

Rule Change Proposal – Seed Counts

For Review Only

Purpose: To combine the existing procedures in Section 12 for mechanical seed counts and Appendix 3 for determination of sample working weights for kinds not listed in Table 2A (non-mechanical seed counts) into one section and to clarify the source of the seed to be used for non-mechanical seed counts. No significant changes are made to either procedure.

Present Rule:

SECTION 12: MECHANICAL SEED COUNT

The following method shall be employed when using a mechanical seed counter to determine the number of seeds contained in a sample of soybean (*Glycine max*), corn (*Zea mays*), wheat (*Triticum aestivum*) and field bean (*Phaseolus vulgaris*).

12.1 Samples.

Samples for testing shall be of at least 500 grams for soybean, corn and field beans and 100 grams for wheat and received in moisture proof containers. Samples shall be retained in moisture proof containers until the weight of the sample prepared for purity analysis is recorded.

12.2 Seed counter calibration.

The seed counter shall be calibrated daily prior to use.

- (a) Prepare a calibration sample by counting 10 sets of 100 seeds. Visually examine each set to insure that it contains whole seeds. Combine the 10 sets of seeds to make a 1,000 seed calibration sample. The seeds of the calibration sample should be approximately the same size and shape as the seeds in a sample being tested. If the seeds in a sample being tested are noticeably different in size or shape from those in the calibration sample, prepare another calibration sample with seeds of the appropriate size and shape. Periodically re-examine the calibration samples to insure that no seeds have been lost or added.
- (b) Carefully pour the 1,000 seed calibration sample into the seed counter. Start the counter and run it until all the seeds have been counted. The seeds should not touch as they run through the counter. Record the number of seeds as displayed on the counter read out. The seed count should not vary more than ± 2 seeds from 1,000. If the count is not within this tolerance, clean the mirrors, adjust the feed rate and/or reading sensitivity. Rerun the calibration sample until it is within the ± 2 seed tolerance. If the seed counter continues to fail the calibration procedure and the

calibration sample has been checked to ensure that it contains 1,000 seeds, do not use the counter until it has been repaired.

12.3 Sample preparation.

Immediately after opening the moisture proof container, mix and divide the submitted sample, in accordance with section 2.2, to obtain a sample for purity analysis and record the weight of this sample in grams to the appropriate number of decimal places (refer to section 2.3 a). Conduct the purity analysis to obtain pure seed for the seed count test.

12.4 Conducting the test.

After the seed counter has been calibrated, test the pure seed portion from the purity test and record the number of seeds in the sample.

12.5 Calculation of results.

Calculate the number of seeds per pound to the nearest whole number using the following formula:

$$\text{Number of seeds per pound} = \frac{453.6 \text{ g/lb} \times \text{no. of seeds counted in d.}}{\text{weight (g) of sample analyzed for purity}}$$

12.6 Tolerances for results from different laboratories.

Multiply the labeled seed count or first seed count test result by four percent for soybean samples, two percent for corn (round, flat or plateless) samples, five percent for field bean samples and three percent for wheat samples. Express the tolerance (the number of seeds) to the nearest whole number. Consider the results of two tests in tolerance if the difference, expressed as the number of seeds, is equal to or less than the tolerance.

Example:

Kind of seed: Corn
Label claim (1st test): 2275 seed/lb.

Lab Test (2nd test): Purity working weight = 500.3 g
Seed count of pure seed = 2479 seeds

$$\text{Number of seeds per pound} = \frac{453.6 \text{ g/lb} \times 2479 \text{ seeds}}{500.3 \text{ g}} = 2247.6 \text{ seeds/lb}$$

Rounded to the nearest whole number = 2248 seeds/lb

Calculate tolerance value for corn:

Multiply label claim by 2%
 $2275 \text{ seeds/lb} \times 0.02 = 45.5 \text{ seeds/lb}$;
Rounded to the nearest whole number = 46 seeds/lb

Determine the difference between label claim and lab test:

$$2275 \text{ seeds/lb} - 2248 \text{ seeds/lb} = 27 \text{ seeds/lb}$$

The difference between the lab test (2nd test) and the label claim (1st test) is less than the tolerance ($27 < 46$); therefore, the two results are in tolerance.

APPENDIX 3: DETERMINATION OF WEIGHT OF WORKING SAMPLES FOR KINDS NOT LISTED IN TABLE 2A

To determine the weight of the purity working sample and its corresponding noxious-weed seed working sample the Weight Determination Method will be followed (adapted from: International Seed Testing Association, Rules for Seed Testing, Chapter 10. Weight Determination).

From the working sample count out at random, by hand or with a germination counter, eight replicates, each of 100 seeds. Weigh each replicate in grams to four significant figures (see Appendix 2). With small-seeded kinds it is not necessary to weigh the replicates with greater precision than four decimal places.

Calculate the variance, standard deviation and coefficient of variation as follows:

$$\text{Variance} = \frac{N\sum x^2 - (\sum x)^2}{N(N-1)}$$

Where x = weight of each replicate in grams
 N = number of replicates
 \sum = sum of

Standard deviation(s) = square root of Variance

$$\text{Coefficient of variation} = \frac{\text{Standard deviation}}{\text{Mean weight of 100 seeds}} \times 100$$

If the coefficient of variation does not exceed 6.0 for chaffy seeds, or 4.0 for other seeds, the result of the determination can be calculated.

If the coefficient of variation exceeds whichever of these limits is appropriate, count and weigh a further eight replicates and calculate the standard deviation for the 16 replicates. Discard any replicates that diverge from the mean by more than twice the standard deviation so calculated.

To calculate the minimum weight for purity analysis (grams): multiply the mean weight of 100 seeds by 25 (2,500 seed weight).

To calculate the minimum weight for noxious weed seed or bulk examination (grams): multiply the minimum weight for purity analysis by 10.

To calculate the approximate number of seeds per gram: divide 100 (the number of seeds) by the mean weight (of the 100 seed replicates).

To calculate the approximate number of seeds per ounce: multiply the approximate number of seeds per gram by 28.35.

For species which have small and large seeded varieties, more than one morphological seed form, or have seed weights which may vary with processing, counts should be made for each type.

Proposed rule:

SECTION 12: SEED COUNT AND WORKING WEIGHT DETERMINATIONS

Procedures outlined in this section may be used to: (1) determine the number of seeds per unit weight, and (2) determine the appropriate weights of purity analysis and noxious weed seed exam working samples for kinds with unusually small or large seeds or for kinds not listed in Table 2A.

12.1 General procedures that apply to mechanical and non-mechanical seed counts.

Samples requiring seed counts should be received and retained in moisture proof containers until the required tests are to be conducted [refer to section 12.2a(2) for when moisture proof containers are mandatory]. Only pure seed units shall be used in seed count and working sample weight determinations (refer to section 3.2)

12.2 Seed count procedures

Two methods of seed counts are described; mechanical seed count and non-mechanical seed count.

a. Mechanical seed count

The following method shall be employed when using a mechanical seed counter to determine the number of seeds contained in a sample of soybean (*Glycine max*), corn (*Zea mays*), wheat (*Triticum aestivum*), and field bean (*Phaseolus vulgaris*). This method is restricted to the species stated above.

- (1) The seed counter shall be calibrated daily prior to use.
 - (a) Prepare a calibration sample by counting 10 sets of 100 seeds. Visually examine each set to insure that it contains whole seeds. Combine the 10 sets of seeds to make a 1,000 seed calibration sample. The seeds of the calibration sample should be approximately the same size and shape as the seeds in a sample being tested. If the seeds in a sample being tested are noticeably different in size or shape from

those in the calibration sample, prepare another calibration sample with seeds of the appropriate size and shape. Periodically re-examine the calibration samples to insure that no seeds have been lost or added.

- (b) Carefully pour the 1,000 seed calibration sample into the seed counter. Start the counter and run it until all the seeds have been counted. The seeds should not touch as they run through the counter. Record the number of seeds as displayed on the counter read out. The seed count should not vary more than ± 2 seeds from 1,000. If the count is not within this tolerance, clean the mirrors, adjust the feed rate and/or reading sensitivity. Rerun the calibration sample until it is within the ± 2 seed tolerance. If the seed counter continues to fail the calibration procedure and the calibration sample has been checked to ensure that it contains 1,000 seeds, do not use the counter until it has been repaired.
- (2) Samples for testing shall be of at least 500 grams for soybean, corn, and field beans, and 100 grams for wheat and received in moisture proof containers. Samples shall be retained in moisture proof containers until the weight of the sample prepared for purity analysis is recorded.
- (3) Immediately after opening the moisture proof container, mix and divide the submitted sample, in accordance with section 2.2, to obtain a sample for purity analysis and record the weight of this sample in grams to the appropriate number of decimal places (refer to section 2.3 a). Conduct the purity analysis to obtain pure seed for the [mechanical](#) seed count test.
- (4) After the seed counter has been calibrated, [run](#) the [entire](#) pure seed portion from the purity test [through the mechanical seed counter](#) and record the number of seeds in the sample.
- (5) Calculate the number of seeds per pound to the nearest whole number using the following formula:

$$\text{Number of seeds per pound} = \frac{453.6 \text{ g/lb} \times \text{no. of seeds counted in d.}}{\text{weight (g) of sample analyzed for purity}}$$

- (6) Tolerances for results from different laboratories. Multiply the labeled seed count or first seed count test result by four percent for soybean samples, two percent for corn (round, flat or plateless) samples, five percent for field bean samples, and three percent for wheat samples. Express the tolerance (the number of seeds) to the nearest whole number. Consider the results of two tests in tolerance if the difference, expressed as the number of seeds, is equal to or less than the tolerance.

Example:

Kind of seed: Corn

Label claim (1st test): 2275 seed/lb.

Lab Test (2nd test): Purity working weight = 500.3 g

Seed count of pure seed = 2479 seeds

$$\text{Number of seeds per pound} = \frac{453.6 \text{ g/lb} \times 2479 \text{ seeds}}{500.3 \text{ g}} = 2247.6 \text{ seeds/lb}$$

Rounded to the nearest whole number = 2248 seeds/lb

Calculate tolerance value for corn:

Multiply label claim by 2%

2275 seeds/lb \times 0.02 = 45.5 seeds/lb;

Rounded to the nearest whole number = 46 seeds/lb

Determine the difference between label claim and lab test:

$$2275 \text{ seeds/lb} - 2248 \text{ seeds/lb} = 27 \text{ seeds/lb}$$

The difference between the lab test (2nd test) and the label claim (1st test) is less than the tolerance (27 < 46); therefore, the two results are in tolerance.

b. Non-mechanical Seed Count

(1) For kinds not listed in Table 2A.

When the minimum working weight for purity analysis is not given in Table 2A pure seed units for the non-mechanical seed count shall be obtained by one of the following methods:

- (a) When the pure seed fraction is estimated to be at least 98 percent, pure seed for the non-mechanical seed count test shall be taken indiscriminately from a representative portion divided from the bulk in accordance with section 2.2, or
- (b) When the pure seed fraction is estimated to be less than 98 percent, the pure seed for the non-mechanical seed count test shall be obtained by separating a representative portion divided from the bulk in accordance with section 2.2, into two components as follows: (a) pure seed and (b) other crop seed, weed seed and inert matter.

(2) For kinds listed in Table 2A.

- (a) When a purity analysis is conducted seed units for the non-mechanical seed count shall be taken indiscriminately from the pure seed.
- (b) When a purity analysis is not conducted seed units for the non-mechanical seed count shall be obtained by one of the methods described in section 12.2a(1)(a). For kinds listed in section 3.6b, the procedure in section 3.6 shall also apply.

(3) Conducting the non-mechanical seed count (adapted from: International Seed Testing Association, Rules for Seed Testing, Chapter 10. Weight Determination).

(a) From the working sample count out at random without regard to size, by hand or with a germination counter, eight replicates each of 100 seed units. Weigh each replicate in grams to four significant figures (see Appendix 2). With small-seeded kinds it is not necessary to weigh the replicates with greater precision than four decimal places.

(b) Calculate the variance, standard deviation and coefficient of variation as follows:

$$\text{Variance} = \frac{N\sum x^2 - (\sum x)^2}{N(N-1)}$$

Where x = weight of each replicate in grams

N = number of replicates

\sum = sum of

Standard deviation(s) = square root of Variance

$$\text{Coefficient of variation} = \frac{\text{Standard deviation}}{\text{Mean weight of 100 seeds}} \times 100$$

(c) If the coefficient of variation does not exceed 6.0 for chaffy seeds, or 4.0 for other seeds, the result of the determination can be calculated.

(d) If the coefficient of variation exceeds whichever of these limits is appropriate, count and weigh a further eight replicates and calculate the standard deviation for the 16 replicates. Discard any replicates that diverge from the mean by more than twice the standard deviation so calculated.

(e) Calculation of results. To calculate the numbers of seeds per pound, per ounce, per gram, or per kilogram use the following formulas and round results to the nearest whole number.

$$\text{Number of seeds per pound} = \frac{453.6 \text{ g/lb} \times 100}{\text{Mean weight (g) of 100 seed units}}$$

$$\text{Number of seeds per ounce} = \frac{28.35 \text{ g/oz} \times 100}{\text{Mean weight (g) of 100 seed units}}$$

$$\text{Number of seeds per gram} = \frac{100}{\text{Mean weight (g) of 100 seed units}}$$

$$\text{Number of seeds per kilogram} = \frac{1000 \text{ g/kg} \times 100}{\text{Mean weight (g) of 100 seed units}}$$

- (f) To determine the weight of the purity working sample and its corresponding noxious-weed seed working sample for kinds not listed in Table 2A refer to section 2.3b(2), or for kinds listed in Table 2A with unusually small or large seed units [refer to section 2.3b(3)] the following calculations shall apply.
- i. To calculate the minimum weight for purity analysis multiply the mean weight of 100 seed units (grams) by 25 (2,500 seed weight).
 - ii. To calculate the minimum weight for noxious weed seed or bulk examinations multiply the minimum weight for the purity analysis (grams) by 10.
- (g) When comparing two tests within a laboratory or among laboratories, if each test does not exceed the allowable coefficient of variance (i.e., 6.0 for chaffy seeds and 4.0 for other seeds), the two tests are considered to be in tolerance.

Harmonization statement: The procedure for non-mechanical seed counts was adapted from the ISTA Rules and added to the AOSA Rules several years ago.

Supporting evidence: The procedures for mechanical and non-mechanical seed counts are not significantly changed from the current procedures described in Section 12 Mechanical Seed Counts and Appendix 3 Determination of Weight of Working Samples for Kinds Not Listed in Table 2A. The purpose of the proposal is to simplify the Rules by combining these two sections of the Rules into one section primarily focused on seed counts. Data derived from non-mechanical seed counts may be used to determine the purity, noxious, and bulk sample working weights for kinds not included in Table 2A and for kinds listed in Table 2A with unusually small or large seeds. Although the order of appearance of some information has been rearranged, the procedures have not changed. A section was added to describe the possible sources of seed for non-mechanical seed counts, which are essentially the same as those described for germination testing. Also included is the recommendation for use of moisture proof containers, working formulas for calculating the test results for seed counts, and tolerances for comparing the results of two tests.

Submitted by: Cindy Finneseth (Rules Committee Chair) and Deborah Meyer (Purity Subcommittee Chair).

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