INTERNATIONAL STANDARD 1162

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Cereals and pulses — Method of test for infestation by X-ray examination

Céréales et légumineuses — Méthode de détection de l'infestation au moyen des rayons X

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 34 has reviewed ISO Recommendation R 1162 and found it technically suitable for transformation. International Standard ISO 1162 therefore replaces ISO Recommendation R 1162-1970 to which it is technically identical.

ISO Recommendation R 1162 was approved by the Member Bodies of the following countries :

Australia	Germany	Poland
Brazil	Greece	Romania
Chile	Hungary	Turkey
Czechoslovakia	India	United Kingdom
Egypt, Arab Rep. of	Iran	U.S.S.R.
France	Israel	

No Member Body expressed disapproval of the Recommendation.

The Member Body of the following country disapproved the transformation of ISO/R 1162 into an International Standard :

United Kingdom

Printed in Switzerland

Cereals and pulses — Method of test for infestation by X-ray examination

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for the detection and measurement of hidden infestation due to insects in grain, pulses and similar material, by means of X-rays.

NOTE — Pest damage and current infestation can both be detected by this method, but insects recently killed (for example by fumigation) may be difficult to distinguish from those still living.

2 REFERENCES

ISO/R 950, *Cereals — Sampling (as grain).*

ISO/R 951, *Pulses — Sampling.*

3 PRINCIPLE

Spreading of a test portion in a layer, one grain thick, on a support interposed between a source of X-rays and a radiographic film; exposure to soft X-rays and examination of the film after development.

4 APPARATUS

The apparatus and installation shall comply with the rules in force in each country with regard to the construction of generators and their accessories and to installations for the production and use of X-rays.

4.1 X-ray apparatus

An X-ray source according to the following specification has been found satisfactory.

4.1.1 *Power supply*

The machine shall not require more than 2 kW of electrical power.

4.1.2 *X-ray tube*

The X-ray tube shall be suitable for producing primarily "soft" X-rays. These X-rays have low penetrating power and because of this the X-ray tube is usually fitted with a beryllium window.

The effective focal spot of the X-ray tube shall be as small as possible but not less than 1,5 mm × 1,5 mm.

4.1.3 *X-ray control*

For most grains it is usual to use an X-ray apparatus producing X-rays in the range of about 20 kV[1)] and 5 mA. In some cases it will be necessary to have X-rays of higher energy, up to 50 kV. In such cases the voltage shall be variable continuously or stepwise between 15 and 50 kV and the current shall be variable between 0 and 20 mA.

The X-ray apparatus shall be equipped with a line voltage control, by means of which fluctuations in line voltage may be compensated. The compensated line voltage shall be read on a special voltmeter, on which the correct value should be marked. The X-ray apparatus shall have an X-ray tube indicator, preferably a milliammeter.

An electric time clock to switch the machine off at the end of the exposure, although not essential, is nevertheless useful. This timer should have a time range of not less than 10 min.

4.1.4 *Mounting*

The X-ray tube shall be mounted in such a way as to ensure that the useful X-ray beam covers the whole area of the largest X-ray film used during the exposure.

4.1.5 *Radiation protection*

The apparatus shall be mounted inside a cabinet protected by lead sheeting, to ensure that the working conditions outside the cabinet are safe as defined in national radiation protection requirements. A lead thickness of 1,5 to 2 mm will generally be adequate. The lead lining of the cabinet shall be covered with plywood on the outside or shall have an adequate paint coating. Access for changing the film and sample can be obtained via a hinged panel equipped with an interlock switch so that the machine cannot be operated with the panel open.

Diagrams of suitable arrangement of the apparatus are shown, for information only, in figures 1 and 2.

4.1.6 *Earthing*

It is essential that the apparatus be electrically earthed.

1) Voltages quoted in this International Standard are *peak values.*

4.2 Film-processing equipment

Any suitable equipment for processing X-ray film may be used. Normal photographic darkroom facilities can accommodate this equipment.

4.3 Viewing screen

Any suitable, commercially available, X-ray film viewing screen may be used.

5 MATERIALS

5.1 X-ray film, of suitable size as indicated in the note to 7.1.1, packed in individual light-tight envelopes.

5.2 Developer, to suit the film used.

5.3 Fixing solution, to suit the film used.

6 SAMPLE

Use a final lot sample of the grain or pulse, obtained as specified in ISO/R 950 or ISO/R 951.

7 PROCEDURE

7.1 Test portion

7.1.1 It is recommended that in case of dispute the test portion should be of such a size that it will cover completely a film area of at least 750 cm^2 with a layer one grain thick.

NOTE – This quantity corresponds to about 10 000 grains of wheat or 3 000 grains of maize. To accommodate the test portion it will be necessary to use several films (for example, three 25 cm × 30 cm films) and to radiograph them individually.

7.1.2 It is possible, however, to detect infestation to a sufficient degree of approximation if a smaller test portion (for example 1 000 to 1 200 grains of wheat) is used. By agreement between the parties concerned, this smaller test portion, which is applicable in particular for rapid routine purposes, may be substituted for that specified in the note to 7.1.1.

7.1.3 The size of the test portion used shall be recorded in the test report.

7.2 Examination

7.2.1 *Exposure*

During the exposure the film remains in its light-tight envelope. Put this in the position shown in figure 1 or figure 2. It is useful to mark the film with the number of the sample. This may be achieved by placing small lead figures and letters on the film together with the grain. The number will then appear on the film after processing.

Ensure that the lead-lined doors at the front of the cabinet are closed during the exposure.

Choose a duration of exposure to suit the nature of the sample and the film being used, so as to reach a film density of not less than 1,0. A minimum of 45 s will normally enable living insects to be distinguished from dead insects.

7.2.2 *Development*

Take the exposed film to the darkroom, remove it from its envelope and process it by the method recommended by the film manufacturer.

7.2.3 *Examination of film*

To facilitate examination, divide the film area into squares of suitable size, for example 5 cm, by scratching with a pointed implement. Then examine the film by means of the viewing screen (see 4.3).

An alternative procedure is to place a wire-mesh grid with squares of suitable size over the film envelope. This ensures that all the grains will lie on one side or other of the grid lines, thus removing the objections that some of the scratched grid lines may cut across images of the grains.

8 EXPRESSION OF RESULTS

8.1 Interpretation of film

In general, the grain or pulse itself appears white or grey on the negative. Any cavity within the grain is represented by a dark region, and an insect within the cavity appears light in colour.

With practice it is possible to distinguish all stages of an insect (for example *Sitophilus*), including the egg. The movement of a live insect, with consequent slightly blurred outlines, may sometimes distinguish it from a dead insect.

8.2 Method of expression

Indicate the number of grains containing insects, as a percentage of the total number examined.

Alternatively, express the result as the number of infested grains per unit mass of sample.

9 TEST REPORT

The test report shall show the method used, the size of the test portion, the result obtained and the method of expression employed; if possible, it shall indicate the stages of development of the insects present. It shall also mention any operating conditions not specified in this International Standard, or regarded as potional, as well as any circumstances that may have influenced the result.

The report shall include all details required for the complete identification of the sample.