INSECT INFESTATION DISTORTS FRASER FIR SEED TESTS

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Germination results from tests conducted in 1960 demonstrated that the value of stratifying Fraser fir *(Abies f raseri)* seed was highly questionable (1). The effect of the date of cone collection on germination was also discussed. This report gives additional data obtained on this interesting but little-known species during the last 5 years.

In 1963 a good crop of cones occurred throughout the range of Fraser fir. Germination, as determined by the Eastern Tree Seed Laboratory, Macon, Ga., varied from 43 to 64 percent, averaging 51 percent. Full seed averaged 87 percent, and there were 62,000 seeds per pound.

In 1964 the crop of fir cones was extremely small except on part of Roan Mountain in North Carolina. Seeds collected on the mountain were smaller than those of 1963, averaging 77,000 per pound. Yield of seed per bushel of cones declined from more than 2.5 pounds to less than 2 pounds. Average germination dropped to 21 percent. Most of this decrease in germination was caused by an insect infestation that was not visible externally. Dissection showed that 29 percent of the 1964 crop was infested by a seed chalcid, *Megastigmus specularis.*

This infestation was detrimental to seed testing because the moisture content could not be determined by normal testing. (The moisture content must be known, particularly if seed is to be fumigated or stored. The proper range is 6 to 8 percent. When over 8 percent, seeds deteriorate more rapidly in storage and are more susceptible to fumigation damage.) Standard seed tests indicated 11 percent moisture content; however, as determined by drying only full seed, it was found to be actually only 8 percent. The difference resulted from dehydration of insect larvae in the seed.

Insect infested seed also presents another problem.

Whether a seed will germinate is not a criterion for determining full seed percent. If the seed has *any* endoderm or embryo tissue, whether deteriorated or solid, within the seedcoat, it is considered a full seed. Decomposed seed looks like seed with a crushed insect larva, particularly' after the period required for stratification and germination tests. Infested seed, unless very carefully examined, can easily be classified incorrectly.

Testing Procedure

After checking Rudolf's review of the tree seed testing facilities in the United States in 1964 (2), we sent samples of 1965 Fraser fir seed to the forest tree seed testing laboratories of the New York Laboratory, Oregon State University, and the Eastern Tree Seed Laboratory. A subsample was taken from each 5-pound bag of a 200-pound seed collection. A portion of this common aggregate sample was sent to each laboratory for analysis under regular commercial testing procedures. The cooperation of these three forest tree seed testing laboratories in processing the seed, answering questions regarding the tests, and in reviewing the results was excellent.

New York Laboratory

The Department of Seed Investigations offers principally purity and germination seed testing services. Other types of tests are supplied upon special request. We requested only germination tests under no-chill and prechilled conditions.

The no-chill germination varied from 50 to 59 % and 6. percent firm seeds remained at the end c the 50-day test period (table I).

Prechilled germination varied from 59 to 61 percent and 1 percent firm seed remained at the end of the combined 60-day prechill and test period.

Eastern Tree Seed Laboratory

Unstratified (no-chill) seed germination, based on lots of 100 seeds, varied from 61 to 67 percent; 18 t 22 percent full seed remained after the 56-day tee period.

Seed stratified for 30 days in sphagnum moss at 38 F., based on 6 lots of 100 seeds, varied from 41 to 5 percent; 32 to 42 percent of the full seed remained after the test.

Other data provided by this laboratory were mois-

TABLE 1.—*Germination of Fraser fir seed under unstratified and stratified conditions at three seed testing laboratories*

Germination test (days)	Unstratified or no-chill			Stratified or prechilled		
	New York Laboratory	Eastern Tree Seed Laboratory	Oregon State University	New York Laboratory	Eastern Tree Seed Laboratory	Oregon State University
	Pct.[1]	*Pct.*[2]	*Pct.*[3]	*Pct.*[4]	*Pct.*[5]	*Pct.*[6]
7	—	6	0	—	9	
14	19	25	7	41	37	
21	34	43	24	55	44	
28	44	53	46	[7] 60	45	
35	48	56	50	—	46	
42	—	60	—	—	—	
49	[8, 9] 50–59	63	—	[8] 59–61	—	
56	—	64	—	—	—	

[1] Based on 4 subsamples of 200 seeds.
[2] Based on 6 subsamples of 100 seeds.
[3] Based on 4 subsamples of 50 seeds.
[4] Based on 2 subsamples of 200 seeds.
[5] Based on 4 subsamples of 100 seeds.
[6] Based on 4 subsamples of 50 seeds.
[7] Only 1 percent firm good seed remained.
[8] These figures were the range in final series under vau tests.
[9] Six firm good seed remained.

ture content, 9 percent; purity, 97 percent; total full d, 81 percent; and seeds per pound, 54,000.

Oregon State University

No-chill germination was reported as 50 percent; 2 percent sound seed remained after the 35-day test period. These results are based on 4 lots of 50 seeds.

Prechilled germination for a 30-day period followed by a 28-day test period was 46 percent; 4 percent sound seed remained. These results are based on 4 lots of 50 seeds.

Other data provided by this laboratory were moisture content, 6 percent; purity, 96 percent; total full seed based on a cutting test, 70 percent; and seeds per pound, 58,000.

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A cutting test was made on 6 lots of 100 seeds from the same sample drawn and sent to the seed testing laboratories. A razor blade was used to cut the seed under a low power microscope (table 2).

TABLE 2.—*Condition of Fraser fir seed as determined by cutting tests, Asheville, N.C.*

Seed condition [1]	1964		1965	
	Range	Average	Range	Average
	Pct.	*Pct.*	*Pct.*	*Pct.*
Full	32–41	36	64–82	78
Empty	32–39	35	12–30	19
Insect infested	24–34	29	0–7	3

[1] Determined by cutting 6 lots of 100 seed.

SUMMARY

Several important facts emerged from these tests. The primary fact is that Fraser fir seed apparently need not be prechilled or stratified before sowing since it shows little or no dormancy. Pretreatment may speed the initial rate of germination a few days, but it increases the rate very little. If pretreatment is needed, soaking the seed in water for possibly a day and treating it to control pathological organisms appears adequate. But contrary to test results, the seed laboratories recommend stratification.

Often seed should be sown in the fall before the seed tests have been completed. To determine the sowing rate, cutting tests may be conducted. This study showed there may be a poor relation between the number of full seed, derived from germination or cutting tests, and the number that will germinate. The difference varied up to 30 percent.

Under present seed testing methods, it may be difficult to account for insect infestation in determining the number of full seed or the moisture content of seed. In the future, X-ray tests will help seed testing laboratories overcome these problems.

During poor seed years, the yield and quality of seed decrease and insect damage increases. The effect of these factors on seed cleaning is seldom if ever mentioned. In a poor seed year, because full seed is smaller and lighter than in good seed years, it is more difficult to clean. This is because there is little or no difference in weight between full, empty, and insect-infested seed. This reemphasizes the desirability of securing seed requirements in good seed years. This seed stored properly will be better than seed collected in poor seed years.

Literature Cited

(1) Speers, Charles F.
1962. Fraser fir seed tests. Tree Planters' Notes 53: 7-9.

(2) Rudolf, Paul O.
1965. Availability of tree seed testing in the United States-1964. Tree Planters' Notes 73: 12-14.