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LONGEVITY OF BLACK CHERRY, WILD GRAPE, AND SASSAFRAS SEED IN THE FOREST FLOOR

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ABSTRACT

The results of this study show that (1) black cherry seed remains viable in the forest floor for 3 years, with a small amount of seed germinating after 4 or 5 years; (2) sassafras seed remains viable for 5 years in the forest floor, and (3) some wild grape seed retains its viability for at least 8 years. These results are important to the forest manager in setting up harvest schedules and controlling unwanted species in the new stand.

LONGEVITY OF BLACK CHERRY, WILD GRAPE, AND SASSAFRAS SEED IN THE FOREST FLOOR

THE LONGEVITY of seeds in the forest floor has important implications for the regeneration of Central Appalachian hardwood stands. For example, Sander and Clark (1971) reported that yellow-poplar *(Liriodendron tulipifera* L.) seeds remained viable for up to 8 years in the forest floor of Central States hardwood forests. Clark (1962) found that white ash *(Fraxinus americana* L.) and hackberry *(Celtis occidentalis* L.) seeds remained viable after three winters of storage in the forest floor. Sassafras *(Sassafras albidum* (Nutt.) Nees) seed was viable for only one winter. Leak (1963) also reported that white ash seeds remained viable for 3 years in the White Mountain area of New Hampshire.

Although most of the competition from wild grape is from sprouts from old stems, some vines are established from seeds. For example, Trimble and Tryon (1974) observed 70,000 grape seedlings per acre the first year after cutting. Six years later 278 tree seedlings per acre had grapevines established in their crowns. Although only two trees showed any damage (leader bent over), the authors reported that most of the vines appeared vigorous and capable of doing future damage. Thus, even with a relatively few trees "infested", the potential for grape problems in the next stand had been established.

For several years on the Fernow Experimental Forest near Parsons, West Virginia, natural seed storage of black cherry *(Prunus serotina* Ehrh.), wild grape *(Vitis aestivalis* Michx. and variety *argentifolia* Munson), and sassafras has been studied.

Early results (Wendel 1972) showed that black cherry seeds remained viable in the forest floor over three winters. Of the seeds stored, fewer than 10 percent germinated the first spring, about 50 percent germinated the second spring, and 25 percent germinated the third spring.

This paper reports on continued tests with black cherry and 5- and 8-year results with sassafras and wild grape seed, respectively.

THE STUDY

The field storage area is on a nearly level site under a fully-stocked stand of 65-year-old mixed hardwoods.

The wild grape storage area consisted of four rectangular 2- by 20-foot plots, each divided into fifteen 24- by 16-inch subplots, making a total of 60 subplots. The sassafras and black cherry seeds were stored in individual rectangular 16- by 24-inch plots. All of the plots were constructed of 12-inch wide, 1/4-inch mesh hardware cloth which was forced into a slit 6 inches deep around the perimeter of the plot to keep out burrowing animals (fig. 1).

Figure 1.—Field storage plot.

In the early fall of 1968 I collected mature wild grapes from vines in the vicinity of Parsons, W. Va. I counted out 120 lots of wild grapes, each consisting of 70 complete fruits. Sixty lots were broadcast on an 8- by 16-inch area in each of the 16- by 24-inch subplots. The other 60 lots were placed in fiberglass screen envelopes (fig. 2) similar to those used by Clark and Boyce (1964), and placed next to the broadcast-seeded areas in the subplots. Since each grape contains 2 or 3 seeds, the number of actual seeds in each lot ranged from140 to 210. Six broadcast- and six envelope-stored lots were retrieved for testing.

In the fall of 1972, an additional 48 samples consisting of 100 grapes each were stored in fiberglass envelopes. The envelopes were laid on the existing litter and covered with leaves. Four envelopes are withdrawn every 2 years, and the seeds are tested for germination. Germination testing will continue for 24 years or until it is obvious that no more viable seed remains.

In the fall of 1971, 50 sassafras fruits were stored in each of 30 fiberglass envelopes, and 200 black cherry fruits were stored in each of 15 fiberglass envelopes. The following autumn an additional 100 black cherry seeds were stored in each of 15 fiberglass envelopes. When leaf-fall was completed the storage plot covers were removed and litter was added to the plots in an amount equal to the current years' leaf-fall. This procedure was repeated each year for all species.

Enough sassafras seed was stored so that five samples could be tested annually for 6 years. For black cherry enough samples were stored so that samples could be withdrawn annually for 5 years.

Samples were removed from the storage plots in April of each year. The broadcast grape seeds were recovered by picking up all litter and humus above mineral soil and then sifting through a sieve to remove large twigs and leaves. The humus-soil-seed mixture was placed in a shallow tin, watered, kept in a warm room, and observed for germination. Black cherry, grape and sassafras fruits in the fiberglass envelopes were taken from the envelopes, the pulp was washed off, the seeds were counted, and then placed between moistened blotters in the germinator where the temperature was maintained at about 80° F for 12 hours each day. Nighttime temperatures varied with the ambient air temperature. Newly germinated seeds observed in the fiberglass envelopes that were withdrawn for testing were included in the total germination for that year.

Observations were made daily and germination was recorded for a period of 30 days. At the end of the test period, the ungerminated seeds were cut open. Seeds that contained a firm, white endosperm and/or cotyledon were tallied as still viable.

RESULTS

Wild Grape.—For the 8 years of the study, annual germination of grape seeds has been erratic. Less than 1.0 percent of the envelope- or broadcast-stored seed germinated the first year after storage and we did not record any the second year (table 1). However, a cutting test on the second year sample showed that 11.3 percent of the broadcast-stored and 10.8 percent of the envelope-stored seed contained healthy-looking endosperms. With the exception of the spring 1972 broadcast-stored seeds, we have recorded germination of grape seeds every year since 1971.

In general, more of the envelope-stored seed germinated than of the broadcast-stored seeds.

Figure 2.—The fiberglass screen envelope used for storing seed.

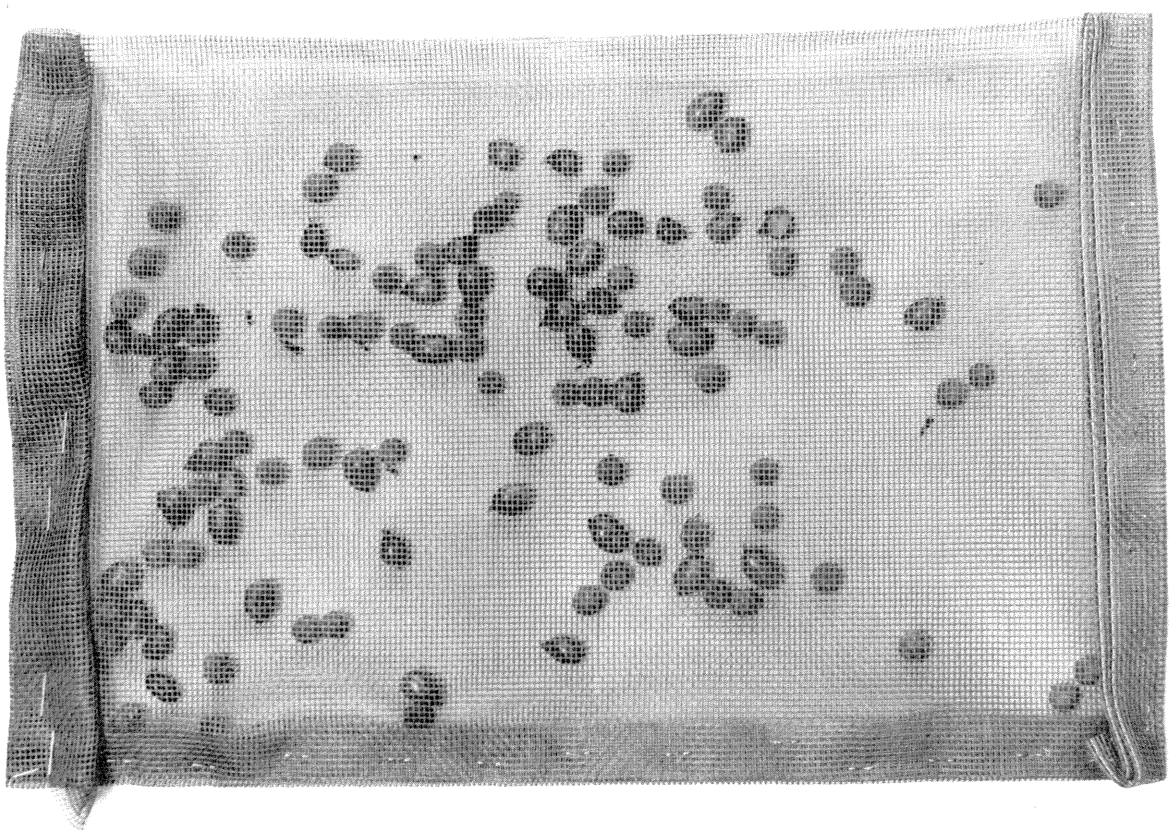

Table 1.—Percentage of germination and healthy endosperm in wild grape seeds

Test year	Broadcast		Envelope-stored	
	Germination [a]	Healthy [b] endosperm	Germination [c]	Healthy endosperm
FIRST LOT—STORED FALL 1968				
Spring 1969	<1.0	— [d]	<1.0	—
Spring 1970	0.0	11.3	0.0	10.8
Spring 1971	2.6	7.8	2.1	4.7
Spring 1972	0.0	4.3	8.0	6.2
Spring 1973	<1.0	1.2	7.2	3.5
Spring 1974	1.7	—	2.3	9.0
Spring 1975	<1.0	—	11.3	7.8
Spring 1976	1.6	—	8.4	6.5
SECOND LOT—STORED FALL 1972				
Spring 1974	—	—	3.0	16.2
Spring 1976	—	—	9.6	9.5

[a] Germinated in shallow tins, in room environment for 30 days.
[b] Determined by cutting test on ungerminated seeds.
[c] Germinated in germinator.
[d] Not tested.

The difference was probably due to the test conditions. Broadcast seeds were subjected to day and night fluctuations in room temperature and humidity whereas the envelope-stored seeds were in the more controlled environment of the germinator. However, cutting test results did not differ greatly between the two types of storage. Cutting tests were discontinued on the broadcast-stored seeds after 1973 because of the difficulty of separating seeds from the humus-soil mixture, and because we felt that the envelope-stored seed was representative of both storage methods.

The amount of grape germination has not shown a steady decline with time, as might be expected, but has been high and low in successive years. This is probably due to natural variation among the various seed lots and possibly some minor variation in storage plot microclimate.

In the second lot of wild grape seeds that were stored in the fall of 1972, germination after the first 2 years of storage was 3.0 percent, with 16.2 percent of the ungerminated seeds containing healthy endosperms. Two years later 9.6 percent of the seeds germinated and 9.5 percent contained healthy endosperms (table 1).

Sassafras.—After five winters of storage, 11.3 percent of the sassafras seeds germinated and 5.7 percent of the ungerminated seed contained

Table 2.—Germination and results of cutting tests in sassafras

Testing date	Average number of seeds stored [a]	Germination	Containing healthy cotyledons
	Number	*Percent*	*Percent*
Spring 1972	50	0.0	78.9
Spring 1973	50	4.0	41.1
Spring 1974	48	12.4	13.2
Spring 1975	48	10.5	16.3
Spring 1976	49	11.3	5.7

[a] Average of 5 samples stored in fall 1971.

Table 3.—Germination and results of cutting tests in black cherry seed

Testing date	Seeds stored	Germination	Containing healthy cotyledons
	Number	*Percent*	*Percent*
FIRST LOT—STORED FALL 1971			
Spring 1972	200	77.4	20.8
Spring 1973	200	26.3	1.3
Spring 1974	200	1.7	0
Spring 1975	200	0	0
Spring 1976	200	0	0
SECOND LOT—STORED FALL 1972			
Spring 1973	100	5.6	92.3
Spring 1974	100	17.8	12.7
Spring 1975	100	7.0	1.0
Spring 1976	100	<1.0	0

firm white cotyledons (table 2). After the first winter, none of the seeds germinated, but about 80 percent contained healthy cotyledons. In general, the viability of sassafras seeds probably does not last more than 6 years, as indicated by the low percentage of ungerminated seeds after five winters of storage.

Black Cherry.—The pattern of germination in the two lots of black cherry seed was not the same. In the 1971 lot, 77 percent of the seeds germinated after the first winter, but only about 6 percent of the 1972 lot germinated after the first winter (table 3). After three winters of storage in the forest floor, there were practically no viable seeds left. Less than 1.0 percent of the second lot of seeds germinated after four winters of storage. This finding confirms results published earlier that most of the black cherry seed germinates within 3 years after it falls from the tree (Wendel 1972), even though a few seeds remain viable for 4 to 5 years.

SUMMARY AND DISCUSSION

Germination of wild grape seed during the first 8 years of the study has been erratic, with no consistent trend toward a decrease with time. After the eighth winter of storage, 8.5 percent of the envelope-stored seed germinated, and 6.5 percent of the ungerminated seeds contained apparently healthy endosperms.

In the second lot of wild grape seed, after 4 years of study, germination was 9.6 percent, and 9.5 percent of the ungerminated seeds contained healthy endosperms.

It appears now that some of the grape seed in the first lot will retain its viability for at least 10 years. With the second lot of seed, we should be able to determine the full longevity of grape seed in the forest floor, because sampling will continue for 24 years.

The data on sassafras indicate that the limit for storage in the forest floor is about 6 years. This is in contrast to results by Clark (1962), who found that sassafras seeds did not germinate after the second winter of storage in the forest litter in Indiana.

The bulk of the germination in the 1971 black cherry lot occurred after the first winter; in the 1972 lot, most of the germination occurred after the second winter. In an earlier study (Wendel 1972), most of the germination occurred after the second winter. Marquis (1975) reported that the bulk of the black cherry seed in northwestern Pennsylvania stands germinates during the first three winters after seedfall. In the West Virginia studies, practically all of the black cherry germination was observed and recorded when the samples were withdrawn from the field storage plots on or before April 22 each year. Ungerminated seeds placed in the germinator failed to germinate even though a cutting test revealed apparently viable seeds. Black cherry requires a rather long stratification at temperatures between 33 and 41° F for after-ripening (Schopmeyer 1974). A couple of relatively warm, mild winters occurred during the test period, which could have influenced the after-ripening process and dormancy of some seeds.

Although individual black cherry trees produce seed every year, good seed crops for entire stands are produced only every 3 or 4 years (Schopmeyer 1974). Marquis (1975) determined that in a 100-year-old stand with 16 percent of the basal area in black cherry, there were 152,000 black cherry seeds in the forest floor. Thus with some new seed being added each year, and some seed remaining viable for 3 years, lack of seed should not be the cause of poor black cherry regeneration after harvest cutting.

When hardwood stands are heavily cut on certain sites, many sassafras and grape seeds germinate. These seedlings and numerous root and stump sprouts of the same species compete with desirable hardwoods. In the case of grape, the vines become concentrated in the tops of small trees and break or bend them down, often killing the tree.

In stands that are scheduled for harvest cutting, sassafras stems of seedling origin could be eliminated from the new stand by removing all of the sassafras trees 6 or 7 years earlier. To curtail the development of stump and root sprouts, the stumps could be poisoned after cutting.

With wild grape the situation is somewhat different. Some of the 8-year-old seed germinated and it appears that some of the ungerminated seed is still viable. We don't know how long grape seed might continue to produce seedlings, but if timber production is the major goal of management, we can cut or poison grapevines as early as practicable in the life of the stand. The source of grape seed would be eliminated and the grapevine roots would die, reducing the number of sprouts and seedlings in the new stand.

The study of wild grape will continue until the longevity of the seed is established. There is a need for information on longevity of some of our other important hardwoods as well as their major competitors. The longevity of fire cherry *(Prunus pensylvanica* L. f.) seed is being studied, and we plan to work with blackberry *(Rubus* sp.) in the future.

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