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Specialized Section on Standardization of Seed Potatoes

Standard for Seed potatoes

Submitted by the secretariat

The following document is submitted to the Working Party for adoption as amendments to the Standard for Seed Potatoes. It is prepared according to ECE/CTCS/2017/10 section II c and ECE/CTCS/2018/2 section VII a.

Proposed changes to the standard for seed potatoes

1. Replacement of the term (or the relevant acronym) 'Designated Authority (DA)'

Replace the term Designated Authority (DA) throughout the standard and the Guides (electronic versions) by "Certifying Authority (CA)" with the following definitions:

Annex VII:

Certifying Authority (CA): Organization(s), agency or agencies designated by government and/or industry to administer the certification of seed potatoes,

Introduction, Section IV:

"Certifying Authorities applying this Standard should notify the UNECE Secretariat".

2. Revision of Annex II and Annex IX

Amendment to Annex II B (2) – 3rd paragraph:

The number of plants inspected should be sufficient to ensure that, with an appropriate level of confidence, the tolerances given in Annex II A are not exceeded. Table 5 and 6 in Annex IX provide guidance on the number of plants to sample and maximum allowable number of each fault in each sample size.

3. Amendments to Annex IX

Proposed new heading: "Sample sizes for virus testing and field inspection"

Proposed new section "1. Introduction"

When undertaking field inspection or testing seed stocks for virus, it is seldom feasible to inspect or test the entire crop or stock, so a test is done on a sample. Ideally, only seed with faults below the tolerance would be accepted and those above the tolerance rejected. However, taking a sample means that only an estimation of the actual incidence of faults can be made.

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

The first is that of rejecting a crop or stock containing fewer faults than the tolerance and is often described as the "grower's" risk. The risk of accepting a crop or stock containing more faults than the tolerance is known as the "buyer's" risk. From the point of view of classification authorities, this could also be described as the risk of passing a crop or stock which fails to meet the official tolerances.

The choice of the testing technique may also have a bearing on the precision of the result, in particular the use of bulking of individual samples into one laboratory analysis. Bulking will have an impact on the confidence interval of the test.

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

The following tables and graphs illustrate some of the principles involved in establishing sample sizes for inspection and testing.

Proposed new heading: "2. Confidence limits for virus testing"

Proposed new heading: "3. Probability of classifying stocks to meet specified virus tolerances"

Proposed new heading: "4. Bulking of samples for virus testing"

Proposed new section "5. Sample sizes for field inspection"

Tolerances for faults detected during field inspection are specified in Annex II A. Annex II B states that the number of plants inspected should be sufficient to ensure that, with an appropriate level of confidence, the tolerances given in Annex II A are not exceeded. Determination of the "appropriate level of confidence" is at the discretion of the Certifying Authority, and the following tables are provided for guidance purposes.

Confidence levels for field inspection

One approach to determining an appropriate number of plants to inspect during field inspection is to determine an appropriate confidence level and inspect the number of plants required to be sure that, if no faults are found, the tolerance has not been exceeded. For example, if a Certifying Authority wishes to be 95% confident that the 0.1% tolerance for a fault in a crop has not been exceeded, a minimum of 3000 plants need to be inspected with no faults found (Table 5).

Table 5:
Rounded minimum sample size (along with no faults in sampled plants) required for statistical proof that the true level of faults is less than the specified maximum, at confidence levels for field inspections of 90%, 95% and 99%.

Specified maximum level of disease	*Minimum sample size (along with NO disease in sampled plants) required for statistical proof that the true level of disease is less than the specified maximum, at confidence level:*		
	90%	*95%*	*99%*
0%	A census (100% sample) of all plants is required for proving this is the case.		
0.01%	23,100	30,000	46,100
0.1%	2,310	3,000	4,610
0.2%	1,150	1,500	2,300
0.25%	920	1,200	1,840
0.5%	460	600	920
0.8%	290	380	580
1%	230	300	460
1.5%	160	200	310
2%	120	150	230
6%	40	50	75

For faults with higher tolerances, the number of plants to be inspected to be 95% confident that the tolerance has not been exceeded may seem quite small. For example, to be 95% confident that a tolerance of 1% has not been exceeded, only 300 plants need to be inspected. However, it is important to recall that the statistical validity of inspection requires that faults are evenly distributed through the crop, and that the plants sampled for inspection are selected randomly. Neither of these criteria are likely to be fully met in field inspections and, to compensate, a larger number of plants may need to be inspected.

Confidence intervals for field inspection

Another way of measuring confidence in an inspection result is to apply a confidence interval, based on the inspection sample size and the number of faults found. This is useful where the number of faults is close to the tolerance, where a standard level of confidence is not specified by the Certifying Authority, or where the actual sample size is below that required to be 95% confident of meeting the tolerance. The buyer can review the number of plants sampled, and the number of faults found, and determine the upper confidence interval.

For example, if a 0.5% tolerance applies to a crop this is the same as 5 faults per 1000 plants. If 1000 plants are inspected and 5 faults are found, the crop passes inspection. Similarly, if 3000 plants are inspected 15 faults are allowed. However, there is less confidence in the accuracy of the inspection result when fewer plants are inspected. In this example, the true number of faults when 1000 plants were inspected could be as high as 1.05%, but only as high as 0.77% when 3000 plants are inspected (Table 6).

Table 6

Upper limit of the 95% confidence interval (one-sided) for tolerances at differing field inspection sample sizes and numbers of faults detected.

Required tolerance (Annexe XI)	*Inspection sample size (actual number of plants inspected*	*Number of faults detected (arithmetically allowable)*	*Upper limit of 95% confidence interval (% faults)*
0.50%	1000	5	1.05
	3000	15	0.77
	6000	30	0.68
0.40%	1000	4	0.91
	3000	12	0.65
	6000	24	0.56
0.20%	1000	2	0.63
	3000	6	0.39
	6000	12	0.32
0.10%	1000	1	0.47
	3000	3	0.26
	6000	6	0.20
0.05%	1000	0	0.30
	3000	1	0.16
	6000	3	0.13
	7000	3	0.11
0.01%	1000	0	0.30
	3000	0	0.10
	6000	0	0.05
	10000	1	0.05
	25000	2	0.03