NATIONAL STANDARD FOR PYTOSANITORY MEASURES

NSPM…….

Technical Guidelines for Sampling in Consignment of NTFPs
2014

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1. INTRODUCTION

1.1 Scope

This standard provides technical guidance to National Plant Protection Organizations (NPPOs) in selecting appropriate sampling methodologies for inspection or testing of consignments of NTFP to verify compliance with phytosanitary requirements.

1.2 References

ISPM 1. 2006.*Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*. Rome, IPPC, FAO.

ISPM 5. *Glossary of phytosanitary terms*. Rome, IPPC, FAO.

ISPM 11. 2004. *Pest risk analysis for quarantine pests including analysis of environmental risksand living modified organisms*. Rome, IPPC, FAO.

ISPM 20. 2004. *Guidelines for a phytosanitary import regulatory system*. Rome, IPPC, FAO.

ISPM 21. 2004. *Pest risk analysis for regulated non-quarantine pests*. Rome, IPPC, FAO.

ISPM 23. 2005. *Guidelines for inspection*. Rome, IPPC, FAO.

ISPM 31. 2008. *Methodologies for sampling of consignments*

NSPM31. 2013. *Methodologies of sampling of consignments*

Cochran, W.G. 1977. *Sampling techniques*. 3rd edn. John Wiley & Sons. 428 pp.

DipeshPyakurel and Ashok Baniya.2011. NTFPs: Impetus for Conservation and

KhilendraGurung and DipeshPokharel. 2069. MAPs Pictorial Identification Manual (Nepali). GTZ publication

Plant Protection Act 2007

Plant Protection Regulation 2010

Ralf Kwaschik.2011. Cross-border value chains for non-timber forest products in four different Asian countries. INBAR working paper no. 64

1.3 Definitions

Definitions of phytosanitary terms used in this standard are as in ISPM 5 (*Glossaryof phytosanitary terms)* and Plant Protection Act,2006 and Regulation, 2009.

Definition of NTFPs (Non-timber forest products):A*ll biological material other than timber, fodder or phalloid includes NTFPs* (Hammett 1993).

1.4 Outlines of requirements

The sampling methodologies used by NPPOs in selecting samples for the inspection of consignments of NTFPs moving in international trade are based on a number of sampling concepts. These parameters include such as acceptance level, level of detection, confidence level, efficacy of detection and sample size.

The application of statistical based methods, such as simple random sampling, systematic sampling, stratified sampling, sequential sampling or cluster sampling, provides results with a statistical confidence level. There are other sampling methods that are not statistically based, such as convenience sampling, haphazard sampling or selective sampling. Such methods may provide valid results in determining the presence or absence of a regulated pest(s). Statistical inference can notbe made on their basis. Operational limitations will have an effect on the practicality of sampling under one or anothermethod.

In using sampling methodologies, NPPOs accept some degree of risk that non-conforming lots may not be detected. Inspection using statistically based methods can provide results with a certain level of confidence only and cannot prove the absence of a pest from a consignment.

2. BACKGROUND

Non Timber Forest Products (NTFPs)consist a group of forest products and functions, and their heterogeneity reflectsthe diversity of forest species used. NTFPs also include non-consumptive services to humanity such as ecological/ environmental, cultural and religious, and tourism and recreation (Walter 1998).

NTFPs contributesto Nepalese economy is well recognized. The collection and marketing of NTFPs is a major source of rural income and an important source of revenue to the government. While forestry contributes about 15 per cent to the Nepalese GDP, NTFPs make up about 5 per cent of the GDP (CECI 2006). It has been estimated that more than 161 species of plants are traded as NTFPs, with an annual transaction of Rs2,500 million (Subedi 2006). About 10,000 to 15,000 tonnes of plant products of more than 100 species are exported. Ninety are exported to India. (Edwards 1996).

This standard provides the basis for, and complements, ISPM 20:2004 and ISPM 23:2005. Inspection of consignments ofNTFPs moving in trade is an essential tool for the management of pest risks and is the most frequently used phytosanitary procedure worldwide to determine if pests are present and/or the compliance with phytosanitary import requirements. It is usually not feasible to inspect entire consignments, so inspection is performed mainly on samples obtained from a consignment. Sampling of NTFPs may occur prior to export, at the point of import, or other points as determined by NPPOs.

It is important that sampling procedures established and used by NPPOs are documented and transparent, and take into account the principle of minimum impact (ISPM 1:2006), particularly because inspection based on sampling may lead to the refusal to issue a phytosanitary certificate, refusal of entry, or treatment or destruction of a consignment or part of a consignment. Sampling methodologies used by NPPOs will depend on the sampling objectives (for example, sampling for testing) and may be solely statistically based or developed noting particular operational constraints. Methodologies developed to achieve the

sampling objectives, within operational constraints, may not yield the same statistical confidence levels in the results as fully statistically based methods, but such methods may still give valid results depending on the desired sampling objective. If the sole purpose of sampling is to increase the chance of finding a pest, selective or targeted sampling is also valid.

Objectives of sampling of consignment of NTFPs

- detect regulated pests
- provide assurance that the number of regulated pests or infested units in a consignment does not exceed the specified tolerance level for the pest
- provide assurance of the general phytosanitary condition of a consignment
- detect organisms for which a phytosanitary risk has not yet been determined
- optimize the probability of detecting specific regulated pests
- maximize the use of available sampling resources
- gather other information such as for monitoring of a pathway
- verify compliance with phytosanitary requirements
- determine the proportion of the consignment infested.

It should be noted that inspection and/or testing based on sampling always involves a degree of error. The acceptance of some probability that the pests are present is inherent in the useof sampling procedures for inspection and/or testing. Inspection and/or testing using statistically based sampling methods can provide a level of confidence that the incidence of a pest is below a certain level, but it does not prove that a pest is truly absent from a consignment.

3. REQUIREMENTS

3.1 Lot Identification

A consignment may consist of one or more lots. Where a consignment comprises more than one lot, the inspection to determine compliance may have to consist of several separate visual examinations, and therefore the lots will have to be sampled separately. In such cases, the samples relating to each lot should be segregated and identified in order that the appropriate lot can be clearly identified if subsequent inspection or testing reveals non-compliance with phytosanitary requirements. Whether or not a lot will be inspected should be determined using factors stated in ISPM 23:2005 (section 1.5). A lot to be sampled should be a number of units of a single commodity identifiable by its homogeneityin factors such as:

- Origin
- grower
- packing facility /types
- species, variety, or degree of maturity
- Area of collection

- Site of collection
- Season of collection
- exporter
- importer
- area of production
- season of production
- regulated pests and their characteristics
- treatment at origin
- type of processing.

The criteria used by the NPPO to distinguish lots should be consistently applied for similar consignment of NTFPs. Treating multiple commodities as a single lot for convenience may mean that statistical inferences can not be drawn from the results of the sampling.

3.2 Sample Unit

In sampling process, at first identification of the appropriate unit for sampling (for example, a fruit,stem, bunch, unit of weight, bag or carton) should be done. The choice of the sample unit is done base on the issues related to homogeneity in the distribution of pests through the NTFPs, the nature of pests whether they are sedentary or mobile, type of package, intended use, and operational considerations. For example, if determined solely on pest biology, the appropriate sample unit might be an individual plant or plant product in the case of a low-mobility pest, whereas in the case of mobile pests, a carton or other commodity container may be the preferred sample unit. However, when inspection is to detect more than one type of pest, other considerations (for example, practicality of using different sample units) may apply. Sample units should be consistently defined and independent from each other. This will allow NPPOs to simplify the process of making inferences from the sample to the lot or consignment from which the sample was selected.

3.3 Statistical and Non-Statistical Sampling

The sampling method is the process approved by the NPPO to select units for inspection and/or testing. Sampling for phytosanitary inspection of consignments or lots is done by taking units from the consignment or lot without replacement of the units selected[1]. NPPOs may choose either a statistically based or non-statistical sampling methodology.

Sampling based on statistical or targeted methods is designed to facilitate the detection of a regulated pest(s) in a consignment and/or lot.

[1] Sampling without replacement is selecting a unit from the consignment or lot without replacing the unit before the next units are selected. Sampling without replacement does not mean that a selected item cannot be returned o a consignment (except for destructive sampling); it means only that the inspector should not return it before selecting the remainder of the sample.

3.3.1 Statistical based sampling

Statistical based sampling methods involve the determination of a number of interrelated parameters and the selection of the most appropriate statistical based sampling method.

3.3.1.1 Parameters and related concepts

Statistical based sampling is designed to detect a certain percentage or proportion of infestation with a specific confidence level, and thus NPPO is required to determine the following interrelated parameters: acceptance number, level of detection, confidence level, efficacy of detection and sample size. The NPPO may also establish a tolerance level for certain types pests, regulated or non-regulated

3.3.1.1.1 Acceptance number

The acceptance number is the number of infested units or the number of individual pests that are permissible in a sample of a given size before phytosanitary action is taken. Many NPPOs determine this number to be zero for quarantine pests. For example, if the acceptance number is zero and an infested unit is detected in the sample then phytosanitary action will be taken. It is important to appreciate that a zero acceptance number within a sample does not imply a zero tolerance level in the consignment as a whole. Even if no pests are detected in the sample there remains a probability that the pest may be present in the remainder of the consignment, albeit at a very low level. The acceptance number is linked to the sample. The acceptance number is the number of infested units or the number of individual pests that are permissible in the sample whereas the tolerance level (see section 3.1.1.6) refers to the status of the entire consignment.

3.3.1.1.2 Level of detection

The level of detection is the minimum percentage or proportion of infestation that the samplingmethodology will detect at the specified efficacy of detection and level of confidence and which the NPPO intends to detect in a consignment.

The level of detection may be specified for a pest, a group or category of pests, or for unspecified pests. The level of detection may be derived from:

- a decision based on pest risk analysis to detect a specified level of infestation (the infestation determined to present an unacceptable risk)
- an evaluation of the effectiveness of phytosanitary measures applied before inspection
- an operationally based decision that inspection intensity above a certain level is not practical.

3.3.1.1.3 Confidence level

The confidence level is the probability that a consignment with a degree of infestation exceeding the level of detection will be detected. A confidence level of 95% is commonly used. The NPPO may choose to require different confidence levels depending on the intended use of the commodity. For example, a higher confidence level for detection may be required for commodities for planting than for commodities for consumption, and the confidence level

may also vary with the strength of the phytosanitary measures applied and historical evidence of non-compliance. Since the NTFPs are generally not used for planting purposes lower confidence level may be applied. Very high confidence level values quickly become difficult to achieve, and lower values become less meaningful for decision-making. A 95% confidence level means that the conclusions drawn from the results of sampling will detect a non-compliant consignment, on average, 95 times out of 100, and therefore, it may be assumed that, on average, 5% of non-compliant consignments will not be detected.

3.1.1.4 Efficacy of detection

The efficacy of detection is the probability that an inspection or test of an infested unit(s) will detect a pest. In general the efficacy should not be assumed to be 100%. For example, pests may be difficult to detect visually, plants may not express symptoms of disease (latent infection), or efficacy may be reduced as a result of human error. It is possible to include lower efficacy values (for instance, an 80% chance of detecting the pest when an infested unit is inspected) in the determination of sample size.

3.3.1.1.5 Sample size

The sample size is the number of units selected from the lot or consignment that will be inspected or tested. Guidance on determining the sample size is provided in section 5.

3.1.1.6 Tolerance level

Tolerance level refers to the percentage of infestation in the entire consignment or lot that is the threshold for phytosanitary action.

Tolerance levels may be established for regulated non-quarantine pests (as described in ISPM 21:2004, section 4.4) and may also be established for conditions related to other phytosanitary import requirements (for example, bark on wood or soil on plant roots).

Most NPPOs have a zero tolerance level for all quarantine pests, taking into account probabilities of pest presence in the non-sampled units as described in section 3.1.1.1. However, an NPPO may determine to establish a tolerance level for a quarantine pest based on pest risk analysis (as described in ISPM 11:2004, section 3.4.1) and then determine sampling rates from this. For example, NPPOs may determine a tolerance level that is greater than zero because small numbers of the quarantine pest may be acceptable if the establishment potential of the pest is considered low or if the intended end use of the product (for example, fresh fruit and vegetables imported for processing) limits the potential of entry of the pest into endangered areas.

3.3.1.2 Links between the parameters and tolerance level

The five parameters (acceptance number, level of detection, confidence level, efficacy of detection and sample size) are statistically related. Taking into account the established tolerance level, the NPPO should determine the efficacy of the detection method used and decide upon the acceptance number inthe sample; any two of the remaining three parameters can also be chosen, and the remainder will be determined from the values chosen for the rest.

If a tolerance level greater than zero has been established, the level of detection chosen should be equal to (or less than, if the acceptance number is greater than zero) the tolerance level to ensure that consignments having an infestation level greater than the tolerance level will be detected with the specified confidence level.

If no pests are detected in the sample unit, then the percentage of infestation in the consignment cannot be stated beyond the fact that it falls below the level of detection at the stated confidence level. If the pest is not detected with the appropriate sample size, the confidence level gives a probability that the tolerance level is not exceeded.

Statistical based sampling methods are the following

- Simple random sampling
- Systematic sampling
- Stratified sampling
- Sequential sampling
- Cluster sampling
- Fixed proportion sampling

The details of the above statistical sampling method is available in NSPM 31, Nepal

3.3.2 Non-statistically based sampling

Other sampling methods that are not statistically based, such as convenience sampling, haphazard sampling or selective or targeted sampling, may provide valid results in determining the presence or absence of a regulated pest(s). The following methods may be used based on specific operational considerations or when the goal is purely detection of pests.

3.3.2.1 Convenience sampling

Convenience sampling involves selecting the most convenient (for example, accessible, cheapest, fastest) units from the lot, without selecting units in a random or systematic manner.

3.3.2.2 Haphazard sampling

Haphazard sampling involves selecting arbitrary units without using a true randomization process. This may often appear to be random because the inspector is not conscious of having any selection bias. However, unconscious bias may occur, so that the degree to which the sample is representative of the lot is unknown.

3.3.2.3 Selective or targeted sampling

Selective sampling involves deliberately selecting samples from parts of the lot most likely to be infested, or units that are obviously infested, in order to increase the chance of detecting a specific regulated pest. This method may rely on inspectors who are experienced with the

commodity and familiar with the pest's biology. Use of this method may also be triggered through a pathway analysis identifying a specific section of the lot with a higher probability of being infested (for example, a wet section of timber may be more likely to harbour nematodes). Because the sample is targeted, and hence statistically biased, a probabilistic statement about the infestation level in the lot can not be made. However, if the sole purpose of sampling is to increase the chance of finding a regulated pest(s), this method is valid. Separate samples of the commodity may be required to meet general confidence in detection of other regulated pests. The use of selective or targeted sampling may limit the opportunities to derive information about the overall pest status of the lot or consignment, because sampling is focused on where specific regulated pests are likely to be found not on the remainder of the lot or consignment.

4. SELECTING A SAMPLING METHOD

In most cases the selection of an appropriate sampling method is necessarily dependent on information available about pest incidence and distribution in the consignment or lot as well as the operational parameters associated with the inspection situation in question. In most phytosanitary applications operational limitations will dictate the practicality of sampling under one or another method. Subsequently determining the statistical validity of practical methods will narrow the field of alternatives.

The sampling method that is ultimately selected by the NPPO should be operationally feasible and be the most appropriate to achieve the objective and be well documented for transparency. Operational feasibility is clearly linked to judgments concerning situation-specific factors, but should be consistently applied.

If sampling is undertaken to increase the chance of detecting a specific pest targeted sampling (described in section 3.2.3) may be the preferred option as long as the inspectors can identify the section(s) of the lot with a higher probability of being infested. Without this knowledge, one of the statistically based methods will be more appropriate. Non-statistically based sampling methods do not result in each unit having an equal probability of being included in the sample and do not allow for quantification of a confidence level or level of detection.

Statistically based methods will be appropriate if sampling is undertaken to provide information about the general phytosanitary condition of a consignment, to detect multiple quarantine pests or to verify compliance with phytosanitary requirements.

In selecting a statistically based method, consideration may be given to how the consignment has been treated in harvesting, sorting and packing, and the likely distribution of the pest(s) in the lot. Sampling methods may be combined: for instance, a stratified sample may have either random or systematic selection of sample units (or clusters) within strata.

If sampling is undertaken to determine whether a specific non-zero tolerance level has been exceeded, a sequential sampling method may be appropriate.

Once a sampling method has been selected and correctly applied, repeating the sampling with the aim of achieving a different result is unacceptable. Sampling should not be repeated unless considered necessary for specific technical reasons (for example, suspected incorrect application of sampling methodology).

Operational Manual for Import and Export Certification in 2005, in which procedures for samplings; sampling different commodities like seeds for propagation, cut flowers, fruit and vegetables have been described in detail (Annext-I, attached). For the sample size of seeds, sampling procedures prescribed by International Seed Testing Association (ISTA) Rules, 1976 have been recommended. Attached operational manual,(Annex-I) which is slight modification of operation manual prepared by NPQP is recommended to follow.

5. SAMPLE SIZE DETERMINATION

To determine the number of samples to be taken, the NPPO should select a confidence level (for example, 95%), a level of detection (for example, 5%) and an acceptance number (for example, zero), and determine the efficacy of detection (for example, 80%). From these values and the lot size, a sample size can be calculated. Appendixes 2–5 set out the mathematical basis for sample size determination. Section 3.1.3 of this standard provides guidance on the most appropriate statistical based sampling method when considering the distribution of the pest in the lot.

5.1 Pests distribution unknown in the lot

Because sampling is done without replacement and the population size is finite, the hypergeometric distribution should be used to determine the sample size. This distribution gives a probability of detecting a certain number of infested units in a sample of a given size drawn from a lot of a given size, when a specific number of infested units exist in the lot (see Appendix 2). The number of infested units in the lot is estimated as the level of detection multiplied by the total number of units in the lot.

As lot size increases, the sample size required for a specific level of detection and confidence level approaches an upper limit. When the sample size is less than 5% of the lot size, the sample size can be calculated using either the binomial or Poisson distribution (see Appendix 3). All three distributions (hypergeometric, binomial and Poisson) give almost identical sample sizes for specific confidence anddetection levels with large lot sizes, but binomial and Poisson distributions are easier to calculate.

5.2. Pest distribution aggregated in the lot

Most pest populations are aggregated to some degree in the field. Because commodities may be harvested and packed in the field without being graded or sorted, the distribution of infested units in the lot may be clustered or aggregated. Aggregation of infested units of a commodity willalwayslower the likelihood of finding an infestation. However, phytosanitary inspections are aimed at detection of infested units and/or pest(s) at a low level. The effect of aggregation of the infested units on the efficacy of detection of a sample and on the required sample size is small in most cases. WhenNPPOs identify that there is a high likelihood that there will be aggregation of infested units in the lot a stratified sampling method may help increase the chance of detecting an aggregated infestation.

When pests are aggregated, the calculation of sample size should ideally be performed using a beta-binomial distribution (see Appendix 4). However, this calculation requires knowledge of the degree of aggregation, which is generally not known and therefore this distribution may not be practical for general use. One of the other distributions (hypergeometric, binomial or Poisson) can be used; however, the confidence level of the sampling will decline as the degree of aggregation increases.

6. VARYING LEVEL OF DETECTION

The choice of a constant level of detection may result in a varying number of infested units entering with imported consignments because lot size varies (for example, a 1% infestation level of 1000 units corresponds to 10 infested units, while a 1% infestation level of 10,000 units corresponds to 100 infested units). Ideally the selection of a level of detection will reflect in part the number of infested units entering on all consignments within a particular period of time. If NPPOs want to manage the number of infested units entering with each consignment as well, a varying level of detection may be used. A tolerance level would be specified in terms of a number of infested items per consignment, and the sample size would be set in order to give the desired confidence and detection levels.

7. OUTCOME OF SAMPLING

The outcome of activities and techniques related to sampling may result in phytosanitary action being taken (further details can be found in ISPM 23:2005, section 2.5).

Annex- I : Details of sampling procedures for different NTFPs

A. NTFPs seeds for propagation

Sampling

- The sampling of the NTFP seed for propagation shall be in accordance with the sampling procedures prescribed by International Seed Testing Association (ISTA) Rules, 1976.

- The maximum size of seed lot for NTFP is 20 MTs for seeds of the same size of wheat or larger. However for small size seeds the lot size is 10 MTs.For tree species with seeds of the size of*Fagus* species or larger, the maximum is 5 MTs, and for seeds still smaller in size it is 5 MTs.

Sampling regime for seed lots in bulk

Lot size	**No. of primary samples required to be drawn**
500 kg.or less	Atleast five primary samples.
501 to 3000 kg.	One primary sample for each 300 kg.but not less than 5 samples
3001 to 20,000 kg.	One primary sample for each 500 kg but not less than 10 samples

Sampling for seed lots in bags or containers of uniform size

Lot size	**Samples requiredto be drawn**
upto 5 containers	Sample from each container.
6 -30 containers	Sample in every 3 containers but not less than 5 samples are drawn
31 or more containers	sample in 1 of every 5 containers but not less than 10

- Sampling is usually carried out by the slotted tube sampler in case of bagged cargo. In case of sampling of seed in bulk from storage bins a sampler is used. Alternatively Nobbe Trier is used for sampling of seed from bagged cargo.

- In case of propagating plant material such as bulbs/ tubers/ cuttings/ saplings etc., atleast 0.1% of units are sampled for inspection in case of bulk consignments.

- In case of small consignments cent per cent inspection is carried out.

- ISTA rules provide minimum weight of submitted samples for various agricultural, horticultural and tree seeds as given below\

Minimum weight of submitted samples for various crop species was prescribed by ISTA as follows

Minimum weight of submitted samples	Crop species
1000 gms	*Avena sativa, Cajanuscajan, Cicerarietinum, Cucurbita*spp., *Dolichos lablab, Fagussylvatica, Glycine max, Gossypium*spp.,*Hordeumvulgare, Leucaenaleucocephala, Phaseolus*spp.,*Pinuspinea, Pisumsativum, Secalecereale, Vignaunguiculata, Triticumaestivum, Vicia*spp.,*Zeamaydis*
900 gms	*Prunusavium, Sorghum vulgare*
500 gms	*Beta vulgaris, Prunusserotina*
400gms	*Oryza sativa, Calopogoniummucunoides*
250 gms	*Sorghum sudanense, Spinaceaoleracea, Trifoliumsubterraneum*
200 gms	*Sinapis alba*
150 gms	*Capsicum spp., Cucumismelo, Cucumissativus, Llinumusitatissimum, Lycopersicaonesculentum, Pennisetumtyphoides, Solanummelongena*
100 gms	*Brassica napus, Brassica oleracea, Brassica rapa, Pinuscaribaea*
80 gms	*Allium cepa, Stylosanthes spp.*
70 gms	*Allium porum, Sesamumindicum*
60 gms	*Cuminumcyminum, Trifoliumalexandrium*
50 gms	*Allium fistulosum ,Cichoriumintyvus, Malus spp., Medicagolupulina, Medicago sativa, Meliolotus spp., Rosa spp., Trifolium pretense.*
40 gms	*Brassica chinensis, Brassica nigra, Cichoriumendivia, Piceaabies*
30 gms	*Daucuscarota, Lactuca sativa, Ulmus spp.*
25 gms	*Apiumgraveolens, Nicotiana tabacum,*

The above prescription can be taken as guideline to decide the quantity of sample NTFPs to be taken considering similar size and economical value of the NTFPs

- The samples shall be drawn at random from bags with the help of a slotted tube sampler or by the corn sampler in case of large size seed as that of maize, pea, beans and gram etc.

- Sampling of the grain from the bins should be carried out by a bin sampler or thermosampler.

- In case of milled NPFP products the sampling by hand should bepracticed.

- A scoop or pelican type sampler should be used for drawing the representative samples from the convoy or at different intervals.

- Each of the primary samples drawn should be thoroughly mixed and balanced to constitute a homogeneous composite sample. From the composite sample a sample of 1 kg. should be drawn and submitted in sealed polyethylene covers with appropriate label for detailed laboratory testing. A minimum of 3 samples should be drawn for commodity for detailed laboratory testing.

- In case consignment is imported in containers atleast one sample should be drawn for each container

B. Sampling for NTFP root, bulbs, and corms

Quantity in a lot (kg)	**Amount of sample to be inspected**
Less than 10 kg	Inspect in total
11-100 kg	Inspect at least 10%, but at least 100 PCs
Over 101 kg	Inspect at least 5 %, but not more than 200 PCs

C. Potted plants

NTFP plants like orchids in pots, whether in flower or not, may be host plants for many pests and diseases.. The intensity and sampling depends on risk category of the plant species.

Pay attention on living insects, mainly thrips and leafminers, and on any symptom of virus or bacterial disease.

Each species and variety shall be inspected separately.

Sampling of potted plants

Number of plants in a lot	**Number of plants to be inspected**
Less than 50	Inspect in total
51-200	10 % or at least 8
201-500	5% or at least 15
More than 500	3% or at least 30

- Shake or tap sampled plants over the white inspection surface. Tap with enough force to dislodge any insect larvae, adult insects, or fecal material.

- Examine the inspection surface to catch thrips, aphids, and early instars larvae. Look for anything that moves and for fecal material that may have been dislodged.

- Pay attention to growing medium in pots, which should be clean growing peat without organic soil.

D. Nursery products (fruit trees, small plants of berries and grape wine, ornamental trees, perennials)

NTFP nursery products are usually imported with roots protected by soil or peat or mixture or both. Pay attention to soil, and if it's field soil, take samples for nematode analyses. Amount of field soil in roots shall not exceed 1% in weight.

Inspect small commodities in total.

In case of larger commodities select at random 10% of plants for inspections but make sure that you select at least 50 pieces.

Open soil or peat balls, inspect the roots, which may be infested by nematodes or bacteria (knots, malformations).

Sampling for nursery products

Number of plants in a lot	**Number of plants to be inspected**
Less than 50	Inspect all
51-200	10%, at least 15
201-500	5%, at least 20
Over 500	3%, at least 30

Pay attention to root knots, discolored stems, dark spots, loose bark in stems. Problems with nursery plants are viral and bacterial diseases, which are difficult to observe and identify, and which may appear only after certain period of growing. Pay attention to plant species, which are known as host plants of known quarantine pests.

This appendix is for reference purposes only and is not a prescriptive part of the standard.

Appendix I: Formulae used in Appendixes 2–5

No.	Formula Purpose	Appendix No.
1	Probability of detecting *i* infested units in a sample.	2
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Appendix -II: Calculating sample sizes for small lots: hypergeometric-based sampling (simple random sampling)

The hypergeometric distribution is appropriate to describe the probability of finding a pest in a relatively small lot. A lot is considered as small when the sample size is more than 5% of the lot size. In this case, sampling of one unit from the lot affects the probability of finding an infested unit in the next unit selected. Hypergeometric-based sampling is based on sampling without replacement. It is also assumed that the distribution of the pest in the lot is not aggregated and that random sampling is used. This methodology can be extended for other schemes such as stratified sampling (further details can be found in Cochran, 1977).

The probability of detecting *i* infested units in a sample is given by

$$P(X = i) = \frac{\binom{A}{i}\binom{N-A}{n-i}}{\binom{N}{n}} \quad \text{Formula 1}$$

Where:

$$a! = b(!a-b)!$$ where a!= a(a-1)(a-2)….. 1 and 0!=1

P(X = i) is the probability of observing *i* infested units in the sample, where i = 0, …, *n*.

The confidence level corresponds to: 1- P(X = i)

A = number of infested units in the lot that could be detected if every unit in the lot was inspected or tested, given the efficacy of detection (level of detection ◊ N ◊ efficacy, truncated to an integer)

i = number of infested units in the sample

N = number of units in the lot (size of the lot)

n = number of units in the sample (sample size)

In particular the approximation that can be used for the probability of finding no infested units is $-n$

where u = (n-1)/2 (from Cochran, 1977).

$$P(X=0) = \frac{\binom{N-u}{n}}{\binom{N}{n}} \quad \text{Formula 2}$$

$$\frac{\binom{N-A}{u}}{\binom{N}{u}}$$

Solving the equation to determine *n* is difficult arithmetically but can be done with approximation or through maximum likelihood estimation.

Tables 1 and 2 show sample sizes calculated for different lot sizes, levels of detection and confidence levels, when the acceptance number is 0.

Appendix need to copy and add !