Danish seed potato regulation, control and certification system

The Danish legislation on production and marketing of seed potatoes is based on Council Directive 2002/56/EC on the marketing of seed potatoes, supplemented by a range of additional or stricter national requirements. Details of the seed potato regulation and production system are described below.

The control measures regarding relevant EU quarantine pests are integrated in the official control leading to certification of seed potatoes.

All producers and growers involved in the production system of seed potatoes are authorized by the official Danish plant health authority, the Danish AgriFish Agency.

1. Process of potato growing

Linear ‘flush out’ production system

- Nuclear stock
  - Mini tubers, grade MK
  - Prebasic seed, grade S or SE
  - Basic seed, grade E (1-3)
  - Certified seed (grade A)

The Danish seed potato certification system implies, that for every field generation, an automatic downgrading happens, as part of the production flow, even if the results of the official control indicates equal plant health status of the seeding material and the harvested crop.

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1Council Directive 2000/29/EC on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community.
This means that seed potatoes grown from grade S or SE will be classified as E1 or lower grade, E1 material as E2 and so on.

There is no back flow which means that no material in the production line above re-enters the line at earlier steps.

**Nuclear stock and mini tuber production**
- Seed potatoes descend in a straight line from disease free (annex 2) nuclear stock plants produced according to EPPO standards
- Nuclear stock material is micro propagated according to guidelines of ISPM 33
- Micro plants are planted in protected production facilities to produce one generation of mini tubers (MK)
- Annex 2 gives a detailed overview of mini tuber production and disease testing requirements

**Pre-basic seed production**
- ‘Closed unit’ production system for each grower
- 10 specialized growers who produce only pre-basic seed (no basic or certified)
- Mini tubers are the only approved entry of seed material at each pre-basic grower
- Maximum of five field generations (S1-S5, non marketed grades)
- Marketed as class S or SE, according to which set of tolerances are complied with (annex 1)

**Basic seed production**
- Maximum of three field generations
- Marketed as class E (1-3 according to field generation)
- Grade E tubers are always a maximum of 8 field generations old

**Certified seed production**
- Only one field generation
- Operating mainly as a catch-grade for downgraded class S, SE or E potatoes
- Classified as A (maximum 9th generation)

### 2. Tracing system

All seed potato plots are recorded officially and the annual harvested crop from each recorded plot of land is identified by a unique tracing number; the ‘harvest number’.

This system allows for trace back to grower, cropping area and initial seeding material (mini tubers) of all seed potato lots in production and trade.
3. Soil preparation

Each grower sends in application for soil sampling of fields intended for seed potato production. Fields have to comply with crop rotation requirements (section 4) and requirements concerning deposition of potato waste. Fields with volunteer potatoes are not accepted for soil sampling.

Soil sampling and potato cyst nematode control

All areas intended for production of seed potatoes are officially sampled and tested for the presence of potato cyst nematodes; *Globodera rostochiensis* and *Globodera pallida*. Soil sampling and restrictions on land found infested with potato cyst nematodes are handled according to EU directive 2007/33/EC. Testing of soil samples are done by PCR methods, and species determination is performed on every positive soil sample by the official Danish laboratory.

Every year approximately 4500 ha intended for seed potato production are sampled and analysed for potato cyst nematodes. Positives results are found on average in only 1-3 % of this area.

Every seed potato grower is obliged to follow control measures against the nematodes by use of resistant varieties of consumption potato cultivars and strict precautions regarding machinery and handling procedures to prevent the spread of nematodes.

4. Requirements regarding machinery and other equipment for seed potatoes

Preventive measures regarding machinery and procedures for handling seed potatoes are an essential part of the national seed potato regulation that ensures the separation between lots of seed potatoes and prevents the introduction of potato pests on the particular place of production.

Pre-basic growers must have their own set of potato machinery which must not be used outside the place of production.

Basic growers may only share machinery with other authorized basic seed growers.

5. Crop rotation and crop separation requirements

All areas for production of basic and certified seed must comply with a crop rotation scheme of three years without potato crops prior to seed potato production. For pre-basic seed production the number of years is four.

However, a majority of Danish seed potato cropping areas have even longer rotation schemes, with six or more years without potatoes prior to seed potato production.

All seed potato areas must be situated at a certain distance from ware potato cropping areas. The exact distance required, depends on the seed potato category:

Pre-basic seed: 50 meters
Basic seed: 25 meters
Certified seed: 15 meters

Ware potato production is not allowed for pre-basic growers. For growers of basic and certified seed
ware potatoes may be grown on specific conditions that aim at preventing plant health problems and ensure traceability of seed potatoes.

6. Field inspections

Official field inspection is conducted once or twice (depending on the results of the first inspection) in all basic and certified seed potatoes in each growing season.

Pre-basic seed potatoes are field inspected three times.

Plants and, where relevant, tubers are inspected for the presence of potato viruses, black leg, off types according to the tolerances in Annex 1, table 1, and for the presence of EU quarantine organisms.

The results of field inspections show on average a very low incidence of plants with symptoms of black leg and low incidence of plants with symptoms of virus. An average over the recent years shows that approx. 90% of the basic seed production comply with the certification requirements for seed potatoes and 10% is rejected as seed potatoes.

For pre-basic production an average of 97% of the production are classified as pre-basic seed, which shows a very low incidence of virus and blackleg in pre-basic seed.

7. Testing for potato viruses and other diseases

All pre-basic seed potatoes are tested for the presence of potato virus Y and potato leaf roll virus as part of the certification process, virus tolerances can be seen in Annex 1, table 2. Tuber samples are also taken at each pre-basic grower and analysed for the presence of potato ring rot and potato brown rot.

Virus tests are conducted as part of the certification process on basic and certified seed in some varieties, virus tolerances can be seen in Annex 1, table 2.

Virus tests are also conducted on seed potatoes destined for export to third countries with import requirements concerning virus.

8. Packaging and marketing

All seed potatoes are packed in new or disinfected packaging material and labelled with an official and uniquely numbered plant passport, which indicates the variety, class, category, lot number and origin of the seed potatoes.

Official control for compliance with the set of tolerances listed in table 3 (which also implements annex 2 in EU directive 2002/56/EC) is conducted on basis of random inspection of lots of seed potatoes ready to be marketed.

Lots for export out of the EU are officially inspected according to the import regulations of the importing countries.
Annex 1. Seed potato production scheme: from nuclear stock to certified seed

New varieties from EU or other countries

Complete pathogen test* for virus, bacteria (incl. quarantine pests)

Trial/experimental tissue culture Bank
In-vitro micro plants

Approved tissue Culture Bank in EU nuclear stock, pathogen test*

The Danish Potato nuclear stock
In-vitro preservation of micro plants

Nuclear stock plants

Micro propagation
In vitro multiplication of micro plants

Micro plants

Production of mini tubers from rooted or unrooted micro plants under protected conditions. Visual crop inspections and CMS/RS test of the production

Minitubers
Class MK

Pre-basic growers

Similar approved material from other EU countries

Basic growers
Annex 2. Tolerance requirements for Danish seed potato certification

Table 1: Tolerances applicable at field inspections of seed potato plants

<table>
<thead>
<tr>
<th></th>
<th>Pre-basic seed potatoes S/SE</th>
<th>Basic seed potatoes E1-E3</th>
<th>Certified seed potatoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Other varieties</td>
<td>0</td>
<td>0.01</td>
<td>0.05</td>
</tr>
<tr>
<td>b. Potato Leaf Roll Virus</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>c. Symptoms of virus A, M, S, X, Y (total)</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>d. Blackleg (Pectobacterium spp., Dickeya spp.)</td>
<td>0/0.01</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>e. Off types</td>
<td>0.01</td>
<td>0.05</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*The tolerances are expressed as the percentage of plants affected*

Table 2: Tolerances applicable at post harvest laboratory testing of seed potatoes

<table>
<thead>
<tr>
<th></th>
<th>Pre-basic seed potatoes Class S</th>
<th>Basic seed potatoes Class E1, E2, E3</th>
<th>Certified seed potatoes Class A</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVY and PLRV</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

* Testing for these viruses on the basis of a survey only.

*The tolerances are expressed as the percentage of tubers affected*
Table 3: Lot tolerances for Danish seed potatoes

The lot shall generally be free from frost damaged tubers and sprouted tubers and must fulfil the following tolerances by weight for pests, diseases, damage and defects:

<table>
<thead>
<tr>
<th>Defect</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Wet rot</td>
<td>0,1%</td>
</tr>
<tr>
<td>b. Dry rot</td>
<td>0,5%</td>
</tr>
<tr>
<td>c. Deep Scab (deeper than 3 mm) on more than 1/10 of the surface</td>
<td>1,0%</td>
</tr>
<tr>
<td>d. Superficial Scab (less than 3 mm in depth)</td>
<td></td>
</tr>
<tr>
<td>on more than 1/5 of the surface</td>
<td>3,0%</td>
</tr>
<tr>
<td>e. Black scurf (sclerotias) on more than 1/20 of the surface</td>
<td>2,0%</td>
</tr>
<tr>
<td>f. External blemishes (regrowth, cracks etc. deeper than 3 mm)</td>
<td></td>
</tr>
<tr>
<td>including mechanically damaged tubers max. 2%</td>
<td>3,0%</td>
</tr>
<tr>
<td>g. Other varieties</td>
<td></td>
</tr>
<tr>
<td>pre-basic and basic seed potatoes</td>
<td>0%</td>
</tr>
<tr>
<td>certified seed potatoes</td>
<td>0,05%</td>
</tr>
<tr>
<td>h. Soil and extraneous matter</td>
<td>1,0%</td>
</tr>
<tr>
<td>i. TOTAL a - h</td>
<td>6,0%</td>
</tr>
<tr>
<td>j. Spraing</td>
<td>5,0%</td>
</tr>
</tbody>
</table>
Annex 1. Danish production scheme: nuclear stock to basic seed potatoes

1. New varieties from EU or other countries
   - Complete pathogen test for virus, bacteria and quarantine pests*
   - Trial/experimental tissue culture Bank
     - In-vitro microplants
     - Trial and/or breeding
   - Approved tissue Culture Bank in EU
     - Nuclear stock with complete pathogen test*
     - The Danish Potato nuclear stock
       - In-vitro preservation of nuclear stock
         - Nuclear stock material
         - Tissue culture production site
           - In-vitro preservation of microplants
           - In vitro multiplication of microplants
         - Mini tuber production site
           - Production of minitubers or mini plants under protected conditions.
           - Visual crop inspections and CMS/RS test of the production
         - Mini tubers
         - Pre-basic growers
   - Equivalent material from other EU countries, as approved by the Danish Agrifish Agency
   - Basic growers
*The Danish potato nuclear stock testing requirements*

All potato material to be accepted for the nuclear stock collection must be tested and found free from the following pathogens:

- Potato A potyvirus, PVA (a,b)
- Potato M carlavirus, PVM (a,b)
- Potato S carlavirus, PVS (a,b)
- Potato V potyvirus, PVV (a,b)
- Potato X potexvirus, PVX (a,b)
- Potato Y potyvirus, PVY (a,b)
- Potato mop top virus, PMTV (a,b)
- Potato leafroll luteovirus, PLRV (a,b)
- Alfalfa mosaic alfamovirus, AMV (a)
- Cucumber mosaic cucumovirus, CMV (a)
- Potato acuba mosaic potexvirus, PAMV (a)
- Tobacco mosaic virus, TMV (a)
- Tobacco necrosis necrovirus, TNV (a)
- Potato/ tomato rattle tobravirus, TRV (a,b)
- Tomato black ring nepovirus, TBRV (a)
- Tomato mosaic virus, ToMV (a)
- Tomato spotted wilt tospovirus, TSWV (a,b)
- *Clavibacter michiganensis* subsp. *sepedonicus* (b)
- *Ralstonia solanacearum* (b)
- *Dickeya* spp. (b)
- *Pectobacterium* spp. (b)
- *Phytoplasma solani*, Potato stolbur phytoplasma (b)
- Potato spindle tuber viroid (b)

(a) Biological test based on indicator plants
(b) Serological or DNA based individual test