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Three Quick Seed Evaluation Methods—A Comparison

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Most restorationists know that the success of many projects depends on viable seeds. Few, however, take the time to test the seed they collect or buy despite yearly variations in seed quantity and quality. We have used three seed evaluation techniques—seed cutting, x-rays, and staining—to determine 1) if a crop is worth collecting in a given year; 2) when seed is mature enough to collect; 3) how much seed to collect for a given level of production and/or for the frequency of a viable seed crop; 4) the amount of seed processing needed or possible to assure better quality seed lots; 5) how seed is faring in interim storage; and 6) when a germination test is not possible, the sowing density required for adequate crop establishment.

A cutting test produces one of the most useful seed evaluations available. It involves taking a representative sample of seed, slicing them open longitudinally with a single-edged razor blade, and inspecting the contents with a hand lens (single or double lens for larger seeds) or a pocket microscope (for seeds as small as pepper grains). While you destroy the seed, this method can be done easily and quickly in the field, is easy to learn, and entails little cost. Cutting tests provide 1) information about the extent of any seed damage; 2) a moderately accurate estimate of the percentage of filled seed; and 3) some indication of the condition and maturity of the seed tissues. Two books—*Seeds of Woody Plants in the United States* (Schopmeyer, 1974) and *Seeds of Woody Plants in North America* (Young & Young, 1992)—include diagrams showing longitudinal sections through seeds of many genera, with all the parts labeled. These diagrams are invaluable when learning how to examine the embryo and other tissues for color, texture, length, development, signs of damage, and apparent moisture content. Restorationists should remember, however, that a cutting test indicates the physical characteristics of a seed and may not match germination test results, which measure a physiologic response. Once a seedlot has been collected and processed, a standard germination test is usually done, since it is still the most reliable way to determine viability.

X-ray analysis offers a very useful means to evaluate seeds, if you have access to the specialized equipment involved. Rapid, non-destructive, relatively low-cost (the chemicals and photographic paper cost less than $1.75 per x-ray), and fairly easy to learn, it allows restorationists to evaluate much larger samples than a cutting test. Its non-destructive aspect is especially important when the seed is extremely valuable and in short supply, like the seeds of threatened and endangered species, or collections from parent plants with known disease resistance. Users will gain information similar to that provided by a cutting test. Many commercial seed testing firms as well as federal, state and university seed processing facilities do x-ray analysis.

A third seed evaluation option is the tetrazolium (TZ) staining test, which relies on the fact that living tissue turns red when exposed to a colorless tetrazolium. This procedure requires slicing the seeds to expose the inner tissue, being careful not to cut the embryo, and then soaking them in the TZ solution for 24-48 hours. While impractical as a field technique, this test requires no special equipment and is relatively low in cost. However, it takes some time to learn because the results are not easy to interpret. For example, there are a number of species for which the TZ overestimates viability or where obviously dead tissue stains red. Furthermore, relatively small variations in technique may have a significant impact on results. Still, for many species this method provides a reasonable estimate of viability.

While none of the evaluation techniques described can fully substitute for a standard germination test, they are more rapid and offer a means for evaluating seed quality in the important, early stages of seed collection, processing and interim storage. In particular, we recommend the cutting test for its ease of field use. Restorationists who invest the time to learn these techniques will be rewarded with better collection planning, higher collection efficiency and improved seed quality. As forester, Al Orr-Ewing, said, "Good seed doesn't cost, it pays!"

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