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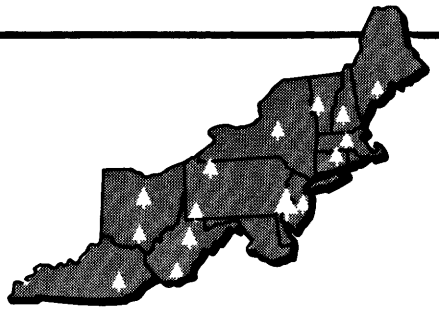

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EFFECT OF SEPARATION IN N-PENTANE ON STORABILITY OF SUGAR MAPLE SEEDS

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Abstract.—Seeds in samaras separated in n-pentane have been stored successfully for 5½ years. The seeds in the separated samaras germinated equally as well as the unseparated controls, indicating that there was no detrimental effect from the n-pentane.

It has been known for several years that sugar maple (*Acer saccharum* Marsh.) seeds can be stored successfully up to 54 months without losing viability *(Yawney 1968, Yawney and Carl 1974)*. More recent studies have shown that flotation in n-pentane is an easy method of separating filled and empty sugar maple samaras without reducing the viability of seeds *(Carl and Yawney 1969)*. It was not known, however, if separation in n-pentane affects the viability of seeds stored longer than 70 days. This work was undertaken to determine if pentane has any long-term effects on sugar maple seeds.

Materials and Methods

The study was begun in the fall of 1967 with seed collected from a single tree. It was expanded in 1968 by including seed from four more trees. Seed from four additional trees were added in 1970, for a total of nine collections. The trees were all located in Vermont, in an area between Westford and East Middle-

bury. The area was between 44° 35′ 15″ and 44° 58′ 20″ north latitude and 72° 58′ 20″ and 73° 5′ 40″ west longitude.

Regardless of the year, all of the seed were handled in a similar manner. After collection, pre-storage viability tests were performed. Immediately afterward, half of the remaining samaras were put in pentane to separate the filled ones from the empty ones. (The ones filled with seed sink; the empty ones float.) The filled samaras were left in the pentane no longer than 5 minues. They were removed from the pentane and allowed to air-dry for a short period to remove the excess pentane.

All the samaras, both separated and unseparated, were then spread on drying racks in an unheated building to dry to a 10- to 15-percent moisture content. After drying, they were counted out into lots of 50 each for the separated samaras and 100 each for the unseparated samaras. Each lot was sealed in a glass jar and placed in storage at minus 10°C. Periodically thereafter, 10 jars for each tree (five containing samaras separated in pentane and five containing unseparated samaras) were removed from storage and the seeds were germinated.

Germination tests were conducted by stratifying the seeds in the dark for 90 days at 2°C, followed by 2 weeks in subdued light at 16°C *(Carl and Yawney 1966)*. A seed was considered germinated when the radicle appeared through the fruit coat. At the end of each germination test, the samaras that failed to germinate were opened to determine the number of ungerminated seeds. These were added to the number of germinated seeds. This determined the total number of seeds in each sample. Germination percentages were based on that total.

Results

Average germination percentages for each of the years of collection and length of storage are given in table 1. The seeds collected in 1967, which had an initial germination of 98.2 percent, have been stored for up to 5½ years with no decrease in viability of the seeds in the separated samaras. There was some apparent loss of viability of the seeds in the unseparated samaras, but they still had a better than 90 percent of germination. After 66 months in storage the seeds in the separated samaras had 98.4 percent germination, but only 93.1 percent of the seeds in the unseparated samaras germinated.

The 1968 seed collections have been stored for up to 60 months but have not withstood storage as well as the 1967 seeds. Initial germination of the collections averaged 94.9 percent. However, after 60 months of storage, the seeds in the samaras separated in pentane have germinated nearly as well—90.3 percent—as the seeds in the unseparated samaras—91.1 percent—which would imply that any loss of viability was due to some factor other than separation in pentane.

The 1970 seed collections, which had an initial germination of 99.0 percent, have been stored for up to 36 months without loss of viability of seeds in either the separated or unseparated samaras. Germination was 97.7 percent for the seeds in the separated samaras,

Table 1.—Effect of separation in pentane and length of time in storage on the percent germination of sugar maple seeds

Year of collection	Treatment	Months in storage										
		0	6	12	18	24	36	42	48	54	60	66
1967[1]	Pentane	98.2	97.2	—	94.8	—	—	95.6	—	96.8	—	98.4
	Control	98.2	91.5	—	94.4	—	—	87.6	—	93.8	—	93.1
1968[2]	Pentane	94.9	—	92.4	—	90.7	86.2	—	88.2	—	90.3	—
	Control	94.9	—	92.0	—	87.3	86.6	—	90.4	—	91.1	—
1970[2]	Pentane	99.0	—	97.1	—	97.8	97.7	—	—	—	—	—
	Control	99.0	—	96.9	—	97.8	98.6	—	—	—	—	—

[1] Single tree.
[2] Average of 4 trees.

and 98.6 percent for the seeds in the unseparated samaras.

Discussion

Germination of sugar maple seeds stored for extended periods does not seem to be adversely affected when pentane is used to separate the filled samaras from the empty ones. Although in some cases a decline in germination of the separated seeds was observed, there was a corresponding decrease in germination of the unseparated controls, which would seem to indicate that such a decrease was not caused by the pentane. Barnett *(1971)* indicated that pentane is relatively safe for separating longleaf pine (*Pinus palustris* Mill.) seed even when storage is necessary.

It was expected that the control seeds should store as well as those reported by Yawney *(1968)* and Yawney and Carl *(1974)*. But the 1968 collections did not store as well as expected. It may be that the seeds were not as mature as those used in the earlier storage study. Barnett and McLemore *(1970)* reported that longleaf pine seeds collected from a given tree 1 year may store well, while seeds collected from the same tree in another year may store poorly.

This is probably the case with sugar maple seeds too. Another factor that may affect storability might be the drying techniques. Although attempts were made to dry the samaras the same way each year, the rate of drying depends on the relative humidity at the time, and this varied between years. This made a difference in the drying schedule and might account for some of the difference in storability.

The door of the freezer containing the 1968 seeds was inadvertently left ajar over a 3-day weekend in 1971; and although the freezer kept running, it is not known how much warming occurred, or how it affected germinability. Although there was a sharp drop in the germination of the separated seeds between 24 and 36 months of storage, the germination returned to the 24-month level, which may indicate that if there was any effect, it was minor.

From this experiment and from observations of other seed collections, it seems perfectly safe to separate sugar maple samaras in pentane even though it is planned to store them for extended periods. Results of our experiment thus far indicate that seeds in samaras separated in pentane can be stored for periods of up to 66 months without loss in viability greater than that of seeds in unseparated samaras.

CAUTION: Pentane is extremely volatile and should only be used in well ventilated places away from any open flame. Also, breathing the fumes is to be avoided as much as possible.

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