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# THE WOODLOT

BY
CHAS A. SCOTT.

(From the Twentieth Biennial Report of the Kansas State Board of Agriculture.)

THE CARE of the woodlot is an important item in farm management that has received but little attention in this state. Every acre of natural or planted timber growing on Kansas farms should be a source of income and profit to the farm. The products from the woodlot are sawlogs, railroad ties, poles, posts, fuel wood and nuts.

The sawlogs from the Kansas woodlots furnish excellent lumber for interior use in farm buildings. It is especially serviceable for joists, beams, studding, and sheathing for houses, and for floors and partition boards for bins and stalls in barns and sheds. For such uses our native lumber is more durable and more satisfactory than the pine lumber from the local lumber yard. A great many of our native logs are sawn into box boards and crating material at the local mills, and command a good price for such uses. In some sections of the state the native logs are in good demand at barrel stave and head factories. The cottonwood is recognized as one of the very best woods for staves for flour, vegetable and fruit barrels. The elm, hackberry, ash and soft maple are used extensively for barrel headings. The black-walnut logs are considered too valuable for local consumption, and the most of them are bought by wholesale walnut-log buyers and shipped to Eastern consumers. Second-growth hickory is in good demand. at vehicle factories, and the cordwood finds ready sale

at good prices at the packing-house centers, where it is used in smoking cured meats.

There are no reliable figures available that show the amount or the value of the woodlot products required annually, but the sum total for such a state as Kansas is immense. To understand fully the economic importance of the woodlot we must remember that the United States, as a nation, is cutting her timber supply at three times the rate of the growth of the timber in her forests, and that lumber prices are constantly and gradually advancing. This advance in price is bound to continue until the price of lumber equals the price of stone,

FIG. 159. Sawing lumber from a Shawnee county, Kansas, woodlot.

brick, tile, and cement as building materials. These materials, and especially lumber, are bulky commodities, and the transportation rates greatly increase the cost to the consumer. All of these conditions increase the value of the products of the farm woodlot.

The term "woodlot" as used in this article includes all land within the state on which natural or planted timber is growing. There are approximately five hundred thousand acres of natural timber land within the state. This land is at present considered waste land by most of the owners, for the reason that the returns from it do not pay the taxes and a reasonable interest on the investment. The present stand of timber on

this land is of little value, because of the fact that for the past fifty or sixty years the settlers and owners have gone into the woodlot from year to year and cut the best trees for their particular needs, and have left such kinds as the white elm, the hackberry, the soft maple, the sycamore, the basswood, the water oak, and like worthless species. These, because of their hardiness and ability to compete with other native vegetation, now occupy the ground that might well be producing such trees as the black walnut, bur oak, cottonwood, red cedar, or Austrian pine.

FIG. 160. A cut-over woodlot in fine condition to plant with acorns, walnuts, pecans, or with seedling trees of some desirable kind.

The problem to be solved in handling the woodlot is. How can the stand of trees be improved and the yield increased? If we want to grow a crop of corn we plant the seed and cultivate the growing crop; if we want to grow good fruit we prune and spray the orchard; if we want to grow high-grade lumber-producing trees we must choose the valuable kinds, plant and care for them as their demands require.

In the eastern half of the state the natural timber is found on three distinct types of land—the overflow land lying along the rivers and their tributaries, the steep hillsides facing these watercourses, and the gravelly and sandy land found in certain sections of the state. By far the greater area of this is included in the first class mentioned, viz., the overflow lands lying along the watercourses. This is the richest land within

the state, capable of producing timber that will under proper management return a good profit and interest on the value of the land. The trees that are best adapted for such land are the cottonwood, black walnut, bur oak, and pecan.

FIG. 161. A worthless sandy hillside that was planted with jack pine in 1903. This picture was taken in 1907. Fig. 162 shows the same hill as it appeared in 1915. —[*Courtesy Forest Service.*]

FIG. 162. The same hill that is shown in Fig. 161. This picture was taken in 1915.

The rough hilisides and steep slopes now supporting an unprofitable stand of black and red oak, hickory, ash, and other similar growth are capable of supporting a profitable growth of trees if the right species are planted. The trees that are peculiarly adapted to this type of soil are the native red cedar and the Austrian pine.

The gravelly and sandy land that is now occupied almost exclusively by post oak and blackjack is a very poor type of land, entirely unfitted for agricultural purposes. The post-oak land is too gravelly and sterile to produce agricultural crops, although when cleared it makes fair grazing land. When cleared and farmed the blackjack land soon becomes exhausted of its fertility and blows and drifts with the prevailing winds. Both of these types of land are capable of producing excellent tree growth when the right species are planted. The trees suitable

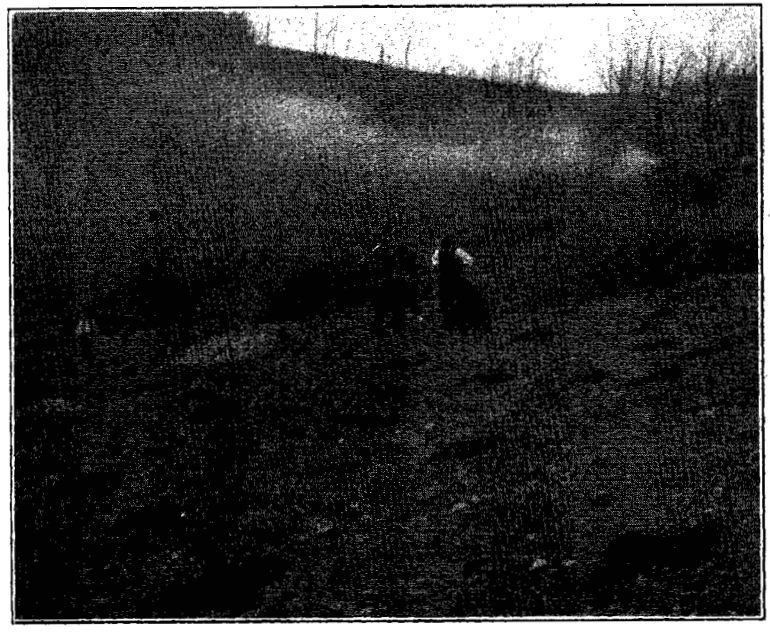

FIG. 163. Clearing, burning brush, digging holes, and generally putting the land in shape for tree planting.—[*Courtesy American Forestry.*]

for these soils are the red cedar, Austrian pine, and Chinese arbor vitæ.

The kind of land and the character of the growth upon it must determine the details of the method to be employed in the improvement of the woodlot. However, the general system will be the same in all cases, and will consist of three distinct operations:

*First.* Thinning: cutting out all mature trees that are worth as much now as they will be at any future time, and all undesirable trees of all ages or sizes.

*Second.* Planting: restocking the land by planting seedling trees or seeds of desirable species.

*Third.* Protecting the young trees against injury from excessive growth of weeds, fire, or live stock.

THINNING.

The first step involves the greatest amount of work and possibly the greatest amount of expense. All the mature trees should be cut to make room for the smaller-sized trees now growing together with them, and to make room for planting

FIG. 164. A force of men planting evergreen seedlings on cut-over land.—[*Courtesy American Forestry.*]

seeds or seedlings of desirable trees for future crops. The undesirable trees of the present stand, regardless of their age or size, should also be cut so as to make room for as many trees of the more valuable species as possible. This cutting may be done by one of two systems—the *group* or *strip* system. The group system consists of cutting the trees in groups of irregular areas here and there throughout the woodlot. One or more groups are cut each year until the entire woodlot has been cut over. This system will probably be found to be the most satisfactory in the Kansas woodlots. The strip

system consists of laying off the woodlot in a definite number of strips of varying widths, and, of cutting one strip a year until the entire woodlot has been gone over.

## PLANTING.

In order that the woodlot may yield the greatest possible crop of wood the land must be kept fully stocked with growing trees. The number per acre will vary with the age and size of the trees. Prof. E. L. Sponsler, University of Michigan, is authority for the following table, which gives the number of trees at different sizes necessary to keep the ground fully stocked.

TABLE 1.—*Number of Trees per Acre Required for a Full Stand.*

| Diameter.[1] | No. per acre. | Diameter.[1] | No. per acre. |
|---|---|---|---|
| 2 inches | 2,000 | 14 inches | 130 |
| 4 inches | 900 | 16 inches | 100 |
| 6 inches | 510 | 18 inches | 85 |
| 8 inches | 320 | 20 inches | 75 |
| 10 inches | 235 | 22 inches | 65 |
| 12 inches | 170 | 24 inches | 55 |

To give a clearer idea of the spacing of trees in a full stand, the following table gives the number of trees per acre for the different spacings.

TABLE 2.—*Number of Plants Required to Set an Acre of Ground at the Given Distances.*

| Spacing. | No. of plants. | Spacing. | No. of plants. |
|---|---|---|---|
| 3 by 7 feet | 2,074 | 12 by 30 feet | 121 |
| 4 by 5 feet | 2,178 | 15 by 30 feet | 96 |
| 4 by 12 feet | 907 | 18 by 24 feet | 100 |
| 5 by 9 feet | 968 | 20 by 20 feet | 108 |
| 6 by 8 feet | 907 | 12 by 42 feet | 86 |
| 7 by 12 feet | 518 | 15 by 36 feet | 80 |
| 8 by 10 feet | 544 | 12 by 48 feet | 75 |
| 9 by 15 feet | 322 | 24 by 24 feet | 75 |
| 10 by 15 feet | 290 | 18 by 36 feet | 67 |
| 10 by 18 feet | 242 | 12 by 60 feet | 60 |
| 10 by 20 feet | 217 | 15 by 48 feet | 60 |
| 10 by 24 feet | 181 | 24 by 30 feet | 60 |
| 15 by 18 feet | 161 | 15 by 54 feet | 53 |
| 10 by 30 feet | 145 | 18 by 42 feet | 57 |

The planting may be done at any convenient time after the thinning has been done. The best time and the best method to follow will be determined by the character of the ground and the kind of trees that are to be planted. Walnuts and acorns may be planted in the fall, soon after they ripen

1. The diameter of a tree is measured at four and one-half feet above the ground.

or early the following spring,[2] in holes four or five inches deep, made with a spade or mattock. Enough nuts or acorns should be planted to insure a stand of not fewer than 2000 seedlings per acre. This will require a plant on every 20 square feet of ground or on an area 4 by 5 feet in extent.

If seedlings are used in restocking the woodlot they should be planted in March or April. These should be planted in sufficient numbers to insure a full stand of trees. (See Table

FIG. 165. Planting a pine tree in a cut-over woodlot. The short growth of brush will protect the pine from the sun and wind.—[*Courtesy American Forestry.*]

No. 2 for spacing.) Because of the stumps and roots that are in the ground a regular spacing cannot be made, but enough trees can be planted to insure a full stand. Seedlings of the broad-leaved[3] species from 3 to 8 feet in height, and evergreens[4] from 15 to 24 inches in height will give best results.

2. Whenever nuts or acorns are held over for spring planting they should be stratified soon after they ripen. Stratifying seeds of any kind consists of storing them in alternate layers with sand, soil, leaves, or straw, so as to prevent overdrying or heating of the seeds. Small quantities of seeds are stratified in boxes that are stored over winter in basement rooms, or buried in pits out of doors; large quantities of seeds are stratified in bins in basements. It is usually desirable to allow the stratified seeds to freeze and thaw throughout the winter with the changes of the weather.

3. The term "broad-leaved" is applied to all forest trees excepting conifers or cone-bearing trees.

4. "Evergreens" is a term generally applied to conifers, and is used to mean conifers in this article.

These must be planted in holes, dug with a spade, large enough to receive the roots spread in natural order.

The reason for planting the seeds and seedlings so much thicker than the trees can grow is in order to shade the ground as soon as possible, so as to keep down the weeds and to protect the ground from the drying effects of the sun and wind, and to develop trees with tall, straight stems, clear of large limbs to as great a height as possible. When not crowded trees develop short stems that divide into several large limbs near the ground, and are of little or no value for lumber, poles. or posts.

FIG. 166. A three-man crew planting evergreen seedlings in lister furrows. In this organization one man carries a supply of trees and two men dig holes and plant. —[*Courtesy Forest Service.*]

## PROTECTION.

The first attention that newly planted trees will demand will be protection against weeds, which if not cut will overtop and shade them out. This protection should consist of cutting the weeds from an area of ground extending at least two feet in all directions from the tree. If all the weeds can be cut from among the trees so much the better. When only a part of the weeds are cut there is danger of fire during the fall, winter, and early spring months. Young trees are easily killed by fire, and protection against this source of danger is very necessary.

Young trees are seriously injured and often killed by live stock trampling the ground and eating the leaves and twigs.

It is therefore necessary that live stock of all kinds be excluded from the land growing young trees. This protection must be maintained until the trees are large enough to shade out the weeds and their tops high enough to be out of reach of live stock.

## DESIRABLE TREES FOR KANSAS WOODLOTS.

### *Black Walnut.*

The black walnut is a native tree throughout the eastern half of the state of Kansas and is the highest-priced wood on the market of any of our commercial American trees. The wood is used in the United States as shown below,

FIG. 167. Loading black walnut hauled in by farmers.—[*Courtesy Forest Service.*]

*Factory Uses of Black Walnut.*[5]

| Purpose. | Per cent. |
|---|---|
| Sewing machines | 33 |
| Musical instruments | 21 |
| Mill work | 19 |
| Furniture and fixtures | 10 |
| Firearms | 7 |
| Caskets and coffins | 2 |
| Electrical machinery and apparatus | 2 |
| Vehicles | 2 |
| Car construction | 1 |
| Other uses | 3 |
| Total | 100 |

In recent years the best grades of black walnut logs have largely been exported to European countries. However, in

5. The tables of factory uses for the various woods given in this article are taken from Kellog's "Lumber and Its Uses," published in 1914.

the past year or two the demand for walnut for American uses has greatly increased. Black-walnut furniture and finishing is now becoming very popular in the United States. The present prices of walnut logs vary, according to the size and quality, from $25 to $100 per thousand board feet on the stump.

*Range and Habit of Growth.* The black walnut grows naturally throughout the hardwood region of the United States in mixture with other hardwood species. It is never found growing in pure stand, nor has it made an altogether successful growth when planted in pure stand. The black walnut is a tree which requires full sunlight, and should be planted only in mixture with trees of smaller size. The foliage of the walnut is rather sparse. This allows sufficient light to reach the ground to support a very satisfactory growth of the more tolerant[6] or shade-enduring species, such as the red cedar, the green or white ash, and the mulberry. The black walnut requires a deep, rich soil in which to make its best growth. Frequent flooding is not seriously objectionable, but the trees will not stand swampy conditions. Being highly intolerant as seedlings, they must begin their growth in the open. Under these conditions they make a rapid height growth, clearing themselves of limbs readily. By the time they have reached middle age they have attained their full height growth, and they must then have sufficient room to develop a broad, spreading top, in order to make a rapid diameter growth. The black walnut will reach its financial maturity[7] in from 75 to 100 years, at which age the tree should measure from 2½ to 3 feet in diameter at the stump.

*The Yield.* While no data is available to show what yield a full stand of black-walnut trees will cut, it is reasonable to expect that a stand of fifty trees per acre will at maturity yield not less than 15,000 feet board measure[8] of merchantable logs,[9] which at present value would be worth, at the very least, $3250. This is equivalent to a rental value of $32.50 per acre per year gross income on a 100-year rotation.[10]

6. Tolerance of trees refers to their ability to grow in the shade of other trees. A tolerant tree is a tree that will grow thriftily in the shade of some larger tree. An intolerant tree is one that demands full sunlight and will not live in the shade of other trees.

7. Trees attain their financial maturity when the value of their annual growth falls below the cost of maintenance.

8. One foot board measure is the unit of measure of lumber, and it is a board 12 inches long, 12 inches wide, and 1 inch thick.

9. Merchantable log is a log that is salable on the market.

10. Rotation is the length of time required to grow trees to merchantable size.

*Cottonwood.*

The common cottonwood is a native through the entire state. It grows the most rapidly and attains the largest size of any of our native species. The wood is light, tough, quite strong, and entirely serviceable for many purposes. It is most commonly used in this state for rough lumber for interior purposes. It is used especially for joists, studding, flooring for bins and mows, stall partitions, and sheathing. In the commercial trade it is used extensively for boxing and crating and for the manufacture of excelsior and fiber for plaster mills. The present price of cottonwood logs on local market is about $12 per thousand board feet.

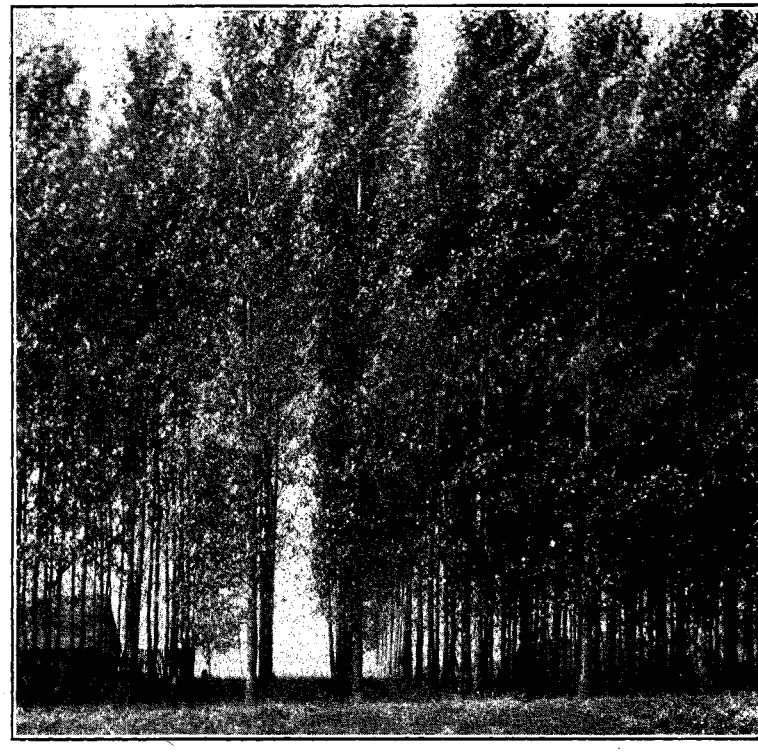

FIG. 168. Fine grove of cottonwoods ten years old, on low ground. Boles unusually straight and clear. Planted five by six feet apart; thinned to six by ten feet.—[*Courtesy Forest Service.*]

*Factory Uses of Cottonwood.*

| Purpose. | Per cent. |
|---|---|
| Boxes and crates | 56 |
| Excelsior | 14 |
| Vehicles | 9 |
| Mill work | 6 |
| Agricultural implements | 4 |
| Woodenware and novelties | 4 |
| Furniture and fixtures | 2 |
| Refrigerators and kitchen cabinets | 1 |
| Other uses | 4 |
| Total | 100 |

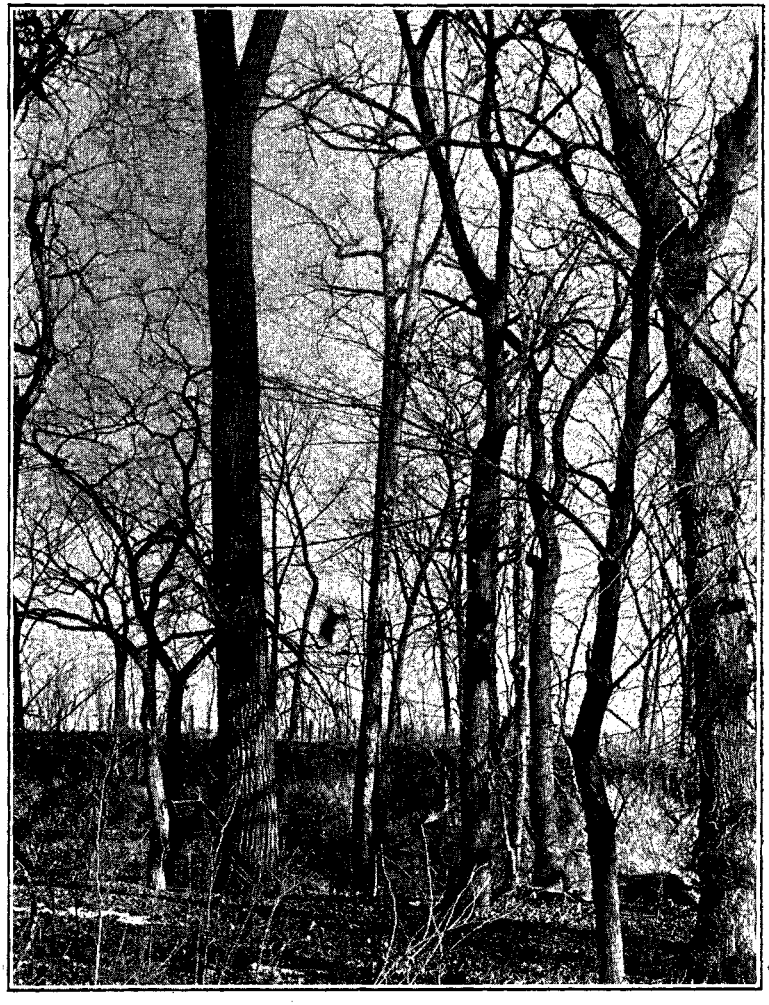

FIG. 169. A cottonwood (in the background), showing fine form. This tree will cut three sawlogs, each fourteen feet long, and all clear of limbs.

*Range and Habit of Growth.* The cottonwood is found growing naturally through the southern Mississippi valley region. It is found in great abundance along the watercourses and on low, rather wet soils, growing in mixture with hardwood species. The cottonwood requires full sunlight for its best growth. On account of the sparseness of its foliage it is a tree that will allow underplanting of some of the more tolerant species, such as the red cedar, mulberry, white or bur oak. The cottonwood will grow successfully in any soil in which there is an abundance of moisture, but it makes its best growth in deep, rich soils. Under these conditions the trees make a very rapid height growth, clearing themselves of

FIG. 170 Lumber cut from cottonwood logs from a planted farm woodlot in Reno county, Kansas.

limbs readily, and at twenty years of age will have practically attained their height, which will vary from 75 to 100 feet, depending upon the strength of the soil. From this time on the rate of growth in diameter is quite rapid, until the trees are from thirty-five to forty-five years of age. At twenty years of age some sawlogs can be cut fromthe stand, but the majority of the trees will not reach merchantable size until thirty years of age. The maximum yield is attained when the trees are about forty years of age. The following growth and yield table for cottonwood is taken from Bulletin 24 of the U. S. Department of Agriculture. The data from which this table was compiled was gathered from 1950 saw mills located throughout the Mississippi valley region.

*Growth and Yield Table of Cottonwood in Pure Fully Stocked Stands in the Mississippi Valley.*

| Age of tree in years. | Number of trees per acre. | Average D. B. H.* inches. | Average height in feet. | Yield per acre. | |
|---|---|---|---|---|---|
| | | | | Stem wood. | Board feet. |
| 5 | ..... | 2.0 | 22 | 650 | ..... |
| 10 | 699 | 5.7 | 56 | 1,800 | ..... |
| 15 | 276 | 9.2 | 81 | 3,850 | 2,400 |
| 20 | 163 | 12.3 | 97 | 4,900 | 6,600 |
| 25 | 114 | 15.0 | 108 | 5,450 | 11,900 |
| 30 | 80 | 17.4 | 115 | 5,825 | 20,800 |
| 35 | 59 | 19.7 | 121 | 6,150 | 29,400 |
| 40 | 49 | 22.0 | 127 | 6,425 | 31,000 |
| 45 | 42 | 24.2 | 132 | 6,675 | 29,500 |
| 50 | 32 | 26.5 | 136 | 6,900 | 29,400 |

*The initials D. B. H. mean "*diameter breast high*," which is four and one-half feet above the ground level.

FIG. 171. A fine stand of second-growth oak. This woodlot will at some future time cut a lot of good logs, poles, posts and fuel wood.

*Yield.* The cottonwood will probably return the greatest financial yield per acre per year of any tree that is suitable for woodlot planting. As shown in the accompanying table, a normal yield at forty years of age is thirty thousand board feet per acre, which at $12 per thousand is $360 per acre, equivalent to a rental value of $9 per acre per year. There is no other species that can be planted in this state that will yield more than half this amount of lumber in the same length of time. Because of its rapid rate of growth it requires less

attention and cultivation than any other tree. It is a tree that is comparatively free from injurious insect attacks or from fungous diseases until it has reached maturity. The demand for the cottonwood lumber is good and will continue to increase. Inasmuch as it is a lumber that can be used generally on the farm, it merits a place in every farm woodlot for the production of farm timber supplies.

### *Bur Oak.*

The bur oak is native throughout the hardwood region of the United States, and is found growing naturally throughout the eastern half of Kansas. On favorable soil and in protected locations it can be grown very successfully in the woodlots. The wood of this species is hard, heavy, strong, and very durable in contact with the soil when thoroughly seasoned. It is a wood that can be used in almost every way on the farm, makes excellent posts, framing timbers, bridge planks, railway ties, and material for general repair purposes. The mature trees are in demand for lumber purposes. It is one of the valuable woods for factory uses, which are as follows:

*Factory Uses of Oak.*

| Purpose. | Per cent. |
|---|---|
| Furniture and fixtures | 32 |
| Mill work | 25 |
| Car construction | 15 |
| Vehicles | 11 |
| Agricultural implements | 3 |
| Boxes and crates | 3 |
| Ship and boat building | 2 |
| Refrigerators and kitchen cabinets | 1 |
| Musical instruments | 1 |
| Sewing machines | 1 |
| Other uses | 6 |
| Total | 100 |

*Range and Habit of Growth.* The bur oak grows in mixture with the other hardwood species. It is seldom found growing in pure stand. As a seedling it will endure considerable shade, but it requires light from above to develop its best form and to make its most rapid growth. When grown in thick stands as saplings they develop tall, straight stems with few limbs. By the time the trees reach middle age they demand full light, and with the approach of maturity develop broad, spreading crowns with massive trunks. The foliage of the bur oak is very dense and allows but little light to strike the

ground. To make its best growth it requires a deep, rich, fresh soil, but grows remarkably well on rather heavy gravelly soils. Being tolerant in youth, the acorns of this species may be planted in partially shaded situations, especially where the shade is from the side rather than directly overhead. When

FIG. 172. White oak and red oak logs at mill, having been shipped by rail from farm woodlots a distance of about twenty miles.—[*Courtesy Forest Service.*]

grown in the open with full light the bur oak develops a short trunk with many heavy limbs. This type of tree is of little value except for fuel and posts. The best form of oak is always developed in dense stands or in partly shaded situa-

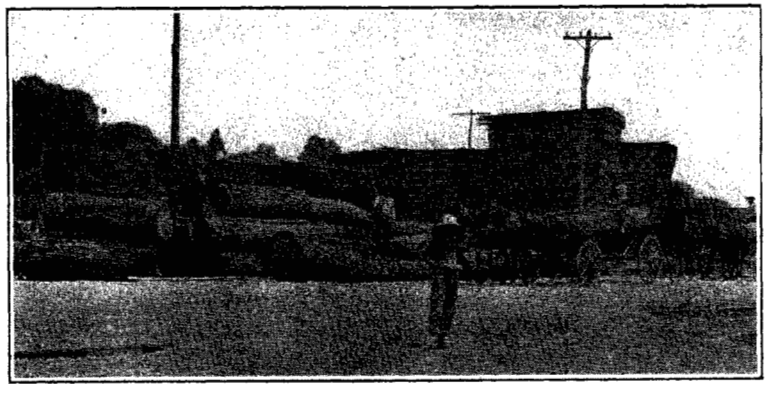

FIG. 173. White and red oak, and some hickory, from small farm woodlot.—[*Courtesy Forest Service.*]

tions. The bur oak will reach maturity in from 75 to 100 years, at which age the trees should be from 2½ to 3 feet in diameter at the stumps.

*Yield.* There are no figures available to show what yield may be expected from a full stand of bur oak. However, the cut in logs at maturity should be not less than 15,000 board feet per acre. The present stumpage price varies from $12 to $25 per 1000 board feet. As the oak is a valuable post timber, no doubt the greater part of it will be used for posts and ties.

*Pecan.*

The pecan is one species of hickory, which grows naturally throughout the southeastern fourth of the state. While the wood of this tree is not considered of any great commercial value, the nuts that the tree produces command a good price, and under proper care the trees yield a good crop, which in many instances will equal or exceed in value the agricultural crop that may be produced on land suitable for growing pecans. The soil along the watercourses in the southeastern fourth of the state is entirely suitable for pecan growing, and many farmers are now considering the possibility of growing such a crop.

An investigation of the conditions under which pecans grow most successfully shows that the trees are well adapted to a variety of soils, but that they make their best growth and attain the largest size on deep, rich, moist soil. They will grow in swampy conditions, but prefer a well-drained soil. Trees have been found growing on dry, gravelly or stony soils, but in such soils their rate-of growth is slow and the trees are small and scraggly in appearance.

Up to this time but very little has been done in this state to determine what is possible in the way of developing an improved strain of our native pecans. There are great possibilities along this line. The so-called paper-shelled pecans of the South are not hardy under our conditions and cannot be used for planting stock. The nuts of our native species are small in size, but the quality is excellent. The shells of some of our native nuts are extremely heavy, while on others the shells are very thin, comparing favorably in thinness with the so-called paper-shelled nut of the South. A careful survey

of the state would undoubtedly reveal some unusually large nuts with medium or thin shells, from which seedlings from the ordinary nuts might be budded.

If a desirable nut can be developed in this way there is a great possibility of growing pecans profitably on large areas of overflowland along the Marais des Cygnes, the Neosho and the Verdigris rivers and their tributaries. The pecan trees in this section of the state, growing under natural conditions, frequently attain a diameter of three and one-half or four feet, and vary from seventy-five to ninety feet in height. Mature trees are known to have yielded as much as 600 pounds of nuts in a single season. However, the nut crop under natural conditions occurs periodically. There are a few nuts practically every year, and occasionally there are extremely heavy crops.

*System of Management.* The pecan is propagated from the nuts. These should be planted in the fall or stratified until spring and planted in March or April before they begin their growth. The ground in which the nuts are to be planted should be under a thorough state of cultivation. The nuts should be planted in rows or at regular spacing at the rate of from 3000 to 5000 per acre. When two years of age the seedlings should be budded with buds from the best stock available. This work should be done during August. The following spring the tops should be cut off the seedlings on which the buds have set. The bud then throws out a shoot which develops into the future tree. When five years of age the budded trees are transplanted to their permanent location. Cultivation must be continued until the trees reach such size as to thoroughly protect the ground by their shade. Some authorities on growing pecans maintain that cultivation should continue as long as the trees live and that the size and quality of the nut is greatly improved by continuous cultivation. Cultivation at least maintains a better supply of soil moisture than it is possible to maintain without tillage.

At twelve to fifteen years of age the trees come into bearing, and at twenty years of age should produce enough nuts to be of considerable value, the quantity of nuts continuing to increase with the increase of the size of the tree. The land on which pecans are most likely to yield a profitable crop is the overflow lands along the streams mentioned. Flood waters

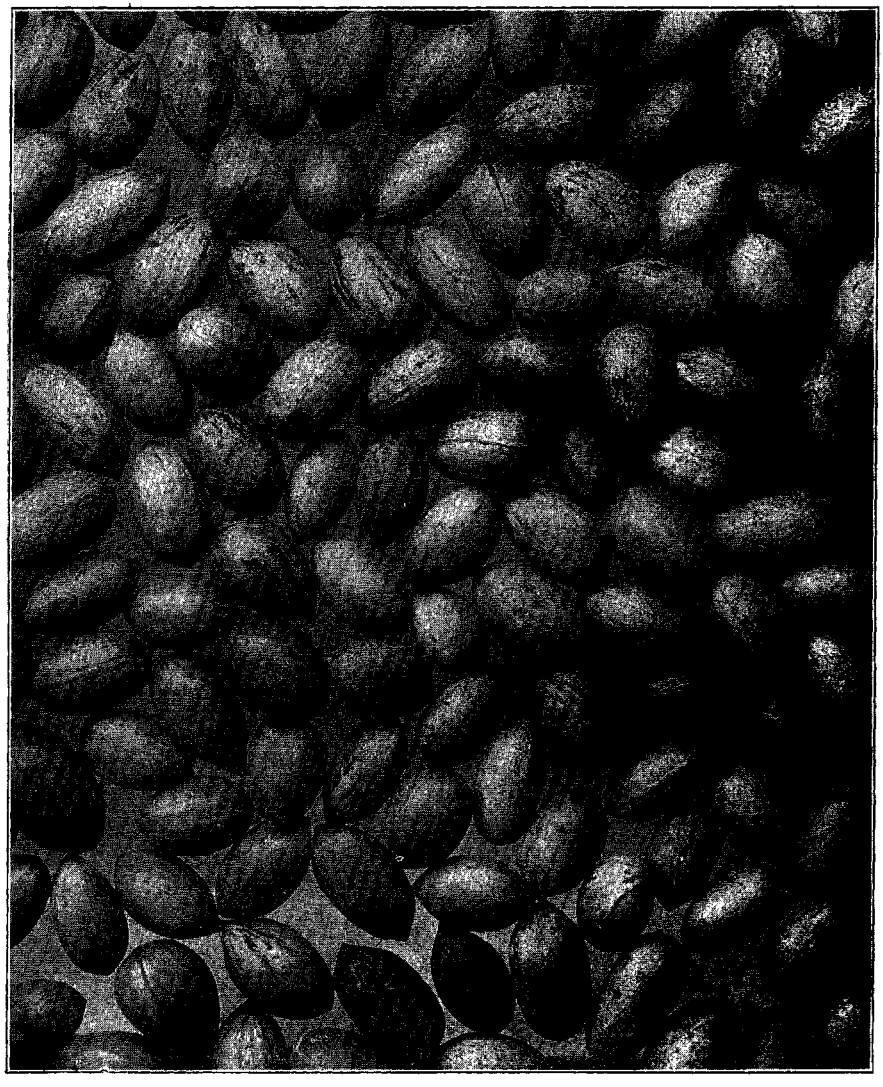

FIG. 174. Nuts from pecan trees growing in Kansas.

are in no way harmful to the growing trees, after they have reached sufficient size not to be completely submerged. Agricultural crops on this character of land are very uncertain, and because of their uncertainty grain farming is not a profitable enterprise.

*Value of the Nuts.* The market price of the nuts varies from year to year, presumably based upon the supply and demand. In years when the nut crop is heavy prices go down; when the nut crop is light the price advances. The range of fluctuation is from 7 to12 cents per pound on the local market. Selected strains would produce nuts of uniform size and shape, and would, because of the cultivation given the tree, be larger than our common nuts and would command a better price. The selling price of the so-called paper-shelled pecans of the South, which are from one-third to one-half larger than our native species, is from 30 to 50 cents per pound.

The local supply of nuts is bought and used by wholesale confectionery concerns located in St. Louis and Chicago. The shelled pecans found on our local market are nuts of some of the improved budded varieties, mostly from Texas, some of the more hardy of which it may be possible to grow successfully in this state. Those that are most likely to give satisfactory results are the Busseron, Indiana, Niblack, Major and Warwick. These varieties are being grown successfully as far north as southern Indiana and Illinois.

The value of any nut meat of the pecan depends largely upon separating it from the shell without breaking or crushing the meat. In order to remove the shell with the least danger of injury to the kernel, the nuts should be steamed or steeped for a few minutes in hot water. This softens the shell and makes the nut meat more pliable and greatly reduces the danger of cracking or breaking it when removing the shell. There are a number of nutcrackers on the market. Among these the Squirrel, the Perfection, the Eureka, and the Bostrom are improved types that crack the shells very satisfactorily without seriously injuring the nut meats. Steaming or steeping the nuts, however, adds greatly to the ease with which the shell can be cracked and separated from the meat.

*Use of Nuts.* The use of nut meats in American homes has greatly increased in the past ten or twelve years. They are

used extensively in nut loaf, in bread, in salads, and shelled, as an article of diet. However, the greatest use for the meat of the nuts is found in the wholesale confectionery trade.

*Red Cedar.*

The red cedar is the only coniferous tree that grows naturally in this state. The wood is of special value for specific purposes. It is used exclusively in the manufacture of all high-grade lead pencils, which calls for absolutely clear wood.

FIG. 175. Grove of pecans that yields heavy crops of nuts.

In recent years the cedar-chest industry has developed rapidly in this country, and a large quantity of inferior lumber, containing knots, sapwood and other defects that disqualify it for use as pencil wood, is used in this industry. Smaller-sized, knotty material, unfit for the cedar-chest industry, is used extensively as posts and poles. The red-cedar wood is the standard of durability of all native timbers. It is practically indestructible to decay. Cedar posts command a higher price than any other post on the market. The only criticism to the red cedar for this purpose is that it is not strong enough to resist a severe strain when the ground is frozen, and the posts generally break off squarely at the surface of the ground at such

times. During the months when the ground is not frozen they are absolutely satisfactory in every respect,

*Range and Habit of Growth.* The red cedar grows naturally throughout the greater part of the United States from Maine to Florida, and from Florida northwest across the plains states to the Rocky Mountain region and British Columbia. Throughout the New England states they are found growing on all types of soil, excepting in swampy, wet situations. In the southern states they are a swamp-type tree. Throughout the plains states and the western mountain regions they are found occupying the bleakest and most exposed situations on north and northeast slopes. This range of habit indicates their

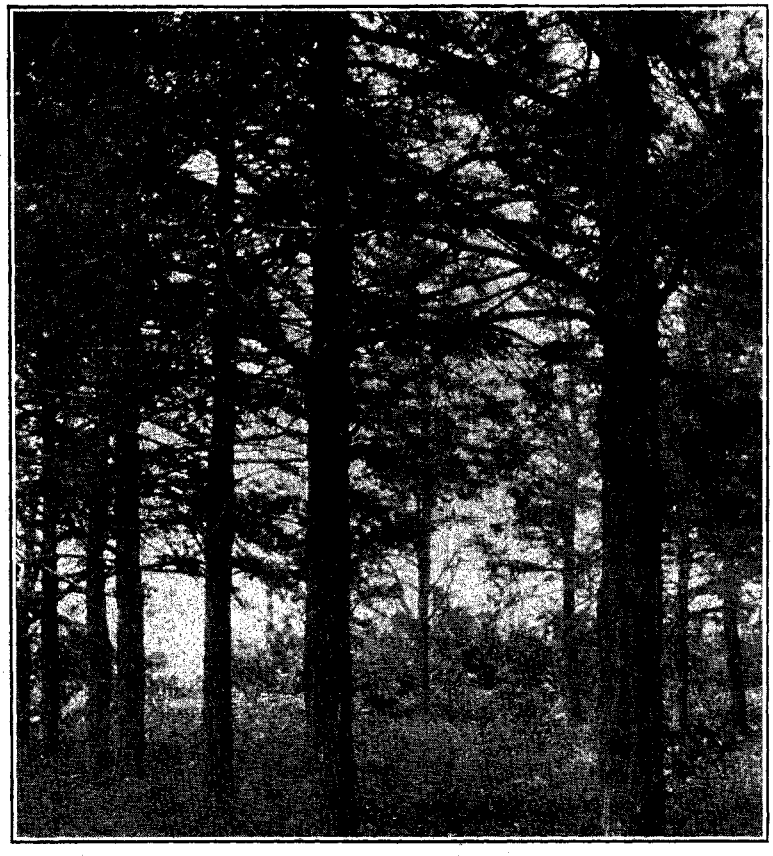

FIG. 176. Red cedar trees in a farm woodlot. These trees are forty-two years of age, and will cut twelve posts each.

adaptability to the various soils and conditions under which they will grow.

In this state we find the cedar in definite areas in different portions of the state, principally throughout the limestone section, and in some instances in the districts having sandstone outcroppings. In these different districts the red cedar first gained foothold on the protected sites with north and northeast exposures, and since the trees have reached maturity and produced seed they have gained a foothold on practically all types of soil, and are now found growing abundantly over the tops of many of our limestone hills, as well as in the deep rich soil found in the bottom lands along the watercourses.

It is a tree that is found growing in pure stand only in the southern states, and grows vigorously either in pure stand or in mixture with hardwoods. It is a highly tolerant tree during youth, but demands full sunlight by the time it reaches middle age. The foliage is very dense and will not permit of underplanting. Being highly intolerant, the trees do not clear themselves readily of limbs, and for this reason few clear stems can be developed except in very dense stands.

The green foliage of the cedar will burn as rapidly as the dry leaves of any other species, and once stripped of its leaves the tree will die. Little thinning will be necessary in a red-cedar stand until the trees have reached pole size, when it will be necessary to thin the trees in order to induce diameter growth. The material removed in such a thinning will make stakes and posts. The remaining trees will reach their financial maturity when between fifty and seventy-five years of age.

*Yield.* The ultimate product will be posts and poles. At the present time it is impossible to buy red-cedar pasts on our local market excepting through special orders. A conservative estimate of the number of posts per acre at fifty years of age will be from 3500 to 4000 posts per acre. This is estimating the final stand to be spaced at 10 by 15 feet, and estimating that each tree will cut 12 to 15 posts each, which is not more than can be expected. At 20 cents per post this gives a gross return of $700 or $800 per acre, equivalent to an annual rental of $14 or $16 per acre.

One great advantage in favor of the red cedar as a woodlot tree in this state is that it is entirely adapted and suitable for

planting throughout the entire state. There is not a quarter section of land in the state of Kansas on which red cedar cannot be grown successfully. It is the hardiest tree growing within the state. It has endured, without serious injury, the severest weather conditions that western Kansas has experienced in the past fifty years. It suffers less injury from hail and wind than any other tree that has been tried in western Kansas. The only objection that can be raised to the growing of red cedars in the woodlot is the fact that it is a host to a fungous disease known as the cedar apple, which in another form attacks and injures apple trees and fruit. It occurs on the apple leaf as rust and on the fruit as scab. How-

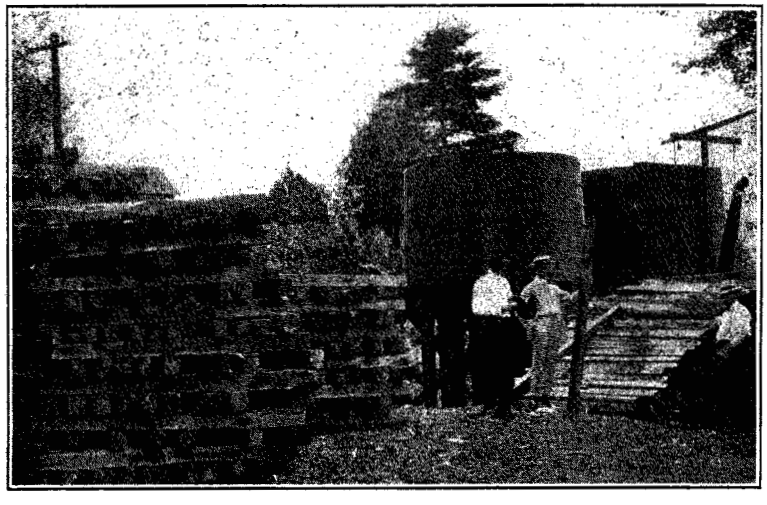

FIG. 177. Red cedar posts grown in a farm woodlot.—[*Courtesy Forestry Service.*]

ever, this injury can be prevented by spraying with a fungicide, and inasmuch as it is impossible to grow apples in this state without spraying for both insects and fungous diseases, this fungus can be readily held in check with the same spray that is applied for other fungous diseases.

### *Austrian Pine.*

The Austrian pine is an introduced species from Europe. It has been planted extensively throughout the eastern half of the United States, where it has grown with much vigor and has proved a very satisfactory tree for protection and ornamental planting. When planted in dense stands the trees clear

themselves readily of limbs and develop straight trunks of good diameter. The wood is straight-grained, of moderate weight, strong, and makes a very satisfactory lumber. The Austrian pine is well adapted to planting in woodlots throughout the eastern half of the state.

*Habit of Growth.* The Austrian pine is an intolerant species, and must be planted in open situations where it will receive full sunlight. It attains its best growth and development in deep, rich, rather moist but well-drained soils. It grows remarkably well on light sandy soils or on thin gravelly clay soils, but on the latter types of soil its rate of growth is considerably slower than on the bottom type.

Three- and four-year-old seedlings of this species, which will range from 15 to 18 inches in height, should be planted in pure stand, either on any cleared land or on old tilled fields or on steep gravelly or stony hillsides. These seedlings should be spaced approximately 6 by 6 feet, which will require 1200 seedlings per acre. They will demand the same general care and attention that is required by other trees. By the time the trees reach middle age it will be necessary to do considerable thinning, at which time the inferior specimens should be removed. This cutting will yield considerable fuel, and perhaps some poles that can be utilized for other purposes. The final stand will reach maturity when from sixty to seventy-five years of age.

*Yield.* The ultimate cut will be sawlogs that will measure from 18 to 35 inches at the stump: In good situations theyield should approximate 15,000 to 18,000 board feet per acre. In European countries the Austrian pine figures extensively in the turpentine industry. The bleeding is continued over a period of twelve or fifteen years prior to the maturity of the crop and final cutting.

The Austrian pine is absolutely free from injurious insects and fungous diseases, and no objection can be raised to its use from these standpoints. The greatest objection at the present time to its use in the woodlots is the high cost of the planting stock.

### *Sugar Maple.*

The sugar maple is a native tree along the eastern border of the state, and grows with much vigor on the rich, deep soils

FIG. 178. A fourteen-year-old pine woodlot. The trees are growing in poor clay soil. All the surface soil was washed or blown away while under cultivation. Originally this was prairie land in eastern Kansas.

along the watercourses and up over the steep hillsides and bluffs on the eastern and northern exposures. This tree is a native through the greater part of the central hardwood region, growing in greatest abundance in the extreme north. The wood is heavy, hard, tough, strong, light colored, and used extensively in the manufacture of furniture, interior finishing, flooring, and in many ways in the various industrial arts, as shown in the following table:

*Factory Uses of Maple.*

| Purpose. | Per cent. |
|---|---|
| Mill work | 34 |
| Furniture and fixtures | 17 |
| Boxes and crates | 10 |
| Boot and shoe findings | 6 |
| Agricultural implements | 5 |
| Musical instruments | 5 |
| Handles | 4 |
| Woodenware, novelties, etc. | 4 |
| Vehicles | 4 |
| Laundry appliances | 2 |
| Other uses | 9 |
| Total | 100 |

*Habits of Growth.* The sugar maple is one of the most tolerant of our broad-leaved species, growing as seedlings in dense stands under other hardwood trees, and even in mixture with conifers. In dense stands it clears itself readily of limbs and develops a narrow, conical crown, until it begins to approach maturity. The crown then assumes a more dome-like appearance, with compact, dense foliage. In this state the trees reach a diameter of three feet or more and a height of sixty feet or more. It is a tree that does not endure extreme heat or droughty conditions, and can only be grown successfully in this state where soil and atmospheric moisture conditions are congenial.

Two- or three-year-old seedlings of the hard maple may be used in woodlot planting to underplant maturing stands. When planted in this way the seedlings will require very little care, unless lopping the weeds is necessary to prevent the trees from being smothered. However, this will seldom be necessary if the stand is at all, dense. In open stands hoeing and lopping the weeds will be required at least two or three years. Eight hundred or one thousand seedlings per acre will give a very fulll stand of hard maple.

*Yield.* The principal returns from the hard maple will be that of sap for syrup or sugar, and the planting should be made with the idea of maintaining a sufficient stand to shade off lower limbs. Trees with full crowns and an abundance of foliage yield the greatest amount of sap, and the planting should be made with this object in view. One thousand trees per acre are entirely too many to allow to grow to maturity. When they begin crowding each other fully half of the trees may be tapped and bled to death during a period of three or

FIG. 179. A grove of sugar maple trees growing in Linn county, Kansas.

four years. These should then be cut out to make room for the remaining trees, which should grow until they reach a diameter of from 12 to 15 inches before tapping is begun. From this time on, by careful management, they may be bled annually without serious loss or injury to the trees.

No very definite data can be given on the yields from the maple industry, as so many factors enter into consideration. From 5 to 40 gallons of sap are obtained from a tree during a season; an average is somewhere between 10 and 20 gallons. Normal sap of an average year contains about 2 per cent of sugar, although it may vary from .5 per cent to as high as 7 or even 10 per cent. The sugar content varies greatly with

the tree, its location and its past growth. A single tree will yield from 1 to 7 pounds of sugar per season, or expressed in syrup of standard density, from 1 pint to 1 gallon, though the average from year to year and from tree to tree is about 3 pounds of sugar or 3 pints of syrup. Expressing these data in other terms, it is seen that in a normal year one barrel of sap (32 gallons) should produce a gallon of syrup or 7½ pounds of sugar. In many camps and for many years it takes sometimes as high as 50 gallons of sap to make 1 gallon of syrup. First runs of sap are generally richer in sugar, hence take less for a gallon of syrup. From 6½ to 9 pounds of sugar, according to the kind, can be made from 1 gallon of standard syrup, with an average, of 7½ to 8 pounds. A camp of 100 trees should produce about 40 gallons of syrup or 300 pounds ofsugarduring a season.

### *Chinese Arbor Vitæ*

The Chinese arbor vitæ is an evergreen tree, generally of low, compact growth in its native habitat—the dry, rocky mountains of northern China. When planted in good soil under favorable climatic conditions the trees attain a height of 60 feet and a trunk diameter of from 5 to 6 feet. They reach their best development in a deep, fertile soil, and they resist even a considerable amount of alkali. According to Chinese observations, these trees are known to live to an age of more than 2000 years. The old specimens develop a very characteristic ragged and irregular outline, and are striking objects in the landscapes in northern China.

This tree thrives especially in those parts of China where the summers are hot and fairly dry, with an annual rainfall of between 15 and 25 inches, practically all of which falls during the months of July, August and September. The summer temperature in this region frequently reaches 110 degrees in the shade, while in the mountainous regions, where the tree grows under natural conditions, the winter temperature falls to 10 degrees below zero. The Chinese arbor vitæ will withstand a greater degree of cold than this if the winters are dry, but will not endure the cold in moist climates. The soil, moisture, and temperature conditions demanded by this tree prevail throughout the western two-thirds of the state of Kansas.

*System of Management.* The Chinese arbor vitæ is a highly intolerant tree, and the two-year-old seedlings or transplants

must be planted where theywill receive full light from overhead. Methods of planting and protection of this tree are identical with those advised for growing the red cedar. It is a tree that can be used to a good advantage in the rocky, dry soils and steep hillsides throughout the eastern part of the state, and it is an especially valuable tree for planting throughout the western part of the state. When planted in dense

FIG. 180. Eight-year-old catalpa trees in a farm woodlot in Sedgwick county, Kansas.

stands of from 2000 to 3000 plants per acre, the trees develop tall, straight stems that make excellent posts and poles. When spaced more widely the trees develop rather broad, spreading limbs and are valuable for windbreaks.

There are two distinct forms of this species. One form grows erect with ascending limbs and is a valuable tree for the purposes mentioned. The other form is a dwarf type that grows very compact and symmetrical, and is prized highly for ornamental planting. It is one of the most beautiful of our ornamental evergreens. The two types are readily distinguishable in the nursery when the trees are two or three years of age, and the different forms should be selected and planted for the purposes they best fulfill.

In general appearance the tree is very much like the American arbor vitæ. The leaves are scale-like, closely appressed. Through the summer they are deep green, changing with the

approach of winter to a rusty brown, again becoming a bright green during the first few warm days of spring.

*Hardy Catalpa.*

The hardy catalpa is a tree that has been planted quite generally throughout the state and most abundantly throughout the central section, where the well-cared-for plantations have proved very profitable. The wood of the catalpa is light brown in color and light in weight, but when seasoned is very durable in contact with the soil. Its principal use is for posts and poles.

*Range and Habit of Growth.* The hardy catalpa is found growing naturally in southern Illinois and Indiana, western Kentucky and Tennessee, southeastern Missouri, northern Arkansas, western Louisiana, and eastern Texas. In its natural distribution it is a tree that frequently attains a height of from 60 to 80 feet, with a diameter often measuring 3½ or 4 feet. In Kansas it is a small-sized tree, seldom exceeding 40 feet in height or 2 feet in diameter. It is a tree that is well adapted to the soil and climatic conditions of the eastern half of the state, but it is not a tree that can be recommended for the western portion. It should be grown in pure stand and planted only in deep, fertile, cultivated soil. The soil requirements of the catalpa are similar to the soil requirements of corn, and any soil capable of producing a good yield of corn will produce a good growth of catalpas.

*System of Management.* One-year-old seedling trees should be planted in rows 7 feet apart and set about 3 or 3½ feet apart in the rows. These may be planted in alternate lister furrows. When set the roots may be partly covered with a spade by hand and the furrows later filled in with a cultivator. The trees should be given at least two seasons' cultivation. Thorough cultivation during this time is very necessary to keep down the growth of weeds and to stimulate as rapid a growth of the trees as possible. By the third summer the trees should have attained sufficient size to shade the ground completely and to keep down all weed growth. Under these conditions they will make a rapid growth. When from 14 to 18 years of age they will have attained their financial maturity, and should then be cut. The cutting should be done in the winter and the ground should be cleared at one cutting. This will allow a growth of sprouts from the stumps to make a second crop,

which in about twelve years will afford another cutting nearly equal to the first.

*The Yield.* The yield for a catalpa plantation will vary with the quality of the soil and with the care that the trees have received. On favorable soil, under this treatment, it is safe to count not fewer than 3500 posts per acre when the trees are from 14 to 18 years of age. The following table gives an itemized account of the cost of growing a 20-acre catalpa plantation and the returns received from it:

*Expenditures Per Acre.*

| | |
|---|---|
| Plants, 2722 at $1.15 per thousand | $3.13 |
| Preparation of the ground, planting, cultivation, and pruning, | 18.46 |
| Total | $21.59 |
| Interest on $21.59 for 16⅓ years at 5 per cent, compounded | 26.34 |
| Cutting and marketing | 61.90 |
| Total expense for growing and harvesting the plantation per acre | $109.83 |

*Receipts from the Twenty Acres.*

| | |
|---|---|
| 31,397 third-class posts, at 5 cents | $1,569.85 |
| 17,349 second-class posts, at 10 cents | 1,734.90 |
| 4,268 first-class posts, at 12½ cents | 533.50 |
| 270 first-class posts, at 15 cents | 40.50 |
| 211 eight-foot posts, at 20 cents | 42.20 |
| 9 ten-foot posts, at 25 cents | 2.25 |
| 4 ten-foot posts, at 30 cents | 1.20 |
| 258 ten-foot posts, at 35 cents | 90.30 |
| 41 twelve-foot posts, at 40 cents | 16.40 |
| 167 fourteen- and sixteen-foot poles, at 50 cents | 83.50 |
| Total for posts and poles | $4,114.60 |
| 214 cords of wood, at $5.25 | 1,123.50 |
| Total income from twenty acres | $5,238.10 |

The total of $5238.10, as the proceeds from twenty acres, is equal to $261.90 per acre. If from this the cost of $109.83 per acre for growing and marketing the crop is deducted, we have $152.17 as the net proceeds per acre, equivalent to an annual net income of $9.31 per acre. In other words, if the land had been rented it would have had to bring an annual cash rental of $9.31 per acre for this period to equal the income derived from the plantation.

This plantation was grown on only ordinary farm land, and the returns should be easily duplicated on favorable locations throughout the eastern half of the state.

## FINANCIAL ASPECTS.

The woodlot crop, unlike most other farm crops, requires a long period of years to reach maturity. Largely for this reason the importance of the woodlot has been overlooked. Few farmers appreciate the value of a stand of finely formed trees in their woodlot. Such a stand of trees in any woodlot, even though they are saplings, is an asset to the farm, and like a growing colt; represents a definite future value. Unless the waste land found on nearly every farm, that is more suitable for growing timber than any other crop, is utilized in this way, the land will continue to be unproductive for an indefinite time and will be a source of expense and detriment to the remainder of the farm.

The financial success of any woodlot proposition depends upon three factors:

1. *The Initial Cost of the Undertaking.* As growing timber is a long-time investment, the first cost must be held down to a minimum or the interest on the investment will use up the possible profits. The cost of the planting stock is one of the first items to consider. This is a small item when nuts or acorns are to be planted, if a plan has been thought out. In seasons when a heavy crop of nuts or acorns are produced the cost of the seed will be very little indeed, and the planting may be deferred until such a seed year occurs.

When seedling stock is used the plants may be grown in a home nursery or under contract by some commercial nurseryman.[11] The seedlings of the broad-leaved species are easily grown at but very little expense. The evergreen seedlings are more difficult to grow, and it is not advisable to attempt to grow these in a home nursery. Such stock when wanted in, large numbers can be contracted for at a much less price than the quoted trade prices.

The cost of the actual planting of the nuts or the seedling trees is also an item of the initial cost. This work must be planned so as to fit in with the regular schedule of the farm work. Plan to begin planting early in the spring before the other work demands full time of the working crew. This work should be organized so that there will be no loss of time when the planting crew is on the ground. In planting trees three

11. The state forest nursery will contract and grow seedling stock as cheaply as the farmer can grow it himself.

FIG. 181. Partial view of woodlot. Sixty thousand catalpa fence posts and 650 ricks of stove wood, from twenty acres of sixteen-year-old trees.

persons usually work to the best advantage. One man can carry a supply of seedling trees and plant them about as fast as two men can dig holes in which to set them. The tools best suited for the work and the rate at which the holes can be dug will depend altogether upon the character of the soil. A crew of three men should plant from 3000 to 5000 seedlings per day, working eight hours,

2. *The Care of the Growing Crop.* Cultivation and protection is absolutely necessary to insure a successful growth of the young trees, and the cost of this item must also be kept as low as possible; but it is work that must not be neglected or deferred until the weeds have sapped the vigor of the trees.

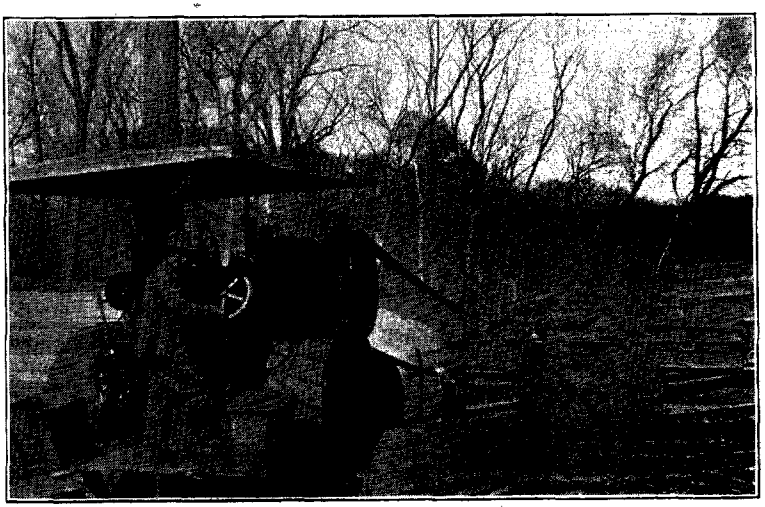

FIG. 182. A portable sawmill. An equipment of this kind will saw from 5000 to 7000 board feet of lumber per day, and it is an economical method of converting logs into useful lumber.

Each year's planting should be limited to the acreage that can be cared for.

3. *The Harvesting.* This item is chargeable to the final cost and carries no compound interest, but the work must be well planned or it will be an expensive operation. This cost includes the felling of the trees, hauling the logs to market, or the cutting of the logs into lumber, as the case may be. The cutting and hauling will cost from $2 to $6 per thousand board feet, depending upon the length of the haul. Cutting the logs into lumber will cost from $7 to $9 per thousand board feet. The cutting and marketing of the posts and wood may be judged by the figures given for the cost of cutting and market-

ing the catalpa. The posts and wood in this instance were hauled 1½ miles.

Determining the number of board feet in a log is a matter with which few farmers are familiar. This is determined by established rules and practices among lumbermen, These rules and practices vary in different sections of the country and with different species of logs. The Doyle rule is the commonly used rule in this state. The logs should be cut about four inches longer than the even feet to allow trimming off weather-checked or broken ends. In the Doyle log table, which follows, the length of the log is given in feet in the top horizontal line; and the diameter, which is always measured inside the bark at the small end of the log, is given in the left-hand vertical column. The contents of the log in board feet is found at the intersection of these columns. For example, a log is 16 feet long and 22 inches in diameter inside the bark at the small end. By following down the verticle column under 16 until it intersects the horizontal column to the right of 22, we find the number 324. This is the number of board feet of lumber that can be cut from a log of the size given according to the Doyle rule. The number of board feet in a log of any other size can be found in like manner.

*Doyle's Log Table.*

| Diameter in inches. | Length in feet. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 10 | 18 | 20 | 23 | 25 | 27 | 29 | 32 | 34 | 36 | 38 | 41 |
| 11 | 24 | 28 | 31 | 34 | 37 | 40 | 43 | 46 | 49 | 52 | 55 |
| 12 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 |
| 13 | 40 | 45 | 50 | 55 | 61 | 66 | 71 | 76 | 81 | 86 | 91 |
| 14 | 50 | 56 | 62 | 68 | 75 | 81 | 88 | 94 | 100 | 106 | 112 |
| 15 | 60 | 67 | 75 | 83 | 91 | 99 | 106 | 113 | 121 | 128 | 136 |
| 16 | 72 | 81 | 90 | 99 | 108 | 117 | 126 | 135 | 144 | 153 | 162 |
| 17 | 84 | 95 | 106 | 117 | 127 | 137 | 148 | 158 | 169 | 179 | 190 |
| 18 | 98 | 110 | 122 | 134 | 147 | 159 | 171 | 183 | 196 | 208 | 220 |
| 19 | 112 | 126 | 141 | 154 | 169 | 183 | 197 | 211 | 225 | 239 | 253 |
| 20 | 128 | 144 | 160 | 176 | 192 | 208 | 224 | 240 | 256 | 272 | 288 |
| 21 | 144 | 162 | 181 | 198 | 217 | 235 | 253 | 271 | 289 | 307 | 325 |
| 22 | 162 | 182 | 202 | 223 | 243 | 263 | 283 | 303 | 324 | 344 | 364 |
| 23 | 180 | 203 | 226 | 248 | 271 | 293 | 313 | 336 | 359 | 383 | 406 |
| 24 | 200 | 225 | 250 | 275 | 300 | 325 | 350 | 375 | 400 | 425 | 450 |
| 25 | 220 | 248 | 276 | 302 | 331 | 358 | 386 | 413 | 441 | 468 | 496 |
| 26 | 242 | 272 | 302 | 333 | 363 | 393 | 423 | 453 | 484 | 514 | 544 |
| 27 | 265 | 298 | 330 | 363 | 397 | 430 | 463 | 496 | 530 | 563 | 596 |
| 28 | 288 | 324 | 360 | 396 | 432 | 468 | 504 | 540 | 576 | 612 | 648 |
| 29 | 313 | 351 | 391 | 430 | 469 | 508 | 547 | 586 | 625 | 664 | 703 |
| 30 | 338 | 380 | 422 | 465 | 507 | 549 | 591 | 633 | 676 | 718 | 761 |
| 31 | 365 | 410 | 456 | 502 | 547 | 592 | 638 | 683 | 729 | 774 | 820 |
| 32 | 392 | 441 | 490 | 539 | 588 | 637 | 686 | 735 | 784 | 833 | 882 |
| 33 | 421 | 473 | 526 | 578 | 631 | 684 | 736 | 789 | 842 | 895 | 946 |
| 34 | 450 | 506 | 562 | 619 | 675 | 731 | 787 | 844 | 900 | 956 | 1012 |
| 35 | 481 | 540 | 601 | 661 | 721 | 781 | 841 | 901 | 961 | 1021 | 1081 |
| 36 | 512 | 576 | 640 | 704 | 768 | 832 | 896 | 960 | 1024 | 1088 | 1152 |
| 37 | 545 | 612 | 681 | 749 | 817 | 884 | 953 | 1021 | 1089 | 1157 | 1225 |
| 38 | 578 | 650 | 723 | 795 | 867 | 939 | 1011 | 1088 | 1156 | 1228 | 1300 |
| 39 | 613 | 689 | 765 | 842 | 918 | 996 | 1072 | 1149 | 1225 | 1302 | 1379 |
| 40 | 648 | 729 | 810 | 891 | 972 | 1053 | 1134 | 1215 | 1296 | 1377 | 1458 |