

Tree Growth Records for Indiana's First State Forest

DANIEL DEN UYL, Purdue University

Indiana's first State Forest had its beginning in 1903 when the Indiana State Board of Forestry purchased 2000 acres of land in Clark County. It consisted of approximately 20 old farms. The early objectives for the forest reservation were to cultivate the timber and to plant seeds and seedlings in the cleared portions. Since the wooded area had been cut over and burned prior to its acquisition by the State, it was recognized that protection from fire and livestock grazing were needed. The old fields were considered suitable for experimental tree planting and so this phase of forestry work occupied an important place.

Tree planting began in the fall of 1903 when some of the old fields were directly seeded with various species of hardwoods. The hardwoods used were black walnut, oaks and hickories. The results secured from these seedings were not too encouraging because the rodents destroyed most of the seed. The records show that each fall and spring during the years of 1903 to 1908 direct seeding and planting of hardwoods was done on the old fields. However, the records of these first few years were not very specific and hence little can be gained from them.

In 1909 Charles C. Deam was appointed State Forester and soon after that he organized the reforestation experiments. He kept detailed records of the experimental plantings and for nearly 20 years he directed the tree planting experiments.

Deam's (1) summary in 1910 showed that between the years of 1903 and 1910, 28 old fields consisting of about 110 acres were seeded or planted. Nineteen different hardwoods were used in these experiments.

In order to encourage the growth of the seeds and seedlings the old fields were plowed and disced prior to tree planting or seeding. Each season most of the plantations were cultivated. Cultivation meant a plowing and when the trees were young it was thought necessary to plow between the rows three times during each season. When the trees were four or five years old it was thought necessary to plow very shallow once or twice between the rows during each season. Hoeing was also done and it meant cutting down the weeds, grass, shoots, sprouts and briars left by the plow. Growing corn crops between the tree rows was also a practice. As the trees developed, cultural measures included pruning, thinning and coppicing. Replanting of the failed places was also done for one or more years following the initial seeding or planting.

Some of these early reforestation experiments were initially successful. The initial establishment and growth of black walnut (*Juglans nigra*), tulip poplar (*Liriodendron tulipifera*), black locust (*Robinia pseudo-acacia*), chestnut (*Castanea dentata*), and catalpa (*Catalpa bignonioides*) were satisfactory. The results with other hardwoods like

elm (*Ulmus sp.*), Kentucky coffee tree (*Gymnocladus dioica*), the oaks (*Quercus sp.*), and the hickories (*Carya sp.*), were not encouraging. One of the species which showed considerable promise was white ash. The 1910 report stated that white ash (*Fraxinus americana*) was one of the most desirable forest trees to plant in Indiana. This conclusion was based on the results secured on nine acres of ash plantings that were either directly seeded or planted.

Hardwoods continued to be used for tree planting and some species like sycamore (*Platanus occidentalis*), tulip poplar (*Liriodendron tulipifera*), ash and black cherry (*Prunus serotina*) continued to show fair development. As the yearly records of the direct seeded and planted areas began to accumulate it became apparent that the growth and development of hardwoods were very unsatisfactory.

In 1923 Deam (2) published a summary of the reforestation experiments for 80 different experimental tracts. By this time many of the hardwood direct seedings and plantings had failed to develop into good young stands. Many of these hardwood experimental areas were underplanted to white pine.

The failure of the hardwoods, the good initial survival and early growth of a few of the older coniferous plantings, and the availability of coniferous planting stock all contributed to the general use of conifers.

To show what has taken place on the old fields which were direct seeded or planted to hardwoods, case histories of areas representative of the reforestation experiments are presented. These selected tracts also represent the longest period of time and they illustrate the forest successional trends on the old fields.

White ash was planted on several areas and Tract I illustrates one of the oldest plantings. White ash seed was drilled thickly in rows in the fall of 1904. Good germination and survival resulted and in the fall of 1906 it was thinned leaving the stand with trees on approximately a 4x4 foot spacing. The trees were cultivated for several years and in 1910 the trees were pruned. In 1915 measurements of the ash were as follows:

Trees Unpruned	1.2 inches d.b.h.
Trees Moderately Pruned	1.1 inches d.b.h.
Trees Severely Pruned	1.4 inches d.b.h.

Apparently these results lent little encouragement to future management since the plantation was left to develop without further cultural treatment. In 1950 nearly half of the original stand is still present. Growth of the ash has been very poor because the 46 year old trees are only 3 to 6 inches d.b.h., with a few trees attaining a diameter of 8 inches. Failure of the ash to attain larger size is probably due to the poor site and because it does not naturally occur or grow in pure stands.

Tract 61 is a sycamore plantation consisting of approximately 4 acres. Seedlings were planted in April 1913 and good establishment resulted. The trees were spaced 4x4 and 5x5 feet, part of them being cultivated for two years and the others receiving no cultivation. For

a few years the trees which were cultivated grew better than the uncultivated trees. This was a temporary condition and as the plantation continued to develop without cultivation, differences in the two plots were not noticeable. After 37 years, half of the planted trees are still present and the trees are now from 3 to 6 inches in diameter. Many of the trees are partly dead and will probably die out during the next few years. Natural succession of sweet gum, tulip poplar, ash, and Virginia pine has taken place and some of these trees are larger than the planted sycamore. Natural seeding of Japanese red pine from planted trees is also found on a portion of the area. Failure of the sycamore to show better development is not due to site but because pure stands of sycamore are unnatural.

An experiment to determine the relative rate of growth and shade tolerance of several hardwoods is found on Tract 74. In May 1913 seedlings of ash, chestnut oak (*Quercus prinus*), basswood (*Tilia americana*), black locust, catalpa, elm, sycamore and tulip poplar were planted. The plan was to grow one row of each species between two rows of each of the other species. In 1914 replanting was done in order to have a complete stand. The area was plowed and disced prior to planting and the trees were cultivated for two years. The chestnut oak failed to grow and the survival of the other species ranged from 65 to 90 per cent. Height growth for a few years after establishment varied from the black locust which grew most rapidly to basswood which made the poorest height growth.

In 1923 sugar maple seedlings were underplanted in the center of the space between each four trees. The initial survival of the maple was about 90 per cent.

The plantation was first thinned in 1937 when a few black locust, which had grown to post size, and some poorly formed tulip poplar and sugar maple were cut. No other treatment has been attempted and the stand in 1950 is composed largely of sugar maple. Seventy-five percent of the 27 year old sugar maple are still present and they vary from 2 to 7 inches in diameter. About 10 per cent of the tulip poplar are present and they are from 5 to 17 inches d.b.h. The other species that were planted are represented by only a few scattered trees none of which have attained a diameter exceeding 5 inches.

The stand is still very dense and forest floor conditions are typical of a closed hardwood stand, with a good cover of hardwood leaves and litter. A few sassafras, black cherry and Virginia pine have come into small openings. Although the growth and development of sugar maple when underplanted or interplanted with other hardwoods is not satisfactory, the experiment does illustrate its extreme tolerance as well as its persistency.

The growth and development of the tulip poplar in this mixed stand is very similar to that exhibited when it grows naturally in the hardwood forest. It tends to be very intolerant and consequently only a few trees survive the competition and tulip poplar occurs as an occasional tree or group of trees in mixture with other hardwoods.

The three cases illustrate what has been the trend when hardwoods were used to reforest old fields. They show that, given enough time to develop, some of the planted hardwoods will grow to merchantable size and eventually form part of the mixed hardwood forest. It is also evident that hardwoods do not grow well in pure stands when planted or seeded on an old field. Apparently hardwoods grow best in mixed stands, in competition with other species and on forest soils. *Old field soil and site conditions appear to be unfavorable for the hardwoods.*

An example of the early hardwood planting which was later planted to white pine is indicative of similar results which were encountered on many of the old fields. Tract 37 was direct seeded to hickory in 1904-1905. A fairly good stand resulted but by 1908 it was thought advisable to plant seedlings of elm and ash. The trees were cultivated for four years and the ash was given a moderate pruning in 1911. In 1919 the average d.b.h. of the ash was 1 inch and the elm 0.7 inches d.b.h. In May 1920 the vacancies in the ash were replanted with white ash seedlings. The elm were practically all dead in 1920 so in 1921 white pine was planted where the elm had failed.

In 1950 the 30 year old white pine is from 3 to 13 inches in d.b.h. and there are approximately 250 stems per acre. The 45 year old hickory still persists but most of the trees are less than 6 inches d.b.h. There are a few elm and ash trees, 1 to 3 inches d.b.h., growing on the area.

Although the white pine have shown good establishment and growth it was necessary to cut out the competing sassafras, persimmon, Virginia pine, and other species as well as cutting vines in order to favor the white pine. Thinning and pruning of the white pine have also been done and to grow the white pine to larger size cultural practices will need to be continued.

Conclusions

Old fields are not suitable for planting or direct seeding hardwoods.

Old field soils have neither the organic content, water holding capacity nor porosity necessary for the growth of hardwoods.

A pine crop can be grown on an old field with proper care and management and at the same time encourage natural hardwood succession.

More time is required to judge the results of a hardwood planting than that of a coniferous planting.

Literature Cited

1. DEAM, C. C. 1910. State of Indiana, Tenth Annual Report of the State Board of Forestry.
2. DEAM, C. C. 1923. Guide to Clark County State Forest, Bulletin 6, Publication 36. State of Indiana, Department of Conservation.