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Specialized Section on Standardization of Seed Potatoes

Draft Guide – Operating a Seed Potato Certification Service

The following document contains the draft Guide to Operating a Seed Potato Certification Service. It is submitted is submitted to the Working Party for adoption as the new UNECE Guide to Operating a Seed Potato Certification Service.

Guide to Operating a Seed Potato Certification Service

1. Purpose of this Guide

This guide has been developed to assist Designated Authorities (DAs) in the operation of their seed potato certification service and to encourage standardisation in the operation of seed potato certification services between DAs. The guide is also intended to assist countries that are not implementing the Standard to establish a seed potato certification system and a DA and participate in the activities of the Specialized Section.

2. Scope of the UNECE Standard S-1

The Specialized Section on Seed Potatoes operates under the authority of the Working Party on Agricultural Quality Standards of the United Nations Economic Commission for Europe (UNECE), and has approved the “UNECE Standard concerning the certification and commercial quality control of seed potatoes” (the Standard). The purpose of the Standard is to act as a world reference to facilitate fair international trade in seed potatoes by creating a harmonized quality certification system, promoting its use, and defining harmonised quality requirements for seed potatoes.

Seed potatoes are defined as tubers (including minitubers) and potato micropropagative material of cultivated tuber forming *Solanum* spp. intended for planting. The Standard describes the quality requirements, controlled by certification, for: varietal identity and purity, genealogy (i.e., line of descent from earlier generations), traceability, diseases and pests affecting commercial quality or yield, external quality and physiology, sizing, and labelling.

The Standard is implemented in an importing or exporting country by a Designated Authority (DA). Countries applying the Standard should notify the UNECE Secretariat of their DA responsible for implementation. In relation to exports the DA certifies and labels seed potatoes for export as meeting at least the requirements of the Standard. In relation to importation the DA accepts seed potatoes certified and labelled in accordance with the Standard as meeting its national standards or technical regulations for seed potato quality.

3. Becoming a Designated Authority

Prior to implementing the Standard, countries should notify the UNECE Secretariat of the Designated Authority (DA) responsible for implementing the standard. The country should provide the name and contact details for the DA with whom the Secretariat can correspond.

A DA may be a government department or agency, industry organisation, or private company as long as the implementing organisation has official authorisation to be responsible for the implementation of the Standard. Depending on the circumstances of the implementing country, the DA's official authorisation may be provided through national law or regulations or by administrative processes. A DA shall be independent, competent, impartial and free from conflict of interest.

The representatives of DAs (as well as any other United Nations member country) may participate in the meetings of the Specialized Section on Seed Potatoes. Details of the meetings can be found on the UNECE website (http://www.unece.org/trade/agr/standard/potatoes/pot_e.html). The Specialized Section reviews the Standard, considers matters of importance to seed potato quality, and engages in capacity building by running workshops and developing guides such as this. DAs

wishing to participate in the activities of the Specialized Section should contact the Secretariat.

4. Establishment of a national standard at least equivalent to the UNECE Standard

Designated Authorities may choose to adopt the UNECE Standard as their national standard without including any additional requirements. Alternatively, DAs may choose to establish their own national standard that contains all of the requirements of the UNECE Standard plus additional requirements or more stringent tolerances to meet the DA's circumstances. It may be appropriate for the DA to establish a Board (or committee or other structure) to provide guidance on the implementation of the Standard.

If a DA establishes a standard that differs from the UNECE Standard, the DA's standard must be at least equivalent to the UNECE Standard. Tolerances and requirements (varietal identity and purity, genealogy, traceability, diseases and pests, external quality and physiology, sizing and labelling) should be no less stringent than those specified in the UNECE Standard.

Where, in relation to import requirements for certified seed potatoes, a DA establishes quality requirements that are more stringent than the UNECE Standard these should be technically justified and the same requirements should be applied to domestic seed potato production. It is not acceptable to apply tolerances to imported seed potatoes that are more stringent than those applied to domestically produced and certified seed potatoes. DAs are required to notify the Secretariat of each additional or more stringent requirement, and to provide the technical justification for this.

Prior to fully implementing the Standard, for example, where a national standard is in the process of being established, the UNECE standard can be used as a point of reference in developing a national standard.

5. Administration of a Seed Potato Certification Service

The Designated Authority has responsibility for ensuring that all of the provisions of the Standard are complied with. To do this the DA needs to establish a service, with the appropriate skills and resources, which acts under its authority to provide seed potato certification. The service may be a specific unit dedicated to seed potato certification or it may involve personnel working in several agencies and organisations. For example, the systems and structures already in place to provide other forms of quality certification (such as arable seed or fruit and vegetable quality certification), or phytosanitary certification, may be able to be adapted to provide seed potato certification. There may be efficiencies in this, or it may be more desirable to establish a stand-alone service, depending on the circumstances of the implementing country.

The successful implementation of a seed potato certification service is dependent on the establishment of an efficient and accurate administrative system. This includes management responsibility, clear definition of responsibilities, authorisation of competent personnel and organisations to carry out certification activities, accurate registration of crops, record keeping, and financial management.

5.1 Management responsibility

The Designated Authority should identify the person or position responsible for the operation of the service. This position should have administrative and financial authority

for the management and operation of the service to ensure that all legislative and administrative requirements related to seed potato certification are satisfied.

5.2 Authorisation

The DA should establish a process for giving individuals or organisations authority to undertake activities within the certification service. These activities include acceptance of varieties for certification, acceptance of tissue culture and minitubers for certification, registration of crops for certification, field and tuber inspections, closing containers, issuance of certification labels, undertaking post-harvest evaluations, and hearing appeals. Individuals or organisations must have appropriate skills and training to undertake these activities. It may be appropriate to establish employment categories or position descriptions appropriate to these tasks. For example, the following titles and tasks could be used to provide clear direction on the scope of authorisation of each position:

- Manager – responsible for the effective operation of the certification service, with authority for financial management including fees for services (if appropriate), administration, staffing, approval of label design, policies, and official communication on behalf of the service.
- Inspector – authorised to schedule inspections, perform field and tuber inspections, record inspection results and communicate these with growers, take samples for testing, close containers, and issue certification labels.
- Administrative assistant – authorised to accept or reject applications for registration of varieties, acceptance of tissue culture and minitubers for certification, registration of crops for certification, issue invoices and administer the financial system, keep records, and generate reports.
- Data administrator – undertakes data entry tasks and tracking the geneology of seed lines.

Other organisations may be involved in activities covered by the scope of the Standard. These may include diagnostic laboratories, facilities for production of tissue culture and mini tubers, and organisations growing tubers for post-harvest evaluations. All of these organisations should be authorised by the DA to undertake these activities and such authorisation should be dependent on an evaluation of the organisation's skills, competencies, independence, and compliance with requirements of the Standard.

Seed potatoes receiving certification are labelled in accordance with Annex V and section VII.A of the Standard. The DA should have a process to approve the design of the label (including appropriate organisational titles or logos) and any subsequent amendments to the label.

5.3 Roles, Responsibilities and Liability

The quality of the marketed seed lot is the applicant's responsibility. The operation of the certification scheme is the DAs responsibility. The DA may, in providing seed certification, may be at risk of legal challenge and financial liability. It may be appropriate for DAs to seek legal advice on measures to limit their liability, such as indemnity clauses in service contracts or a statement of limitation of liability.

5.4 Cost recovery

Depending on its circumstances and national policies, the DA may wish to recover the costs of operating the seed potato certification service. An equitable structure of charges will need to be developed by the DA giving consideration to any established cost recovery principles. Successful cost recovery systems are simple, easy to understand, and equitable.

They are seen to be fairly applied to all parties participating in the scheme. There are several options for charging, such as these examples:

- Fee per area planted – A fixed fee is charged per hectare (or other unit of area) registered into the scheme. For example, a set fee may be charged per hectare registered. A grower may have several classifications of seed to be registered, and the same fee per hectare will be charged for all. The fee may cover time and travel for field and tuber inspections, post-harvest evaluations, administration, closing containers, and issuance of certification and labels.
- A general fee to participate in the Scheme plus specified fees for services. The general fee may cover only part of the Scheme, with additional costs recovered depending on the certification activities required such as tuber inspection or container closing.
- Fee per tonne (or other unit of mass) certified – similar to the first example except that the fee is based on tonnes certified irrespective of the area registered.

Each charging option has advantages and disadvantages. The first example is simple but undercharges the true cost of field inspections for small pre-basic and basic plantings or crops that are very distant from the inspector's base. The second option may be fairer where there are a large number of small lots being exported (more time per tonne is required for small lot inspections and container closing), but is more complicated and more difficult for the grower/exporter to predict the cost of certification. The third option may be seen as more equitable for low yielding classifications or varieties, but may not recover fees from crops failing certification. Other fees may also need to be established to cover authorisation of diagnostic laboratories and tissue culture and mini-tuber production facilities, and hearing appeals.

5.5 Operating policies

The DA may also need to establish a range of policies to guide the operation of its seed potato certification service. Policies specify what an organisation does in certain circumstances. These policies help to ensure there is consistency of decision making. Policies are usually developed at a high level by a governing board, committee, or other advisory structure.

For example, a policy on confidentiality of information would make clear the circumstances under which information collected by the service would be made public. Lists of registrations, results of inspections, or areas planted may be considered to be commercially sensitive. The policy will guide managers, inspectors and administrators on what information they may or may not release.

5.6 Documented procedures

It is important that the seed potato certification service operates in a consistent manner, applying the requirements of the scheme in an even and equitable manner for all participants. In particular, the outcome of inspections should be consistent between individual inspectors. Training described in Section 5.8.2 will help ensure consistency, and this can be assisted by the development of documented procedures and work instructions. Procedures describe the purpose of a task; identify who is responsible for doing the task, the steps to be followed when undertaking the task, and the records that should be kept.

5.7 Communication

The DA may benefit from regular communication with seed potato growers and other members of the industry to explain changes to the Standard, provide industry statistics,

seasonal updates, or to explain other changes that may affect the industry. This may be done through a range of media such as newsletters, meetings, websites, or email notifications.

DAs should have in place procedures for official communication. Official communications may include notices to growers in relation to the certification status of their crops, letters of authorisation issued to diagnostic laboratories or facilities producing tissue culture and minitubers, and communications with the UNECE Secretariat and other DAs. Communication procedures can help the DA to ensure that official communications are signed off at the correct level of authority, are appropriate to the audience, and that where necessary other agencies have been consulted (for example when making official comment on UNECE documents).

5.8 Human resources

5.8.1 Staff numbers

It is important that the DA has sufficient staff to carry out inspection of crops and tubers and to complete other administrative tasks. In temperate climates the seasonal nature of the seed potato season condenses the field inspection work into a relatively short season. In other regions the seed potato season may extend across a longer season. The seasonal nature of this work can make it difficult to manage staff numbers as some times of the year are very busy and at other times there is little or no work to be done. It is useful for the DA to estimate the number of inspectors needed to inspect all of the crops (at least twice per crop) during the growing season. Time required for inspections depends on the size of the crop, the class of the crop and distance between crops.

Tuber inspections can be carried out over a longer period, but again crop practices and climate may dictate the period available for tuber inspections. For example, in very cold climates it may be necessary to harvest soon after haulm destruction. Again it is useful for the DA to estimate the number of inspectors needed based on an average number of tuber inspections per day.

5.8.2 Training and competency

Staff involved in seed potato certification must be competent to undertake their assigned tasks.

Administrative staff require training which enables them to:

- Understand the Standard, in particular the classifications of seed
- Understand and follow procedures for registration of crops and maintaining the registration database
- Deal with difficult clients and manage situations of conflict.

Inspectors require a wider range of training and competencies:

- In depth knowledge of the Standard and its application
- Strong interpersonal skills and the ability to manage conflict
- Knowledge of occupational health and safety requirements (equipment, handling treated crops/tubers)
- Basic knowledge of plant health and farm biosecurity requirements
- In-depth knowledge of symptoms of diseases in crops and /or tubers as appropriate
- In-depth knowledge of varietal characteristics

Inspectors may also be required to undergo regular tests for visual acuity and colour perception.

Training can be provided through specific training courses and / or on-the-job training and mentoring by an experienced inspector. Crop inspection training plots are a valuable training resource as described in Annex 1.

It is recommended that all new inspectors, regardless of training, are mentored by a senior inspector for a period of time until the mentor is confident that the new inspector is operating in a competent and consistent manner. The senior inspector may undertake a series of comparative inspections of a crop or lot previously inspected by a new inspector prior to approving the new inspector to work alone.

Maintaining consistency between crop inspections and between inspectors can be challenging. It is recommended that all inspectors undertake comparison inspections early in the season. The crop training inspection plots, described in Annex 1, can be used for this purpose.

In order to maintain on-going competence, all inspectors should undertake training and assessment of competence on a regular basis and be monitored by a senior inspector.

5.9 Traceability through generations

Seed potatoes and their progeny are maintained within the certification programme for several generations. The DA should establish a system for identifying each crop/lot of seed and tracing its progeny as the crop/lot is multiplied through subsequent generations and growing seasons. The system should identify the origin of the seed (the previous season's harvest classification, as this is the class of seed sown) and have a process for changing the classification from the class of the seed planted to the harvested class (i.e., the origin of the planted seed may be Basic I, which is then classed as Basic II upon harvest). The system should record the outcome of inspections where a crop/lot is subsequently downgraded to a lower classification, or is rejected from the scheme.

It may be appropriate to establish a 12-month period that is designated to be a "seed year" as the period during which all crops of seed will be grown, harvested, graded and made available for sale or further propagation in the following seed year. This has the advantage of allowing the year of production to be included in a registration or reference number without the confusion that may be caused by a production cycle spanning two calendar years (as is the case in the Southern Hemisphere countries). For example, it may be sensible to establish a seed year that runs from early spring through to the end of the following winter. In countries where multiple crops can be grown within a year, or where there is continuous cropping, establishing a common seed year may not be possible. An alternative may be to follow the financial year of each seed company.

For small areas of seed, it may be feasible to manage registrations manually (paper records) or in a spreadsheet programme. Large areas of seed manual systems are difficult to maintain and are prone to errors, especially where information must be copied from one record to another; DAs should consider establishing a database to manage seed potato registration.

Crop application process

The DA should establish and publicise the process for submitting seed crops for certification. The DA should specify the information required to be provided as part of submission. This could be done by generating an application form for growers to complete or establishing an on-line application system. Information required may include:

- Grower name and contact details
- Variety of seed
- Classification of seed planted
- Identity of the seed planted (reference number of the seed lot) including evidence of identity of the seed lot planted (e.g. seed labels, bulk certificate)
- Area planted
- Location of the crop (this may include farm identification numbers, GPS coordinates, and maps showing the location and entry points to the crop).

Some of these details may be declared and verified later in the certification process depending on the system.

It is recommended that the DA requires that crop applications are submitted within a certain period from planting to ensure that application information can be passed to inspectors in time for them to make inspections at the most appropriate growth stages. For example, there may be a requirement that crops are submitted within 21 days of planting (or another appropriate time period). To encourage timely crop applications, the DA may wish to establish penalties for late submissions (e.g. a late fee) or impose an absolute cut-off date after which no applications will be accepted. Some leniency is recommended as long as this does not impact on the inspector's ability to inspect the crop at the most appropriate growth stage.

5.10 Approval of tissue culture and minituber production facilities

Tissue culture plantlets or minitubers entering the certification scheme should meet the requirements specified by the DA. The DA should establish a process for approval of these facilities, which may include audits of the facilities on an on-going basis (ISPM 33¹ may provide a reference for developing requirements appropriate for tissue culture and minituber facilities). A list of approved facilities should be made available to growers.

5.11 Traceability of tissue culture and minitubers

The DA should also set up a system to ensure that tissue culture and minitubers entering the scheme are traceable to approved facilities. This may be achieved by the DA itself issuing labels or by approving tissue culture and minituber production facilities to issue statements of origin specifying details of:

- Name of minituber production facility.
- Type of material (tissue culture or minituber).
- Variety.
- Source of tissue culture material.
- Quantity of material (number of plantlets or number/weight of minitubers).
- Name of company material supplied to.
- Date material supplied.

¹ FAO, 2010. ISPM 33: Pest free potato (*Solanum* spp.) micropropagative material and minitubers for international trade. Rome, IPPC, FAO.

The DA may require these labels or statements of origin to accompany the registration of pre-basic seed crops. Tissue culture and minitubers may also be imported from other countries, and under these circumstances the DA is encouraged to work with the DA of the exporting country to confirm the eligibility of the stock for certification.

6. Operation of a seed potato certification service

Once the administrative system for the certification service has been established, and the staff have been trained, the service can begin to register crops for certification.

6.1 Varieties for certification

Varieties accepted by the DA may enter the seed potato certification scheme; this may include varieties undergoing variety registration or varieties from other countries. The first applicant of any new variety must make a reference sample available to the DA and provide a description of the variety, unless the description has been provided by the plant variety office. The description may be the description provided as part of the process of obtaining plant variety rights or national listing of the variety and will normally include the UPOV character set. Photographs may be helpful to show the colour and characteristics of:

- Flowers (where the variety is not a flowering variety, this should be stated)
- Leaf shape, colour, and growth habit
- Tuber shape and skin and flesh colour
- Sprout colour
- Any other characteristics unique to the variety.

6.2 Verification of crop applications

Following receipt of crop applications, the DA should verify that all necessary information has been provided by the applicant. This is particularly important to ensure that the crop is eligible for acceptance into the scheme and that the inspector has all of the information needed to locate and identify the crop. The DA should follow procedures established for verification of crop applications, which may include checking:

- Reference numbers, variety and class of the seed planted matches with records
- Eligibility of the field (past disease history of crops in the field, crop rotation, and isolation distances)
- Origin of pre-basic material (e.g. approved tissue culture and minituber facilities and labels or statements of origin) and other material
- Completeness of information describing the location of the crop
- Completeness of applicant's details, including necessary contact details (e.g. the grower).

The Designated Authority should only accept crops that are traceable to earlier generations within the certification scheme, unless these are from approved tissue culture or minituber production facilities, or they are accompanied by appropriate certification provided by another DA.

Once applications have been processed the DA should advise the applicant that the application has been accepted and may issue unique reference numbers for the crops accepted into the scheme. The DA should also provide this information as soon as possible to inspectors, to allow them to begin to schedule their inspection programme. Depending

on the policies established by the DA, it may be appropriate to publish a list of registered crops.

6.3 Field inspections

Guidance to field inspectors is provided in the *UNECE Guide to Seed Potato Field Inspection: Recommended practices*, which is available from the UNECE website.

6.4 Tuber inspections

Guidance on seed tuber inspection is provided in the *UNECE Guide to Seed Potato Tuber Inspection: Recommended practices*, which is available from the UNECE website.

6.5 Closing containers

Guidance on closing containers is provided in the *UNECE Guide to Seed Potato Tuber Inspection: Recommended practices*, which is available from the UNECE website.

6.6 Second opinion inspections

When an inspector rejects or downgrades a crop or lot, the applicant may ask for a second opinion. DAs should make reasonable provision for such appeals but it is not desirable to have every decision of an inspector challenged. To discourage frivolous appeals the DA may consider implementing a second inspection fee, or an appeal hearing fee, or a bond which is only refundable if the inspector's decision is overturned.

DAs should establish timeframes for requesting second opinion inspections and for these to be dealt with by the DA. Suggested timeframes are that second opinion inspections should be requested within 24 hours of notification by an inspector, and that the second opinion should be provided by the DA within 72 hours of the request. This short timeframe is necessary as the condition of crops may change quickly. The crop must not be improved (e.g. by further roguing) prior to the second opinion inspection taking place.

6.7 Post-harvest evaluations

Post-harvest evaluations may be carried out as an additional validation of the field and tuber inspections. Evaluations can be done through laboratory testing for viruses and bacterial diseases or they can be done as grow-out tests.

Samples of seed may be taken after haulm destruction or during harvest or storage. When necessary, dormancy can be broken chemically or by temperature manipulation. Resultant plant material can be assessed visually or by laboratory testing.

Varietal purity and trueness to type can be assessed in a field grow out. Varietal identity can also be assessed, in most cases, by diffuse light sprout assessment or molecular methods. Glasshouse assessment is not suitable for plant identification as plants may not exhibit typical traits under glasshouse conditions.

Post-harvest Evaluation procedures are provided in Annexes IV and VI of the Standard.

6.8 Traceability

The DA is responsible for verifying traceability of all seed within the certification scheme. This may be done by checking that harvest and storage containers are correctly labelled during inspections and at container closing. Traceability information should be held in appropriate information systems.

6.9 Confirmation of eligibility of seed lot for certification

Prior to issuing certification labels the DA should ensure that the lot is eligible for certification. This may include checking that:

- The lot is traceable to a crop correctly registered into the scheme
- The lot is derived from a crop that was inspected and met the tolerances for the classification of seed applicable to the crop
- Any additional testing has been carried out and the lot complies with the Scheme requirements (e.g. absence of zero tolerance pests)
- The lot was inspected and met the tolerances for the classification of seed applicable to the lot.

6.10 Issuance of certification

Labels may only be issued by the DA or persons authorised by the DA. Once eligibility for certification has been confirmed the labels are issued to the applicant who is required to attach these to each container. An official statement must also be provided by the DA and placed inside each container unless the labels are made of untearable material, are adhesive, or are indelibly printed onto the container. The official statement should be the same colour as the label and include the name of the DA, the reference number of the lot, and the variety.

6.11 Revocation of certification

There may be circumstances where a DA issues labels in error or where the DA becomes aware that a lot is no longer compliant with certification requirements (for example where a zero tolerance pest is detected in the field of origin). In these circumstances the DA will revoke labels.

The DA will communicate with the applicant and advise them of the revised status of the lot and have the applicant return the labels. Alternatively, an inspector may visit the grower's premises to repossess the labels. In the case of zero tolerance pests, appropriate steps should be taken.

Where the lot has been exported the DA will advise the DA of the importing country as soon as possible and follow procedures for non-compliance.

7. Record keeping

It is recommended that records be kept by the Designated Authority for a period greater than the time required to multiply a seed lot from pre-basic through to certified seed and for it to be then grown as a table or ware potato crop. By keeping records for this period the DA can ensure traceability and provide information to an applicant on request.

The DA may keep some information for longer periods (e.g. sites of occurrence of zero tolerance pests).

8. System Review

The Designated Authority should periodically review the performance of its seed potato certification service. Most critically, the DA should ensure that the service is being operated in accordance with the Standard. The DA may also wish to gauge the satisfaction of seed potato growers and buyers on the operation of the service and obtain feedback on

the performance of certified seed. This can help the DA identify any problems with the operation of the service and make improvements.

9. Non-compliance

The Designated Authority may receive notification from, or give notice to, another DA regarding non-compliance of a lot or consignment of certified seed potatoes. Non-compliance may be due to the presence of faults above the specified tolerances, failure to meet requirements for sizing and packaging, or administrative requirements.

Where the DA has identified non-compliance in an imported consignment it should notify the DA of the exporting country promptly. It is recommended that notification is made within three days. The notifying DA should provide details of the consignment, copies of certification labels, a description of the nature of the non-compliance, and identify any actions that the DA wishes to be taken by the DA of the exporting country.

The DA receiving notification of non-compliance may wish to review and identify the cause of non-compliance and take actions to ensure that the risk of future non-compliance is minimised. This can include requesting that a joint inspection be done by both DAs to confirm the non-compliance. Experts from both countries may participate in the joint inspection.

Where non-compliance is confirmed the DA of the exporting country should review inspection records to determine whether a mistake has been made or whether there is any information to suggest that there were problems with the crop or lot. If the DA is able to identify a probable cause of non-compliance it should take actions to improve procedures to ensure the non-compliance doesn't recur and advise the DA of the importing country of its findings.

10. Glossary

All terms used in this guide are in accordance with definitions and usage in the Standard.

11. References

FAO, 2010. ISPM 33: Pest free potato (*Solanum* spp.) micropropagative material and minitubers for international trade. Rome, IPPC, FAO

UNECE Standard S-1 concerning the certification and commercial quality control of seed potatoes

UNECE Guide to Seed Potato Field Inspection: Recommended practices

UNECE Guide to Seed Potato Tuber Inspection: Recommended practices

UNECE Guide to Seed Potato Diseases, Pests and Defects

Annex

Crop Inspection Training Plots

1. Purpose of training plots

Training plots are grown specifically for the purpose of providing a training resource. Such plots are normally planted with parental tubers from mother plants with known faults or from plants known to be healthy. Inspectors are then able to view and become familiar with a range of disease symptoms.

Establishing a full set of demonstration plots and providing the training described requires considerable preparation and resources. It is possible to establish training plots on a smaller scale depending on the available resources. Implementing Designated Authorities may initially wish to participate in training offered by other DAs, or in capacity-building activities provided by the UNECE. For further details, please see the UNECE website.

2. Sourcing seed for planting training plots

The training plots will be planted using mother tubers from both healthy stocks and tubers known to have specific symptomatic faults (virus, not true-to-type, bacterial diseases). It is important that the healthy material is of high quality and does not contain unintended faults as these will have to be removed (rogued) prior to the training event(s).

The healthy demonstration plots should be planted using reliably healthy seed tubers. The most effective method for this is for the host institute to maintain a disease free field collection at an isolated site. Where such a collection is not available commercial pre-basic seed may be used. The diseased and not-true-to-type potatoes should, if possible, be sourced from collections held by the host institute.

For mosaic and leafroll virus, the virus collection should contain the virus–variety combinations most commonly seen. The best way to build up this collection is for seed inspectors to take tuber samples from symptomatic plants during the inspection period and submit these to the host institute for planting the following year. Immediately prior to the training event, leaf samples can be taken from the plants to confirm which virus is present. The progeny of these tubers can then be retained for further planting. One drawback of this approach is that the virus collection can become infected with multiple viruses; therefore, inspectors should be encouraged to submit samples each year.

Where the host institute does not have these collections, tuber samples should be drawn from diseased plants found in commercial crops in the growing season prior to planting the training field. It is also possible to source virus-infected tubers, for some viruses, from inoculated plants though this should be used as a fall back source. In this case the host institute should prepare the inoculated plants the growing season prior to planting the training plots in order that tubers are available in time for planting.

For plants not true-to-type (off types or undesirable variations) the host institution should establish a collection of off types from tuber samples submitted from off type plants seen in commercial seed crops.

3. Planting training plots

It is suggested that plots are planted in a training field situated close to the host institution for ease of preparation of the plots for discussion during the inspection period. As the field, by necessity, will contain infected plants (virus and bacteria) the field should be isolated from commercial seed crops or other high health potato plants.

The field should be carefully marked out for planting. This can be achieved by preparing a detailed field plan/map with precise plot measurements. The field should be laid out according to the number of plots required in blocks that accommodate cultivation and spraying equipment (i.e. in spray boom widths). Paths and tracks should be provided between plots at the end of the rows to allow access and leave room for inspectors and trainers discussing the plants. Gaps between rows should be avoided to prevent the potatoes collapsing. Guard rows (an extra row of non-demonstration plants) can be used to maintain typical growth habit of the demonstration plants; this is particularly helpful on windy sites.

The tubers for planting each plot should be placed in a marked bag or tray prior to planting. Once the seed drills have been prepared the field plan can then be marked out using measuring tape and strings. Tubers from the marked containers can then be hand planted into the drills between the strings according to the field plan.

Once planting and post-planting cultivations are complete and the plants have emerged, the field plan should be used to mark each plot with a numbered stake to identify the plot. A “guide to plots” should be produced for use by inspectors. During plant growth prior to the training period an experienced inspector or field scientist should ensure the plots are in good condition - rogueing plants where necessary. The field should be given normal agronomic care throughout. Crop spraying should be avoided immediately prior to the field being used by trainees.

4. Types of training plots

4.1 Varieties in commerce collection

These are the main varieties grown commercially. The purpose of these training plots is to teach the varietal characteristics in a crop setting as the plots are sufficiently large to simulate commercial cropping.

The main commercial varieties are planted in large plots - 48 tuber plots (4 drills by 12 tubers). Less common varieties can be included as smaller plots of 24 (4 rows of 6) or 6 tubers (1 row of 6). The number of plots will be dependent on the number of varieties in commerce in the country.

4.2 Foliar characteristics training plots.

These are smaller plots of the main varieties which are grown in close proximity to allow comparison between varieties. These plots provide the principle training asset for new inspectors. The rationale for this approach is that where inspectors can differentiate 30 or so varieties, some of which will have similar and subtle differences, then the inspectors will be able to pick out faults in commercial seed crops.

The plots will include the top 30 varieties by area planted. In these plots 6 tubers (1 row of 6) of each variety are arranged by a range of characteristics to provide plots suitable for practicing variety recognition.

Suggested characteristics for arranging the plots:

Foliage Habit	(30 rows of six tubers)
Similar Varieties	(30 rows of six tubers)
Area Planted	(30 rows of six tubers)
Maturity	(30 rows of six tubers)
Foliage Colour	(30 rows of six tubers)
Leaflet Size	(30 rows of six tubers)

Flower Colour	(30 rows of six tubers)
Tuber Colour	(30 rows of six tubers)
Tuber Shape	(30 rows of six tubers)
Sprout Colour	(30 rows of six tubers)
<u>Total</u>	300 rows of 6 tubers

The number of varieties and characteristics may be varied according to the scale of the field and the resources available.

4.3 *Virus collection plots*

Virus collection plots are intended to teach virus symptom recognition within different varieties with healthy and diseased example plants immediately adjacent to each other. These plots provide the principle virus training asset to new inspectors. A senior inspector or field scientist should bench mark the plants to establish what is scored as severe and mild symptoms (if severe/mild differentiation is used); coloured canes are helpful for this (e.g. red cane for severe and white cane for mild). The trainees should be provided with a list of the viruses present in the demonstrated plants.

The most common varieties demonstrating virus symptoms (mosaic virus and leafroll) should be included. These plots are made up of 6 tubers (1 row of 6). For each variety demonstrated, the first plot (row of 6 plants) should be a healthy example of that variety, then the following plots should be the same variety with known virus infection. As many examples as possible should be included in this collection with a focus on the combinations of virus and variety most commonly seen in commercial seed crops.

4.4 *Not true-to-type (variations) collection*

These plots include commercially important varieties demonstrating undesirable variations from the normal foliar characteristics (e.g., blistered leaves, variegation, wilding, bolters). The variations are genetic variations rather than symptoms caused by stress or chemical damage.

These plots teach recognition of not true-to-type within different varieties with normal and healthy plants and variation example plants immediately adjacent to each other. These plots also allow training to distinguish between unhealthy plants and variations as some variations can have a similar appearance to virus infected plants. Inspectors should also be made aware of bolters or strong types which can have different maturity characteristics giving an uneven tuber size distribution at harvest.

These plots are made up of 6 tubers (1 row of 6). For each variety demonstrated the first plot (row of 6 plants) should be a normal and healthy example of that variety then the following plots should be the same variety from a mother plant known to be not-true-to-type. As many examples as possible should be included in this collection with a focus on the most common variations seen in commercial seed crops.

4.5 *Fault Demonstration plots*

These plots are used to demonstrate faults that are not covered above or the above faults in a mixed plot situation. These plots are 40 tubers (4 rows of 10 tubers) planted either with healthy and normal plants of each variety and between 4 and 8 tubers showing the demonstrated fault or in the case of blackleg 30 infected tubers.

(i) Blackleg

Thirty tubers of a commonly grown susceptible variety are stab inoculated with blackleg and planted randomly amongst the 10 healthy tubers of the same variety (blackleg caused by *Pectobacterium* spp. and *Dickeya* spp. should be demonstrated separately).

(ii) Mosaic virus

In these plots a healthy plot of each variety is mixed with 4 tubers of the same variety known to have virus infection showing mosaic symptoms (mild and severe). Several varieties should be chosen with some showing obvious mosaic (e.g. a strong mottle with distortion and/or stunting) and some where the symptoms are more subtle (e.g. paleness in the foliage with no obvious mottle). The number of plots used will depend on the available resources; however, four plots would give a reasonable demonstration.

(iii) Leafroll

In these plots a healthy plot of each variety is mixed with 4 tubers of the same variety known to have leafroll infection. Several varieties should be chosen. The number of plots used will depend on the available resources; however, four plots would give a reasonable demonstration.

(iv) Variations (plants not true-to-type)

In these plots a healthy and normal plot of each variety is mixed with 4 tubers of the same variety known to be stable variations. Several varieties should be chosen with some showing the most commonly seen type of variant in the host country (e.g. bolters/variegation/blistered leaves). These plots are predominantly important for pre-basic inspections as variations should be eliminated early in the multiplication chain.

(v) Rogues

In these plots a healthy plot of each variety is mixed with 4 tubers of a different variety. Several variety combinations should be chosen with some showing obvious differences between the varieties and some with a combination of more similar (challenging) combinations. Where possible, variety combinations likely to occur in commercial crops should be chosen e.g. two varieties used by the same production chain. The number of plots used will depend on the available resources; however, four plots would give a reasonable demonstration.

4.6 Seeded fault plots

These plots are intended to provide a simulated inspection environment where a background of healthy and normal tubers has a range of faults randomly distributed throughout the plots to allow inspectors to practice identification of faults within crop. These plots can be used to provide practice tests during training.

The plots should be made up of 400 tubers (4 rows of 100). In each plot 330 healthy and normal tubers of one variety chosen from the most commercially important varieties to the host and participant countries should be planted with 40 tubers with known faults planted randomly throughout the plot. Faults should include mild and severe mosaic of the same or different variety, leafroll of the same or different variety and variations of the same or different variety. Additionally, 30 healthy tubers of different varieties should be included. The number of plots used will depend on the available resources; however, eight plots would give a reasonable demonstration. It would be possible to have a similar demonstration on a smaller scale.

4.7 *Test Plots*

These plots are designed to examine the proficiency of the inspectors. The plots are similar to the seeded fault plots but are smaller, contain fewer faults and are more precisely planted.

The plots should be made up of 50 tubers (2 rows of 25). In each plot between 44 and 50 healthy and normal tubers of one variety chosen from the most commercially important varieties to the host and participant countries should be planted with up to 6 tubers with known faults planted randomly throughout the plot. Faults should include mild and severe mosaic of the same variety, leafroll of the same variety and variations of the same variety. Additionally, healthy tubers of a different variety should be included in some plots. The number of plots used will depend on the available resources; however, ten plots would allow a reasonable assessment of competence.

5. **Training**

An experienced inspector (or several inspectors) should provide the training – first guiding new trainees in the identification of varieties using the varieties in commerce and foliar characteristic plots, then going on to cover diseases using the virus collection and demonstration plots, and finally covering variations. During the training, the trainers should routinely use the seeded fault plots to mark example plants in order to provide a test for the trainees giving the trainees immediate feedback on their progress and identifying weaknesses to focus the remaining training effort.

More experienced inspectors can use the plots without direct supervision of a trainer. For this group, a senior inspector and/or field scientist should provide a guided tour of the plots highlighting key elements and drawing out discussion of the plots. The aim of the discussion is to encourage a harmonised approach and to ensure that all inspectors are aware of all of the elements of inspection.

For all trainees it is helpful for a representative of the DA and other scientific staff to give presentations of topical issues to the inspectors. Supervisory inspectors should ensure that the inspectors are fully aware of inspection methods, particularly where changes have been made. It is helpful to be able to demonstrate quarantine faults/organisms using posters during the period of the training course.

New trainees are advised to spend a period of around 8-10 days in the field and experienced inspectors should spend around 3-4 days in the field.