QUICK TEST VS. STANDARD GERMINATION TEST [1]

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ABSTRACT

Three "quick tests" were compared with standard germination tests on lots of Douglas fir, Pinus species, Abies species, spruce and bitterbrush. All three tests, when properly performed and evaluated, can predict viability which correlates with the standard germination tests on the same sample, except in Abies species. All "quick tests" indicate higher viability on Abies than was obtained by the standard germination test.

Germination by standard procedures under ideal conditions have long been used by nurserymen to establish viability of tree seed lots. Standard germination tests are a long, drawn-out process for most tree seed, requiring long periods of stratification under cool, damp conditions, followed many times by equally long periods in germinators under optimum conditions for the particular kind of seed. Many things can happen to seed under such conditions. Questions have been raised concerning the ability of these tests to determine the full potential of the seed. Also, because of the time required to complete the standard germination tests, the nurseryman often cannot use them in his decision process.

For these reasons, the Oregon State University Seed Laboratory has for years worked on "quick tests" which could provide information to the user more rapidly than standard germination tests. Years of effort and research have gone into refining techniques which would better correlate these quick tests with maximum germination. We feel that these correlations have been very good in recent years and would like to share a summary of some results. I hope they will acquaint you with the tests and build confidence in their results, so that they can be used to your advantage when making decisions concerning the seed you will plant to produce future tree crops.

The three tests compared here with standard germination are the tetrazolium test (TZ), which takes two days for completion, the hydrogen peroxide test, which requires eight days, and the X-ray test which can be completed during a working day. Standard germination of most tree seeds requires four to twelve weeks.

Details for conducting the tests were discussed by Rodger Danielson and are printed in your 1972 proceedings, therefore, I will not go into procedural details. If interested, you can look up the 1972 proceedings and follow his well-described instructions.

[1]Presented to the joint meeting of the Western Forest Nursery Council and the Intermountain Forest Nurseryman's Association, Boise, Idaho, August 12-14, 1980.

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1978-79 was a good tree seed year in many parts of the West, as most of you are aware. Seed supplies were low and seed was badly needed by many nurseries. There was extreme pressure on the part of some to plant seed the same year it was collected. Some reported to me that seed had been planted without the knowledge of its viability. Various quick tests were used by some to help in decision making. The results of these tests are the data used in this paper.

I would first like to discuss the TZ test as it compares with standard germination. Tetrazolium chloride is a colorless solution. When it comes in contact with hydrogen, it forms a red pigment called formazan. Live seeds release hydrogen during the germination process. This happens very soon after water is introduced and the very first stages of germination are initiated. It was determined that if tetrazolium was introduced into seeds, those live parts would turn red and those dead would not stain. By careful observation and a knowledge of the morphology and physiology of the seed, a trained technician can determine abnormal staining from normal staining, thereby correlating the TZ test with the normal, abnormal and dead seed found in a standard germination test.

Table I compares four species of tree seed and one shrub seed on a number of different tests. Forty-seven lots of Douglas fir were tested by both TZ and standard chill and no-chill germination. Results of forty-seven tests were averaged so that a comparison could be made. The results of the TZ test were very close to both the chill and no-chill. The same was true for 45 lots of pine. In comparing 27 lots of Abies, the TZ test averaged somewhat higher than both chill and no-chill. This concerns us. Abies are a difficult species to work with, as most people working with them realize. It is often difficult to obtain high germinating lots. There seems to be considerable variation within lots. We are concerned that perhaps the proper germination conditions have not been developed to obtain the maximum germination. There may be inherent reasons, however, that deteriorate a good embryo during its germination period and in this case, the TZ may not represent what a seed would do in-a planting bed. More research is needed in the case of Abies. Spruce compares favorably in the two lots compared. Many of the shrub species are dormant and difficult to germinate. Standard germination tests are not developed for some species. We have developed TZ techniques on most shrub seed being used. The TZ test on three bitterbrush lots correlated favorably with the chill germination results. These lots obviously need chilling to break dormancy since the no-chill germination test produced no seedlings.

The second test discussed is the hydrogen peroxide (H202) test. It was determined that if this material was introduced into the seed, the embryo would elongate rapidly. By evaluating the embryo development, a judgment could be made and the results could then be compared with a standard germination test.

Table 2 first compares 50 samples of Douglas fir seed tested by H202 and then followed by standard no-chill and chill germination tests. The peroxide test correlates very well with the chill but obviously some lots of Douglas fir seeds need chilling since the average no-chill was considerably below the chill method. This same trend held true for the two Pinus lots and 21 lots of Abies. It would appear that this test rather accurately predicts the potential germination of the seed.

In Table 3 we were able to compare the X-ray test with TZ and standard chill and no-chill germination test. In comparing the results of 25 lots of Douglas fir seed, it would appear that the TZ came closer to the average chill test than did the normal reading of the X-ray test. This may indicate that the X-ray is not quite as definitive as a TZ test, but is still a good indicator of the potential germination of a seed lot. In comparing the results of three Abies lots, it would appear the full

potential of the seed was not realized in the germination test. TZ and X-ray compared favorably but were much higher than the standard germination.

In summary, the results would indicate that the three "quick tests" discussed here are good indicators of potential seed viability. The Abies results did not compare as well as the other species. One can only speculate why quick tests indicate higher viability in Abies than is obtained by standard germination. With good "quick tests" available, a nurseryman should not have to sow without knowledge of the viability of his seed. More than one viability determination on high value seed may be in order so that the nurseryman can better choose lots for seeding and thereby maximize his production.

TABLE 1. Comparison of seed viability of various species as determined by TZ and standard laboratory germination tests. Results shown are averages of all samples tested.

Species	Number Samples Tested	TZ	% Germination	
			No-Chill	Chill
Douglas Fir	47	87	86	89
Pinus Spp.	45	81	79	79
Abies Spp.	27	67	45	49
Spruce	2	97	98	97
Bitterbrush	3	53	0	52

TABLE 2. Comparison of seed viability of various species as determined by H_2O_2 and standard laboratory germination tests. Results shown are averages of all samples tested.

Species	Number Samples Tested	H_2O_2	% Germination	
			No-Chill	Chill
Douglas Fir	50	80	74	82
Pinus Spp.	2	87	69	84
Abies	21	62	48	57

TABLE 3. Comparison of X-ray, TZ and standard germination tests conducted on various species. Results are averages of all samples tested.

Species	Number Samples Tested	TZ	X-Ray			% Germination	
			Normal	Questionable	Total	No-Chill	Chill
Douglas Fir	25	87	90	7	97	79	84
Abies Spp.	3	69	63	21	84	47	44