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Working Party on Standardization of
Perishable Produce and Quality Development

Specialized Section on Standardization of Seed Potatoes
Thirty-second session, Geneva, 4 to 6 March 2002

REPORT OF THE THIRTY-SECOND SESSION

Addendum 1

Note by the secretariat

This document contains the revised UNECE Standard for Seed Potatoes (S-1) as agreed by the Specialized Section on its thirty-second session for transmission to the Working Party for adoption.

S-1: Seed Potatoes

UNECE STANDARD
concerning the certification and
commercial quality control of

SEED POTATOES
moving in international trade between and to
UNECE member countries

INTRODUCTION

In October 1949, the Economic Commission for Europe's Committee on Agricultural Problems established the Working Party on Standardization of Perishable Foodstuffs¹. The Working Party was entrusted with the task of "determining common standards for perishable foodstuffs" and "studying steps to be taken on the international level in order to secure the general adoption of standards and control systems".

The standards have been drawn up within the framework of the Geneva Protocol on Standardization of Fruits and Vegetables, adopted by the Working Party in 1958 and last amended in 1984. They apply to produce moving in international trade and are intended for application at the export control point by the control authorities of the exporting countries.

The standard contained in this document is a revision of the UN/ECE Standard for Seed Potatoes adopted by the Working Party at its 58th session (28-31 October 2002). The standard introduces provisions for the subdivisions of categories into international classes and minimum conditions for production of pre-basic TC.

¹*At its twenty-fifth session in 1974, the Committee extended the responsibility of the Working Party to cover non-edible horticultural produce, and agreed to change the name of the Working Party to "Working Party on Standardization of Perishable Produce" in order to reflect the greater scope of its activities. The name of the Working Party was further changed by the Committee at its forty-second session to reflect the Working Party's involvement with quality development.*

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UNECE STANDARD S-1
concerning the certification and
commercial quality control of

SEED POTATOES
moving in international trade between and to
UNECE member countries

I. DEFINITION OF PRODUCE

Seed potatoes are tubers or any other propagation material, other than true seed, of *Solanum tuberosum L.* which, after regular inspection :

1. during growth
2. at sorting
3. during verification inspection

are certified by an officially approved body as suitable for reproduction.

This standard does not apply to seed potatoes :

1. intended for trials or scientific purposes
2. intended for selection work.

These shall, however, always be covered by documentary confirmation of quality by an officially approved body.

II. PROVISIONS CONCERNING QUALITY

The purpose of the standard is to define the quality requirements of seed potatoes at the export control point, after preparation and packaging.

A. Minimum requirements

Seed potatoes shall be substantially free from injurious diseases and pests and from any defects likely to impair their quality as seed. They shall be substantially dry outside and, in general, of normal shape for the variety.

These requirements shall be observed in conjunction with the standards and tolerances set out under B. Classification.

Neither growing crops of seed potatoes nor seed potatoes shall be treated with sprout inhibitors.

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B. Classification

Seed potatoes shall be classified according to variety and the standards given below. Their classification shall be subject to official control in the producing country. Seed potatoes shall be placed in two classes within each of three categories as defined below:

(i) Pre-basic Category Seed

These are seed potatoes of generations prior to basic seed

- (a) Pre-basic TC class seed shall be directly derived by micropropagation and may be tissue culture plantlets or tubers of the first generation meeting the requirements specified in Annexes I, II, III and IV.
- (b) Pre-basic class seed shall be generations of seed multiplied in the field prior to basic seed, meeting the requirements specified in Annexes II, III, and IV.

(ii) Basic Category Seed

These are seed potatoes descended directly from Pre-basic or Basic category seed or produced under special provisions of a national certification scheme and are mainly intended for the production of certified seed potatoes.²

Seed shall be classified as either Basic I or Basic II according to the minimum requirements given in Annexes II, III and IV.

(iii) Certified Category Seed

These are seed potatoes descended directly from Pre-basic, Basic or Certified category seed and are mainly intended for the production of potatoes other than seed potatoes.

Seed shall be classified as either Certified I or Certified II according to the minimum requirements given in Annexes II, III and IV.

(iv) Field generation:

Each class may additionally be classified according to the number of generations (FG1, FG2 etc.). The final designation of a class will therefore contain a class name and may contain a field generation record (e.g. Basic I FG3, Certified I FG3).

²*The representatives of the European Commission and France reserved their position on this issue.*

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C. National Classification

Producing countries are, however, free to create within the categories and classes provided for in paragraph B, classes which are subject to specific requirements.

~~B. Classification~~

~~Seed potatoes shall be classified according to variety and the standards given below. Their classification shall be subject to official control in the producing country. They shall be placed in one of the three categories defined below:~~

~~————— (i) ***Pre-basic Seed***~~

~~————— Seed potatoes of generations prior to basic seed as specified in Annex I~~

~~————— (ii) ***Basic Seed***~~

~~————— Potato tubers which are~~

~~————— (a) descended directly from Pre-basic Seed or Basic Seed or are produced under special provisions of a national certification scheme.~~

~~————— (b) are mainly intended for the production of certified seed potatoes~~

~~————— (c) meet the minimum requirements given in annexes III, IV and V for basic seed potatoes.~~

~~————— (iii) ***Certified seed***~~

~~————— Potato tubers which~~

~~————— (a) are descended directly from Pre-basic, Basic or Certified seed~~

~~————— (b) are mainly intended for the production of potatoes other than seed potatoes~~

~~————— (c) meet the minimum requirements given in annexes, III, IV and V for certified seed potatoes.~~

~~C. Subdivision of the categories~~

~~Producing countries are free to create within the categories provided for in paragraph B, classes which are subject to specific requirements.~~

D. Sampling

Sampling of seed potatoes for certification purposes shall be carried out officially or under official supervision.

E. National phyto-sanitary provisions

The provisions of this standard do not hinder national legislation provisions justified by reasons of the protection of the health of persons and animals or the protection of crops or industrial or commercial property.

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However, each producer country for the marketing of seed potatoes in the whole or any part of its territory, take more vigorous measures than those provided for in annexes II and IV against the introduction of certain regulated non-quarantine pests which do not exist there or which seem particularly injurious to the crops in that country or in any part of its territory.

F. Comparative tests

It is recommended that trials be established by national certifying authorities to ascertain the condition of the seed potatoes certified according to this standard. The guidelines given in annex VI of this standard could be followed.

The results of such trials shall be treated in confidence but on request the results relating to individual consignments may be exchanged between the certifying authorities of the importing and exporting countries concerned.

III. PROVISIONS CONCERNING SIZING

Pre-basic TC are exempt from the minimum sizing requirements.

The minimum size of tubers must be such that they do not pass through a square gauge of 28 mm; for varieties having, on average, a length of at least twice the greatest width, the square gauge must not be less than 25 mm. In the case of tubers which are too large to pass through a square gauge of 35 mm, the difference between the maximum and minimum limits of size should be expressed in multiples of 5.

The maximum variation in size between tubers in a lot must be such that the difference between the dimensions of the two square gauges used does not exceed 20 mm unless the buyer and seller agree to deviate from this requirement.

IV. PROVISIONS CONCERNING TOLERANCES FOR SIZING

A lot shall not contain more than 3 per cent by weight of tubers smaller than the minimum size indicated nor more than 3 per cent weight for tubers larger than the maximum size indicated.

V. PROVISIONS CONCERNING PRESENTATION

- (i) ***Condition of units of presentation***
Packages of up to 50 kg or one "hundredweight" (112 lbs avoirdupois) as the case may be, shall be new. Larger units of presentation shall be clean.
- (ii) ***Closing of units of presentation***

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Units of presentation shall be closed officially or under official control in such a manner that they cannot be opened without damaging the official sealing device or without leaving evidence of tampering on the official label provided for in section VI (i).

The official system of closing shall comprise either the incorporation into the system of the label mentioned above if it is without a stringhole or in all other cases, by the application of an official seal.

Only the official control service may, in case of need, reclose a package or container.

(iii) ***Weight***

With the exception of bags for Pre-Basic TC, the packaging unit for bags shall be 50 kg net, but the "hundredweight" may be used in trade with countries using that measure, unless the buyer and seller agree to deviate from these requirements.

(iv) ***Nature of contents of units of presentation***

Each unit of presentation shall contain tubers of the same variety, category, class, size and origin.

A lot should be sufficiently homogeneous.

VI. PROVISIONS CONCERNING MARKING

(i) ***Official label***

Units of presentation shall bear on the outside an official label in accordance with annex V and which has not been previously used; the label shall be white with a diagonal purple line for pre-basic seed, white for basic seed and blue for certified seed. Reference to the UN/ECE Standard may be included on the label.

(ii) ***Official statement***

Units of presentation shall have on the inside an official statement of the same colour and showing at least the particulars indicated under 3, 5 and 7 in annex V. The statement shall be so worded that any confusion with the official label referred to in (i) shall be avoided.

This statement is not necessary when an adhesive label or a label of untearable material is used. The particulars given on the label may be indelibly printed on the unit of presentation in substitution for the official statement provided for above.

(iii) ***Re-labelling***

If a second check appears necessary, the authority which carried out the second check must be stated on the label, as well as the date of the re-closing. If a new label is necessary, this must show the particulars which appeared on the old label, the date of the re-closing and the authority concerned.

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(iv) ***Supplier's label***

The units of presentation may be accompanied by a special label of the supplier.

(v) ***Chemical treatment***

The nature of the active substance of any chemical treatment of the seed potatoes shall be indicated on the outside of the unit of presentation, on a tear-resistant or adhesive label being either the official label or a label provided by the supplier, or printed on the unit of presentation. This information may also appear inside the unit of presentation.

Adopted 1963 as European Standard No. 19
Revised 1982, 1994, 1998, 2000, 2001, 2002

Annex I

~~PROVISIONS CONCERNING PRE-BASIC SEED~~

~~A. Directly derived from micropropagation~~

~~Tissue Culture plantlets or tubers of any size in the first generation directly derived thereof may be marketed under the standard provided the following conditions are complied with:~~

- ~~1. They have been certified by an officially approved body as suitable for reproduction.~~
- ~~2. Packages or containers shall be marked in accordance with the provisions concerning marking laid down in Section VI, subject to the following special conditions in respect of the official label:
 - ~~(i) the label shall be white with a diagonal purple line;~~
 - ~~(ii) the particular required in respect of the category shall be "PRE-BASIC SEED-TC".~~~~
- ~~3. They have been produced in accordance with requirements set out in annex II.~~

~~B. Not directly derived from micropropagation~~

~~Seed potatoes of generations prior to basic seed may be marketed under the standard, provided that the following conditions are complied with:~~

- ~~1. They have been certified by an officially approved body as suitable for reproduction in accordance with at least the provisions concerning quality laid down under Section II for basic seed.~~
- ~~2. They are placed in packages or containers, in accordance with the provisions concerning presentation laid down under Section V.~~
- ~~3. Packages or containers shall be marked in accordance with the provisions concerning marking laid down in Section VI, subject to the following special conditions in respect of the official label:
 - ~~(i) the label shall be white with a diagonal purple line;~~
 - ~~(ii) the particular required in respect of the category shall be "PRE-BASIC SEED".~~~~

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ANNEX H I

MINIMUM CONDITIONS TO BE SATISFIED IN THE PRODUCTION OF PRE-BASIC TC SEED POTATOES

1. The parent material must be true to type for the variety.
 2. These seed potatoes must be produced from officially certified nuclear stock which has been tested by appropriate methods.
 3. The facilities and procedures used for this production must be subject to official approval by the certification authority. Measures must be applied to avoid contamination e.g. protected environment, double door entry, protective clothing, dedicated footwear or disinfection. The record-keeping system should document the source of the material and the volume of production.
 4. The growing medium should be pest-free.
 5. All reasonable husbandry practices for the prevention or spread of pests and diseases must have been effectively carried out.
 6. The growing crop must have been kept free from *Synchytrium endobioticum* (Schilb) Prc., potato viruses, bacterial diseases and from deviations of variety and type.
 7. The satisfaction of these conditions and the tolerances prescribed for this class in Annexes II, III and IV shall be established by official inspection and/or testing. Confirmation of variety purity or trueness-to-type may be dependent on inspection of the crop derived from the seed potatoes.
-
1. ~~The facilities and procedures used must be subject to official approval by the certification authority.~~
 2. ~~The parent tuber must be true to type for the variety and the initial plantlet(s) free from pathogenic organisms.~~
 3. ~~The growing medium shall not be contaminated by *Globodera rostochiensis* (Wall) nor *Globodera pallida* (Stone).~~
 4. ~~All reasonable husbandry practices for the prevention or spread of pests and diseases must have been effectively carried out.~~
 5. ~~The growing crop must have been kept free from *Synchytrium endobioticum* (Schilb) Prc., potato viruses, bacterial diseases, and from deviations of variety or type.~~
 6. ~~Diagnostic tests shall be prescribed by the official authority.~~
 7. ~~The seed potatoes shall be practically free from defects and diseases.~~

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- ~~8. The satisfaction of these conditions shall be established by official inspection and/or testing. Confirmation of varietal purity or trueness to type will be dependent on inspection of the crop derived from this Pre-Basic material.~~

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Annex ~~HH~~ II

MINIMUM CONDITIONS TO BE SATISFIED BY THE CROP

1. The field shall not be contaminated by *Globodera rostochiensis* (Woll) nor *Globodera pallida* (Stone).
2. The proportion of growing plants affected by blackleg shall not exceed:
 - ~~(a) in crop for the production of pre-basic category seed, 0 per cent;~~
 - ~~(b) in crop for the production of Basic I class seed, 0.5 per cent and of Basic II class seed, 1 per cent;~~
 - ~~(c) in crop for the production of Certified I class seed, 1.5 per cent and of Certified II class seed, 2 per cent.~~
 - ~~(a) in crop for the production of pre basic TC seed, 0 per cent~~
 - ~~(b) in crop for the production of pre basic seed, 0 per cent;~~
 - ~~(c) in crop for the production of basic seed, 1 per cent;~~
 - ~~(d) in crop for the production of certified seed, 2 per cent.~~
3. The crop shall be free from:
 - (a) *Synchytrium endobioticum* (Schilb) Perc.
 - (b) *Clavibacter michiganensis Spp. sepedonicus* (Spieck. and Kotth.) Skapt. and Burkh.
4. Depending on the circumstances and character of potato production in the country, there may be considered:
 - (a) Requirements for isolation of the crop;
 - (b) Without prejudice to the requirements of Annex IV the establishment of tolerances for virus diseases and varietal purity.
5. The satisfaction of the above-mentioned standards or other conditions shall be established by official inspection and/or testing.
6. Depending on the circumstances and character of potato production in the country a programme of post-harvest testing for virus diseases may be considered.

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Annex ~~IV~~ III

MINIMUM QUALITY CONDITIONS FOR LOTS OF SEED POTATOES

A. Tolerances for defects and disease allowed for seed potato tubers:

1. Presence of earth and extraneous matter
 - pre-basic TC 1 per cent by weight
 - pre-basic 1 per cent by weight
 - basic and certified 2 per cent by weight

2. Dry and wet rot, where not caused by *Synchytrium endobioticum*, *Clavibacter michiganensis* Spp. *sepedonicus* (Spieck. and Kotth.) Skapt. and Burkh., *Ralstonia solanacearum* (E.F. Smith) E.F. Smith
 - pre-basic TC 0 per cent by weight
 - pre-basic 0.2 per cent by weight
 - basic and certified 1 per cent by weight

3. External defects (e.g. misshapen or damaged tubers)
 - pre-basic TC 3 per cent by weight
 - pre-basic 3 per cent by weight
 - basic and certified 3 per cent by weight

4. Common scab³: Tubers affected over a specified per cent of their surface (see Annex VIII)
 - pre-basic TC (0% surface cover) 0 per cent by weight
 - pre-basic (> 10% surface cover) 5 per cent by weight
 - basic and certified (> 33.3% surface cover) 5 per cent by weight

5. Powdery scab⁴: Tubers affected over a specified per cent of their surface
 - pre-basic TC (0% surface cover) 0 per cent by weight
 - ~~pre basic TC 0 per cent;~~

³ *Reservation by Sweden: (> 33% surface cover) for common scab, (> 10% surface cover) for rhizoctonia and 6 per cent by weight as total tolerance would be acceptable.*

⁴ *Reservations: Belgium, in favour of 0 per cent for pre-basic.
Belgium and Romania need further consultations with the trade on tolerances for basic and certified.
Greece in favour of a 1% tolerance for basic and certified seed.*

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- pre-basic (> 10% surface cover) 1 per cent by weight
- basic and certified (> 10% surface cover) 3 per cent by weight

6. Rhizoctonia : Tubers affected over a specified per cent of their surface

- pre-basic TC (0% surface cover) 0 per cent by weight
- pre-basic (> 1% surface cover)³ 1 per cent by weight
- basic and certified (> 10% surface cover) 5 per cent by weight

Total tolerance for items 2 to 6 :

- pre-basic TC 3 per cent by weight
- pre-basic 5 per cent by weight³
- basic and certified 6 per cent by weight

B. The seed potatoes shall be free from *Globodera rostochiensis* (Woll) and *Globodera pallida* (Stone), *Synchytrium endobioticum* (Schilb.) Perc., *Clavibacter michiganensis* Spp. *sepedonicus* (Spieck. and Koth.) Skapt. and Burkh., and *Ralstonia solanacearum* (E.F. Smith) E.F. Smith.

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Annex V IV

**MINIMUM CONDITIONS TO BE SATISFIED
BY DIRECT PROGENY OF SEED POTATOES**

~~1. Pre basic TC seed~~

- ~~(a) The proportion, in direct progeny, of plants of other varieties should be 0 per cent.~~
~~(b) The proportion, in direct progeny, of plants showing symptoms of mild or severe virus diseases should be 0 per cent.~~

1. **Pre-basic seed**

- (a) The proportion, in direct progeny, of plants of other varieties should be 0 per cent for Pre-Basic TC class. The proportion, in direct progeny, of plants not true to the variety and of other varieties should not exceed 0.01 per cent for Pre-Basic Class.
- (b) The proportion, in direct progeny, of plants showing symptoms of mild or severe virus diseases should not exceed:
- | | |
|---|--|
| - | 0 per cent for Pre-Basic TC class |
| - | 0.1 per cent. ^{5 6} for Pre-Basic class |

2. **Basic seed**

- (a) The proportion, in direct progeny, of plants not true to the variety should not exceed 0.25 per cent. The proportion, in direct progeny, of plants of other varieties should not exceed 0.1 per cent.
- (b) ~~The proportion, in direct progeny, of plants showing symptoms of mild or severe virus disease should not exceed 4 per cent with not more than 2 per cent showing severe virus disease.~~

The proportion, in direct progeny, of plants showing symptoms of virus disease should not exceed 2 per cent, with not more than 1 per cent showing severe virus disease, for Basic I class seed and 4 per cent, with not more than 2 per cent showing severe virus disease, for Basic II class seed.

3. **Certified seed**

⁵ *Reservation by Belgium, France and Portugal requesting 0.5 per cent tolerance.*

⁶ *Reservations by the delegations of ~~France~~, Germany and Poland ~~and~~ Portugal as regards the proportion, in direct progeny, of plants showing symptoms of mild or severe virus diseases.*

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- (a) The proportion, in direct progeny, of plants not true to the variety should not exceed 0.5 per cent. The proportion, in direct progeny, of plants of other varieties should not exceed 0.2 per cent.
- (b) ~~The proportion in direct progeny of plants showing symptoms of severe virus disease should not exceed 10 per cent. Mild mosaics merely causing discolouration and no leaf deformation should be ignored.~~

The proportion, in direct progeny, of plants showing symptoms of virus disease should not exceed 10 per cent, with not more than 5 per cent showing severe virus, for Certified I class seed and 10 per cent showing severe virus for Certified II class seed. Mild mosaic symptoms of discoloration and no leaf deformation should be ignored in categorizing virus for Certified II class seed.

- ~~4. In assessing the progeny of a variety carrying a chronic virus, account will not be taken of slight symptoms caused by the said virus.~~
- 4. The tolerances allowed under points 1 (b), 2(b), and 3. are applicable only where the virus diseases are caused by viruses already prevalent in countries applying the UN/ECE Standard for Seed Potatoes.
- 5. The incidence of virus in the direct progeny may be determined by testing a sample of tubers from the crop for virus. Annex X describes the principles of developing a sampling regime for this purpose.

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Annex V V

LABEL

A. Required particulars

1. Nature of the contents: "**Seed potatoes**"
2. The certification authority or its recognized initials
3. Country and/or region of production
4. Reference number of the lot, including where appropriate the producer's identification number
5. Month and year of closing
6. Variety
7. Category and Class and, where appropriate, record of field generation
8. Size
9. Declared net weight

B. Minimum dimensions

110 X 67 mm.

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Annex VIII VI

ORGANIZING THE INSPECTION OF CROPS GROWN FROM SAMPLE LOTS OF SEED POTATOES

(certified according to the standard)

I. PURPOSE OF THE INSPECTION

The examination of seed potatoes in crop tests enables the quality (vigour, purity, healthiness, productivity) of home-grown and imported lots put on the market to be checked at random.

II. ORGANIZATION

1. *Place of sampling*

Depending on the mode of transport (road, rail or waterway), the sample should preferably be taken when the lot arrives at its destination.

2. *Organs responsible for the sampling*

The sampling shall be done by an official department.

3. *Sampling*

(a) The lot as defined in annex VIII is the unit represented by a sample. If the lot is a large one, the number of samples shall be increased to :

- One sample per wagon or vehicle, in the case of transport by rail or road;
- One sample for every 50 tonnes, in the case of transport by ship.

(b) A sample consists of 110 tubers, taken from different places in the container or from at least 10 sacks.

(c) The sample shall be placed in a sealed sack; its label shall bear the number of the wagon or the name of the ship, in addition to the information mentioned in annex VI.

4. *Preservation of samples*

Samples shall be preserved in a uniform manner in favourable conditions.

5. *Trial fields*

(a) The land must be suitable for potato growing.

(b) Planting should be done in plots of 100 plants. The plots should be grouped by variety in order to facilitate comparison.

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- (c) Manuring must be adapted to the needs of the crop, but moderate; the use of nitrogen during growth should be prohibited.
- (d) The usual cultural care must be conducive to keeping the field clean and the foliage intact.

6. *List of plots*

A nomenclature of all the samples planted in the same field with the number of the plot concerned shall be sent to the organs responsible for evaluating them.

7. *Evaluation of the crop inspection*

In order to be accurate, the evaluation shall in principle be carried out in two stages, with an interval of 10-15 days between them. Primary virus infections should not be taken into consideration.

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Annex VIII VII

DEFINITIONS OF TERMS APPLICABLE TO THE STANDARD

The definitions provided herein apply specifically to certified seed potatoes moving into international trade under provisions of this standard and their meaning may therefore differ from their classical meaning.

Incorporation of the terms in this glossary signifies their unique use by countries which have adopted the standard.

Blackleg:

Commonly used name of a bacterial disease of potatoes, generally caused by *Erwinia carotovora* subsp. *atroseptica*. Similar symptoms may, however, be caused by *E. carotovora* subsp. *carotovora* and *E. chrysantemi*.

Certification:

An official control procedure which aims at ensuring the production and supply of seed potatoes which satisfy the requirements of this standard.

Certification authority:

Organization or agency designated and empowered by national legislation to administer the certification of seed potatoes.

Consignment:

A quantity of seed potatoes consisting of one or more lots which have been consigned to one commercial party and is covered by one set of documents.

Contaminated field:

A field made subject to regulatory action because of the presence of a designated pathogenic organism in the soil.

Disease:

Any disturbance of a plant caused by pathogenic organisms which interferes with its normal structure, function or economic value.

Field:

A defined area of land used for cultivation of seed potatoes.

Free from:

Not present in numbers or quantities that can be detected by the application of appropriate sampling, inspection and testing procedures.

Generation number

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The generation number is defined by the number of growing cycles since the first introduction in the field after micropropagation or selection.

Homogeneous :

Uniform in composition and appearance.

Inspection:

Visual examination of plants, tubers, units of presentation, equipment or facilities by an authorized person, to determine compliance with regulations.

Lot:

A quantity of seed potatoes bearing the same reference number, which has been prepared for marketing and being of the same variety, category, class, size and origin.

Mild mosaic:

Disease symptom, caused by a virus, characterized by foliage discolouration or mottle and not easily discernible by visual inspection.

Origin:

Officially defined area where a lot of seed potatoes was grown.

Phytosanitary provisions :

Provisions in accordance with the International Plant Protection Convention.

Primary virus infection:

Infection occurring during the current growing season and not arising from the seed tuber.

Quality:

The sum of all characteristics that determine the acceptance of seed potatoes in relation to the specifications of this Standard.

Quality Control:

The control by the certification authorities of all activities encountered in the process of producing and marketing seed potatoes in conformance with the Standard.

Quality pest:

A pest carried by planting material, subject to official regulatory control, but not a quarantine pest.

Quarantine pest:

A pest of potential national economic importance to the country endangered thereby and not yet present there, or present but not widely distributed and being actively controlled.

Regulated non-quarantine pest:

A non-quarantine pest whose presence in plants for planting affects the intended use of these plants with an economically unacceptable impact and which is therefore regulated with the territory of the importing part.

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Sampling:

The procedure of drawing at random a number of tubers, plants or parts of plants which may be taken as representative of the lot or the field.

Seed Potatoes:

Tubers which are certified by an official certification authority as meeting specified requirements and being suitable for reproduction.

Severe Mosaic:

Disease symptom caused by a virus, characterized by discolouration and distortion of foliage and easily discernible by visual inspection.

Sprout inhibitor:

Chemical substance, applied either to the plants during the growing season or to the tubers after harvest which suppresses or prevents the normal development of sprouts.

Substantially free:

Not present in numbers or quantities in excess of those that can be expected to result from and be consistent with normal handling and good cultural practices employed in the production and marketing of the commodity.

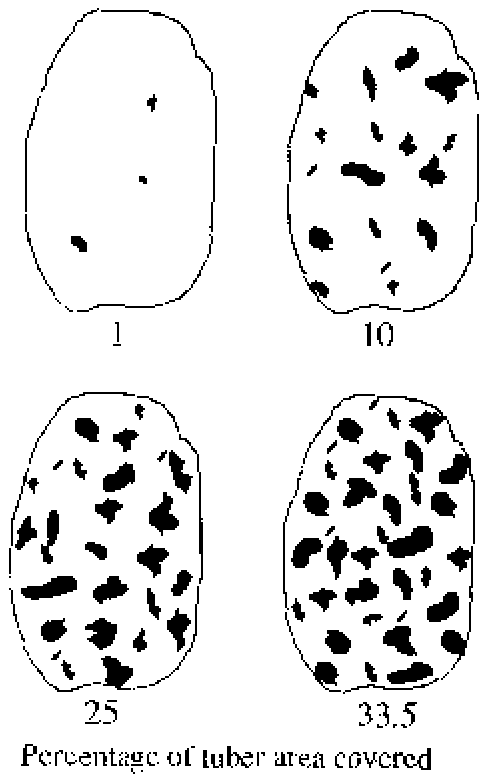
Testing:

The use of one or more procedures for determining the presence or absence of a pathogenic agent.

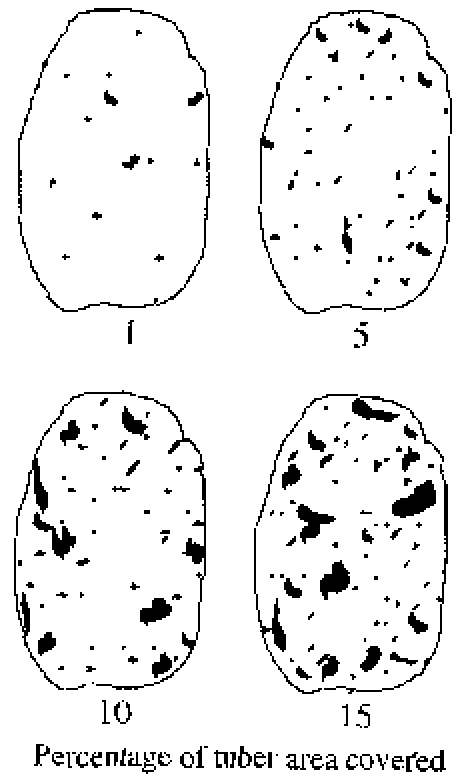
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Annex ~~X~~ VIII

Common Scab of Potatoes



Rhizoctonia of Potatoes



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Annex X IX

SAMPLING tubers for VIRUS testing

Introduction

In testing seed stocks for the incidence of virus, it is seldom feasible to test the entire stock, so a test is done on a sample from the stock. Ideally, only seed stocks with infection levels below the tolerance would be accepted and those above the tolerance rejected. However, taking a sample from a stock means that only an estimation of the actual incidence of virus can be made.

The reliability of this estimation will vary with the size of the sample, relative to the size of the lot, and the population standard which is set for the test. Defining an acceptable population standard for any sample entails two types of risk.

The first is that of rejecting a stock containing less virus than the tolerance and is often described as the “grower’s” risk. The risk of accepting a stock containing more virus than the tolerance is known as the “buyer’s” risk. From the point of view of classification authorities, this could also be described as the risk of passing a stock which fails to meet the official tolerances.

Such testing makes a number of important assumptions, which are, primarily, that the infected tubers are distributed homogeneously in the stock and that tubers are sampled randomly. In addition, the choice of the size of sample to be tested will need to be balanced by other practical factors such as cost, available facilities, labour, logistics of handling samples, seed stock size, etc.

The following tables and graphs illustrate some of the principles involved in sampling tubers for testing for virus.

Confidence limits

Testing different samples from the same seed stock will give a range of results which, statistically, will lie within a specific interval with a certain percentage confidence. This interval is known as the confidence interval.

The acceptable level of confidence or probability should be decided before the testing is conducted but 95% confidence/probability is normally used. The accuracy of the estimation can be improved by increasing the sample size and by adjusting the allowable number of infected tubers in the sample, i.e. the sample tolerance (Table 1).

For example, the size of the confidence interval for a sample tolerance of 4% (4 allowable tubers) is 8.8% based on a sample of 100 tubers but, on a sample of 200 tubers, the interval decreases to 6% i.e. 7.7-1.7. The effect on the confidence interval of increasing the sample size does, however, become smaller at the larger sample sizes. Increasing the sample size from 100 to 200 tubers improves the accuracy of the estimation by 32 %, i.e. confidence interval reduced from 8.8 to 6.0%, whereas increasing the sample size from 300 to 400 tubers only gives an improvement of 15%.

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In practice, therefore, the benefits of increasing the sample size have to be weighed up against the additional cost of the testing. The accuracy of the estimation can also be affected by changing the allowable number of infected tubers in the sample (table 1). For example, by decreasing the number of allowable tubers from 4 to 3, i.e. changing sample tolerance from 4 to 3 %, the confidence interval is decreased from 8.8 to 7.9 % and the confidence limits themselves become lower. Decreasing the allowable number of infected tubers in the sample also has a significant effect on the probability of classifying at higher tolerances than those allowed in the sample as illustrated in the next paragraph.

Table 1: Confidence limits, at a probability of 95%, for various sample tolerances of virus in relation to the size of the sample.

Tolerance(%) for virus in a seed stock	Size of sample	Allowable no of infected tubers	Confidence limits	
			Lower	Upper
4	100	4(3)	1.1(0.6)	9.9(8.5)
	200	8(7)	1.7(1.4)	7.7(7.1)
	300	12(11)	2.1(1.8)	6.9(6.5)
	400	16(15)	2.3(2.1)	6.4(6.1)
10	100	10(8)	4.9(3.5)	17.6(15.2)
	200	20(18)	6.2(5.4)	15.0(14.0)
	300	30	6.9	13.8
	400	40	7.2	13.4

Probability of classifying stocks to meet specified tolerances

From the confidence intervals, it can be seen that classifying stocks based on a sample will contain a risk that some stocks, which fail a test, do, in fact, meet the tolerance and others, which pass, should fail. Table 2 and Figure 1 show the effect of varying sample size and the number of virus infected tubers allowed in the sample on the probability of classifying seed stocks with different incidences of virus infection. For example, in a test on a sample of 100 tubers where 3 virus infected tubers were allowed, there would be a 14% chance of classifying a stock containing 6% virus as meeting a tolerance of 4%.

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Table 2: Probability of classifying seed stocks at two tolerances for virus based on a laboratory test in relation to the size of sample and the allowable number of virus-infected tubers in the sample:

Tolerance (%) for virus in a seed stock	Size of sample	Allowable no of infected tubers	Probability of acceptance or classification						
			% infected tubers in stock						
			0.5	1	2	4	6	8	10
4	100	3	100	98	86	43	14	4	1
	200	7	100	100	95	45	8	1	0
	300	11	100	100	98	46	5	0	0
	400	15	100	100	99	46	3	0	0
10	100	8	100	100	100	98	85	59	32
	200	18	100	100	100	100	97	75	37
	300	30	100	100	100	100	100	91	55
	400	40	100	100	100	100	100	94	54

NOTE: The allowable number of tubers is, often, set at a lower level than the overall seed stock tolerance of 4 and 10% respectively, particularly in the case of a relatively small sample size. By lowering the tolerance in a sample the 'buyers risk' is reduced.

Figure 1: Probability of classifying seed stocks with different incidences of virus as meeting a tolerance of 4% or 10% for virus in a laboratory test in relation to the size of sample and the allowable number of virus infected tubers in the sample.

tolerance up to 4%

tolerance up to 10%

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Figure 1a

BASIC SEED (4%)
Probability of classification

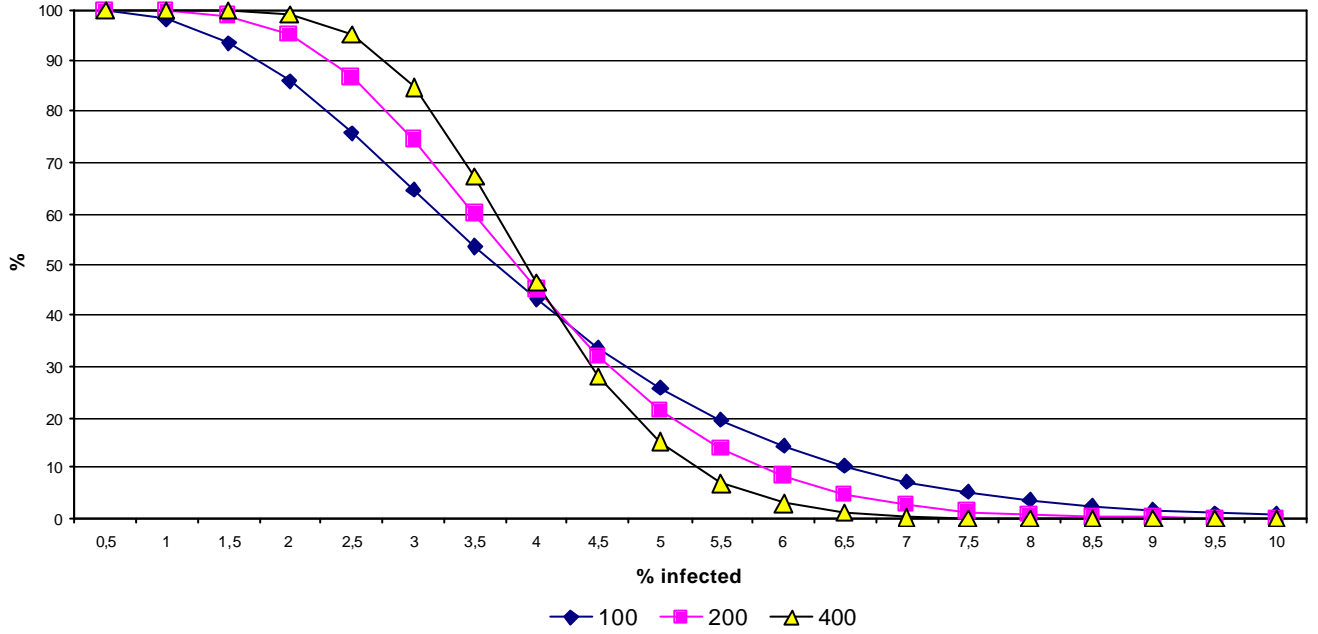


Figure 1b

CERTIFIED SEED(10%)
Probability of classification

