# FLOTATION IN ETHANOL AFFECTS STORABILITY OF SPRUCE PINE SEEDS

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Flotation in 95-percent ethanol quickly separates full and empty seeds of spruce pine (*Pinus glabra* Walt.) without reducing viability measured soon after treatment. Results of two studies reported here, however, indicate that soaking in ethanol causes viability of the seeds to decline rapidly in storage. This phenomenon led to the erroneous conclusion that spruce pine seeds are difficult to store.[2] If the seeds have not been soaked in ethanol, their viability can easily be maintained for 1 year, and probably longer, under the currently recommended storage conditions for southern pine seeds.

## Methods

In the first study, spruce pine seeds were divided into five lots. Seeds in four lots were soaked for 4 minutes in 95-percent ethanol. After drying at room temperatures (about 75° F.) for 1, 4, 8, or 24 hours, they were sealed in polyethylene bags for storage. The other lot, not soaked in ethanol, was the control. Each treatment was replicated three times. After treatments, 200-seed samples were drawn for initial germination tests. The remaining seeds were stored at 34° F., at a moisture content of 10 percent. After 1 year, samples were again drawn for testing. All seeds were stratified 28 days prior to the germination tests.

In the second study, the same combinations of seed moisture contents and storage temperatures that were earlier tested after ethanol flotation[2] were reevaluated to determine if seeds cleaned of the empty husks with an aspirator stored better than those separated by flotation. Seeds were collected in the fall of 1967 and held for nearly 1 year at temperatures near freezing and moisture contents of about 6 percent. Then empty seeds and trash were removed with an aspirator, and the test lots were adjusted to either 6-, 9-, 12-, or 15-percent moisture content a stored at either 0°, 25°, or 34° F. Each of the possible storage conditions (four moisture contents three temperatures) was replicated three times. Se sampled for testing initially and after 1 year of st age were stratified 28 days.

## Results and Discussion

Ethanol flotation adversely affected storabil Seeds soaked in 95-percent ethanol and dried fo or 4 hours prior to storage were essentially nonvia after 1 year (table 1). Only 17 and 31 percent those dried 8 and 24 hours germinated. Althou viability of the control was unexplainably low ( percent) after 1 year, the results clearly illustr the detrimental effect of ethanol flotation.

When the seeds were separated with an aspirat they were not very sensitive to storage conditions. a previous study in which seeds were separated flotation, viability averaged 94 percent initially a 78 percent after 1 year. In the second study ported here, germination (initially 86 percent) creased to 88 percent after 1 year (table 2). Ger nation of seeds stored at 0° F. averaged 91 perce those stored at 25° and 34° F. averaged 90 and percent. Although there were no significant diff ences because of moisture content, seeds stored 34° F. germinated significantly less than those sto at 0° and 25° F. The lower viability of seeds w 15-percent moisture content was responsible for t difference at 34° F.

Spruce pine seeds store well for at least 1 year a can be held for longer periods under the currer recommended conditions for southern pine seed subfreezing temperatures and seed moisture conte below 10 percent. If empties are to be removed ethanol flotation, separation should be deferred u immediately before use.

[1] Stationed at Pineville, La.

[2] Barnett, J. P., and McLemore, B. F. Improving storage of spruce pine seed. Tree Planters' Notes 18 (2): 16. 1967.

TABLE 1.—*Viability of spruce pine seed soaked in ethanol, dried for varying periods, and tested initially and after 1 year of storage*

| Drying time (hours) | Length of storage | |
|---|---|---|
| | 0 years | 1 year |
| | *Percent* | *Percent* |
| 1 | 91 | 2 |
| 4 | 90 | 4 |
| 8 | 92 | 17 |
| 24 | 91 | 31 |
| Control | 90 | 56 |

TABLE 2.—*Viability of spruce pine seed after 1 year of storage* [1]

| Moisture content | Germination after 1 year at— | | | |
|---|---|---|---|---|
| | 0° F. | 25° F. | 34° F. | Treatment means |
| | *Percent* | *Percent* | *Percent* | *Percent* |
| 6 | 89 | 88 | 88 | 88 [2] |
| 9 | 92 | 90 | 86 | 89 |
| 12 | 91 | 90 | 90 | 90 |
| 15 | 90 | 93 | 76 | 86 |
| Treatment means [2] | 91 | 90 | 85 | |

[1] Initial viability averaged 86 percent.

[2] Means of storage treatments, which are underlined by the same line or lie within the same bracket, are not significantly different at the 0.05 level, according to Duncan's multiple range test. Values were transformed to arc sine $\sqrt{\text{percent}}$ prior to analysis.

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