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Storing Red Oak Acorns

Cherrybark, Shumard, and water oak acorns can be stored for 3 years or longer if kept at a moisture content of at least 30 percent of fresh weight and at a temperature of 37° F. Polyethylene bags are good containers . . .

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Large seeds with high moisture contents, such as acorns, are difficult to store. Studies at the Forest Tree Seed Laboratory, State College, Miss., have shown, however, that acorns of some species will survive through three winters (2-½ years) if held at high moisture content in polyethylene bags a few degrees above freezing. Preliminary findings for cherrybark *(Quercus falcata var. pagodaefolia Ell.)*. Shumard *(Q. shumardii* Buckl.), and water oaks *(Q. nigra* L.) were summarized in 1970, [2] and this note reports the final results after 30 months.

Methods

Acorns from at least five trees of each species were collected in the fall of 1968 in east-central Mississippi. Composite lots of each species were floated to remove trash and bad acorns, then divided into sublots to test all combinations of several conditions:

Temperature: 46°, 37°, and 14° F.

Container: polyethylene bags (4-mil thickness) and cloth bags. Initial acorn moisture content:

- Cherrybark: 24, 31, and 33 percent of fresh weight
- Shumard: 24 and 34 percent
- Water: 21 and 32 percent

Length of storage: 6, 18, and 30 months.

Most acorns had moisture contents intermediate to those being tested. Lots destined for storage at low moisture content were, therefore, dried on laboratory benches for about 24 hours, while other lots were soaked in tapwater until they reached 32 to 34 percent. Moisture contents were determined by withdrawing 10 acorns from each sublot and weighing them before and after they were dried for 24 hours at 105° C.

All treatment combinations were replicated three times. For cherrybark oak, 60 acorns were placed in each container; 50 were used to test germination at the end of the storage period, and 10 were used for determining moisture content. For Shumard and water oaks, 30 acorns per entry were used, 25 for the germination test and five for moisture determination.

At the end of the storage period, the acorns in each replication were given 30 days of moist stratification at 37° F. Germination was then tested on Kimpak under an alternating day-night regime of 86°-68° F. for 8 and 16 hours respectively. An acorn was considered to be germinated when the emerging radicle showed positive geotropic response.

Germination before storage was measured similarly; averages for species composites were 57 percent for cherrybark, 77 percent for water, and 91 percent for Shumard.

Results and Discussion

Not a single acorn survived storage at 14°. Storage in cloth bags was almost a complete failure also, although some Shumard acorns survived for 6 months at 46°.

Viability was good among lots stored in polyethylene bags at 37° and 46° (tables 1-3). The lower temperature appeared preferable, and the data suggest 30 percent as a minimum moisture content. After 30 months, mean germination values averaged 31 and 42 percent for Shumard and water oak held at 37° and at the highest moisture levels. While these means are low, they include some bags in which no acorns germinated. Cherrybark acorns had higher germinative capacities after storage than before.

Apparently, the cloth bags failed because the acorns lost excessive moisture in the low-humidity coolers. The 4-mil polyethylene prevented moisture loss but allowed limited gas exchange. Some gas exchange is apparently needed, for in another experiment storage in closed glass jars failed completely.

[1] Stationed at the Forest Tree Seed Laboratory, maintained at State College, Miss., in cooperation with Mississippi State University.

[2] Bonner, F. T. Storage of acrons and other large hardwood seeds—problems and possibilities. Southeast. Nurserymen's Con., Proc. P. 77-82. USDA Forest Serv. Southeast. Area State and Private Forestry. 1971.

TABLE 1.—*Germination and moisture contents of cherrybark oak acorns stored in polyethlene bags at 37 and 46°F. (Each value is a mean of 3 replications.)*

Original moisture content and storage period	Germination		Final moisture content	
	37° F.	46° F.	37°F	46°F.
		Percent		
24 percent				
6 mo.	80	76	27	28
18 mo.	9	0	30	34
30 mo.	25	24	32	33
31 percent				
6 mo.	99	99	34	34
18 mo.	99	96	35	35
30 mo.	81	71	36	36
33 percent				
6 mo.	100	98	34	32
18 mo.	93	95	31	36
30 mo.	94	34	37	40

These results are supported by work in Europe, where high acorn moisture contents, polyethylene bags, and temperatures near freezing have been successful for other *Quercus* species. [3], [4] It seems likely that acorns can be stored by such methods for at least 5 years.

[3]Schonborn, A. Die Aufbewahrung des Saatgutes der Waldbaume. BLV Verlagsgesellcraft, Munich. 158 p. 1964.

[4]Vlase, I. [Development of a method of prolonged storage of *Quercus robur* acrons. *Rev.* Padurilor 85(10):616-619. 1970. [Rum.] [Forestry *Abs. v. 32. abs. 4141. 1971.*]

Sprouting in storage, and to a lesser degree during stratification prior to testing, was widespread for cherrybark and Shumard acorns. This early germination is included in the mean percentages in tables 1 and 2. It amounted to 25 to 50 percent of the totals in some cases. Most of the sprouting acorns took root and grew in the germinator, but survival probably would be poor under field conditions. The brittle radicles are easily broken in handling. Water oak acorns did not sprout.

There are good indications, however, that the sprouting observed in the tests will not occur in bulk storage. Several lots, ranging from 4 quarts to 2 bushels, were collected over the past 3 years and stored in large polyethylene bags at high moisture contents; storage temperature was 37°. No sprouting occurred, and germination was high for all except one lot:

Species	Storage period	Germination	Moisture content after storage
	Yrs.	Pct	
Shumard	1	85	32
Cherrybark	3	91	33
Nuttall (*Q. nuttallii* Palmer)	3	74	32
Water	3	62	33
Willow (*Q. phellos* L.)	3	2	35

TABLE 2.—Germination and moisture contents of Shumard oak acorns stored in polyethlene bags at 37 and 46° F. (Each value is a mean of 3 replications.)

Original moisture content and storage period	Germination		Final moisture content	
	37° F.	46° F.	37° F.	46° F.
		Percent		
24 percent				
6 mo.	90	28	28	28
18 mo.	4	15	32	35
30 mo.	0	30	36	41
34 percent				
6 mo.	100	94	38	39
18 mo.	68	0	42	47
30 mo.	31	22	44	44

TABLE 3.—Germination and moisture contents of water oak acorns stored in polyethylene bags at 37 and 46° F. (Each value is a mean of 3 replications.)

Original moisture content and storage period	Germination		Final moisture content	
	37° F	46° F.	37° F.	46° F
		Percent		
21 percent				
6 mo.	14	22	20	20
18 mo.	0	0	25	27
30 mo.	0	0	24	25
32 percent				
6 mo.	76	64	29	30
18 mo.	20	61	36	33
30 mo.	42	14	35	36