TREES AND TREE PLANTING

for posts, windbreaks and erosion control

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OKLAHOMA AGRICULTURAL EXPERIMENT STATION

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TREES AND TREE-PLANTING FOR POSTS, WINDBREAKS, AND EROSION CONTROL

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Many plantings of forest trees in Oklahoma are doing extremely well. Others have failed completely. Still others are in such poor shape that time and money spent on them were practically wasted.

The "batting average" of forest tree plantings in Oklahoma can be considerably increased, research recently completed by the Experiment Station indicates. Several hundred windbreak and post-lot plantings scattered over the state were studied. The conclusion was:

Survival of trees can be greatly increased by choosing the right species for the location, planting the trees properly, and giving them good care for the first few years after planting.

This bulletin summarizes the facts about selection of species, planting method, and after-care as shown by study of both successful and unsuccessful plantings.*

The principal controllable causes of failures among the forest tree plantations studied have been:

(a) Planting sites not capable of maintaining tree growth, with the soil as the most important element;

(b) Faulty selection of species;

(c) Unfavorable moisture conditions during and immediately after planting;

(d) Failure to care for and protect young plantations against heavy competition and against injury by livestock and rodents; and

(e) Faulty handling of planting stock.

* Methods of study, and a more detailed report of results, are given in Oklahoma Agricultural Experiment Station Technical Bulletin No. T-29, A Preliminary Study of Tree Plantations in Oklahoma; Relative Survival by Species, and Factors Affecting Survival.

Left.—High winds causing heavy erosion of dry sandy soil exposed the upper part of the roots of this honey locust. Many trees have been similargely affected in northwestern Oklahoma shelterbelts. Either deeper planting or use of a self-seeding cover crop might help correct this situation.

Right.—Green ash in the same shelterbelt as the honey locust shown at the left. Note the partly exposed roots and also the tendency of the trees to lean along the direction of the prevailing wind (northward). The picture was taken during a strong south wind.

Drought, although responsible for loss of a large number of young trees, is not included here because it cannot be controlled. However, the probability of a prolonged dry spell should always be considered, particularly in regard to selection of species.

GENERAL PLANTING SUGGESTIONS

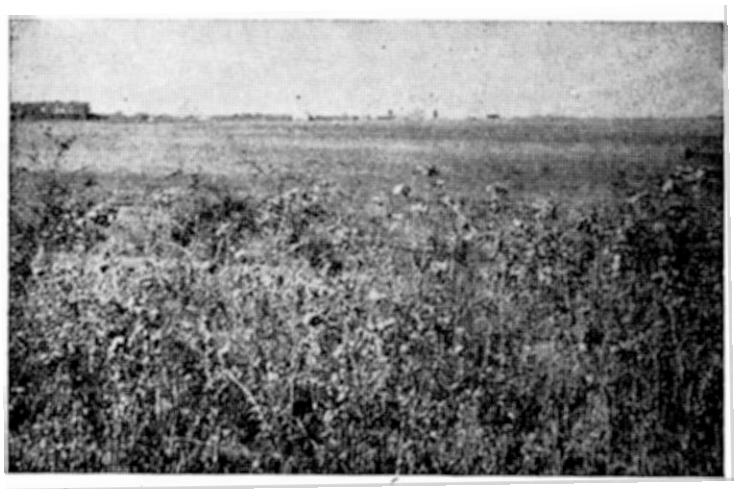
Complete success in tree planting can not be expected. However, the chances of success can be increased by following these suggestions:*

1. Have everything ready for field planting early in the season. In Oklahoma the planting season normally starts in late November or December when plants be-

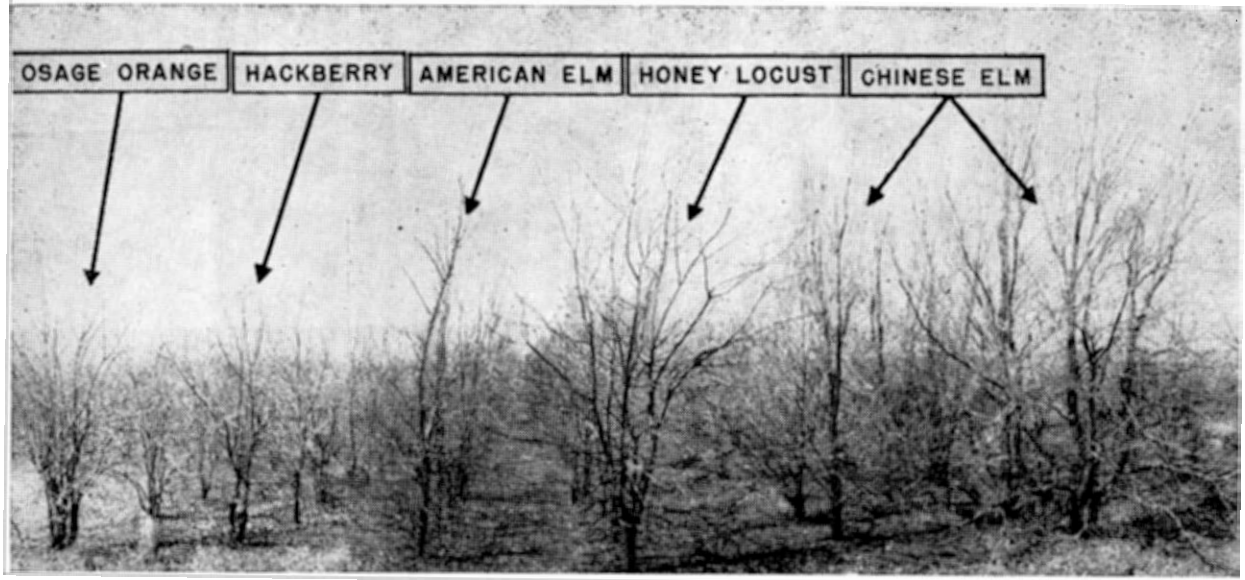
* Additional information on how to plant trees is found in Oklahoma Extension Circular E-450, "Fence Post Production in Oklahoma," by H. P. Rigdon.

come completely dormant. Plant on a cool, calm, cloudy day when the soil is moist and when it is likely to rain soon after planting is completed. Consider weather forecasts in selecting a day for planting.

2. While planting, always keep roots of the planting stock protected against drying. Use moist burlap or buckets of thin mud or water to carry the plants in the field. Cedar and pines are particularly susceptible to injury by excessive drying.
3. Plant trees somewhat deeper than they were growing in the nursery. This is especially important on sites where water or wind erosion is likely to occur.
4. Give special attention to selecting the site. Avoid soils containing 25 percent or more clay within the top 36 inches. Avoid spots containing excessive amounts of alkalies ("slick" soils).
5. In heavy soil or on generally poor sites, use only species which have proved their ability to grow under such conditions. Red cedar, honey locust and Chinese elm have a better chance on such sites than other species



What looks like a patch of weeds in the foreground is a part of a badly kept shelterbelt. Despite lack of care and a generally poor site, survival of all species (except red cedar) is 90 percent or higher, showing the high degree of adaptability and sturdiness of many native Oklahoma trees. Growth is definitely stunted, however.



A partial cross-section of a shelterbelt in Greer County. Average survival of all species in this southwestern Oklahoma shelterbelt was approximately 85 percent. The belt was planted in 1936, on sandy soil, on ground sloping slightly to the north. The trees are spaced 6 feet x 8 feet.

commonly planted in Oklahoma. Black locust and shortleaf pine can stand dry situations but should not be expected to thrive on heavy soils. Black locust will survive on unfavorable sites but will not produce material of fence post size or quality.

6. Space the trees far enough apart to permit cultivation with equipment available.
7. Cultivate as long as the size of trees and the spacing will permit. Cultivation may be needed for from two to six years or longer, depending on the site, rate of growth, and species used.
8. Keep livestock off the planted area.
9. Protect plantation from fire by clean cultivation and by maintaining a fire break.
10. Prune fence post trees early.
11. In fence post plantations containing trees having more than one stem (osage orange, mulberry), remove all but one stem per plant.
12. In case more than 10 to 15 percent of the trees are lost during the first year, replace them the following season. Delay in replacement for two or three years may seriously handicap the new trees because of competition from those already established. This is particularly true of deciduous species.

ADAPTATION OF SPECIES

Because of considerable variation in soils and in the amount of precipitation in different parts of the state, trees do not thrive equally well in all parts of Oklahoma. Some species are satisfactory for central Oklahoma but will not do well further west. The following discussion describes the uses and adaptations of various kinds of trees as shown by the Station's study of existing plantations.

Eastern Oklahoma

Practically all trees commonly used in forest plantations in Oklahoma are well adapted to the eastern part of the state,

therefore no specific suggestions on individual species are offered. The recommendations made for the north central part of the state also apply in eastern Oklahoma.

North Central Oklahoma

In general, north central Oklahoma is well suited for tree growth, provided that sites and species are carefully selected and the trees are given proper care.

RED CEDAR.—Red cedar is generally well adapted to the north central part of Oklahoma, except on particularly unfavorable sites. It transplants with more difficulty than most broadleaved species; but, once established, red cedar is likely to persist even through very unfavorable weather conditions. Low land with poor drainage should be avoided.

Many old red cedar farmstead windbreaks are found in this section of the state. Even a one- or two-row windbreak of this species provides efficient all-year protection against the wind if the trees are left untrimmed at the bottom.

AMERICAN ELM.—American elm is a moisture loving species found in nature mainly along the streams and on lowlands. Its use in forest planting should be confined to locations similar to its natural habitat. It does not grow well in heavy shade, therefore it should not be planted close to trees of excessively fast growth.

Three rows of cedar make an excellent windbreak in central Oklahoma.

BLACK LOCUST.—Black locust wood is very durable, and in the early stages of its life this species grows very rapidly. Some excellent fence post material has been produced on fair sites with good drainage, but black locust on dry heavy soil fails to maintain its vigor and rapid growth before reaching fence post size. Black locust is subject to heavy damage by locust borers, particularly in a state of low vigor. Its habits of suckering heavily, of forking close to the base of the trunk, and of producing a mass of thorny branches make it one of the most difficult and expensive species to manage.

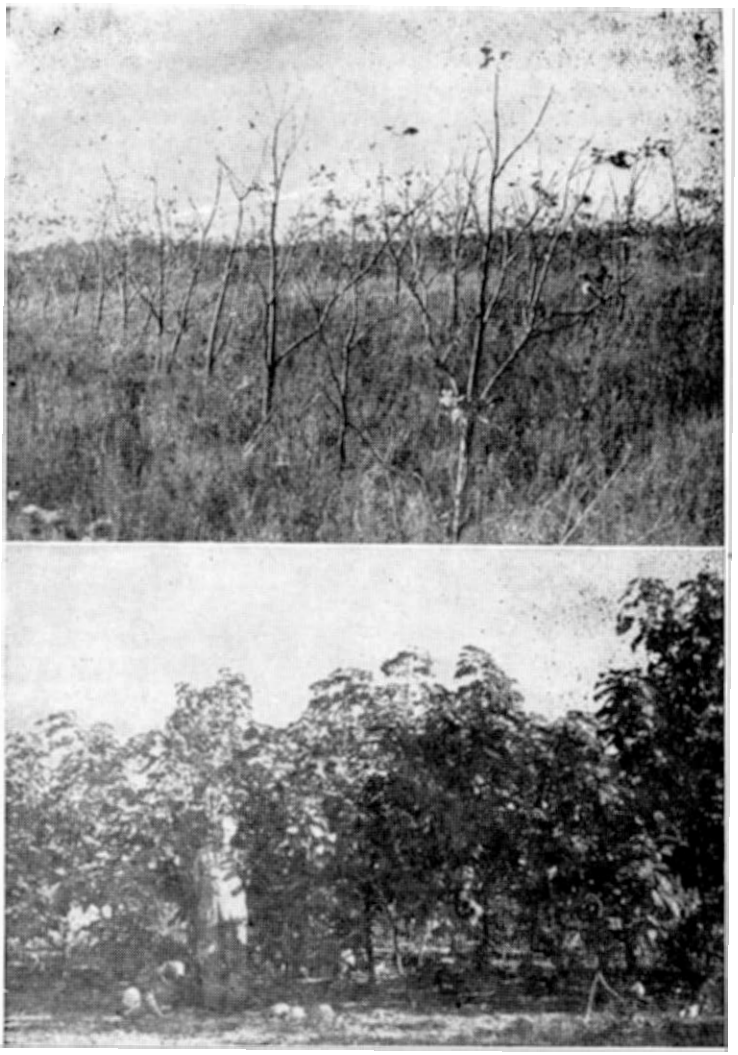
It is questionable whether black locust should be recommended for fence post production in the central part of the state. On the other hand, because of its extensive root system and profuse suckering, it should serve well for soil erosion control.

BLACK WALNUT.—Black walnut is extremely desirable from the standpoint of its potential value as wood and nut producer, but it is rather exacting in moisture, drainage, and soil requirements. It should be planted only where both soil and moisture conditions are at least fair. It is a fast grower on good soil, but it is usually outgrown by other broadleaved species in Oklahoma. Therefore it should not be surrounded by other species but must form the outside row or rows in a windbreak. Its extreme intolerance combined with a relatively slow growth on poor soil make it unsuitable for any interior row in a plantation.

CATALPA.—Catalpa is one of the most desirable species for farm planting in central Oklahoma. It makes very effective wind protection, and is one of the best fence post species. Catalpa is rather exacting in its requirement of soil and moisture. On moist, reasonably light soil it survives and grows well. On drier land (upland) it is likely to stagnate before reaching fence post size, or at best take unduly long to produce a post-size trunk. Under such conditions it is apt to branch profusely, thus still further reducing its value as a source of fence post material.

Catalpa sprouts easily and under favorable conditions may produce straight stems (sprouts) of 8 to 10 feet in height in one season.

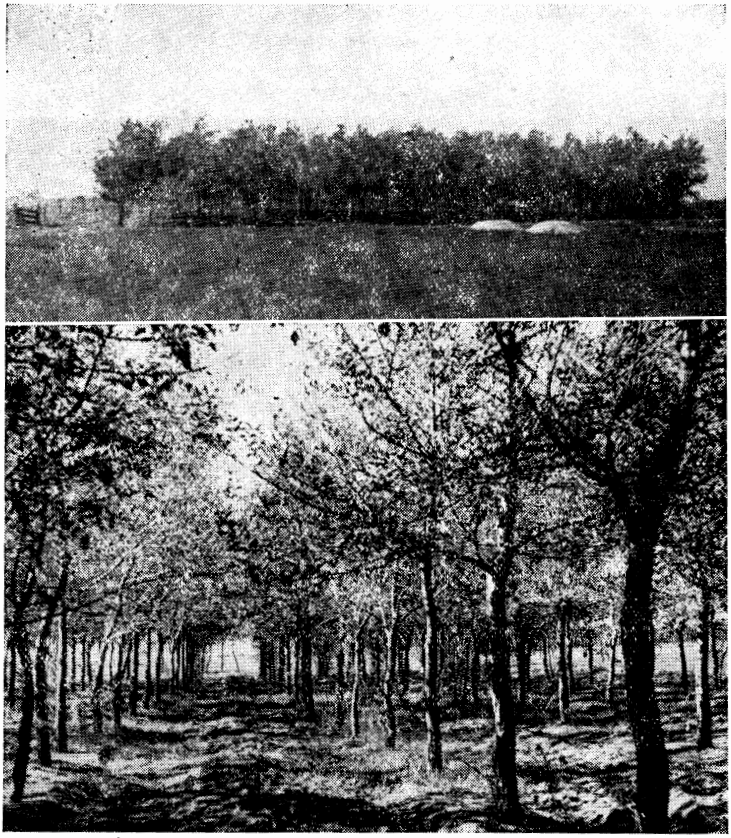
Catalpa grows rapidly on light sandy soil with a fair supply of moisture. This plantation is 6 years old. Spacing 3 feet x 10 feet; average height of trees 18 feet.



Top.—On dry upland catalpa grows slowly, particularly when neglected. This plantation is two years older than the one in the picture below. Average height 7½ feet.
Bottom.—Three-year old catalpa plantation. Survival 98 percent; average height, 10 feet, spacing 6 feet x 10 feet.

This five-year old plantation of catalpa is located along a creek on bare sandy soil. Trees are spaced 6 feet x 6 feet. In five years they attained an average height of 12 feet and an average diameter of 2 inches. Part of the plantation (upper photo) is periodically flooded and bears no grass or weeds. The growth of catalpa is equally good in both flooded and drier parts of the plantation.

CHINESE ELM.—Chinese elm is one of the most desirable and most fully adapted species for shelterbelt and windbreak planting in north central Oklahoma, but it cannot be planted "just anywhere." It fails completely or exists only with difficulty on some sites. Plantings of Chinese elm are likely to fail on heavy shallow soil with poor drainage, particularly on low ground. It is also likely to fail in locations where rodents in large number cannot be kept under control while the trees are young. It should be planted at least 50 feet away from



Seven-year old pure Chinese elm plantation. Average height 22 feet, average diameter (base) 8 inches. Located next to the front yard, it provides protection and adds much to the appearance and comfortable living on the farm.

Chinese elm planted in the spring of 1940. Photographed November 1944. Average height 20 feet. Average diameter 3 inches. Sandy, well-drained soil.

gardens and orchards because it has an extremely extensive root system. In planning location and size of a shelterbelt, reduction in the yield of field crops in a strip adjacent to the belt should be taken into consideration.

GREEN ASH.—Limited observation of green ash does not permit drawing any conclusion except as to its behavoir on a good site. It does well on a very favorable location, although its rate of growth is slower than that of most other species.

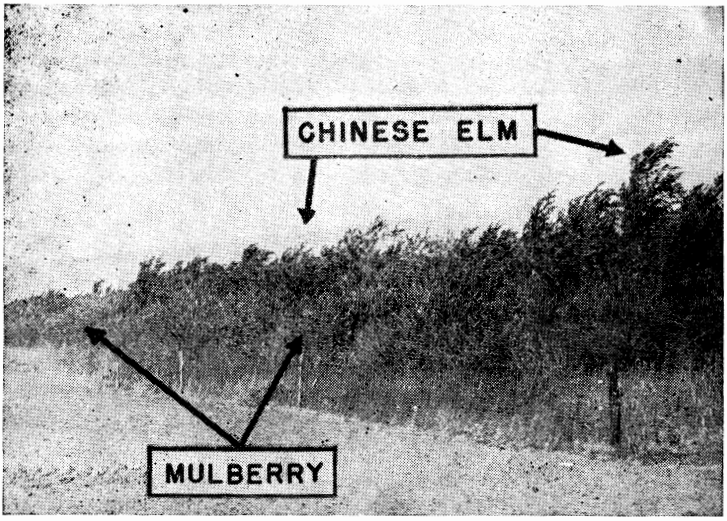
HACKBERRY.—Hackberry is one of the most dependable and widely used trees in street and yard planting in Oklahoma. With good care during its early stages, an individual hackberry tree grows well and makes an excellent shade tree even on poorer soils. Yet in shelterbelts it proved to be one of the poorest among the species commonly used. Many more dependable trees are available, therefore planting of hackberry in shelterbelts appears to be undesirable.

HONEY LOCUST.—Honey locust is well adapted to many sites in north cntral Oklahoma. Its rapid growth, relative freedom from injury by insects and diseases, and the high durability of its wood place it among the most desirable trees

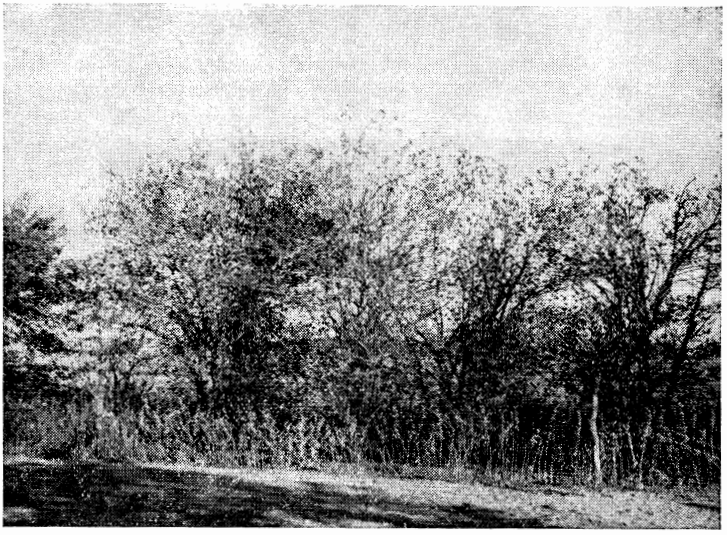
for forest planting. It should be used more widely than it has been to date. It appears to do better than most trees used in farm plantations.

One strong objection to this species is the presence of long stiff thorns. These interfere with any work in a honey locust grove, and might even make it dangerous close to the farmstead. Efforts are being made to propagate and distribute only the thornless variety. However, not all seedlings produced from thornless trees come true to type. The selection of seedlings is complicated by the fact that thorns may begin forming after the trees have been planted in the field.

MULBERRY.—One of the most remarkable features of mulberry is its persistence in growth even under extremely unfavorable growing conditions. It is on the poorer sites that mulberry proves its unusual adaptability.



The first (south) row in this Garfield county shelterbelt is mulberry spaced 6 feet apart. Forming dense bushy growth, it provides an effective barrier against the wind. Being a fast grower, it should be planted in shelterbelts next to such species as Chinese elm, cottonwood, and honey locust.



Osage orange left to nature provides an excellent protection against the wind but little first class material for fence posts.

Like osage orange, mulberry tends to be bushy while young, providing more complete and effective early protection against the wind than other common species. This, together with its reasonably fast growth and ability to grow on poor sites, makes it one of the most desirable species for planting in windbreaks and shelterbelts.

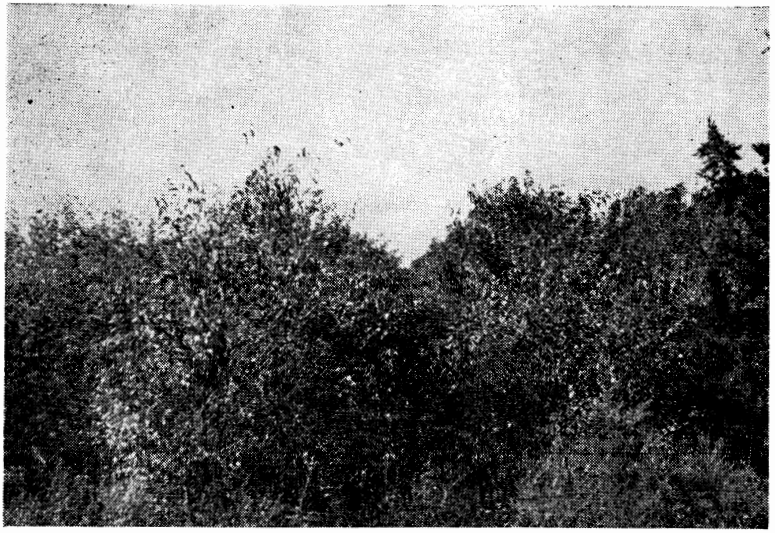
OSAGE ORANGE.—Osage orange trees have been grown successfully as individual specimens, in hedges, and in mixed forest plantations. They appear to be well adapted to most sties in central Oklahoma, although they do best on low but reasonably well drained land. Osage orange is an excellent shelterbelt tree and a source of the most durable native fence post material. Whether osage orange can be used to produce fence posts in mixed windbreaks and shelterbelts is questionable unless each plant is heavily and persistently trimmed to one or two stems.

Western Oklahoma (Exclusive of Panhandle)

RED CEDAR.—Red cedar, once established, has a good chance of developing into a useful tree, barring injury by fire or an excessively long drought. Heavy or complete losses of planted red cedar have occurred soon after planting because of the pronounced susceptibility of small plants of this species to drying. Planting on moist, cool days is more important with this species than with any other commonly used in forest planting.

PINES.—Practically all pines used in forest plantations in this state require light soil. On heavy soils, pines are likely to die before reaching useable size. Pines are more difficult to transplant than deciduous species, but once established on well drained soils are capable of withstanding dry spells as well as most broadleaved trees.

AMERICAN ELM.—American elm is highly susceptible to drought injury. Its planting in the western part of the state should be avoided unless the plantation is to be located in a river bottom or very close to it.



Typical growth of osage orange on a good, well drained soil in Garfield county. Note the tendency to grow bushy and form a solid wall of foliage. The value of these plants in a windbreak is very high; their value as a source of fence posts is questionable.

Nine-year old shelterbelt in Greer county. Survival of red cedar 60 percent, average height 6½ feet. With the exception of mulberry and hackberry, 80 percent of other trees are still living.

BLACK LOCUST.—Few species can rival black locust in the performance and the value of its wood in the plantations of western Oklahoma. Planted on light soil and properly cared for, it has a good chance to develop into a useful tree in all types of forest planting. Being a fast grower and a source of very durable wood,it can be relied upon to produce good quality fence posts in a shorter period of time than any other species grown in the western part of the state. It needs early pruning and thinning for the best and quickest results.

On heavy soils with little moisture it is likely to stagnate, weaken and finally to deteriorate completely, particularly when no effort is made to assist the trees in their struggle for existence.

BLACK WALNUT.—Black walnut was found in only five out of a total of 41 plantations inspected in the western counties. The results of study suggest the need of caution in using black walnut. Unless fertile moist soil is available for tree planting, attempts to establish black walnut in forest plantings are likely to fail. Under western Oklahoma conditions it grows slowly, and is likely to be among the first species to disappear from mixed plantations when long droughts occur. Due to the prevalence of strong winds, no wood of commercial quality can be expected from black walnut in the shelterbelt zone.

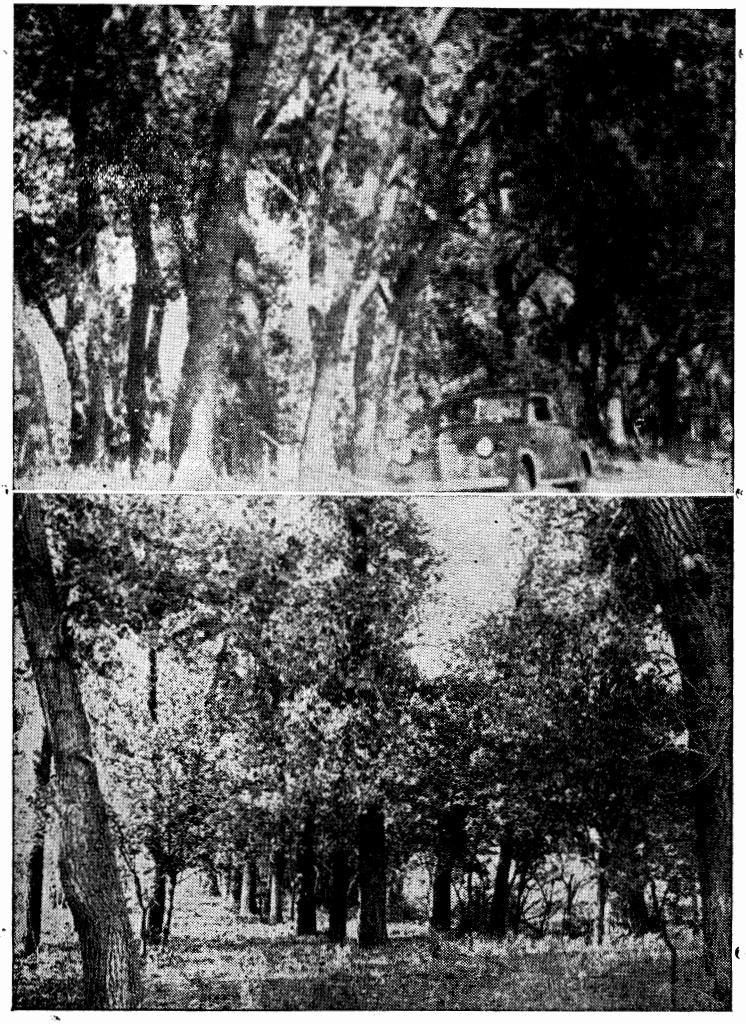
A block of Chinese elm on heavy soil in Greer county. Trees were planted December 17, 1937. Spacing 12 feet x 20 feet. Survival 90 percent; average height 25 feet; diameter 6 inches.

CATALPA.—Catalpa can be suggested for planting in the western part of the state in places where no excessive drying of soil can normally be expected, i. e., close to streams or on low ground. Under favorable weather canditions catalpa grows reasonably fast, but shortage of moisture would slow its growth probably more than that of most other species. If it can be trained to form straight, limb-free trunks, catalpa would be a source of excellent fence post material. At present it is being used in the west mainly in shelterbelts. Under such conditions, when density of foliage is of primary importance, production of fence post material is uncertain and slow.

CHINESE ELM.—With the exception of the poorest sites, particularly in regard to excessively heavy soil and unusually unfavorable weather conditions, Chinese elm can be expected to do reasonably well in forest plantations of western Oklahoma. If tree growth can succeed at all in any given location, Chinese elm is likely to succeed also, at least for the first 8 or 10 years. Not many plantations in the western section of the state are older than 10 years and therefore the behavior of Chinese elm beyond that age is still a matter of speculation. It should be pointed out, however, that a fairly large number of older Chinese elms (10 to 12 feet tall) are in very poor condition and some are dying or dead. The cause of this situation has not been determined, but the very fact that such a situation exists should be taken into consideration in any decision on planting.

COTTONWOOD.—Planted on light soil, on sites with at least a fair supply of moisture, cottonwood is likely to grow into a tall, healthy tree. Tight soils and ground liable to dry rapidly must be avoided. Cottonwood is capable of drawing moisture from a large area but its root system is rather shallow. It is the fastest growing species in the western part of the state.

GREEN ASH.—Green ash is well suited for planting on some sites in the western part of the state. It may survive on upland in a rather dry situation, but under such conditions could not be expected to thrive as well as such deep or extensively rooted species as locusts, Chinese elm or mulberry. Being very intolerant of shade and rather slow growing, it is



Properly located, spaced and cared for, cottonwood can be expected to grow to sawlog size in the western part of the state.

likely to be suppressed by faster growing neighbors in a mixed plantation, unless provided with ample space. Its position in a shelterbelt should be next to such relatively slow growers as hackberry, red cedar and osage orange.

HACKBERRY.—Although hackberry made a satisfactory showing in some mixed plantations, it remains one of the least desirable species for the western part of the state. Its principal weakness is its relatively slow growth and its apparent inability to overcome the effects of heavy competition.

HONEY LOCUST.—Honey locust is one of the most desirable species for forest planting in the western part of the state. If a prospective planting site is at all suitable for trees, honey locust is as likely to succeed as any other species. In addition to its high degree of adaptation to the conditions of western Oklahoma, it has a good form, durable wood, and grows rapidly, thus offering the possibility of producing good post material in a relatively short time.

One objection to honey locust is the presence of thorns on some trees of this species. This problem has been discussed above (page 14).

MULBERRY.—The behavior of mulberry in the west is somewhat like that of osage orange. It is well suited for shelterbelts, provided the soil is not excessively heavy. Because of its tendency to grow bushy, mulberry should not be counted on to produce fence posts in a shelterbelt without considerable pruning and thinning. Widespreading, multistemmed plants are desirable in shelterbelts, while production of fence post material calls for a tree with a single straight trunk. Under the relatively dry conditions of western Oklahoma, mulberry can be expected to produce useable posts only on better sites, and even there only rather slowly.

OSAGE ORANGE.—Planting of osage orange in the western part of the state can be recommended only for well drained soils. On such sites, in properly located shelterbelts it is likely to serve its purpose well. Osage orange produces a wide-spreading, bushy growth with little or no useable post material but very effective in breaking the force of the wind. Its upward growth is slow. Under such conditions one should not expect osage orange to produce fence post material unless it is given special pruning and heavy thinning.

Because of its unruly and slow upward growth, osage orange might not be as desirable for fence post production as catalpa or black locust.