
International Standard



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Sowing equipment — Test methods — Part 2 : Seed drills for sowing in lines

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Foreword

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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.

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It has been approved by the member bodies of the following countries :

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Contents

	Page
0 Introduction	1
1 Scope and field of application	1
2 References	1
3 Definitions	1
4 General test conditions	2
5 Mandatory tests	2
6 Test procedure	4
7 Results	4
8 Test report	5
Annexes	
A Programming of mandatory tests	6
B Optional tests	7
C Example of test report on a seed drill for sowing in lines	9

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Sowing equipment — Test methods — Part 2 : Seed drills for sowing in lines

0 Introduction

The aim of this part of ISO 7256 is to make available to test offices and other interested organizations a standardized test method permitting reproducibility of tests when they are carried out in geographically remote areas and/or in different climatic conditions; the main objective being comparability for any one model of equipment.

This condition of reproducibility limits the number of mandatory tests which can be used and eliminates mandatory tests in the field. However, these tests may be carried out optionally at the instigation of the test office or at the request of the manufacturer.

The test method takes into account the effects of the type of seed, the level of seed in the hopper, the application rate adjustment, the forward speed, the slope of the ground and the condition of the soil surface (bumps).

1 Scope and field of application

This part of ISO 7256 specifies a test method for seed drills for sowing in lines, including seed drills attached to a basic machine.

The test method permits the determination of performance using reproducible tests so that comparable results in numerical or graphical form which take into account the influence of the following can be obtained:

- type of seed;
- the forward speed;
- the level of seed in the hopper;
- the application rate adjustment;
- the slope of the ground;
- the condition of the soil surface (bumps).

Optional tests (see annex B) may supplement the test method by taking into account the effects of products used for treatment and distribution on the sowing site.

The mandatory tests do not give any picture of the true distribution of the seeds on the sowing site.

NOTE — Part 1 of ISO 7256 deals with single seed drills (precision drills). (See ISO 3339/0 for the classification.)

2 References

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

ISO 3339/4, *Tractors and machinery for agriculture and forestry — Classification and terminology — Part 4: Sowing and planting equipment.*¹⁾

ISO 3534, *Statistics — Vocabulary and symbols.*

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

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

ISO 7424, *Agricultural equipment — Matching of wheeled tractors and rear mounted implements — Code numbering system.*

3 Definitions

For the purpose of this part of ISO 7256, the following definitions apply.

3.1 seed drills for sowing in lines: See ISO 3339/4.

3.2 feed mechanism (for seed): A mechanism which takes seed from a hopper and transfers it at a constant determined flow rate into a furrow created by the coulter.

3.3 flow rate (of seed): The quantity, expressed as mass or volume, of seed sown per unit time.

3.4 application rate (of seed): The quantity, expressed as mass or volume, of seed sown per unit length or unit area.

1) At present at the stage of draft.

3.5 hopper height: The internal height of the hopper, *H*, shall be the vertical distance between the lower edge of the outlets and the lower edge of the top of the hopper.

4 General test conditions

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

4.1 Seed drills

4.1.1 Selection

The seed drill to undergo testing may be selected by the representative of the test office in agreement with the manufacturer.

The seed drills shall, in all respects, conform strictly to the specifications which the manufacturer is required to send to the test office in writing.

The test report (see annex C) shall specify how the seed drill to be tested was chosen.

If the test on the seed drill is associated with a test on a basic machine, the seed drill chosen shall be that attached to the basic machine to be tested.

4.1.2 Manufacturer's instructions¹⁾

Use the seed drill in accordance with the manufacturer's instructions, which shall specify, among other things

- a) the maximum working speed, expressed in kilometres per hour or in metres per second;
- b) the types of seed which the seed drill can sow or discharge;
- c) in the case where the device includes several interchangeable mechanisms, the types of feed mechanism and types of seed which can be sown or discharged by each model;²⁾
- d) the maximum and minimum application rates permitted by the feed mechanism(s) for each type of seed;
- e) any accessories which may be required for distributing certain types of seed;
- f) the inflation pressure, if the seed drill or the basic equipment is fitted with pneumatic tyres.

4.1.3 Checking of specifications

The technical characteristics supplied by the manufacturer shall be checked and shall be noted in the test report. When comparing laboratory test results with application rate and flow rate

data supplied by the manufacturer, it shall be noted that manufacturer's data may have been adjusted for wheel slip-page.

4.2 Seed

4.2.1 Types

Each of the performance tests shall be carried out with the following seeds:

- type a: an average size seed of regular shape, wheat (mandatory);
- type b: a small round seed (for example clover);
- type c: a light bearded seed (for example rye-grass from Italy);
- type d: a large, irregular shaped seed (for example field bean).

If the manufacturer judges his seed drill to be unsuitable for the sowing of one or more types of seed, these types will be excluded from the tests and the fact noted in the test report.

NOTE — For the mandatory reproducible tests, these seeds should not have been subjected to any treatment (with phytosanitary or other products) likely to modify their physical characteristics.

4.2.2 Physical characteristics

The seed used shall be of current commercial quality.

The dimensions, germination percent, bulk density, mass of 1 000 seeds, purity (percentage of foreign bodies, broken seed and bad seed), and the water content of each batch shall be noted in the test report.

4.3 Ambient conditions

The degree of atmospheric humidity shall be noted in the test report.

5 Mandatory tests³⁾

5.1 Nature of tests (see annex A)

The essential aim of these tests is to determine the evenness of the flow rate and the accuracy of metering.

These tests shall be carried according to two methods:

- static tests;
- mobile tests;

to give the appropriate results.

1) These instructions shall be attached to the test report.

2) Applicable to seed drills for ergot.

3) For the optional tests, see annex B.

5.1.1 Static tests

With the seed drill stationary, the drive wheel shall rest on a drive mechanism. It shall be driven at a speed equal to that which it would have in actual operation, that is at the theoretic forward speed of the seed drill travelling without slipping.

5.1.2 Mobile tests

The seed drill shall be driven at a constant speed on a hard and uniform surface. An adhesive strip, or visual or acoustic processes shall be laid on the surface over which the seed drill passes.

5.2 Distance between the feed mechanism and the surface

Care shall be taken that the mechanism is placed, in relation to the surface (for example an adhesive strip), at an average distance corresponding to that in actual operation.

5.3 Types of tests

5.3.1 Evenness of flow rate

The test shall be carried out with the machine stationary. The seed shall be collected in separate troughs placed under each feed mechanism or coulter.

5.3.2 Accuracy of metering

If the test has to be carried out with the machine stationary, in order to establish the relative seed drill/ground displacement, a suitable method shall be used; for example an adhesive strip shall be passed under the coulter, which will move in the opposite direction to the direction of movement of the seed drill at the theoretic speed of the seed drill travelling without slipping. The seed shall be deposited on the adhesive strip and shall be counted. The method shall be noted in the test report.

If the test has to be carried out with the machine mobile, it shall be moved over a fixed adhesive strip laid on the surface. The seeds shall be deposited on the adhesive strip and shall be counted.

5.3.3 Metering tests with bumps

To simulate bumps, place, along the course of each wheel of the equipment, a series of obstacles of height 50 mm and length 200 mm, preceded by a 150 mm ramp and placed in such a way that the obstacles are met with simultaneously by both wheels. Each course shall include at least three pairs of obstacles distributed over its length so that the distance between two obstacles is not less than 4 m.

5.4 Adjustments and measurements

5.4.1 Selection of feed mechanisms

1) In the case of multirow equipment.

5.4.1.1 Flow tests

Each test shall be carried out simultaneously on all feed mechanisms of the seed drill.

5.4.1.2 Application rate tests

Each test shall be carried out simultaneously or successively on three feed mechanisms, one at the centre and one at each end of the seed drill.¹⁾

5.4.2 Filling the hopper

Load the seed, in accordance with the specifications of the manufacturer, into the hopper immediately prior to testing so that there is no time for settling or consolidation.

5.4.3 Forward speed

The speeds of the seed drill relative to the ground, corresponding to normal working speeds, shall be 1,50 m/s, 2,50 m/s, and the maximum admissible speed. If one or more of these speeds is considered unacceptable by the manufacturer, it shall be replaced by one recommended by the manufacturer; mention of this shall be made in the test report.

For static tests, if the driving wheel is mounted on tyres, the rotary speed, ω , is given by the equation

$$\omega = \frac{v}{2\pi R}$$

where

v is the speed of travel;

R is the radius of the tyre under average load.

5.4.4 Adjustment of application rates

The tests shall be carried out at three rates:

- a) minimum: the minimum rate given by the manufacturer;
- b) maximum: the maximum rate given by the manufacturer;
- c) mean: arithmetic mean of the minimum and maximum rates.

If a mean rate cannot be obtained within the range of adjustments of the seed drill, take the nearest rate which this range of adjustments allows, and note this in the test report.

5.4.5 Slope tests

The slope tests shall be carried out as follows:

- a) ascending a slope : incline the seed drill 11° towards the rear (corresponding to a 20 % slope);
- b) descending a slope : incline the seed drill 11° towards the front;
- c) slope to the right : incline the seed drill 11° to the right;
- d) slope to the left : incline the seed drill 11° to the left.

5.4.6 Duration of metering tests

The number of tests may vary according to the length of the test rig, which shall provide an overall effective length of 30 m. Before each reading a sufficient time shall be allowed for cancelling out the unevennesses due to starting up accelerations and to allow the establishment of flow of the seed through the spout of the feed mechanism.

5.4.7 Taking measurements

5.4.7.1 Flow rate test

The seeds collected in a trough shall be weighed. Five runs lasting 30 s shall be made for each test.

5.4.7.2 Metering test

Measurement shall be carried out by counting the seeds deposited.

Where measurement is to be noted, divide the strip into sections of 100 mm in the direction of the length, and record the number of seeds contained in each section.

NOTES

- 1 When an adhesive strip is used, it is useful, before adhesive is applied, to draw parallel lines on the strip 100 mm apart perpendicular to the direction of forward movement.
- 2 In the case of visual or acoustic processes, a graphic means of recording on recording tape is generally used. The tape shall be cut into sections of length corresponding to the time necessary for the seed drill to travel 100 mm.

6 Test procedure

The programming of the mandatory tests shall comply with annex A.

6.1 Effect of the seed level in the hopper (test 1)

Determine whether the level of seeds in the hopper (settling or blocking) has an influence on the evenness of the flow rate.

6.2 Effect of the flow rate (test 2)

Determine the combined effect of the application rate adjustment and the forward speed. Determine whether the flow rate has an influence upon

- a) the evenness of flow (test 21);

- b) the accuracy of metering (test 22).

NOTE — A flow rate test shall be repeated to check the reliability of the adjustment mechanism of the feed mechanisms.

6.3 Effect of slope (test 3)

Determine whether the position of the equipment working on sloping ground has an influence on the evenness of flow.

6.4 Effect of bumps (test 4)

Determine whether bumps due to the unevenness of the ground (stony or lumpy ground) have an influence on the accuracy of metering.

7 Results

NOTE — The statistical terms used in this clause are defined in ISO 3534.

7.1 Flow rate test

7.1.1 Calculate the mean of five readings for each test to obtain a single flow figure, *D*.

7.1.2 Calculate the mean deviation in the readings according to the formula

$$\frac{D_{\max} - D_{\min}}{D} \times 100$$

7.2 Metering test (longitudinal and transverse distribution)

7.2.1 Draw up a frequency table showing the number, *x*, of seeds included in each section of 100 mm; the number of times, *n_i*, a given *x* occurs; and the associated frequency, *f_i*, calculated according to the equation

$$f_i = \frac{n_i}{n}$$

where

$$n = \sum n_i .$$

Calculate the mean number, \bar{x} , of seeds per section

$$\bar{x} = \frac{\sum n_i x}{\sum n_i}$$

and insert in the frequency table, opposite each *x_i* value, the value of the variable given by the equation

$$X_i = \frac{x_i}{\bar{x}} (\bar{x} = 1)$$

7.2.2 Plot a frequency histogram with the *x_i* values on the abscissa and the corresponding *f_i* values on the ordinate.

7.2.3 Calculate the standard deviation, s , according to the equation

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

where X is the number of seeds recorded in 100 mm band.

The coefficient of variation, a , is equal to $\frac{100 s}{\bar{x}}$.

8 Test report

See details in annex C.

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Annex A

Programming of mandatory tests

Table 1

Designation of test	Type of test	No. of test	Conditions of tests							
			Slope	Seed level in hopper ¹⁾	Forward speed, m/s	Application rate adjustment	Type of seed (see 4.2.1)			
1 Effect of seed level in the hopper	static	100	none	—	1,50	min.	a			
		101		1/8	max.	max.	a			
		102		—	1,50	min.	b			
		103		1/8	max.	max.	b			
		104		—	1,50	min.	d			
		105		1/8	max.	max.	d			
2 Effect of flow rate 21 Evenness of flow	static	210	none	1/2	1,50	min.	a			
		211		—	2,50	mean	a			
		212		—	max.	max.	a			
		213		—	1,50	min.	a ²⁾			
		214		—	1,50	min.	b			
		215		—	max.	max.	b			
		216		—	1,50	min.	c			
		217		—	max.	max.	c			
		218		—	1,50	min.	d			
		219		—	max.	max.	d			
		22 Accuracy of metering		mobile	220	none	1/2	1,50	min.	a
					221		—	2,50	mean	a
					222		—	max.	max.	a
					223		—	1,50	min.	b
224	—		max.		max.		b			
225	—		1,50		min.		c			
226	—		max.		max.		c			
227	—		1,50		min.		d			
228	—	max.	max.	d						
3 Effect of slope 31 Frontal	static	310	20 % when ascending	1/2	max.	max. ³⁾	a			
		311		—	2,50	mean	a			
		312		—	max.	max. ³⁾	b			
		313		—	2,50	mean	b			
		314	—	1,50	mean ³⁾	a				
		315	20 % when descending	—	2,50	min.	a			
		316		—	1,50	mean ³⁾	b			
		317		—	2,50	min.	b			
		32 Lateral	static	320	20 % to the right	1/2	2,50	mean	a	
				321		—	2,50	mean	b	
322	20 % to the left			—	2,50	mean	a			
323		—	2,50	mean	b					
4 Effect of bumps	mobile	400	none	1/2	1,50	min.	a			
		401		—	max.	max.	a			
		402		—	1,50	min.	b			
		403		—	max.	max.	b			
		404		—	1,50	min.	c			
		405		—	max.	max.	c			
		406		—	1,50	min.	d			
		407		—	max.	max.	d			

- 1) The hopper shall be full except where stated otherwise.
- 2) Repeat the test to examine the reliability of the adjustment.
- 3) When the seed outlet is situated at the rear of the feed mechanism. If the outlet is situated at the front, the adjustments are changed as follows :

No. of test	Forward speed m/s	Application rate adjustment
310	1,50	min.
312	1,50	min.
314	max.	max.
316	max.	max.

Annex B

Optional tests

B.0 Introduction

These tests are left to the discretion of test offices. They should allow the observation of visible operating faults. Under no circumstances do they concern robustness testing.

B.1 Ease of use

The loading facility (the dimensions of which shall comply with ISO 5698 and ISO 5699), adjustment and cleaning shall be demonstrated as well as the possible effect of the presence of the seed drill upon the ease of use of the basic machine.

B.2 Evenness of distribution on the sowing site

B.2.1 Nature of tests

These tests carried out on the sowing site are concerned basically with the precision of placement and the regularity of feed as well as the influence of seed settling in the hopper.

B.2.2 Test conditions

The sowing site shall be relatively level cultivated earth, of uniform nature and structure.

The depth of working of the soil for the previous crop, the nature of the terrain, its structure (size and distribution of clods of earth as shown by vertical section), resistance to water, and temperature at the depth of sowing, shall be noted in the test report.

The duration of the test shall be sufficient to obtain meaningful results.

The machine, from when it is started up until the end of the test, shall function under normal working conditions; i.e. it shall not stop except for the half turns normal at the extremities of the sowing site.

If one test only is carried out, it shall be performed at average speed and flow for the type of seed used.

The depth of sowing shall be that normally adopted for this type of cultivation. It shall be noted in the test report.

The types of seed to be sown during these tests shall be the responsibility of the individual test office. However, they shall include at least one test on a seed likely to cause blocking. During this test, particular attention shall be paid to the flow of the seed, in order to detect signs of blocking.

B.3 Effect of agrochemical treatment of seed

B.3.1 Nature of test

Determine the influence of products for treating seed on the precision of the feed mechanism.

B.3.2 Test conditions

The test shall be made on a type of seed (preferably with a rough surface to provide maximum retention of the product used for treatment) chosen by the test office.

If national legislation requires it, this treatment may be made with a non-toxic product or a dummy treatment product.

B.3.3 Method of operation

The test shall be carried out with the seed drill stationary, on three feed mechanisms, either simultaneously or successively. The feed mechanism shall run at maximum speed for approximately 30 min, the hopper constantly being supplied with treated seed. During the period of operation of the metering device, three checks shall be made:

- one at the start of the period;
- one in the middle of the period;
- one at the end of the period.

B.3.4 Aim of the test

B.3.4.1 Determination

Determine whether the product used for treatment has an influence on the evenness of flow — particularly where the quantity of flow is low (faults in the discharge).

B.3.4.2 Test programme (see table 2)

Table 2

Description of test	Type of test	Slope	Seed level in hopper	Theoretical forward speed m/s	Adjustment of application rate	Type of seed (see 4.2.1)
Effect of products for treating seeds	static	none	variable	max.	max.	a or b or d

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