Step-by-step instructions

For using the sample size calculator

Risk-Based Sampling RBS

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North American Plant Protection Organization
Organización Norteamericana de Protección a las Plantas
MEXICO - USA - CANADA

Step-by-step Instructions for Using the Sample Size Calculator

The North American Plant Protection Organization - NAPPO - has developed different tools to facilitate the implementation of Risk-Based Sampling (RBS). Among them is a sample size calculator that can be found on the NAPPO website at https://www.nappo.org/index.php. In order to access this and all other RBS tools click on "more information" in the Risk-Based Sampling section of the home page (Figure 1).
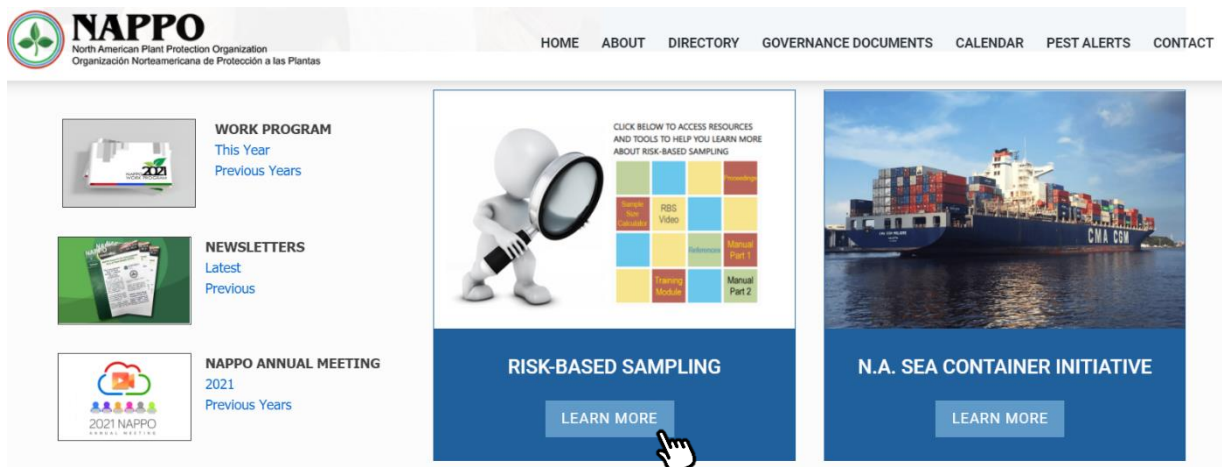

Figure 1. NAPPO home page and how to access the Risk-Based Sampling (RBS) tools.

The sample size calculator was specifically designed for a Risk Management and Risk-Based Sampling Workshop jointly organized by USDA/APHIS and the Inter-American Institute for Cooperation in Agriculture (IICA) in Lima, Perú in September of 2018. The workshop was hosted by the General Secretariat of the Andean Community (CAN).

The tool helps us calculate the appropriate sample size for inspection but also assists users in the organization of data derived from inspection activities at ports, airports and border points.
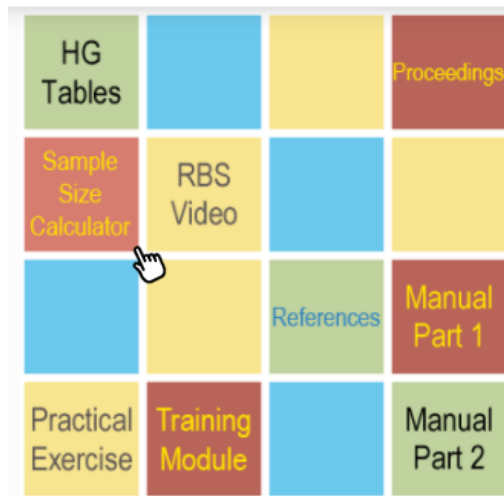
Figure 2. Details on finding/accessing the sample size calculator.

At the bottom of the page is the link to the sample size calculator in Excel format. Download it by clicking XLSX (Figure 3). Once you download the Excel file to your PC, you can begin using the tool which includes the following workbooks:

- Sample size calculator
- Database for inspection data
- How to randomize the samples
- Directory of importers
- Directory of exporters
- Directory of producers
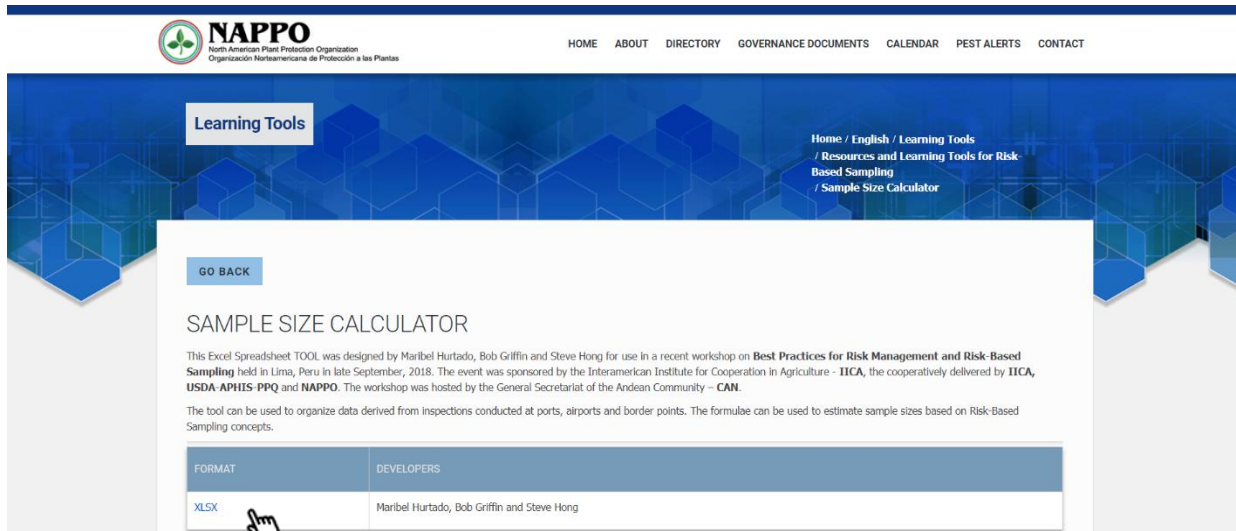
Figure 3. Where to download the sample size calculator tool.

Below we describe each workbook and its use:

- **Cover page:** the cover page has links to each of the workbooks (Figure 4).

Figure 4. Cover page for the sample size calculator.

- **Sample size calculator:**

This workbook is used to calculate the number of samples that an inspector should inspect from a commercial consignment or lot given the following parameters – level of detection or level of risk acceptance, level of confidence, lot size and sample unit. The workbook will calculate the sample size if the parameters are entered in the appropriate workbook cells. The formula used to calculate the sample size (n) is based on hypergeometric probability (Fosgate, 2009).

$$n = \left(1 - (\alpha)^{1/D}\right)\left(N - \frac{D-1}{2}\right)$$

Where,

D is the level of detection, **1-(α)** is the level of confidence and **N** is the lot size.

- ✓ **Level of detection/acceptance (D)**: is the minimum infestation percentage or proportion detected at a specified level of confidence established by the National Plant Protection Organization (NPPO). For illustration purposes we will use 10%.

- ✓ **Confidence level (1-α)**: indicates the probability that a consignment with a particular level of infestation is detected. A 95% confidence level is routinely used; it should be entered as 0.95 in the workbook.

- ✓ **Lot size (N):** the total number of units in the consignment.

- ✓ **Sampling Unit:** the unit chosen for sampling, for example box, individual fruit, individual bouquet, etc.

Sample size calculator		
Hypergeometric distribution		
Detection level Risk acceptance level	10%	The detection level [To calculate the sample size, register the data for the detection level, confidence level, lot size and sampling unit.] station percentage or proportion that the sampling methodology will efficacy level and the specified confidence level that the NPPO set to detect
Confidence level (1-α)	0,95	The confidence le bility that a consignment with a degree of infestation exceeds the detection level to be detected. A 95% confidence level is usually applied.
Lot size (N)	100	Total number of units in the lot.
Sampling unit	Box	The units of a lot which will be sampled (e.g., box, bag, plant, etc.)
Sample size (n)	25	The sample size is the number of sample units selected from the lot or consignment to be inspected or subject to testing.

Go to presentation
Go to database for inspection data
Go to randomized samples

Go to directory of importers
Go to directory of exporters
Go to directory of producers

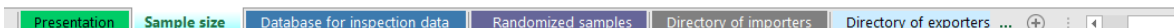| Presentation | Sample size | Database for inspection data | Randomized samples | Directory of importers | Directory of exporters ... |

Figure 5. Sample size workbook.

In our example using a level of detection of 10%, a confidence level of 95% and a lot size of 1,000 boxes, the resulting sample size is 29 boxes.

- **Database for inspection data:**

Use the workbook table to collect/organize data gathered during inspections at ports, airports, and border points (Figure 6).

Figure 6. Table to collect/organize inspection data.

Additional details on data for this workbook.

- Consignment number or ID: enter the consignment unique identification number.

- Certificate number: enter the phytosanitary certificate number.

- Date (dd/mm/yyyy): enter the consignment shipment date.

- Import/Export: indicate if consignment is being imported or exported.

- Lot size N: enter the consignment lot size.

- Sampling unit: enter the unit chosen for sampling (box, fruit, etc.)

- Sample size: enter the calculated sample size or the number of units that were sampled or tested.

- Randomization of samples: indicate whether samples were randomized or not.

- Country of origin: for imports indicate country of origin.

- Country of destination: for exports indicate country of destination.

- Product: common name of the product.

- Consignment: For each consignment select "1".

- Scientific name of the product: indicate scientific name of the product.

- Product category: indicate category for example: fruit, vegetable, seed, plant for planting, flower, etc.

- Product type: for example, fresh fruit, processed fruit, vegetable seed, tree seed, ornamental seed, wild plants for planting, in vitro plants for planting, etc.

- Additional product information: to note additional product information that could be relevant.

- Importer: provide importer unique identification number.

- Exporter: provide exporter unique identification number.

- Producer: provide producer unique identification number.

- Pest common name: if a pest is found during inspection record its common name. Note – each pest should have an individual data entry.

- Pest scientific name: if a pest is found during inspection record its scientific name.

- Pest type: indicate the type of pest that was intercepted; for example, insect, mite, nematode, weed, mollusk, etc.

- Pest stage: indicate the developmental stage of the pest; for example, egg, nymph, adult, etc.

- Number of pests: indicate the total number of a specific pest found in the consignment.

- Pest categorization: is the pest a quarantine pest, a non-quarantine pest or a regulated non-quarantine pest (consult ISPM 5).

- Pest risk level: indicate whether pest risk is high, medium, low or no risk.

- Action: if the consignment will require mitigation of the intercepted pest enter 1; otherwise enter zero "0".

- Name of inspector performing the inspection.

- General observations: if appropriate note additional observations concerning the consignment.

▪ **How to randomize the samples**

This workbook assists in the selection of samples to inspect. The data for lot size and sample size come from the sample size workbook. In the example the lot size is 1,000 and the sample size is 29; according to the workbook, the appropriate randomized simples should include boxes 642, 839, etc., as seen in Figure 7.

Figure 7. Randomizing the samples taking into account lot size and sample size calculated using in the Sample Size workbook.

▪ **Directory of importers**

In this workbook we collect pertinent data on the importers including the registration code or number of the importing company or the importer assigned by the NPPO, the name or registered name of the importing company, the unique identification number of the importing company, the complete address, the GPS coordinates, the importer's name, telephone, email and a space for general comments (Figure 8).

Figure 8. Directory of importers.

- **Directory of exporters**

In this workbook we collect pertinent data on the exporters including the registration code or number of the exporting company or the exporter assigned by the NPPO, the name or registered name of the exporting company, the unique identification number of the exporting company, the complete address, the GPS coordinates, the exporter's name, telephone, email and a space for general comments (Figure 9).

Figure 9. Directory of exporters.

▪ **Directory of producers**

In this workbook we collect relevant data on the producers including the registration code or number for the field/farm or the producer assigned by the NPPO, the name or registered name of the field/farm, the complete address, the GPS coordinates, species of fruits and vegetables being produced in the field/farm, area (in ha) that is planted per species, estimated monthly production by commodity, producers name, telephone, email and a space for general comments (Figure 10).

Figure 10. Directory of producers.

Using these tools to calculate the sample size and organize inspection data facilitates the conduct of simple statistical analyses that can guide/inform future sampling approaches and lead us to adopt more precise, strategic, and effective sampling schemes that take into account the appropriate level of protection given the risk of introduction of each pest. An additional benefit is it allows us to optimize the use of resources dedicated to inspection.