LONG-TERM STORAGE OF LONGLEAF PINE SEEDS

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Seeds of longleaf pine *(Pinus palustris* Mill.) are considered the most difficult of the southern pines to store, because their thin seedcoats are easily damaged during processing and their high moisture content after extraction causes rapid deterioration. The results here reported show, however, that high viability can be maintained for at least 10 years by drying seeds to moisture contents of no more than 10 percent and storing them at 0° F.

Methods

The three studies reported here were installed in the mid-1950's to determine the optimum moisture content and temperature for longleaf seed storage. In all three, large lots of fresh seeds, which had been extracted without damaging seedcoats, were dried to desired moisture contents,. placed in sealed containers, and stored at various temperatures. Viabilities after 5 years were reported by McLemore (4).

The initial study compared 12 treatments: All combinations of temperatures of 0°, 25°, and 34° F.; moisture contents of 8 and 13 percent; and winged and dewinged seeds.

In the second study, 14 treatments included seven moisture contents ranging from 6 to 18 percent in 2-percent intervals, and temperatures of 0 and 34°. All seeds in this study were stored with wings attached.

The treatments in the third study were the same as those in the second. They were applied to two seed lots from Mississippi and one from Louisiana. Seeds in this study were dewinged prior to storage.

Treatments in the first two studies were replicated three times; those in the third were replicated twice with each lot. Standard 30-day germination tests were run with at least 200 seeds from each treatment replicate. Results of tests are given as percents of sound seeds. Some of the treatments in studies 2 and 3 were terminated after 7 years, but sufficient data remain to evaluate the effects of both temperature and moisture content on viability after 10 years of storage.

Results and Discussion

Study 1.-Seeds held at lowest temperatures and moisture contents were most viable. Those stored for 10 years at 8-percent moisture content and 0° had an average viability of 83 percent (wing treatments combined) ; only 86 percent of fresh seeds germinated. at the beginning of the study (table 1). Viability was acceptable following 10 years of storage at 8-percent moisture content and 25° and at 13 percent and 0°. All other treatments were clearly unsatisfactory for long-term storage.

Seeds from this study were direct seeded after 7 years of storage (1) Those from the three best environments-0° with 8-, 0° with 14-, and 25° with 8-percent moisture content-yielded tree percents almost as high as that obtained with fresh seed.

Careful dewinging did not influence germination either initially or after 10 years. Germination of all moisture-temperature treatments after storage averaged 48 percent for winged and 45 percent for dewinged seed. Similar results after 4 years of storage are reported by Belcher and King (3).

TABLE 1.—*Viability of longleaf seed initially and after storage for up to 10 years (study 1)*

Temperature (°F.)	Moisture content	Wing treatment	Years in storage					
			0	2	4	6	8	10
			Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
0	8	Winged	87	83	81	85	79	89
		Dewinged	83	71	71	85	73	77
	13	Winged	81	76	77	83	61	65
		Dewinged	95	72	69	84	64	72
25	8	Winged	85	75	85	85	73	68
		Dewinged	83	65	72	84	72	65
	13	Winged	84	77	68	59	23	13
		Dewinged	91	69	60	63	27	9
34	8	Winged	85	76	72	80	52	51
		Dewinged	84	68	72	73	45	47
	13	Winged	88	65	61	23	5	1
		Dewinged	88	65	52	20	4	1

TABLE 2.—*Effect of seed moisture content on viability of longleaf seed stored at 0° F. for 7 years (study 2)*

Moisture content (*Pct.*)	Years in storage						
	0	1	2	3	4	5	7
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
6	85	78	80	86	81	87	80
8	92	75	82	89	81	84	82
10	88	80	84	90	82	85	82
12	88	79	81	88	82	88	77
14	81	80	82	89	76	86	81
16	84	79	84	90	80	85	78
18	89	77	84	86	75	77	74

Study 2.-Seed stored at 0° kept well for 7 years regardless of moisture content, although a slight loss in viability occurred at 18 percent moisture content (table 2). Initial germination averaged 86 percent; after 7 years germination for all moisture treatments averaged 79 percent. In this study, seeds were not stored for 10 years at 0°.

Few of the seeds stored for 10 years at 34° with moisture contents greater than 12 percent were viable. Those dried to 12 percent or less germinated well; storage reduced their germinability by only 8 percent (fig. 1) .

All seeds stored well for 1 year at 34° F. Lots with more than 12-percent moisture content deteriorated seriously between the second and fifth years. Those with higher moisture contents failed even sooner.

Study 3.-After 10 years, seeds stored at 0° and at moisture contents of 12 percent or less retained high viability (table 3). Only those stored at 18percent moisture content had unacceptably low germinability.

All seeds at 34° F. deteriorated markedly in 10 years. At this temperature, seeds dried to 6- or 8-percent moisture contents stored reasonably well for 7 years. At 10-percent moisture content, seeds deteriorated rapidly after 3 years.

Seed source influenced initial germination, but it did not appear to affect storability. Initially, ger-

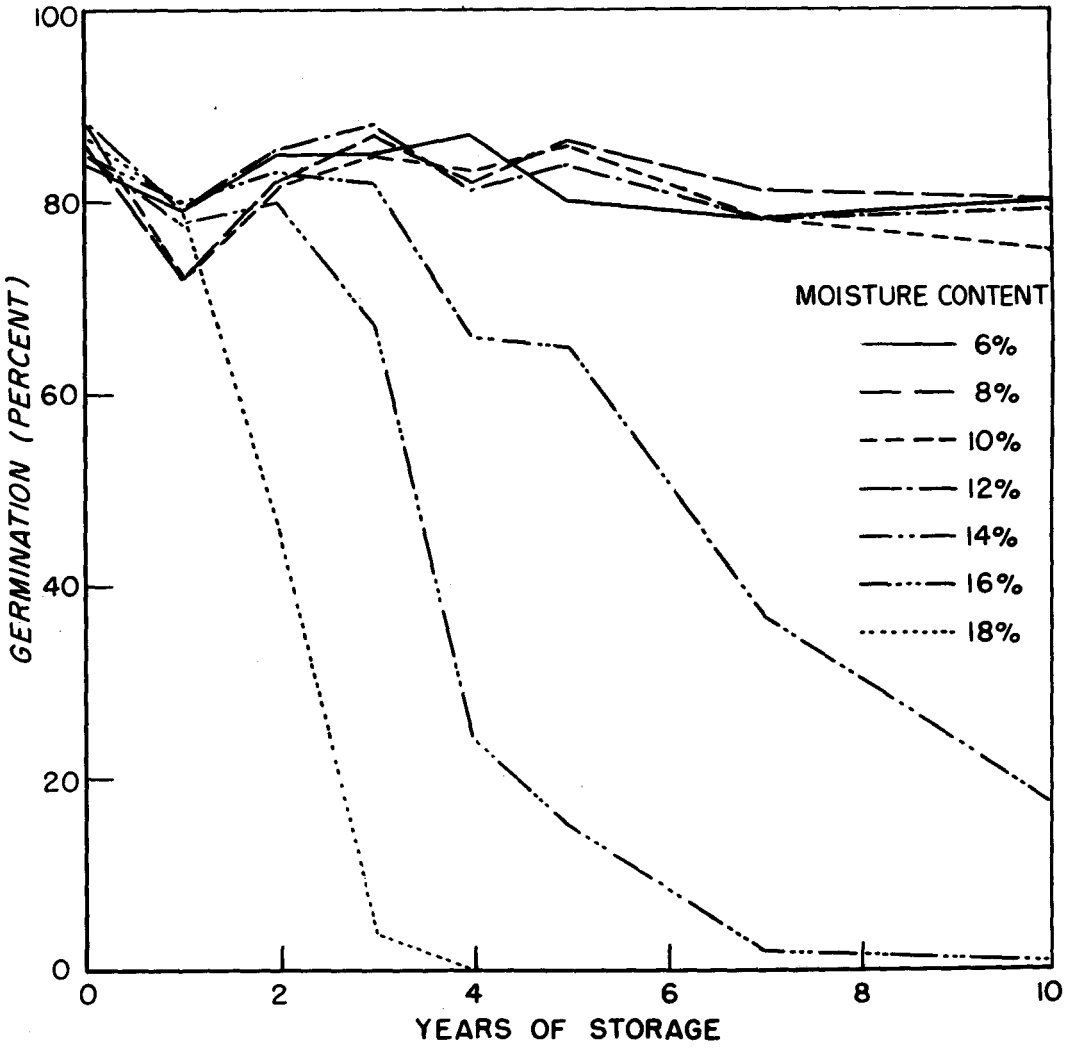

Figure 1.—Germination of longleaf pine seeds stored at 34° (study 2).

minability of one of the Mississippi seed lots was 15 percent higher than that for the other Mississippi lot and 10 percent higher than that for the Louisiana lot. During storage for 10 years, average germinability of each lot decreased about 40 percent *(all treatments combined)*.

Recommendations

The results of the studies reported here, plus those of earlier work *(2, 4, 5, 6)*, show that both moisture content and temperature must be carefully controlled to maintain high viability of longleaf pine seeds. Recommended conditions vary with the length of storage:

One year.-For storage at temperatures near 34°, reduce the moisture content of seeds to no more than 10 percent. At 0°, viability is maintained with moisture contents up to 18 percent.

Two to 3 years.-Moisture content must be reduced to 8 percent to maintain viability at 34°. At 0°, moisture contents up to 18 percent are acceptable. Seeds that contain 13-percent moisture store well at 25°.

Four to 7 years.-Do not store at 34°. Reduce the moisture content to 10 percent for storage at

TABLE 3.—*Viability of longleaf pine seeds initially and after storage for up to 10 years (study 3)*

Temperature (°F.)	Moisture content	Years in storage						
		0	1	2	3	5	7	10
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
0	6	78	80	79	80	75	77	75
	8	82	81	83	81	77	79	77
	10	80	79	78	79	76	75	73
	12	82	83	79	81	78	78	73
	14	81	80	80	80	72	73	68
	16	83	77	77	80	62	68	58
	18	82	79	78	75	51	52	36
34	6	80	83	79	82	76	76	48
	8	79	86	78	84	72	69	33
	10	81	81	78	79	62	53	18
	12	81	75	62	62	30	15	2
	14	81	72	43	35	10	3	0
	16	79	68	26	16	3	0	0
	18	80	47	2	0	0	0	0

25°. Moisture levels up to 15 percent are acceptable at 0°.

Eight to 10 years.-Reduce moisture content to 10 percent or less and hold temperature at 0°.

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