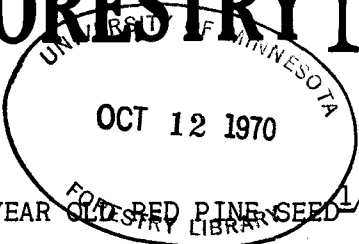




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GERMINATION OF 29-YEAR OLD RED PINE SEED^{1/}

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How long can the seeds of red pine (Pinus resinosa Ait.) maintain their viability? Tests recently completed shed some light on this question which is important because (1) red pine is one of the most widely planted species in the Northern States, (2) it produces good seed crops only every 3 to 7 years, (3) large seed supplies are required annually, and hence (4) longtime seed storage often is necessary. For regular reforestation purposes seed storage beyond 10 years probably is unnecessary, but for some research purposes longer storage may be desirable.

The seed used in these tests was of the 1928 crop. It was purchased by the Lake States Forest Experiment Station in February 1930, and divided into samples of about 280 seeds each. At that time the seed had a viability of 95 per cent and a moisture content of 5.9 per cent (based on oven-dry weight). Half of the seed samples were held at 20 per cent relative humidity until the seed moisture content reached 4.7 per cent, and half of them were held at 40 per cent relative humidity until the seed moisture content reached 6.5 per cent. Then the samples were placed immediately in glass bottles which were stoppered and sealed with wax.

Several sealed samples of each moisture content were then placed in large glass jars which also were sealed as an added precaution and then stored under the following three conditions:

- A. Fruit cellar -- 32° to 68° F. temperature range.
- B. Coldroom -- 41° to 50° range to 1955, 36° from 1955 to date.
- C. Seedhouse attic -- 0° to 100° range.

Germination was tested by the Lake States Station in 1930, 1936, and 1940. The 1940 tests indicated that after 10 years' storage the original viability remained almost complete in the coldroom, had dropped to about one-half in the fruit cellar, and to about one-third in the seedhouse attic.^{3/}

In March 1958, 4 replicates of 200 seeds for each of the 6 treatments (4,800 seeds) were sowed at random in flats of steam-sterilized sand. The flats were placed in the greenhouse and watered daily. Temperatures ranged from about 65° at night to 75° on cloudy days and 85° to 90° on clear days. Daily records of germination were maintained for 40 days after which the ungerminated seeds were cut and classified as sound, spoiled, or empty.

^{1/} These tests were made in cooperation with the Lakes States Forest Expt. Station.
^{2/} Research Assistant, School of Forestry, University of Minnesota; and Forester Lake States Forest Experiment Station, Forest Service, U. S. Department of Agriculture, respectively.
^{3/} Roe, E. I. 1940. Longevity of red pine seed. Minn. Acad. Sci. Proc. 8: 28-30.



Results of the tests (Table 1) show the following: (1) Some viability remains in seed from each of the three storage places 29 years after collection, (2) viability decreased markedly under all storage conditions between the tenth and twenty-eighth years of storage, (3) on the average, germination was best for seed stored in the coldroom, nearly as good for those stored in the cellar, and poorest for those stored in the attic, (4) in the two more favorable conditions germination was best for the seed stored at 6.5 moisture content, (5) the best germination of any subsample (29 per cent) was for seed stored at 6.5 per cent moisture content in the cellar,

TABLE 1 -- Condition of 29-year-old red pine seed
after 40-day germination test

Storage condition	Seed moisture content	Per cent of seeds -				
		Germinated		Sound	Spoiled	Empty
		Average	Range			
Fruit cellar	4.7	0	0 - 0	96.5	2.9	0.6
	6.5	11.0	2.0-29.0	80.0	6.6	2.4
Cold- room	4.7	3.2	.5-9.0	93.5	2.5	.8
	6.5	10.1	0 -19.5	82.6	6.3	1.0
Seedhouse attic	4.7	1.2	0 -3.0	83.9	14.6	.3
	6.5	0	0 - 0	96.0	4.0	0
Average	---	4.3	0 -29.0	88.7	6.2	0.8

(6) only a small proportion of any of the seed lots consisted of empty or spoiled seeds (3 to 15 per cent), but a high proportion (80 to 96 per cent) consisted of apparently sound, nongerminating seeds, (7) for each storage condition the seed with the moisture content having the highest germination also had the highest percentage of spoilage.

These tests leave a number of unanswered questions, such as the reasons for nongermination of the apparently sound seed remaining after 40 days, the range of germination between subsamples in the same treatment, the better germination of seed with 6.5 per cent moisture in two conditions (contrary to the 10-year results), and the accelerated reduction of viability in cold storage since the 10-year results. A possible answer to the last question may be the high temperatures developed in the coldroom at least three times in the past 10 years as a result of failures of power or the compressor.

The tests do, however, indicate that red pine seed can be stored so as to maintain some viability for almost 30 years. This may be of considerable importance to tree improvement and other forest research specialists.