

Establishment and Growth of Seedling Reproduction of Sugar Maple (*Acer Saccharophorum*)

DANIEL DENUYL, Purdue University

Reproduction of sugar maple (*Acer saccharophorum*) is very common in the beech-maple woods of Indiana from which livestock have been excluded and which are not burned. Even in the oak-hickory woods sugar maple regeneration is commonly found along with elm, ash, hickory, and oak. The question that frequently arises is "What happens to the sugar maple seedlings and how many survive and grow into saplings, poles, and larger sized trees?" An answer to these questions comes from the records of permanent sample plots which were established in 1931. The purpose of these plots was to study the natural regeneration in woods from which livestock and fire were excluded. Quadrats 1/1000 acres in size were laid out and on these reproduction of all tree species was tagged. Measurements on many of the quadrats were taken annually for 5 years after which time periodic measurements were made. It is from these records that the establishment and growth habits of sugar maple will be described.

Sugar maple is a frequent and abundant seed producer. During the period 1931-1947 it was observed that in the woods where sample plots were located that 9 years out of 17 were good seed years.

Following an abundant seed crop thousands of newly germinated seedlings will be present in the woods. In some woods a dense carpet of seedlings numbering up to 1½ million per acre will become temporarily established. In other woods patches of dense sugar maple reproduction will be present. To illustrate what happens to the seedling population a record of one typical quadrat is presented.

TABLE 1. Sugar Maple Regeneration on a 1/1000 Acre Quadrat
Height Classes in Feet

Year	0.5	1	2	4	6	8	Totals
	Numbers of Seedlings						
1932	1350						1350
1933	600	15					615
1934	300	67					367
1935	232	96					328
1937	25	100	9				134
1938	34	110	19				163
1939	71	35	51	6			163
1940	44	49	34	35			162
1942	23	10	9	5	1		48
1944	18	8	6	6	2	1	41
1947	12	9	5	5	2	2	35

The number of sugar maple seedlings shown in the 0.5 foot height class does not represent all of the seedlings that start growing because measurements were taken in July or August and so some seedlings had already died before counts were made. Observations show that many seedlings become temporarily established but do not persist and grow into the larger height classes. The marked drop in numbers between 1935 and 1937 was in a large measure due to the hot dry season of 1936. Measurements were not made in August 1936 because most of the seedlings appeared to be dead. The record of 1937 and the years following indicate that many seedlings survived and some have grown into the larger height classes. The figures also show that the mortality is high even of maple that seems to be well established, as is indicated by the number present in 1947. Although the quadrat record shows 9 sugar maples four feet or more in height in 1947, it is apparent that this number will be reduced as competition for space becomes more intense.

To illustrate what may happen to sugar maple saplings a record of the growth of trees in the smaller diameter classes is shown for trees growing in a woods where sugar maple constitutes 60% of the trees in the overhead stand.

TABLE 2. Growth of Sugar Maple per Acre

Diameter Class (inches)	Number of Trees			
	1932	Percent	1947	Percent
1	12	26		
2-3	8	17	18	39
4-5	20	43	12	26
6-7	6	14	10	21
8-9			6	14
	—	—	—	—
	46	100	46	100

Although there was no mortality of the trees during the 15 year period, there is a marked change in the diameter class distribution. As these smaller maples compete with the larger trees in the stand some of them will eventually die.

Records of individual trees shed some interesting light on the growth of sugar maple. A maple tree 5.1 inches dbh in 1932 grew to a diameter of 5.8 inches in 10 years. In 1942 competing trees were cut and this sugar maple added 1.2 inches to its diameter during the 5 years, 1942-47, which is almost twice the growth previous to the removal of its competitors. Numerous examples of a similar response could be given. However, not all trees respond in this way but this record illustrates

that some trees may grow into the larger diameter classes while others of the same size may lose out in the competition or fail to respond to changed growing conditions. In many regeneration quadrats it was observed that other hardwood species may offer sugar maple serious competition for growing space. Elm is an interesting example and often the number of young sugar maple seedlings may be reduced as elm seeds in and becomes temporarily established.

Summary

An initial stand of over 1 million sugar maple seedlings per acre will be reduced in 15 years time to 35 thousand or less. Following this many decades of competition for growing space will result in the establishment of a sugar maple woods composed of approximately 40 sugar maple trees per acre with 30 to 40 other hardwood associates. For sugar maple to maintain its position in a beech-maple woods it appears that an initial establishment of large numbers of seedlings is necessary to insure a satisfactory distribution of saplings, poles, and young timber sized trees.