

## 2018 Rule Proposal 16

### Purpose of Proposal

The purpose of the proposal is to (1) correct the instructions for using Tables 14G and 14H, (2) change the title of Table 14H to clarify the appropriate use of the tolerance table. “Maximum tolerated number of weed or other crop seeds, by numbers, allowed between two bulk seed exams of an equal sample weight from the same seed lot tested in the same or different laboratory (two-way test;  $P=0.05$ ), and (3) add Table 14H footnotes clarifying the restricted use of that table.

### Present Rule

#### 14.3 Tolerances for noxious-weed seeds.

Noxious-weed seed tolerances are based on the Poisson distribution. Table 14G is mostly used for regulatory purposes to determine if a second test has significantly more noxious-weed seeds than stated on the label or found in a first test. Tolerance values in Table 14G are based on a **one-way test** at five percent probability level and are for tests made on two different samples drawn from the same seed lot tested in the same or in different laboratories. The tolerances in Table 14G are determined by entering the number of noxious-weed seeds listed on the label in column A; and the maximum number of noxious-weed seeds that may be found in the second test and considered within tolerance is found on the same line in column B. If the number of noxious weed seeds found in the second test does not exceed the allowed maximum tolerance in column B, then the number of noxious weed seeds on the label or found in the first test and the number of noxious weeds found in the second test are within tolerance. Table 14G is adapted from Elias *et al.* (2000).

Table 14H is adapted from Miles (1963; Table F1b, p. 615). It is used to determine whether results of two tests are comparable (within tolerance) or if one test has significantly more or less noxious-weed seeds than the other. This table is used to compare test results within and among laboratories for internal training, referees, quality assurance, or similar purposes. The tolerance values in Table 14H are based on a **two-way test** at five percent probability level, and are for tests made on two different samples drawn from the same lot and tested in the same or in different laboratories. Both tests should be made on equal quantities of seed. The tolerances in Table 14H are determined by locating in column A the average number of Noxious-weed seeds found in the two tests; and the maximum tolerated difference between the two tests is found on the same line in column B. If the difference between two tests exceeds the tolerance value found in column B, the test results are significantly different (out of tolerance).

For both tolerance applications, it is important that the number of noxious-weed seeds per weight unit (e.g., gram) remains the same in both tests. For example, if the label or report of analysis states two seeds in 50 grams; then the second test should be conducted on 50 grams. If the label or report of analysis states 18 seeds per pound; then the information must be converted to number of seeds in 50 grams (i.e., 2 seeds in 50 grams for the

example stated above); providing that both tests were made on equal quantities of seed (e.g., 50 grams).

**Example 1**

**Use of Table 14G:**

A lot of red clover is labeled to contain 18 dodder seeds per pound. Four dodder seeds were found in 50 grams. The labeled number is at the rate of 2 seeds per 50 grams.

- 1) **Test Results:** Label: 18 seed/lb (2 dodder seed/50 g); Analysis: 4 dodder seed/50 g
- 2) **Application of Tolerance:** In Table 14G on the line that has 2 in Column A (Number labeled or represented), Column B shows 4 as the maximum number within tolerance. The label is satisfactory as far as dodder seed is concerned, because the number found (4) does not exceed the maximum tolerated value (4).

Note that before entering the table, the labeled number per pound is converted to the number per 50 grams, the weight examined.

**Example 2**

**Use of Table 14G:**

Suppose 7 dodder seeds were found in the 50 gram sample of example 1. This exceeds the tolerance (4). The analyst decided to examine a second 50 grams. Only 2 dodder seeds were found in the second examination. The total found is now 9 dodder seeds in 100 grams. The labeled number is at the rate of 4 seeds per 100 grams.

- 1) **Test Results:** Label: 18 seed/lb (4 dodder seed/100 g)  
Analysis: 9 dodder seeds/100 g
- 2) **Application of Tolerance:** In Table 14G, on the line that has 4 in Column A (Number labeled or represented), Column B shows 7 as the maximum number within tolerance. The label is not satisfactory as far as dodder seed is concerned, because the number found (9) in 100 grams examined exceeds the maximum tolerated value (7).

**Example 3**

**Use of Table 14H:**

In a referee study, two submitted samples were drawn from a seed lot, one lab found 4 dodder seeds in 50 grams; another lab found 10 dodder seeds in 50 grams. Determine if the two test results are comparable (within tolerance):

- 1) **Test Results:** Analysis 1: 4 dodder/50 g; Analysis 2: 10 dodder/50 g
- 2) **Tolerance Calculation:** Average:  $(4 + 10) \div 2 = 7$   
Difference:  $10 - 4 = 6$
- 3) **Application of Tolerance:** In Table 14H, the line that has the average of the two test results (7) in Column A (Average of two test results), Column B shows 8 as the maximum tolerated difference between the two tests. The test results of the two laboratories are comparable (within tolerance) because the difference in the number of noxious-weed seeds found between the two tests (6), does not exceed the maximum tolerated value (8) found in Table 14H.

**Table 14G. Maximum tolerated number of noxious-weed seeds allowed in a second test made on an equal quantity of seed in the same or different laboratory (one-way test at P=0.05).**

Number labeled or represented	Maximum number within tolerance	Number labeled or represented	Maximum number within tolerance	Number labeled or represented	Maximum number within tolerance
A	B	A	B	A	B
0	2	34	43	68	81
1	2	35	44	69	82
2	4	36	45	70	83
3	5	37	46	71	84
4	7	38	47	72	85
5	8	39	49	73	86
6	9	40	50	74	87
7	11	41	51	75	89
8	12	42	52	76	90
9	13	43	53	77	91
10	14	44	54	78	92
11	16	45	55	79	93
12	17	46	56	80	94
13	18	47	58	81	95
14	19	48	59	82	96
15	21	49	60	83	97
16	22	50	61	84	98
17	23	51	62	85	99
18	24	52	63	86	101
19	25	53	64	87	102
20	27	54	65	88	103
21	28	55	67	89	104
22	29	56	68	90	105
23	30	57	69	91	106
24	31	58	70	92	107
25	32	59	71	93	108
26	34	60	72	94	109
27	35	61	73	95	110
28	36	62	74	96	111
29	37	63	75	97	112
30	38	64	76	98	114
31	39	65	78	99	115
32	41	66	79	100*	116
33	42	67	80		

\* To compute tolerance values beyond 100, use the following equation  $P = x + 1.65\sqrt{x} + 0.3$  (from *Elias, et al., 2000*), where P is the maximum tolerated number of noxious-weed seed in a second test, and x is the number of noxious seed labeled.

**Table 14H. Maximum tolerated number of noxious-weed seeds between two tests made on equal quantities in the same or different laboratory to determine whether the two tests are within tolerance (two-way test at  $P=0.05$ ).**

Average of two test results* A	Maximum tolerated difference B	Average of two test results A	Maximum tolerated difference B	Average of two test results A	Maximum tolerated difference B
		64 - 69	23	231 - 241	43
		70 - 75	24	242 - 252	44
3	5	76 - 81	25	253 - 264	45
4	6	82 - 88	26	265 - 276	46
5 - 6	7	89 - 95	27	277 - 288	47
7 - 8	8	96 - 102	28	289 - 300	48
9 - 10	9	103 - 110	29	301 - 313	49
11 - 13	10	111 - 117	30	314 - 326	50
14 - 15	11	118 - 125	31	327 - 339	51
16 - 18	12	126 - 133	32	340 - 353	52
19 - 22	13	134 - 142	33	354 - 366	53
23 - 25	14	143 - 151	34	367 - 380	54
26 - 29	15	152 - 160	35	381 - 394	55
30 - 33	16	161 - 169	36	395 - 409	56
34 - 37	17	170 - 178	37	410 - 424	57
38 - 42	18	179 - 188	38	425 - 439	58
43 - 47	19	189 - 198	39	440 - 454	59
48 - 52	20	199 - 209	40	455 - 469	60
53 - 57	21	210 - 219	41	470 - 485	61
58 - 63	22	220 - 230	42	486-501	62

\* Two tests with an average of one or two noxious-weed seeds found are not significantly different.

## Proposed Rule

### 14.3 Tolerances for noxious-weed seed **examinations and bulk seed examinations.**

Noxious-weed seed tolerances in Table 14G are based on the Poisson distribution. Tolerance values in Table 14G are based on a one-way test at five percent probability level and are for tests made on two different samples drawn from the same seed lot tested in the same or in different laboratories. Table 14G is adapted from Elias et al. (2000).

Table 14G is used primarily for regulatory purposes to determine if a second test contains significantly more noxious weed seeds than stated on the label or found in a first test. If the number of noxious weed seeds found is less than stated on the label or found in a first test, then no tolerance evaluation is necessary.

It is important to note that each noxious weed seed species found in a sample must be evaluated independently. Also, the labeled value (or first test finding) and a second test must be made on or adjusted to equal quantities of seed (refer to Appendix 1 in the AOSA, vol. 1. for conversion of

sample quantities). For example, if the label (first test) states 18 seeds per pound and the second test is conducted on 50 grams; then the labeled value must be converted to number of seeds in 50 grams (i.e., 2 seeds in 50 grams).

A tolerance value from Table 14G is determined by entering the table at the number of noxious-weed seeds listed on the label in Column A; and the maximum number of noxious-weed seeds considered within tolerance is found on the same line in Column B. If the number of the noxious weed seeds found in the second test is equal to or less than the number in Column B, the labeled value (first test) and the second test result are within tolerance. If the number of noxious weed seeds found exceeds the number in Column B, the labeled value (first test) and the second test are out of tolerance.

**Example 1.** A lot of red clover is labeled to contain 18 dodder seeds per pound. In a second test, 4 dodder seeds were found in 50 grams. Is the number of noxious weed seeds found in the second test within tolerance of the label claim?

- 1) Convert test results to number of seeds found per same sample weight:** The label states 18 seeds per pound, while the second test found 4 dodder seeds per 50 grams. The number of seeds per pound should be converted to seeds per 50 g (1 pound = 453.6 g) before tolerances can be tested. Note that it is equally correct to convert the second test result from 4 seeds per 50 g to number of seeds per pound.

$$\frac{18 \text{ seeds}}{1 \text{ pound}} = \frac{18 \text{ seeds}}{453.6 \text{ grams}}$$

**Use of Table 14G:** A lot of red clover is labeled to contain 18 dodder seeds

$$\frac{18 \text{ seeds}}{453.6 \text{ grams}} * 50 \text{ grams} = 1.98, \text{ rounded to 2 dodder seeds per 50 g}$$

- 2) Application of tolerances:** Enter Table 14G under Column A on the line that shows 2 (number labeled or represented). The same row under Column B shows 4 as the maximum tolerated number within tolerance. The label is satisfactory as far as dodder seed is concerned because the number found (4) does not exceed the maximum tolerated value (4).

**Example 2.**

**Use of Table 14G:** Suppose 7 dodder seeds were found in the 50 gram sample shown in example 1. This exceeds the tolerance (maximum number within tolerance equals 4). The analyst decides to examine an additional 50 grams. Only 2 dodder seeds were found in the second 50 grams. The results of the two sequential tests are combined together, and the total found is now 9 dodder seeds in 100 grams. Is the combined number of noxious weed seeds found (9 per 100 g) within tolerance of the label claim of 4 per 100 g?

- 1) Convert test results to number of seeds found per same sample weight:** The label states 18 seeds per pound, which is equivalent to 4 dodder seeds per 100 grams:

$$\frac{18 \text{ seeds}}{453.6 \text{ g}} * 100 \text{ grams} = 3.98, \text{ rounded to 4 dodder seeds per 100 g}$$

The combined (second) test results found 9 dodder seeds per 100 grams.

- 2) Application of tolerances:** Enter Table 14G under Column A on the line that shows 4 (number labeled or represented). The same line under Column B shows 7 as the maximum number within tolerance. The label is not satisfactory as far as dodder seed is concerned because the number found (9) exceeds the maximum tolerated value (7).

**Table 14G. Maximum tolerated number of noxious-weed seeds allowed in a second test made on an equal quantity of seed in the same or different laboratory (one-way test at P=0.05).**

Number labeled or represented	Maximum number within tolerance	Number labeled or represented	Maximum number within tolerance	Number labeled or represented	Maximum number within tolerance
A	B	A	B	A	B
0	2	34	43	68	81
1	2	35	44	69	82
2	4	36	45	70	83
3	5	37	46	71	84
4	7	38	47	72	85
5	8	39	49	73	86
6	9	40	50	74	87
7	11	41	51	75	89
8	12	42	52	76	90
9	13	43	53	77	91
10	14	44	54	78	92
11	16	45	55	79	93
12	17	46	56	80	94
13	18	47	58	81	95
14	19	48	59	82	96
15	21	49	60	83	97
16	22	50	61	84	98
17	23	51	62	85	99
18	24	52	63	86	101
19	25	53	64	87	102
20	27	54	65	88	103
21	28	55	67	89	104
22	29	56	68	90	105
23	30	57	69	91	106
24	31	58	70	92	107
25	32	59	71	93	108
26	34	60	72	94	109
27	35	61	73	95	110
28	36	62	74	96	111
29	37	63	75	97	112
30	38	64	76	98	114
31	39	65	78	99	115
32	41	66	79	100*	116
33	42	67	80		

\* To compute tolerance values beyond 100, use the following equation  $P = x + 1.65\sqrt{x} + 0.3$  (from *Elias et al., 2000*), where P is the maximum tolerated number of noxious-weed seed in a second test, and x is the number of labeled noxious weed seed.

Table 14H, as adapted from Miles (1963; Table F1b, p. 615), follows the binomial distribution. The tolerance values in Table 14H are based on a two-way test at five percent probability level, and are used to determine the maximum tolerated number of weed or other crop seeds, by numbers, allowed between two bulk seed examinations of an equal sample weight from the same seed lot tested in the same or different laboratory. This table may be used to compare two test results within or among laboratories for internal training or quality assurance, and should not be used for regulatory purposes. For noxious-weed seed examination tolerances use Table 14G.

The working sample weights of the two tests must be equal quantities, or adjusted to equal quantities (refer to Appendix 1 in the AOSA, vol. 1. for conversion of sample quantities). Tolerance values in Table 14H may be applied to any one species of weed seed or other crop seed, to inert matter particles (e.g., sclerotia), and to the sum of any two or more of these species or particles (Miles 1963, Sec. 5 Foreign Seeds, p. 597).

The tolerances in Table 14H are determined by locating in Column A the average number of weed or other crop seeds found in the two tests (rounded to the nearest whole number); and the maximum tolerated difference between the two tests is found on the same line in Column B. If the difference between the two tests is equal to or less than the value found in Column B, the test results are not significantly different (in tolerance). If the difference between two tests exceeds the tolerance value found in column B, the test results are significantly different (out of tolerance).

### Example 3.

**Use of Table 14H:** In a referee study, two submitted samples were drawn from a seed lot, one lab found 4 little mallow seeds in 50 grams; another lab found 10 little mallow seeds in 50 grams. Are the two test results comparable (within tolerance)?

**1) Test Results:** Lab 1 (test 1): 4 little mallow seeds found in 50 g.

Lab 2 (test 2): 10 little mallow seeds found in 50 g.

**2) Calculations:** The average of the two tests:  $(4 + 10) \div 2 = 7$

The difference between the two test results:  $10 - 4 = 6$

**3) Application of Tolerances:** In Table 14H, on the line with the average of the two test results (7) in Column A, Column B shows 8 as the maximum tolerated difference between the two tests. Therefore, the test results of the two laboratories are comparable (within tolerance) because the difference in the number of weed seeds found between the two tests (6) does not exceed the maximum tolerated value (8) found in Table 14H.

**Table 14H. Maximum tolerated number of weed<sup>a</sup> or other crop seeds, by numbers, allowed between two bulk seed exams<sup>b</sup> of an equal sample weight from the same seed lot tested in the same or different laboratory (two-way test;  $P=0.05$ ).**

Average of two test results <sup>c</sup> A	Maximum tolerated difference B	Average of two test results A	Maximum tolerated difference B	Average of two test results A	Maximum tolerated difference B
		64 - 69	23	231 - 241	43
		70 - 75	24	242 - 252	44
3	5	76 - 81	25	253 - 264	45
4	6	82 - 88	26	265 - 276	46
5 - 6	7	89 - 95	27	277 - 288	47
7 - 8	8	96 - 102	28	289 - 300	48
9 - 10	9	103 - 110	29	301 - 313	49
11 - 13	10	111 - 117	30	314 - 326	50
14 - 15	11	118 - 125	31	327 - 339	51
16 - 18	12	126 - 133	32	340 - 353	52
19 - 22	13	134 - 142	33	354 - 366	53
23 - 25	14	143 - 151	34	367 - 380	54
26 - 29	15	152 - 160	35	381 - 394	55
30 - 33	16	161 - 169	36	395 - 409	56
34 - 37	17	170 - 178	37	410 - 424	57
38 - 42	18	179 - 188	38	425 - 439	58
43 - 47	19	189 - 198	39	440 - 454	59
48 - 52	20	199 - 209	40	455 - 469	60
53 - 57	21	210 - 219	41	470 - 485	61
58 - 63	22	220 - 230	42	486-501	62

<sup>a</sup>Noxious weed exams for regulatory purposes must be done using Table 14G.

<sup>b</sup>Use of this table should be restricted to comparing results for internal training or quality assurance purposes, and not for regulatory purposes.

<sup>c</sup>Two tests with an average of one or two noxious-weed seeds found are not significantly different.

## Harmonization

In ISTA Rules, the determination of other seeds by number is included in Table 4A which is the same as Table F1b (foreign seeds) in Miles, 1963. This Table (F1b) is appropriate for determination of other crop seed and weed seeds by number. This table follows the binomial distribution and is the same as table 14H in the AOSA Rules.

ISTA does not have a comparable table to 14G in the AOSA Rules.

## Supporting evidence

In AOSA Rules, the regular purity tolerances for pure seed, weed seed, other crops, and inert matter included in Tables 14A and 14B are based on percentage by weight. Table 14G follows the Poisson distribution, which assumes that the number of noxious weed seeds in each sample is independent and that the population mean (mean of number of noxious weed seeds within the lot) is constant and does not change following its estimation for testing or labeling purposes.



(Elias et. al., 2000). This table is strictly used for comparison of noxious weed seed examination results (second test) to a label claim (first test). Table 14H, on the other hand, follows the binomial distribution and is used to determine the maximum tolerated number of weed or other crop seeds, by numbers, allowed between two bulk seed examinations of an equal sample weight from the same seed lot tested in the same or different laboratory.

In the ISTA Rules, the determination of other seeds by number is included in Table 4A (in ISTA Rules), which is the same as Table F1b (foreign seeds) in Miles 1963. This table (F1b) is appropriate for determination of foreign seeds by number, and is appropriate for the purpose ISTA is using it for. This table is based on the binomial distribution and similar to Table 14H in AOSA Rules. As stated in section 5 “Foreign Seeds” in the Tolerance Handbook of Miles 1963, tolerance tables F1a to F1d apply to any 1 species of weed seed and of other-crop seed, to inert-matter particles, and to the sum of any 2 or more of these species or particles.

Tables 14G and 14H in AOSA Rules follow different distribution models. Therefore, we should not use them alternatively for noxious weed exams. Table 14G is the appropriate one for the determination of noxious weed seeds in a sample.

## **Reference**

Miles, S. R. 1963. Handbook of tolerances and of measures of precision for seed testing. Proc. Int. Seed Test. Assoc. 28(3): 525-686.

Elias, S. G., H. Liu, O. Schabenberger, and L. O. Copeland. 2000. Re-evaluation of tolerances for noxious weed seeds. Seed Technol. 22(1) 5-14.

## **Submitted by:**

Sabry Elias; Statistics Subcommittee Chair; [sabry.elias@oregonstate.edu](mailto:sabry.elias@oregonstate.edu)

Debbie Meyer; Purity Subcommittee Co-chair, [deborah.meyer@cdfa.ca.gov](mailto:deborah.meyer@cdfa.ca.gov)

Riad Baalbaki, Germination Subcommittee Co-chair, [riad.baalbaki@cdfa.ca.gov](mailto:riad.baalbaki@cdfa.ca.gov)

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