# COMPARISON OF PURITY TEST RESULTS OF VARIOUS GRASS SPECIES USING AUTOMATIC SAMPLER VS. PROBE SAMPLING

*R. Hankins and S. Elias*

## Introduction

A sample is a small quantity of a seed lot intended to show the quality of the whole lot. Increasing accuracy and precision in seed testing is highly correlated with the precision of sampling procedure. No matter how carefully and accurately a seed test is performed, it shows only the quality of the sample submitted for testing (AOSA, 2012). Thus, it is imperative that samples be properly drawn and adequately represents the quality of the seed lot from which it is sampled. If taken with carelessness or biased procedures, all subsequent tests or analyses may not be representative of the quality of the seed lot and are of little value. Any compromise or disregard of the principles of good sampling risks a bias in results and does a disservice to both the seed producer and the consumer (Elias et al., 2012).

Proper and representative sampling is only possible if the sampled seed lot is sufficiently uniform, which makes the distribution of the contaminants within the seed lot as even as possible. The rule of the thumb is that the cleaner the seed lot, the more uniform it is. The level of contaminants in the field from which seed is harvested, as well as post-harvest operations, contribute to seed lot heterogeneity. However, a seed lot must be sufficiently uniform if subsamples are to represent the overall lot quality. Samples drawn from heterogeneous seed lots do not represent the true quality of the lot (Elias et al., 2012).

Recently, a question was raised about the effect of automatic sampling and probe sampling on the final results of a seed purity test. Automated sampler is a portable unit that can be programmed to collect discrete sequential samples, time-composite samples or flow-composite samples (WCD, 2007). In the automatic sampler, samples are taken at equal increments of time and are composited proportional to the flow rate at the time each sample is taken. Samples are drawn from the seed stream automatically in the final step of the cleaning process at specified time intervals. Thus, automatic sampling does not involve human subjectivity in drawing samples. On the other hand, probe sampling is an approved sampling method where samples is drawn from a seed lot by a trained sampler using certain procedures, thus it involves human subjectivity. To ensure a representative sample using probe sampling, proper procedure should be followed. Such procedures include sampling equal portions from evenly distributed parts of a seed lot with appropriate probes (also called triers) of sufficient length to reach all areas in a seed bag or a bin. Following this sampling methodology, individual primary samples taken from bags or bins from well-distributed locations throughout the seed lot are combined into one composite sample. In both sampling methods, a composite sample that comprises the primary samples taken from a seed lot is collected and submitted to a seed laboratory for testing.

There are no published reports available on the accuracy and precision of automatic sampling compared to probe sampling in grass seeds. The objective of this study was to measure the effect of using automated sampling and probe sampling on purity test results of various grass species. Our hypothesis was that if the purity test results of samples drawn by the automated sampling method were comparable (i.e., within tolerance) to the results of the samples drawn by probe sampling, then either sampling method may be used without affecting the results of purity testing.

## Materials and Methods

Seed warehouses in Clackamas, Marion, Washington, Polk, Yamhill, Linn, Lane, and Benton counties in Oregon, with automatic samplers, were asked to provide one or two grass seed lots representing eight grass species including, tall fescue, annual, intermediate, and perennial ryegrass, orchardgrass, red fescue, chewing fescue, bentgrass, and Kentucky bluegrass. The seed lots provided by the warehouses represented four growing seasons from 2008 to 2011. One hundred and twenty four official certification samples were drawn using the automatic samplers and were randomly selected for the comparison study with the probe sampling method.

An official sampler from the Oregon Seed Certification Program used an 11" rice trier (probe), as specified in the OSCS guide for samplers and tagging, to collect samples from the same 124 seed lots provided by the warehouses for the comparison with the automated sampling method. The OSU Seed Laboratory compared the official purity test results from the 124 samples drawn by the automated sampling method with parallel purity tests on the samples drawn by the probe sampling method.

The data were subjected to statistical analysis to compare the difference in purity test results between each two parallel samples drawn by automated vs. probe sampling method. The tolerance Table 14B in the AOSA Rules for Testing Seeds, Vol. 1 were used to detect whether the difference between each two parallel test results drawn by automated vs. probe sampling method is significant or due to random sampling variation (AOSA, 2012).

**Results and Discussion**

Sampling method did not significantly affect ($P \leq 0.05$) purity test results in 103 (83%) of the 124 samples included in the study according to the AOSA (2012). The majority of purity test results were comparable regardless of the sampling method (Fig. 1).

However, the results also indicated that purity test results were significantly different ($P \leq 0.05$), i.e., out of tolerance, in 21 (17%) out of the 124 samples tested. Neither the automated nor the probe sampling methods had consistently higher or lower purity results. Of the 21 samples that differed significantly in purity results, 18 had lower purities from the probe sampling method, and 3 had lower purities from the automated sampling method. It should be noted that even though the samples were out of tolerance it does not mean that they did not meet certification standards. In this study, sampling method did not affect the certification status in 97.6% of the samples. Generally, as the purity level of samples increases, the tolerated difference value between two tests decreases.

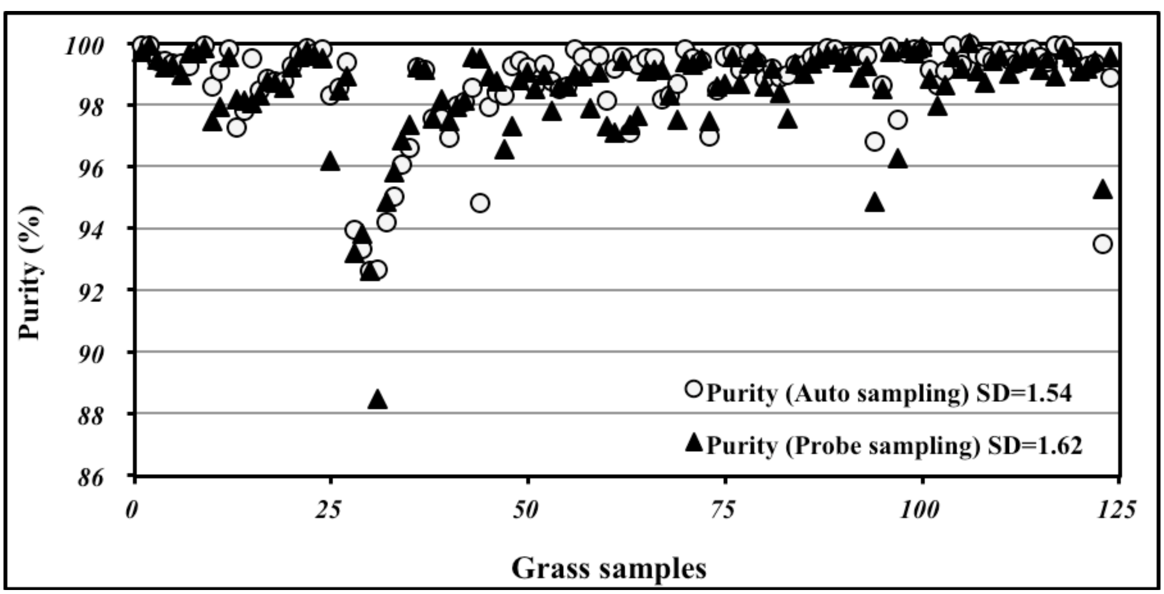


**Figure 1.** Comparison of purity test results of 124 grass seed samples drawn by automated and probe sampling methods tested at Oregon State University Seed Laboratory.

In the 21 samples that showed out of tolerance results in purity tests between the two methods of sampling, random sampling variation contributed to the accumulative effect of variation. Random sampling variation represents the random distribution of contaminants (i.e., weed seed, other crops and inert matter) in a seed lot. This type of variation cannot be avoided (Elias, et al. 2012). In general, random sampling variation increases in heterogeneous and in unclean seed lots or samples.

The overall standard deviation values, 1.54 and 1.62, respectively, for the purity results of the 124 samples tested using the automated and the probe sampling methods was similar. The comparable standard deviations of all samples means neither sampling method caused drastic change in the purity results.

Table 1 indicates the individual standard deviations for the purity tests of eight grass species using the automated and the probe sampling methods. Orchardgrass and Kentucky bluegrass had the largest difference in standard deviations between the automatic sampler and the probe sampling method, and it was larger when probe sampling was used (Table 1). This result indicates that the automatic sampler was more consistent in drawing samples from the seed lots for these two species than the probe sampling method.

**Table 1.** Means and Standard deviations of purity tests conducted on samples drawn by automated and probe sampling methods of eight grass species.

| Crop | Automatic Sampler | Probe Sample |
|---|---|---|
| | Mean (SD) | |
| Bentgrass | 98.84 (0.35) | 97.68 (0.33) |
| Orchardgrass | 94.30 (1.49) | 94.12 (2.83) |
| Kentucky bluegrass | 98.75 (0.57) | 97.85 (1.46) |
| Annual ryegrass | 99.57 (0.27) | 99.52 (0.32) |
| Intermediate ryegrass | 99.76 (0.08) | 99.60 (0.13) |
| Perennial ryegrass | 98.50 (1.08) | 98.47 (0.76) |
| Fine fescue | 98.75 (0.85) | 98.38 (0.82) |
| Tall fescue | 99.18 (1.00) | 99.83 (1.0) |

The overall small values of standard deviations confirmed the importance of seed lot homogeneity and cleanness in reducing sampling variability regardless of whether automatic sampler or probe sampling method is used. Variability among subsamples drawn from a seed lot is expected to be low for seed lots that are cleaned thoroughly, regardless of the sampling methods. Thus, variability of purity test results among laboratories is also reduced for cleaned seed samples compared to uncleaned samples.

Whether using automated or probe sampling, utilizing proper sampling procedures and ensuring seed lot homogeneity increase uniformity among subsamples drawn from the same seed lot. Consequently, these factors decrease variability between two seed purity tests of subsamples drawn from the same seed lot, whether they were tested in the same laboratory or in two different laboratories.

**Conclusions**

Similar purity test results for the grass seed species used in this study were obtained whether the automatic sampler or the probe sampling method is used, with some exceptions. No consistent pattern of high or low purity results was associated with the automatic or the probe sampling method. Therefore, either sampling technique may be used, as long as the proper sampling procedures are followed.

**References**

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