever positions and flow (see figure 4).

6.3.2 Effects of fertilizer level in the hopper

Note the results as a percentage in relation to the first recording.

7 Test report

A typical model of a test report is shown in annex C.

Dimensions in millimetres

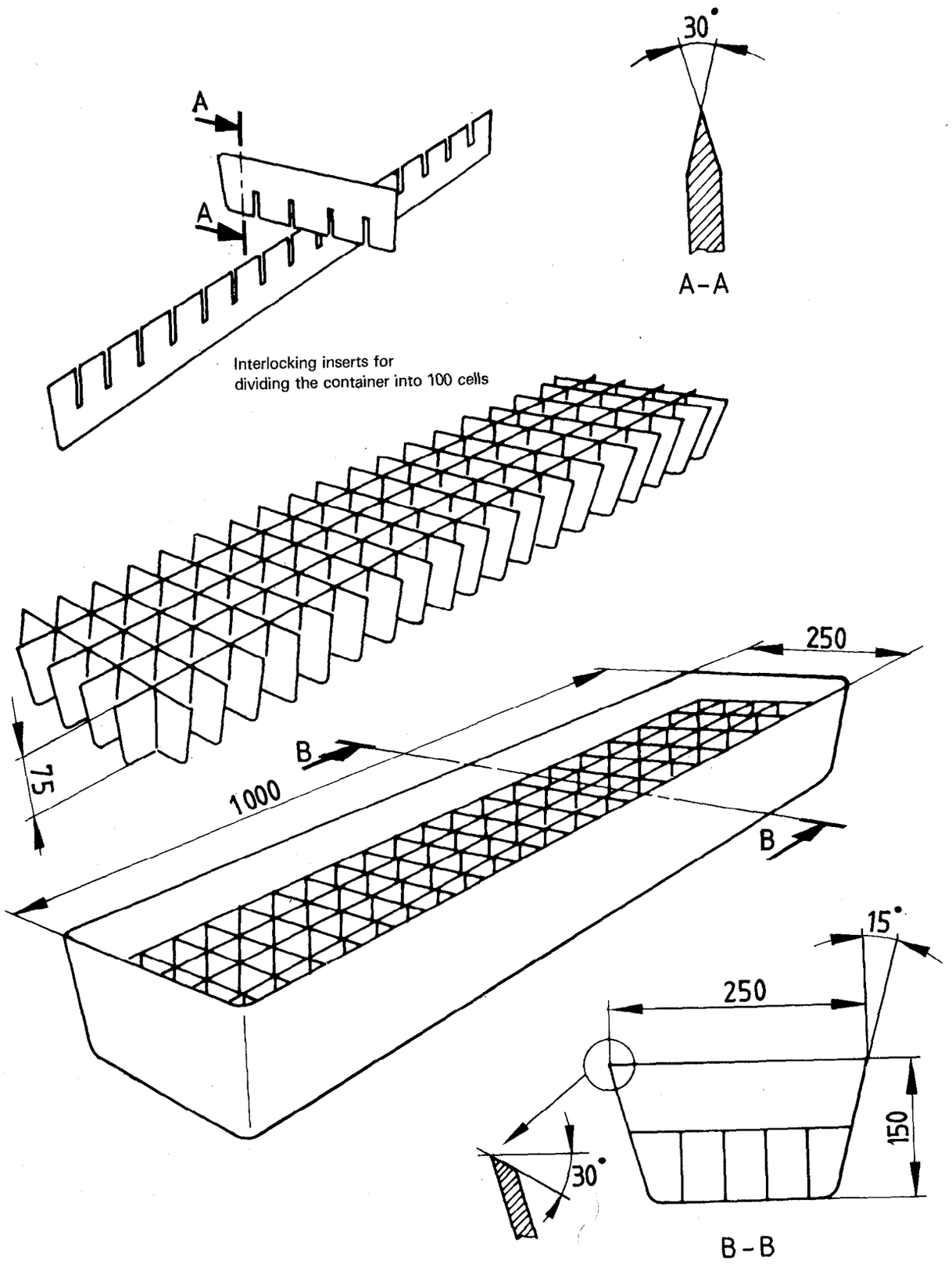

Figure 1 — Example of a fertilizer-collecting container for fertilizer distributor tests

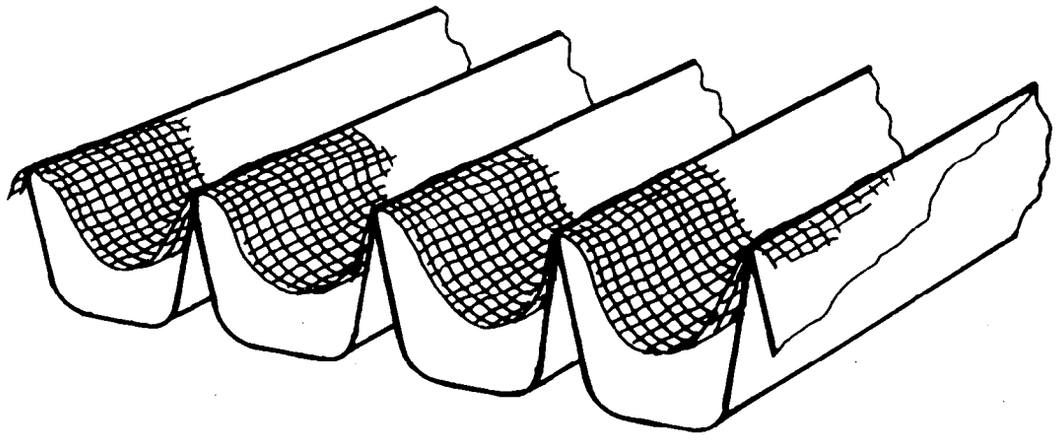

Figure 2 — Example of arrangement of a protective net over the containers to protect against ricochet

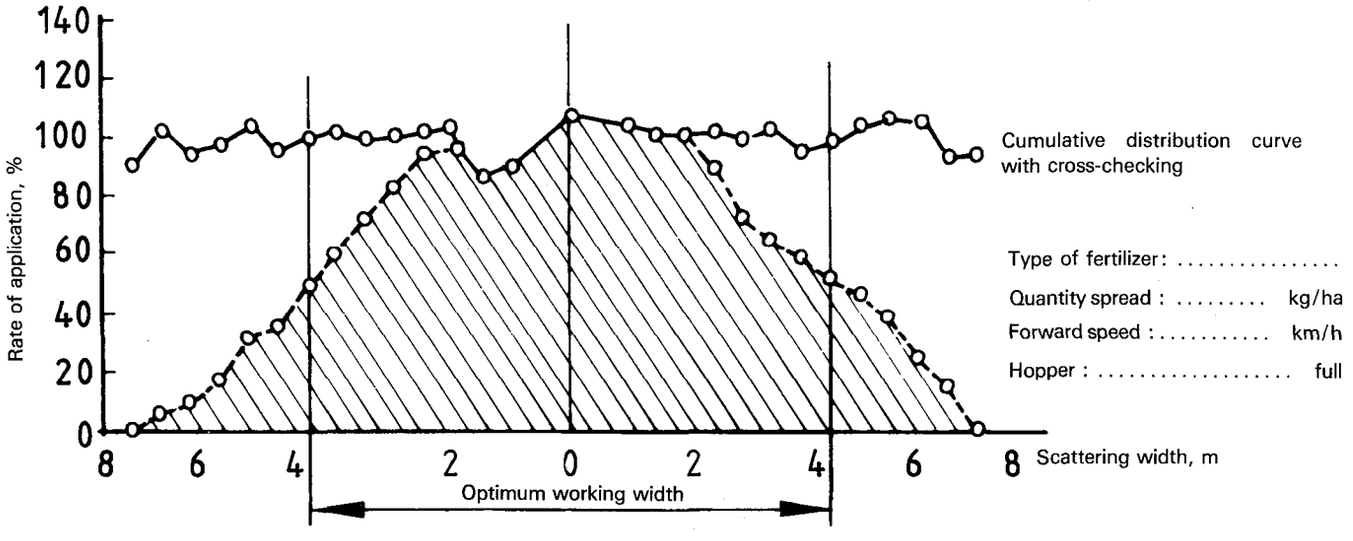

Figure 3 — Schematic example showing evenness of transverse distribution

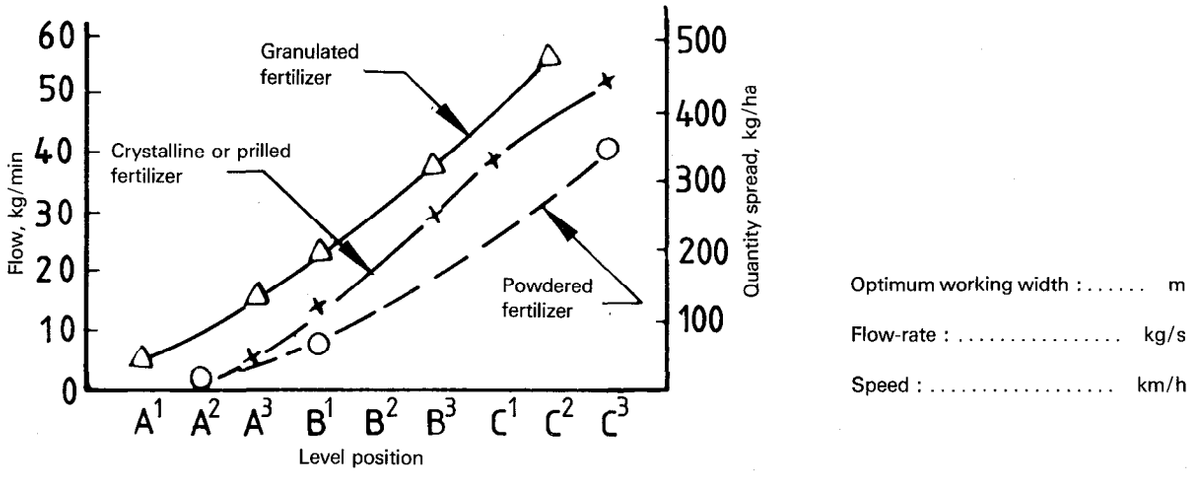

Figure 4 — Schematic example of flow test

Annex A

Determination of physical properties of fertilizers

A.0 Introduction

This annex classifies commercially available fertilizers to be used for testing fertilizer distributors. On no account may these recommendations be taken as specifications for them. In some cases, additional treatment may be necessary to obtain sufficient fertilizers to ensure complete conformity.

A.1 Granulometric analysis

The classifications of granulometry are laid down with respect to fertilizer products of commercial manufacture; their granulometry shall normally be within the size ranges indicated[1] :

Group 1 : 0 to 0,180 mm
Group 2 : 0,180 to 0,710 mm
Group 3 : 0,710 to 1,700 mm
Group 4 : 1,70 to 4,00 mm
Group 5 : 4,00 to 8,00 mm

By convention, the fraction containing more than 50 % will determine the classification of the fertilizer. 90 % of the granulometry sizes of fertilizer shall be within the two or three adjoining groups.

A.2 Volumetric mass unheaped

See ISO 3944.

A.3 Determination of moisture content

Under study.

A.4 Angle of repose

Under study.

1) The granulometric sizes correspond to the sieve opening sizes specified in ISO 565.

Annex B

Optional tests

B.1 Special conditions for carrying out optional tests

B.1.1 Duration and organization

The machine shall work for a minimum of 10 h during the test (longer if possible) and the work shall extend over at least one "distributing season", i.e. autumn or spring. Both top-dressing and ground dressing shall be included and care shall be taken to work under a range of meteorological conditions representative of the country concerned.

B.1.2 Fertilizer

As wide a variety of materials as possible shall be handled during the field work including, where appropriate, farm-stored materials which are in less than perfect condition, with the provision that the fertilizer should not be so badly caked that it is unreasonable to expect the test machine to distribute it.

B.1.3 Forward speed

For each field condition, the maximum practicable forward speed shall be recorded together with details of limiting factors (for example, tractor bounce, operator comfort, uneven distribution of fertilizer).

B.1.4 Slope and nature of the ground

If, when working on sloping or rough land, the evenness of distribution is appreciably affected, this shall be reported. State the slope as a percentage and the direction of travel of the distributor in relation to the slope.

B.2 Site, aims and limitations

These tests are carried out *in situ*. They shall allow visible operating faults to be noted. Under no circumstances does this test concern robustness.

B.2.1 Ease of use

B.2.1.1 Ease of assembling for work

Indicate the ease of coupling and uncoupling on a representative number of tractors as well as the number of people necessary to carry out these operations.

B.2.1.2 Ease of loading

Show the dimensions relating to ease of loading. Indicate whether these dimensions satisfy ISO 5698 and ISO 5699.

B.2.1.3 Ease of access to controls and ease of operation

In the case of self-propelled implements, indicate whether the controls satisfy ISO 3789.

B.2.2 Ease of adjustment

Pay very special attention to the facility with which the operator can obtain a required quantity and determine the optimum adjustment for all the controls or adjustment devices exercising an influence on the evenness of distribution. Indicate also the extent to which the service manual renders the operator's task easy in this area and the languages in which it is printed.

B.2.3 Efficiency of mixing

Indicate the efficiency of the mixing system used to prevent bridging, irrespective of the test conditions and show the state of the fertilizer giving rise to such difficulties.

Indicate the degree of damage to the fertilizer particles caused by the mixing mechanism.

B.2.4 Evenness of distribution

Carry out the distribution using the optimum working width (see 7.1.1). In addition, show the detailed test results, any remarks relating to evenness of distribution and the conditions which may have an effect on the evenness of distribution — in particular:

— condition of terrain;

— speed and direction of wind in relation to the forward direction of the distributor. After several weeks, examine the areas where the fertilizer has been applied to check for the existence of stripes or other unevenness.

B.2.5 Turning facility

In the case of towed machines, state whether the presence of the machine makes turning difficult.

B.2.6 Maintenance and cleaning

Estimate the ease of daily and periodic maintenance. Similarly note the ease of daily and periodic cleaning and certain special features such as access to the working parts, facilities for emptying, resistance to corrosion.

B.2.7 Structural strength

Point out any failure or deformation owing to the structure of the machine which occurs during testing.

B.2.8 Slope inclination test

If the topography of the ground permits, carry out two runs each, up, down and across a slope with a minimum 15 % inclination. Note the results.

Annex C

Example of a test report on a full width fertilizer distributor

Name and address of manufacturer : .....

Name and address of importer : .....

Method of selection of distributor : .....

Date and place of testing : .....

C.1 Features of the fertilizer distributor

Make : .....

Type : .....

Model : .....

Serial No. : .....

Year of manufacture : .....

C.1.1 Description

Short description of distributor. Show also whether it is possible to operate the distributor so that the distribution is done on only one side at a time (for headlands and cultivation in lines).

C.1.2 Dimensions and specifications

C.1.2.1 Common to all types

C.1.2.1.1 All models

Overall length (with control levers located as far as possible so as to project beyond the body of the implement) : ..... m

Overall height of the distributor not hitched to tractor : ..... m

Overall width : ..... m

Loading height : ..... m

Unladen mass : ..... kg

Numbering code of instruments (only on mounted implements) : .....

Hopper capacity (level) : ..... m^3

Other (accurate) dimensions significant in identifying the model tested : .....

p.t.o. rotational frequency : ..... 540 to 1 000 min^{-1}

Maximum working speed allowed by manufacturer : ..... km/h

Maximum flow allowed by manufacturer : ..... dm^3/s

Minimum flow allowed by manufacturer : ..... dm^3/s

Number of feed adjustment positions : .....

C.1.2.1.2 Towed machines

Tyre dimensions : ..... x .....

Radius under load : ..... m

and corresponding inflation pressure : ..... kPa

Track set : ..... mm

Ground clearance : ..... mm

Distribution of loads at maximum loading

drawbar eye : ..... kg

rear axle : ..... kg

front axle : ..... kg

Method of braking : .....

C.1.2.2 Centrifugal distributors

Height of discs or mechanism above the soil or crop as recommended by the manufacturer (machine in operation) : ..... mm

Diameter of discs : ..... mm

Distance between discs (if there are several of them) : ..... mm

Means of drive : mechanical/hydraulic[1)]

Rotational frequency of disc(s) recommended by manufacturer : ..... min^{-1}

Number of positions of the angular distribution control device : .....

Arrangement of blades on the disc : .....

C.1.2.3 Oscillating tube distributor

Height of the centreline of the tube at the fertilizer exit above the soil or crop as recommended by the manufacturer (machine in operation) : ..... mm

Length of tube : ..... mm

Diameter of tube at fertilizer exit : ..... mm

Oscillating angle : ..... °

Oscillating frequency : ..... min^{-1}

Nature of materials : .....

Method of drive : mechanical/hydraulic[1)]

1) Delete as appropriate.

C.1.2.4 Full-width distributors

Means of transfer of fertilizer : pneumatic/mechanical[1)]

Working width : ..... m

Distribution mechanism (short description summary) : .....

Number of outlets : .....

and distance between each outlet : .....

Height of the distributor mechanism, for example spreading plates above ground or crop when working as recommended by the manufacturer : ..... mm

Type of metering mechanism : .....

Method of drive for the metering mechanism : mechanical/hydraulic[1)]

Maximum flow by mass (for pneumatic distribution devices) : ..... kg/s

C.2 Physical properties of the fertilizer

Physical property	Types of fertilizer			
	a: Powder	b: Granular	c: Crystalline or prill	d: Other types
	Percentage passing through the sieve			
Granulometric size, mm: 0 to 0,180 0,180 to 0,710 0,710 to 1,700 1,70 to 4,00 4,00 to 8,00				
Bulk density (loose), kg/m³				
Moisture content, %				
Angle of repose, °				

C.3 Test methods

Wind

— speed : ..... m/s

— direction in relation to forward movement of the machine : .....

Humidity : ..... %

1) Delete as appropriate.

C.4 Test results

C.4.1 Mandatory tests

C.4.1.1 Evenness of transverse distribution on flat ground

C.4.1.1.1 Statistical results

Coefficient of variation.

C.4.1.1.2 Graphic results

Graph showing correlation between optimum working width and the degree of variation (see figure 3 for model).

C.4.1.2 Evenness of transverse distribution on sloping ground

Follow the same presentation as in 4.1.1.

C.4.1.3 Evenness of longitudinal distribution

Effect of forward speed.

C.4.1.3.1 Test without jolting

Table for each speed.

Types of fertilizer	Degree of variation in the following quantities					
	Min. as per manufacturer's instructions kg/ha	Powder 600 kg/ha	Granular 400 kg/ha	Crystalline or prill 200 kg/ha	Others kg/ha	Max. as per manufacturer's instructions kg/ha
a: Powder						
b: Granulated						
c: Crystalline or prilled						
d: Other						

Graph for each speed

C.4.1.3.2 Effects of jolting

Prepare same tables and graphs for each speed as in C.4.1.3.1.

C.4.1.4 Rate tests

C.4.1.4.1 Effects of flow adjustment

Graph showing correlation between the lever position and flow. (See figure 4 for model.)

C.4.1.4.2 Effects of fertilizer level in the hopper

Recordings	Percentage of mass of first reading
First recording	100
Second recording	
Third recording	
Fourth recording	
Fifth recording	

C.4.2 Optional tests (if carried out)

C.4.2.1 Fertilizer

C.4.2.2 Speed progress

C.4.2.3 Slopes and jolts

C.4.2.4 Ease of use

C.4.2.5 Ease of adjustment

C.4.2.6 Blocking and shaking

C.4.2.7 Evenness of distribution

C.4.2.8 Turning

C.4.2.9 Maintenance and cleaning

C.4.2.10 Structural strength

C.5 Remarks .....

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