

# Storage Technique Affects White Oak Acorn Viability

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*Viability of acorns stored in 1.75-mil polyethylene and cloth bags did not change with increased storage time, while viability of acorns stored in 4-mil bags declined rapidly. If 4-mil polyethylene bags are to be used for moist white oak acorn storage, the bags should be kept open.*

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The best way to maximize germination of white oak (*Quercus alba* L.) acorns is to sow them in the fall immediately after collection. Prompt sowing is not always possible, and often the acorns must be stored for short periods. For example, when acorns are collected for provenance tests, acorns from northern sources, which mature 30 to 60 days earlier than those from southern sources, must be stored until collection is complete. To facilitate such storage, we compared the suitability of three different containers for short-term fall storage of white oak acorns.

## Methods

Acorns from several trees in the vicinity of Carbondale, Ill., were collected in early October 1982. Within hours after collection, the acorns were in cold storage at 2 to 3° C in a walk-in cooler. On the following day, the acorns were bulked, floated to remove defec-

tive acorns, and equally divided among four each of 4-mil and 1.75-mil wall thickness, zip-lock polyethylene bags and four muslin cloth bags. These bags had a capacity of 1 quart (0.95 l), and each contained approximately 400 acorns. Each of the four bags of each type corresponded to a storage interval. The bags were sealed until the designated date. This was done to prevent opening and closing of bags, which would allow gas exchange and could negate the effect of bag type on acorn viability.

Thirteen days after collection and at three 2-week intervals thereafter, one bag of each type was taken out of storage and a sample of 100 acorns from each bag type (4 groups of 25 acorns each) was tested for viability in a germinator. Each group consisted of a tray with 25 acorns in moist vermiculite covered with a damp tissue and a sheet of plastic. Germination counts were made daily except for weekends for 30 days. Acorns were scored as germinated when shoots (epicotyls) emerged.

The experiment was considered as a randomized complete block design with a factorial arrangement of treatments (containers and storage intervals) in which all treatments were fixed while blocks were assumed to be random. Analyses were performed on actual germination counts and not percentages.

In a further attempt to explain the relation between storage time and viability, acorns from Minnesota, southern Illinois, and Mississippi were stored in 4-mil polyethylene bags and sown in the germinator on the same four dates as in the container portion of the study. (Acorns from Mississippi matured later and were subject to only three storage periods.) Analysis of variance of these data was by State in a simple two-way ANOVA with blocks and storage intervals considered as treatments.

## Results and Discussion

Results from analysis of variance showed the effects of bag type, time in storage, and their interaction to be statistically significant ( $p > 0.001$ ) for both number of acorns with emerging roots and those with emerging shoots. There were no differences among blocks. Storage in cloth bags provided the same germination as storage in 1.75-mil polyethylene bags, while substantially lower viability was obtained from storage in 4-mil bags (table 1).

Time in storage affected acorn viability only in the 4-mil bags (table 1). In both the cloth and the 1.75-mil polyethylene bags, approximately the same number of radicles and shoots were present after 54 days as after 13 days of storage. By contrast, with one exception, the number of germinating acorns decreased rapidly with

**Table 1** —Average number and percentage of acorns with emerging shoots and radicles after storage in three bag types for four intervals<sup>1</sup>

Bag type	Storage interval	Acorns with emerging radicles		Acorns with emerging shoots	
	Days		%		%
Cloth	13	25	98	19	75
	26	25	99	21	85
	41	23	93	21	84
	54	24	97	19	77
Mean		24	96a	20	80a
1.75-mil polyethylene	13	24	94	20	79
	26	23	93	20	80
	41	25	98	22	86
	54	25	99	19	77
Mean		24	96a	20	80a
4-mil polyethylene	13	22	89	20	78
	26	16	64	8	32
	41	24	97	20	78
	54	6	23	1	0
Mean		17	68b	12	47b

with emerging shoots. We can only speculate about the cause for this difference. Generally, this difference was much less among acorns from cloth and 1.75-mil bags (table 1) than among acorns from 4-mil bags. It may be that there is a buildup of volatile toxic metabolic byproducts in the 4-mil bags caused by the greater wall thickness; 1.75-mil and cloth bags allow greater gas exchange and therefore less accumulation. The aroma of ethanol was common when 4mil bags were opened. Furthermore, a preliminary chromatography analysis of gas in bags containing white oak acorns showed extraordinarily high CO<sub>2</sub> concentrations. These gaseous metabolic byproducts may reduce the viability of shoot meristems.

<sup>1</sup>Means followed by the same letter are not significantly different from each other (0.05 probability level).

increased storage time in 4-mil bags (table 1). The 41-day storage treatment was the anomaly in this trend; we surmise that the 4-mil bag corresponding to the 41-day storage treatment had not been tightly sealed.

This trend of decreasing germination is also evident among acorns from the three other provenances, all of which were stored in 4-mil bags (table 2). In every case, the number of acorns with emerging shoots declined rapidly with increased storage time.

Another striking feature of the data in table 2 is the difference between the number of acorns with emerging roots and those

**Table 2** —Average number and percentage of acorns from three provenances with emerging shoots and radicles after different storage intervals<sup>1</sup>

Provenance	Storage interval	Acorns with emerging radicles		Acorns with emerging shoots	
	Days		%		%
Minnesota	13	21	82a	15	59a
	26	25	98a	17	69a
	41	23	90a	5	19b
	54	23	90a	1	2b
Illinois	13	18	72a	12	48a
	26	20	81a	9	37ab
	41	13	50ab	3	12bc
	54	5	20b	0	0c
Mississippi	13	24	97a	22	89a
	26	24	96a	16	63b
	41	19	76b	10	39c

<sup>1</sup>Means followed by the same letter are not significantly different from each other (0.05 probability level).

The use of 4-mil polyethylene zip-lock bags is commonly recommended for red oak acorn storage (2, 3). However, based on past experience and on these results, 4-mil bags should be used for white oak acorn storage even for short periods of time only if the bags are to be opened at least once a week to allow gas exchange and aeration. This stipulation was pointed out by Bonner (1) and cannot be stressed enough. According to our data, 1.75-mil polyethylene and cloth bags should allow enough gas exchange for short-term storage of moist acorns without opening and are preferable to 4-mil bags.

#### Literature Cited

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