

by Clayton M. Carl, Jr.
and Albert G. Snow, Jr.

MATURATION of SUGAR MAPLE SEED



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NORTHEASTERN FOREST EXPERIMENT STATION, UPPER DARBY, PA.
FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE
WARREN T. DOOLITTLE, DIRECTOR

The Authors

CLAYTON M. CARL, JR., research forester, received his bachelor of science degree in forestry from the University of Maine in 1955, and his master of forestry degree from Duke University in 1959. He then joined the staff of the Northeastern Forest Experiment Station as a research forester and worked in timber-management research at the Paul Smiths Research Center, Paul Smiths, New York. In 1961 he transferred to Burlington, Vermont, where he is now doing research on the artificial regeneration of sugar maple.

ALBERT G. SNOW, JR., received his bachelor of science degree in forestry from Washington State College in 1933, and his master of science degree from Yale University in 1935. He joined the Northeastern Forest Experiment Station in 1935 and worked as a research forester in spruce management and forest genetics. He transferred to the Southeastern Forest Experiment Station, Lake City, Florida, in 1942 as a research forester in naval stores. He was center leader at the Virginia Pine-Hardwood Research Center, Laurel, Maryland, from 1952-61. He served as project leader and chief of laboratory of the Station's unit in Burlington, Vermont, from 1961 until he retired in May 1971.

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THE SEEDS of a sugar maple tree (*Acer saccharum* Marsh.) do not mature at the same time every year. And different trees mature their seeds at different times. So time of year is not a reliable measure of when seeds are ripe. Better criteria are needed.

In recent studies we have found that moisture content and color are the best criteria for judging when sugar maple seeds are ripe.

METHODS

Tree Selection

We collected sugar maple samaras from three trees growing in an open stand of sugar maples about 9 miles southeast of Burlington, Vermont. The trees were selected for percentage of filled samaras (50 percent or more contained seeds in 1964) and the proximity of the trees to each other. All three trees were mature, about the same height and diameter, and had full and fairly open-grown crowns. Because of the nearness of the trees to each other, we assumed that site and climatic conditions were uniform.

Samara Collection

The samaras were collected by hand-picking those that could be reached from the ground, and by pruning the tips of the higher samara-bearing branches. For each collection we tried to obtain samaras from all portions of the crown we could reach. The weekly collections were discontinued when not enough samaras could be gathered for the regular viability tests.

We started collecting samaras on 26 August 1964 from all three trees. Because the time of samara-fall varied between trees, the final collections were made on 7 October for tree A, on 21 October for tree B, and on 30 September for tree C—a total of 22 individual collections. The weekly collections consisted of approximately 1,100 samaras from each of three trees.

In 1967 samaras were collected from the same trees so that a comparison could be made between seed years. We started collecting on 30 August and continued collections weekly until the final collections were made on 12 October for trees A and C, and on 20 October for tree B—again a total of 22 individual collections. It was noted that tree C had a high aphid infestation on the fruits. With minor exceptions the samaras were handled the same as those collected in 1964.

Samara Handling

Moisture content determinations were made each week on five 100-samara samples from each tree. After removal from the tree, the samples were sealed immediately in glass jars. Upon return to the laboratory, the samples were weighed, dried at 100°C. for 24 hours, and reweighed. Percent moisture content at time of collection was calculated on a dry-weight basis.

Another five samples of 100 samaras each were used in the germination tests. They were slowly air-dried in an unheated building to a moisture content of about 10-15 percent. After drying they were stored at a temperature of 2°C. over winter until the germination tests were begun.

The remaining samaras from each collection were used for color determinations. The colors of the samaras and seed coats were compared to color plates in the Maerz and Paul *Dictionary of Color* (1930).

Germination Tests

The samaras were taken from storage the spring after collection and were soaked in tapwater for 24 hours at 2°C. They were then stratified for 90 days at 2°C., on germination paper in small plastic boxes (*Carl and Yawney 1966*). At the end of the 90 days they were transferred to a temperature of 15°C. for an additional 2 weeks. Weekly germination counts were begun, and germinated seeds were removed, after about the 30th day of stratification.

After the final germination counts were made, the remaining

samaras were opened to determine the number of ungerminated seeds present. This number plus the number of germinated seeds equaled the total number of seeds present in the original sample. Germination percentages were based on the total number of seeds present, not on the total number of samaras.

RESULTS

Time of Collection and Seed Germinability

In 1964, seeds could be collected any time after 1 September—for trees A and C—and they would be over 95 percent germinable (fig. 1). In tree B this state of seed maturation was not reached until the 23 September collection.

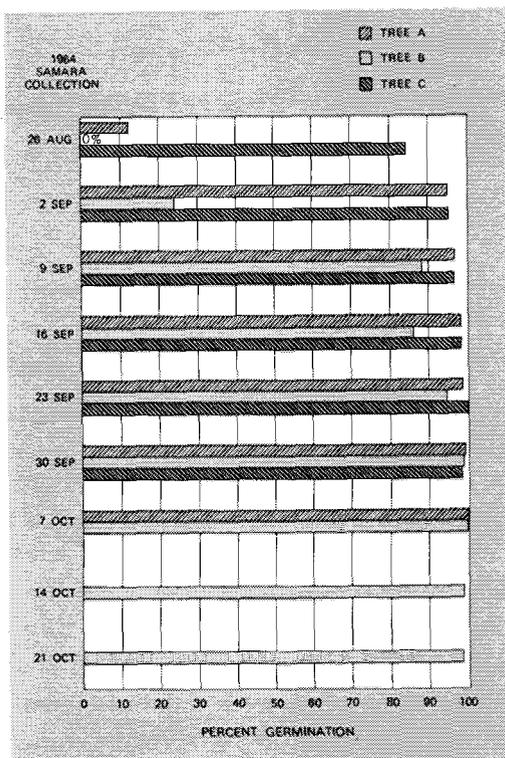


Figure 1.—Percent germination for each tree, by date of collection, 1964.

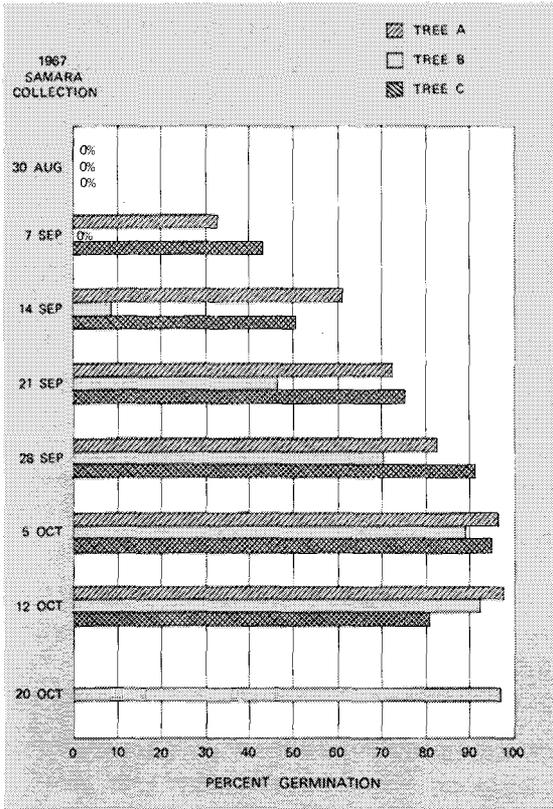


Figure 2.—Percent germination for each tree, by date of collection, 1967.

Seed matured at a much later date in 1967 (fig. 2). Not until about a month later—5 October—were seed over 90 percent germinable. Again tree B lagged behind the other two in time of maximum seed maturation. The seasonal rate of seed maturation was also slower in 1967 than in 1964.

These results indicate two things. First, individual trees seem to have a built-in phenologic system that is repeatable from year to year for maturation of seed. Second, neither chronologic date of maximum seed germinability or rate of seed maturation are the same each year, thus ruling out both factors for predicting when samaras may be collected for best results.

There were only 2 weeks in 1964 when seeds from all three trees germinated at least 95 percent. Again in 1967, total germi-

nation varied between trees for the same date of collection and between dates of collection for each tree. No single week's collections had seeds from all three trees that germinated at the 95-percent level.

Moisture Content and Seed Germinability

There was a gradual decline in moisture content of the samaras for the 1964 season until about the last week of collection. Then there was a sharp drop in moisture content, and the samaras were shed. With minor exceptions, the 1967 pattern for change in the average moisture content was similar to that observed in 1964 (fig. 3). There was a general decline until about the last week, when again there was a sudden drop, and the samaras were shed.

Figure 3. — Moisture content of the weekly samara collections.

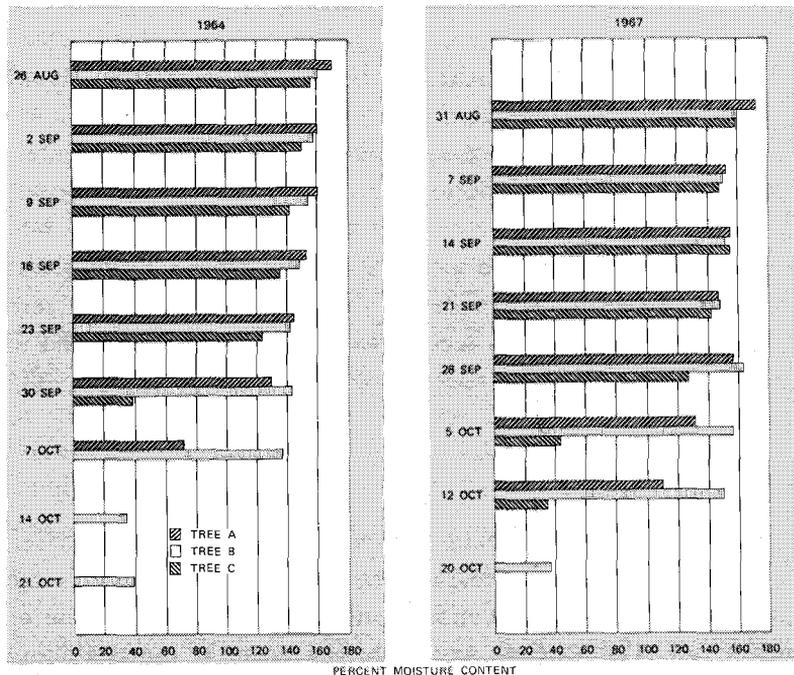
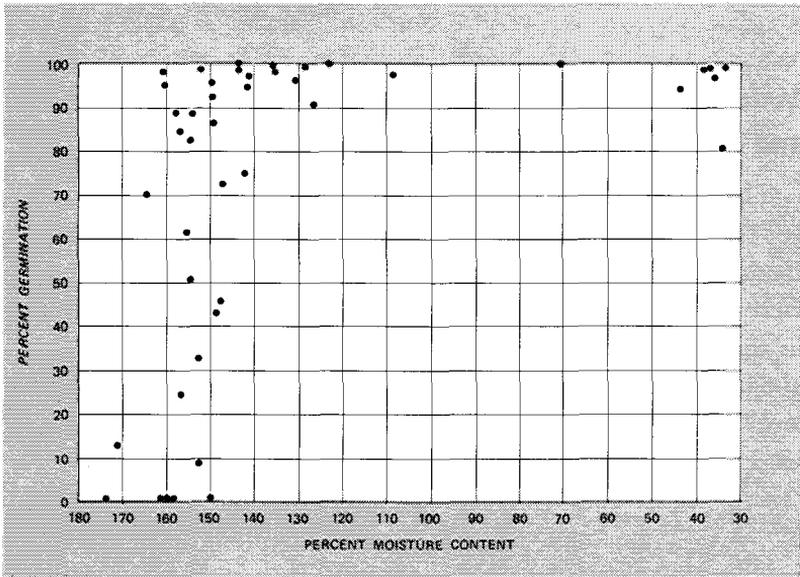


Figure 4.—The relationship between percent moisture content of the samaras at the time of collection and total percent seed germination.



When the moisture content was below 145 percent, nearly all the seed samples germinated at 95 percent or better (fig. 4). The exception to this was tree C, which had a high aphid infestation in 1967. This infestation may have had an adverse effect on seed germinability.

Seed collected when the moisture content of the samaras was over 145 percent varied in germinability all the way from zero to about 95 percent. Thus seed collectors should be cautioned to wait until the moisture content of the samaras falls to 145 percent.

Color Comparisons

Timing of harvests by field personnel would probably be based mostly on color of the samaras. The color changes were for the most part gradual, with a more abrupt change near the time of samara fall. The samaras were a bright green at the beginning

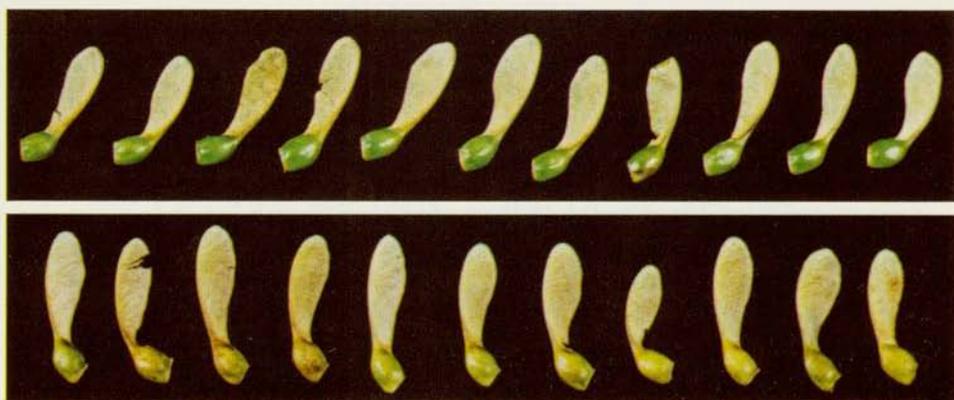


Figure 5.—Sugar maple samaras from the same tree at two stages of development. The top row shows them when they are bright green, before they are ripe. The samaras in the bottom row have turned yellowish green, and are ripe. At least 95 percent of the seeds from the samaras in the bottom row will germinate.

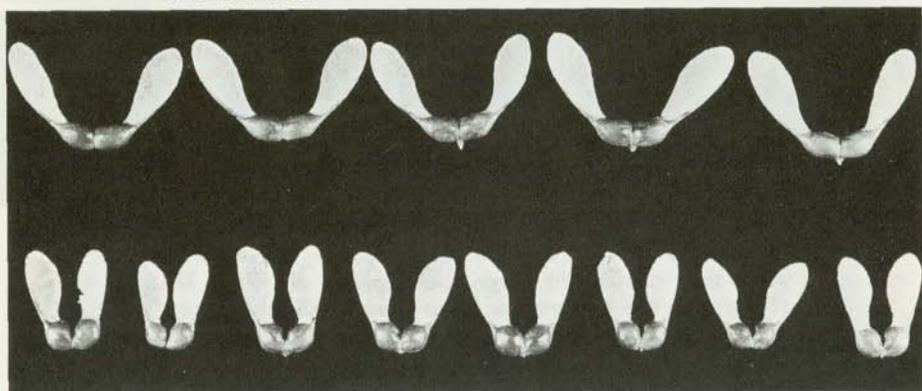
of the study, changing to yellowish green, and then to brown. By the time the majority of the samaras had changed from bright green to yellowish green (fig. 5), the seeds were fully ripened. Once they have reached this condition they can be collected at any time until seedfall.

If the samaras have turned completely brown, they should be picked immediately. We found that the samaras will soon be shed after developing to this stage.

DISCUSSION

Seed ripening was much slower for the 1967 seed crop than for the 1964 seed crop. For the 1964 seed crop, germination reached 95 percent by the beginning of September for trees A and C and by late September for tree B. For the 1967 crop, none of these trees reached 95-percent seed germination until collections on 5 October. For the 22 individual collections made in 1964, 16 approached or exceeded 95-percent germination. Of the 22 collections made in 1967, only 4 approached or exceeded 95-percent germination. In 1964 there were 2 weeks when seeds

Figure 6.—Differences in the angles of attachment of samaras from different trees. Samaras in the top row are from tree B, in which the male portion of the flowers bloomed first and the seeds matured last. Samaras in the bottom row are from tree C, in which the female portion of the flowers bloomed first and the seeds matured first.



from all 3 trees germinated at least 95 percent, but in 1967 no single week's collection had seeds from all three trees germinate at this level.

Another factor apparently related to timing of seed maturity was noted: differences in the angles of attachment of the bodies of the samaras, which are relatively constant for individual trees (fig. 6), appear to be related to flower dichogamy. William J. Gabriel, geneticist at the Station's research unit at Burlington, Vermont, drew this conclusion from his previous research on the reproductive behavior of sugar maple.

Samaras from tree C (fig. 6, lower row) were derived from flower parts where the female portion bloomed first, while in tree B (fig. 6, upper row) the male portion bloomed first. Seeds of tree C always matured before those of tree B. Further study of this relationship is under way.

Because of the variability between trees in seed development, we found that collection has to be timed on an individual tree basis. Seeds will generally have reached their maximum germination potential when their moisture content has dropped below 145 percent or the samaras are yellowish green.

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