

Kansas State Agricultural College.

EXPERIMENT STATION.—Bulletin 165.

ED. H. WEBSTER, *Director.*

FARM BULLETIN.

DIVISION OF FORESTRY.

ALBERT DICKENS, *State Forester.*

Report of

*State Forester upon Forest Conditions in
Central and Western Kansas.*



MANHATTAN, KAN. .

MARCH, 1910.

DIVISION OF FORESTRY.

ALBERT DICKENS. State Forester.
ROBT. E. EASTMAN. Assistant Forester.
CHRISTIAN JENSEN. Assistant in Charge Dodge City
Forestry Station.
F. J. TURNER. Foreman, Ogallah Forestry Sta-
tion.

FORESTRY has been one of the important lines of investigation since the early days of the Agricultural College, and some of the first experiments authorized by the Experiment Station were investigations of the growth of forest trees. These lines of work have been continued, and the work along forestry lines now includes:

1. Observations concerning the adaptation of species to Kansas conditions, plantings made at various dates from 1874 up to the present time being under observation.
2. Measurements of the rate of growth of various species.
3. Methods of propagation.
4. Influence of transplanting compared with trees grown from seed and not transplanted.
5. Investigation of the distribution and value of native species.
6. A study of the causes of success and failure of artificial forests.
7. The value of various species for windbreaks, for commercial plantations, and as ornamental trees.

Since May, 1909, the Forestry Stations at Ogallah and Dodge City have been under the care of the Department, and a special study of the forest conditions of the state has been commenced. A part of the state forestry work is the investigation of the fitness of soils and locations for forest trees. The preparation of plans for plantings and for the management of wood lots is being undertaken.

THE NEW FORESTRY LAW.

The recognized need of a vigorous forestry policy and an aggressive campaign for tree planting on every farm in Kansas prompted the legislature of 1909 to pass the following forestry bill, which was signed by Governor Stubbs on March 8 and became effective on March 15, 1909:

SENATE BILL No. 231.

AN ACT to establish at the Kansas State Agricultural College a division of forestry under the direction of the board of regents of that institution, and appropriating funds for the support of same, and repealing chapter 405 of the Session Laws of 1907.

Be it enacted by the Legislature of the State of Kansas:

SECTION 1. For the promotion of forestry in Kansas there shall be established at the Kansas State Agricultural College, under the direction of the board of regents, a division of forestry. The board of regents of the Kansas State Agricultural College shall appoint a state forester who shall have general supervision of all experimental and demonstration work in forestry conducted by the Experiment Station. He shall promote practical forestry in every possible way, compile and disseminate information relative to forestry, and publish the results of such work through bulletins, press notices, and in such other ways as may be most practicable to reach the public, and by lecturing before farmers' institutes, associations and other organizations interested in forestry.

SEC. 2. The state forester shall employ, under the direction of the board of regents of the Kansas State Agricultural College, such assistants, who shall be practical foresters, laborers and clerks, and shall purchase necessary office furniture and equipment as may be needed to carry into effect the purposes of this act.

SEC. 3. The state forester shall, upon request, cooperate with towns, counties, corporations and individuals in preparing planting plans and plans for the protection, management and replacement of trees, wood lots and timber tracts under an agreement that the persons obtaining such assistance shall pay the field expenses of such work.

SEC. 4. The board of regents of the State Agricultural College may also conduct on the Dodge City and Ogallah Stations other demonstrations and experiments of local interest, such as seed breeding and tillage experiments, whenever such demonstrations may not interfere with the work in forestry.

SEC. 5. For carrying the provisions of this act into effect there shall be appropriated from moneys in the state treasury, not otherwise appropriated, the sum of one thousand dollars for the fiscal year ending June 30, 1909; two thousand dollars for the fiscal year ending June 30, 1910,

and two thousand dollars for the fiscal year ending June 30, 1911. All vouchers for salaries and other expenses shall be paid in the same manner as expenses of the Kansas State Agricultural College,

SEC 6. The Forestry Stations at Ogallah and Dodge City shall remain the property of the state for the purpose of conducting experimental and demonstration work in forestry under the direction of the board of regents of the State Agricultural College, who shall have all power in relation thereto now exercised by the Executive Council. And for the purpose of maintaining said Stations and for the purchase of trees, plants, seeds and cuttings, and for the payment of other incidental expenses, there is hereby appropriated the following sum, or as much as may be necessary, to wit:

For the Station at Ogallah.

For the fiscal years ending June 30, 1910, and June 30, 1911:

	1910	1911
Maintenance and repairs.....	\$500	\$500
For the purchase of trees, seeds and cuttings.....	300	300
For labor	1,200	1,200
For postage, freight and incidentals.....	200	200
	\$2,200	\$2,200

For the Station at Dodge City.

For the fiscal years ending June 30, 1909, June 30, 1910, and June 30, 1911:

	1910	1911
Maintenance and repairs.....	\$500	\$500
For the purchase of trees, seeds and cuttings.....	300	300
For labor	1,200	1,200
For postage, freight and incidentals.....	200	200
	\$2,200	\$2,200

For the Dodge City Station \$500, or as much thereof as may be necessary, for the purchase of a team, said sum to be available at once.

SEC. 7. Chapter 405, Session Laws of 1907, and all acts and parts of acts conflicting with this are hereby repealed.

SEC. 8. This act shall take effect and be in force from and after its publication in the official state paper.

I hereby certify that the above bill originated in the Senate, and passed that body February 27, 1909.

W. J. FITZGERALD,
 President of the Senate.

Z. E. WYANT,
 Secretary of the Senate.

Passed the House March 8, 1909.

J. N. DOLLEY,
 Speaker of the House.

C. H. BRILHART,
 Asst. Chief Clerk of the House.

Approved March 12, 1909.—W. R. STUBBS, Governor.

STATE OF KANSAS,
OFFICE OF THE SECRETARY OF STATE.

I, C. E. Denton, secretary of state of the state of Kansas, do hereby certify that the above and foregoing is a correct copy of the original enrolled bill now on file in my office.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed my official seal, this 13th day of March, 1909.

[SEAL.]

C. E. DENTON,
Secretary of State.

At the first meeting of the board of regents after the passage of the bill, as a preliminary measure to get the new work under immediate headway, Albert Dickens, professor of horticulture and forestry at the Kansas State Agricultural College, was appointed state forester. A reorganization of the work at the Dodge City and Ogallah Stations was at once undertaken in conformity with the provisions of the law. Mr. Christian Jensen, a man of experience and training in forest nursery and tree-planting work, was selected as assistant forester and placed in charge of the Dodge City Station. Mr. Jensen had received his training in forestry at the Biltmore estate, Asheville, N. C., under Doctor Schenck, and had several years' experience in nursery work in Iowa and Kansas. Mr. Turner, a practical farmer and a man of considerable experience in nursery work, was employed as foreman of the Ogallah Station. The efficient work that these men accomplished is described in the following pages of the bulletin.

The appointment of Professor Dickens as state forester was recognized by him as a temporary arrangement until such time as he could recommend the appointment of a permanent state forester who could devote his entire time to the work. The Forestry Service of the United States Department of Agriculture was asked to recommend a man who had the ability and training to undertake the duties of state forester as prescribed by the law. Very happily the regents were able to secure the man recommended by the Forestry Service. Professor Dickens recommended that the forestry work be put on an independent basis, and the plans as outlined by him were submitted to the Forestry Service. Their recommendation was made in the following words:

"We heartily approve of your suggestion of putting forestry on an independent basis at the College and of the plans you have outlined for handling the subject. It gives us great pleasure to be able to recommend to you a man whom we are

very glad unqualifiedly to indorse. He is Charles A. Scott, professor of forestry at the Iowa State College, Ames, Iowa. Professor Scott is a native Kansan, and a graduate from the agricultural course at Manhattan in 1901. Immediately after graduation he entered the forest-service work and, with the exception of one year spent at the Yale Forest School, he was in the service continuously until the fall of 1907. During this time he was engaged principally in tree-planting work in Nebraska, South Dakota and Kansas, although he also had some experience in other regions. From 1903 to 1907 he was in charge of the Nebraska and Kansas national forests, a place of considerable responsibility. In the fall of 1907 he was elected to his present position at Ames, where he has done excellent work, both in teaching forestry and in studying forest conditions in Iowa. Professor Scott meets people well; is used to public speaking and farmers' institute work; has executive ability, and is in every way a strong, clean, capable man."

At the January, 1910, meeting of the board of regents Professor Scott was elected state forester, and he has accepted and will enter upon his duties as soon as he can complete his work at the Iowa Agricultural College, not later than June 1, 1910.

The work at the Stations at Dodge City and Ogallah will be supplemented by extensive work to be conducted at the Fort Hays Branch Station.

The office of the state forester will be at Manhattan, Kan. Every farmer, town, county, school board or corporation interested in tree planting should address the state forester for information.

The following report submitted by Professor Dickens gives the results of his work at the Ogallah and Dodge City Stations under the new law, and sums up his experience of twenty or more years of careful observation and study of the forest conditions in central and western Kansas, and his conclusions on these matters may be accepted as entirely trustworthy.

H. J. WATERS, *President.*

Report of the State Forester.

By ALBERT DICKENS,

Professor of Horticulture and Forestry, and State Forester.

THE forestry work that has been done in central and western Kansas in the past quarter century has resulted in a large number of good tree plantations, many poor ones, some total failures and as might be expected a great variety of opinions concerning the possibility of growing forest trees in the various soils and situations found in the state. Theories, opinions and notions are easily manufactured. Frequently more ardor is exhibited in defending a notion than in securing facts, but the lessons that are valuable for the present and future settlers on the plains of Kansas must be drawn from facts.

Explanations concerning the treelessness of Kansas prairies have been plentiful, varying from the effects of wind and sun to the presence in the soil of substances and organisms which are fatal to tree growth, but any explanation that in any degree explains must give large measure of importance to the effects of fire.

Early settlers remember the story of an old Indian who was the last of his tribe to leave the head-waters of the creeks now known as the Kiowas, how they attempted to discourage winter visits of northern tribes by burning the prairies north of the Arkansas. The deer and buffalo would desert the burned tracts and the roving Indian would find no pasture for his war horse or pack pony. Other years his northern neighbors reached the river with a friendly north wind and then the fire raged to the creeks of the Cimarron watershed. And all the time the fire was the factor that kept the timber growth from encroaching upon the domain of the prairie. In central and western Kansas, the natural timber is restricted to very narrow belts along the streams.

Wherever the banks were sufficiently broken to check the fires, timber grew. Numerous examples of this might be given, taken from many localities. A striking example is furnished by Cedar Bluffs, in southern Trego county. The Smoky Hill river runs along the foot of the bluffs, cutting very close to the rocky ledge at each point of a crescent, the points being



PLATE 1. Red cedar can stand any hardship except fire.

something over a half mile apart. The limestone bluffs rise almost perpendicularly to heights of from fifty to one hundred feet, furnishing in combination with the river a very efficient protection from fire. In this protected spot, high above the stream, the red cedar has for ages declared its ability to withstand any hardship except fire.

In Hodgeman county, Buckner creek furnishes another example. The creek has cut through the deep soil, leaving occasional high banks, and in the creek bed good growths of hackberry, elm, willow and cottonwood are common.

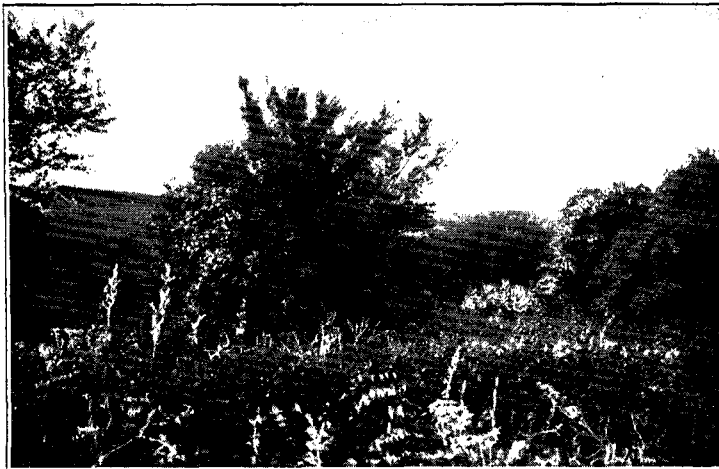


PLATE 2. Timber on Buckner creek, Hodgeman county.

The Arkansas and Cimarron rivers and their Kansas tributaries flow for the greater part of their lengths through alluvial soils. There are few rocky ledges and few high banks, and for the most part the prairie grass grows up to the very edge of the low bank. Wherever banks or broken surface afford protection, trees were found.

The need of the early settler for fuel was imperative. The wood contract was necessary for the existence of the frontier army post, and the few trees that might have produced seed for extending the forest area of Kansas were cut to provide for the soldier and settler. The vicinity of every army post has the same story. Mulberry creek and Crooked creek provided for Fort Dodge; the Pawnee and Walnut creeks for Fort Larned.



PLATE 3. Black walnut on Crooked creek, Meade county.

At Fort Hays, the limits of the old reservation may be easily noted by the trees which were preserved by the government. The wood contracts were filled from the land outside the reservation, and nearly every tree large enough to make fuel was sacrificed to provide for the advance guard of civilization.

A distance of forty-five miles seemed to mark the limit of profitable wood contracts, and on Crooked creek, about that distance southwest of Fort Dodge, some few of the big trees, mostly hackberry and black walnut, are still standing. The few that escaped the ax of the pioneer are those whose form made them hard to work for fuel and difficult to split into posts.

One of the largest of the black walnut trees measures four feet in diameter at five feet from the ground, and is fifty feet high. Like most large trees in western Kansas, it exhibits the type which is best fitted to survive under such conditions, short trunk with a widespreading top which protects the stem and the soil about it from the burning sun of summer. In one locality where the land adjoining Crooked creek has been protected from fire for a quarter century the timber is making considerable headway in its contest with the prairie.

Since the prairie fires have been restricted and the fuel need of the settler supplied by the coal miner and freight car, the area of natural timber has increased at a most gratifying rate. Thirty years ago the Arkansas, west of Hutchinson, and its tributaries from the south, were practically devoid of trees. To-day there are many acres that are under forest conditions and the forest area is increasing. Most of this growth is cottonwood and willow, species that produce large quantities of seed that is blown long distances and germinates very soon after ripening. Species that produce heavier seeds are not so readily distributed, and the time required for their distribution over a given area is very much greater. With Nature's slow methods centuries of the most favorable conditions would probably be required to extend the area of heavy-seeded species, but as the forest area increases the forest inhabitants—birds, squirrels and other animals—increase in numbers, and these agents of distribution help, very slowly but surely, in the introduction of other species. The increase of forest area in the past has been confined for the most part to the alluvial soils of the valleys; soils easily changed from prairie to forest because the soil is easily penetrated by roots and well adapted to nearly any forms of plant life.

Nature extends the forest back from the streams along ravines and broken surfaces, and works from these back into the upland prairie. The struggle for existence between prairie and forest is a bitter one. The species is indeed fit to survive that can compete for existence with the drought-enduring buffalo grass. But in the few localities where the buffalo grass has been deprived of its allies, fire and cattle, the forest is making progress. A few years' growth of buffalo grass accumulates, the rainfall is held for a longer time by the mulch on the soil, the buffalo grass itself grows stronger and roots deeper, but its prosperity augurs defeat, for the bunch grass

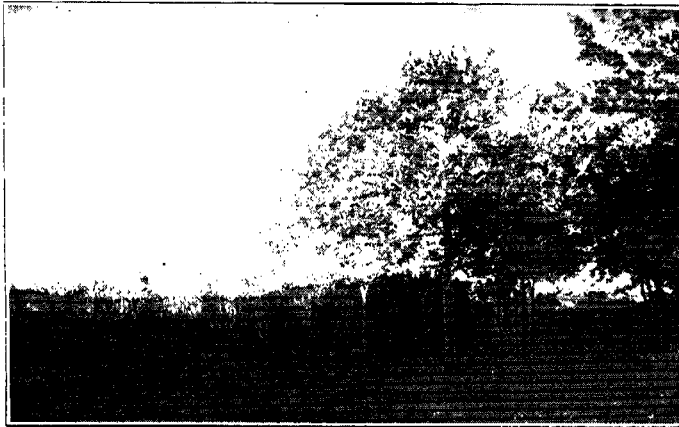


PLATE 4. Following the bunch grass the trees proclaim their title to the soil.

encroaches, then takes possession, and is succeeded by blue stem, the roots ever growing deeper and the soil mulch heavier. Very little rainfall now escapes. The buffalo grass lying close to the ground, packed by hoofs and baked by sun, held little water; but now the drought cannot wilt the blue stem with its roots five feet deep, making a way for the soil water. Then the shade from the trees, which have all the time been gaining in size, favors the horseweed, the buckbush and sumac appear, and these make a nurse crop for the tree seed; and up the slope, following the bunch-grass scouts and the skirmish line of sumac, the forest trees proclaim their title to the soil. The sermon they preach over and over is that even the driest, hardest soils may grow trees if only the soil be prepared for their needs. The difference in the adaptability of soils for trees was not easily appreciated by the early settlers, and the fact that on the uplands many failures resulted from even well planned efforts, has been discouraging. Later investigations concerning soil conditions have added to the knowledge of these soils facts which make it surprising that so many successes resulted from plantings made in soils so poorly adapted to their growth, and also the encouraging fact that most of the Kansas prairie soils improve rapidly with proper cultivation.

Professor TenEyck, of the Kansas State Agricultural College, in securing soil samples from high prairie where the buffalo grass was the only growth found it impossible to drive the soil tube or even a soil augur deeper than two feet into the soil.

Yet such soils after a few years of cultivation and good farming show a measurable quantity of soil water to a depth of four or five feet.

The soil loosened by plowing and cultivation holds the moisture, which penetrates a little deeper; the roots of plants follow and open the way for more water to moisten to a greater depth. The length of time required to insure any given depth of soil moisture varies, of course, with the season and the character and composition of the soil, but in every soil good farming is the great factor in soil improvement.

It is now hard to realize that men seemed to expect the same results on the high buffalo grass lands as on the valley soils. But the optimism of the settler was too often pure enthusiasm with not even a trace of cool judgment. Many times a small hole was dug in the buffalo grass sod, a tree crowded into it, and when it failed to survive such a severe change of conditions the optimist turned pessimist and was sure that Nature had placed the ban upon tree life and that it was "flying in the face of Providence", and "combating Nature's irrevocable laws" to attempt to grow trees under such conditions. Often the tree was killed by supposed kindness. Water was poured into the small area of loosened soil, poured in frequently and abundantly and at great cost of time and labor, and the soil held the water, the tree stood in mud, with none of the life-giving oxygen in the soil about its roots, and it drowned.

A long drive in any of the western counties is certain to afford an opportunity to note how hard a struggle some trees can endure. Occasionally the long line of the prairie is broken by the survivors of a hedge row or line of road trees set in the days of the "first invasion" of the cattle country, in the later eighties. Set in a narrow strip of breaking that marked the line of the "claim," neglected for years, they have been pro-

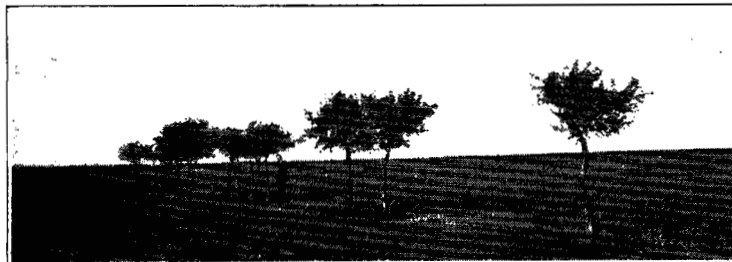


PLATE 5. The story of hard times that are gone.

tected only by the deeply worn ruts of a trail which forms a poor substitute for a fire guard. In hot dry summers they were browsed by cattle, hungry for something besides the brown buffalo grass, and in winter were gnawed by horses high as the starving creatures could reach. Their poor misshapen trunks and bush-like tops tell the story of hard times that are gone. They are sad reminders of the day when optimism ran, riot and theories of agriculture expounded by novices fresh from the office and shop were rife in the land.



PLATE 6. The story of trees planted by the man who tried.

On the opposite page of the prairie, a page made of the same material and exposed to the same sun and wind and storm, is written large the story of the trees planted by the man who tried. The man who used thought rather than theory, and who in the hard years gave the soil opportunity to secure every ounce of moisture that fell, and then worked to help the soil sold it.

There are enough successful plantations throughout the West to furnish lessons for future planters.

A study of the successes and failures resulting from the plantings made in western Kansas forces the conclusion that the factors which determine success or failure are, soil preparation, selection of species and condition of tree when set. The seasonal variation, particularly as regards rainfall, constitutes a factor of uncertainty, but with the three controllable factors all favorable there have been very few seasons when tree plantations have not attained a very fair measure of success.

In 1887 the legislature established two Stations for work in

forestry, one about one and one-half miles west of Ogallah, in Trego county, and the other nearly three miles east of Dodge City, in Ford county. Both of these Stations are located on high prairie land that is representative of the greater part of the western third of Kansas.

The work of these Stations for the most part has been that of growing and distributing forest-tree seedlings to citizens of the state.

It is quite evident that the plantations at these Stations have not always received the best of care, for in some tracts the grass has encroached upon the plantations and only the hardiest species have had sufficient vitality to survive the struggle. Cultivation ceased before the trees were of sufficient size to shade the ground and prevent the wind from blowing the leaves from the site of the plantation.

In one or two cases fire has evidently burned over part of the plantation, destroying many trees and all the soil cover. Considering the hardships endured by these plantations they offer great encouragement to the citizen who wishes to make his home in western Kansas a place where life may mean more than the mere making of money.

The visitor at these Stations usually notes with some surprise the vigor of the evergreens. These were planted so far apart that they have not served to protect each other and so secure the most desirable form.

RED CEDAR.

The red cedar at Ogallah was brought from Cedar Bluffs, about twenty miles southwest of the Station. In their earlier



PLATE 7. Ogallah Forestry Station.

years they evidently became the victims of someone with a mistaken idea of beauty in tree form, and were shortened in to become globes or cones. They have in some degree outgrown the mutilation, but it is not possible to compare their rate of growth with the pines. They are, however, thrifty and vigorous even though the buffalo grass for several years disputed their right to the ground they covered. The cedars at Dodge City have been more fortunate than the ones at Ogallah, in that they have never been mutilated. They compare well with other species in rate of growth and offer an object lesson in the value of this species for western Kansas planting.



PLATE 8. Dodge City Forestry Station.

The red cedar is the only evergreen tree native to Kansas, but it is, or has been, widely distributed over the state. All along the valleys of the Kaw and its tributaries even yet an occasional group of this species may be found. The word "cedar" is part of the name of a number of places in the state: Cedar Bluffs, in Decatur county; Cedar Vale, in Chautauqua county; Cedar Point, in Chase county, are evidence of its wide distribution. On the older maps of the state the short range of limestone bluffs in Trego county bear the name "Cedar Bluffs," and in early days many a canyon in Barber and Comanche counties bore local names denoting the fact that cedar posts were a resource after the buffalo bones had all been collected and hauled to the shipping points on the various railroads. Every citizen in central and western Kansas whose memory reaches back thirty years or more well remembers the trade in cedar posts, which kept the wolf from the door of many a sad shanty, but was disastrous to the forest area of

southern Kansas and northern Oklahoma. Many young trees from these cedar tracts were carried by the cedar "rustlers" to the homesteads in distant counties and frequently were sold in the towns; when sufficient care was taken in packing and planting them, they have in a measure atoned for the depredations that left only stumps in canyons that formerly grew fine trees. Many were hauled a hundred or more miles, piled high upon a load of posts and exposed to wind and sun, and when set could produce only loss and discouragement. But enough have survived to demonstrate in every county that red cedar deserves a place high in the list of trees fitted to endure the most trying conditions.

AUSTRIAN PINE.

The Austrian pines have done bravely and have been particularly successful, making finely formed trees in spite of their constant exposure to the wind. They have made a regular growth and demonstrated their great value for planting in locations where trees are most needed. Occasional specimens have been noted in other localities, and in every case their hardiness and success have been most gratifying. The rate of growth during their early years is slow; it is never rapid, but the growth of an evergreen is always effective. Their work is done most economically. The central trunk grows true and straight, the side branches protecting the trunk from sun and wind.

At both Stations the Austrian pines have attained a height of twenty-two feet and a diameter of four inches at four feet from the ground. An encouraging observation is that which records the rate of growth as increasing as the trees attain greater age.

The same conclusion is drawn from measurements taken of trees on other plantations. Near Offerle, on high prairie soil, where the water is sixty feet below the surface, a little plantation made thirty-five years ago contains twenty-two trees planted fifteen feet apart. These trees now measure thirty feet in height and 8.7 inches in diameter.

A good Austrian pine is a handsome tree. Single specimens or groups make the finest of lawn trees and add much to the appearance of any home.

SCOTCH PINE

The Scotch pine has not been so widely planted in the western part of the state, but where planted compares very favorably with the Austrian in rate of growth and hardiness. The young trees are somewhat more slender in their growth than are the Austrian pines and the trunks of single specimens are liable to be crooked and ill-shaped. But where planted in sufficient numbers to protect each other the Scotch pine is a very valuable tree.

The spruces have been less successful than the pines and red cedars. A few trees at the Dodge City Station have done fairly well, and for lawn planting they deserve further trial. All observations seem to indicate that they are much less desirable for western planting than the pines and cedars.



PLATE 9. Red cedar at Glover Park, Bluff City.

For ornamental purposes evergreens are unsurpassed, offering as they do the same general good appearance throughout the season. The red cedar is not quite so handsome throughout the year, as in dry, cold winters the foliage often assumes a brownish-red tint, which in close view is not so desirable as the pure green of the pines. For park and lawn planting the pines are rated as superior to the cedar for the eastern part of the state. But the hardiness of the red cedar recommends it for the ornamental plantings throughout the central and western part of the state. At Glover park, near Bluff City,

Kan., some very fine results have been obtained with the red cedar. Trees planted in 1888 made a growth in height of practically one foot each year and are handsome, well-grown specimens. It is sometimes necessary in order to secure a symmetrical, well-formed tree to pinch back a branch that is making too rapid growth, but heavy pruning of evergreens should never be allowed. The natural form of the tree is vastly superior, both from a practical, commercial point of view and landscape effect, to any form that may be secured by severe pruning.

These evergreens are the best trees for windbreak purposes, they are at work all the year, and while their growth is not rapid they have demonstrated their hardiness and ability to withstand any hardship except fire, when once they are well established in the soil.

I am well aware that many settlers have had many discouraging failures result from their attempts to grow the various species of evergreens. As a rule high prices were paid for the little trees, and they were set with fond hopes and happy expectations of the improvement the trees would work in the appearance of the home.

In many cases the hopes were short-lived, and the planter saw his trees fade, and when they assumed the brown color of the buffalo grass he remembered the oft-repeated prophecy of the deposed ranchman, "The desert will come back and claim its own," and as he saw the leaves drop and next winter only the bare stem where he had hoped for a beautiful snow picture of green and white, he feared the prophecy was a true one. The great cause of loss in planting has been due to the fact that when the roots of these species become dry the gummy sap hardens in the tissue, or even exudes and forms a coat about the roots, enclosing each in a water-tight compartment. The little tree may hold its color for some time, but no root growth is possible. Unless carefully protected from sun and air every moment of the time it is out of the soil the chance for its success is very small.

Packing in wet moss should always be practiced, and whenever possible the tree should be "balled"—the soil in which the roots have grown taken up with the tiny tree and taken with it to its new location.

The best success in growing evergreens has been secured by

procuring the seedlings, and setting them in nursery rows, the trees being a foot or more apart in the row. The row should be partially shaded until they are well started at least, and in very trying seasons it is well to continue the shade throughout the summer and early fall. The nursery row must be well cultivated and the soil kept in good condition. After a year or two in the nursery row the trees may be moved to the location desired with little danger of loss. The best plan is to take quite a ball of the earth with the tree, and carefully set earth and tree in a hole previously dug.

The best results have followed the setting of young trees moved in winter with the earth frozen about the roots. With trees 18 to 24 inches high a good method is to plow a deep furrow each side of the row and then cut down between the trees with a spade. A mulch of wet straw or hay is applied to prevent the soil becoming dry, and when frozen the chunks of soil may be pried out with a bar and the tree taken to holes dug in the fall before the ground is frozen. Some soil is stored in cellar or barn, or a pile of it covered with hay, to use in filling in about the frozen ball. The Experiment Station has shipped trees thus handled to Fort Hays Branch Experiment Station, and a very high degree of success has always followed the use of this method.

DEMONSTRATION PLANTINGS.

Demonstration plantings were inaugurated at both of the Forestry Stations. The most extensive ones were made from 1889 to 1892. These were set in rows eight feet apart and cultivated for some years. Observations made in 1909 as to the success and growth of the species planted note that for a good many years no cultivation has been given plantations at Ogallah. At Dodge the same condition prevailed for some years prior to 1908, when the sod was broken up and has since been worked into very fair condition in preparation for some extensive work in underplanting.

It is apparent that cultivation was discontinued before the trees were sufficiently large or numerous to shade the soil, and the grass has made quite a thick sod. In one or two places fire has evidently done some damage, but in spite of all the hardships and neglect some of the species have made a very fair

growth and are now more than holding their own against the odds which have been so long against them.

GREEN ASH.

The green ash has fought a good fight at Ogallah in a block planted in 1892. The rows are remarkably even, and show nearly ninety per cent of the original number. Their heights vary but little except on the south edge, where the friendly south wind has piled soil and Russian thistles about them, and these trees are about four feet higher than the ones not so favored. The entire plantation averages slightly more than



PLATE 10. Green ash at Ogallah Station.

eleven feet high, and four inches in diameter at three feet. The best trees are sixteen feet in height and six inches in diameter. At Dodge City the ash are especially good, a number being over twenty feet high and five inches in diameter, the best reaching twenty-six feet and a diameter of seven inches. They are well formed and in every way desirable trees. The value of the ash as a shade and ornamental tree has been noted in many localities. Particularly effective use has been made of this species in the Glover park, at Bluff City, named in honor of Jas. Glover, who planned, planted and cared for it during its entire history. The trees on Ash avenue, planted in 1888, have attained a height of thirty feet, and are as uniform in shape, size and beauty as could be desired.



PLATE 11. Ash avenue, Glover Park.

BLACK LOCUST.

At Ogallah the black locust has fared badly. Borers evidently destroyed the original trees and fire has burned many of the sprouts, the best one now being a double trunk grown from two sprouts, each trunk being twelve feet high, and three inches in diameter at three feet. For many years the borer, known to entomologists as *Cyllene robiniae*, has ravaged this species to such an extent as to make it seem unwise to recom-

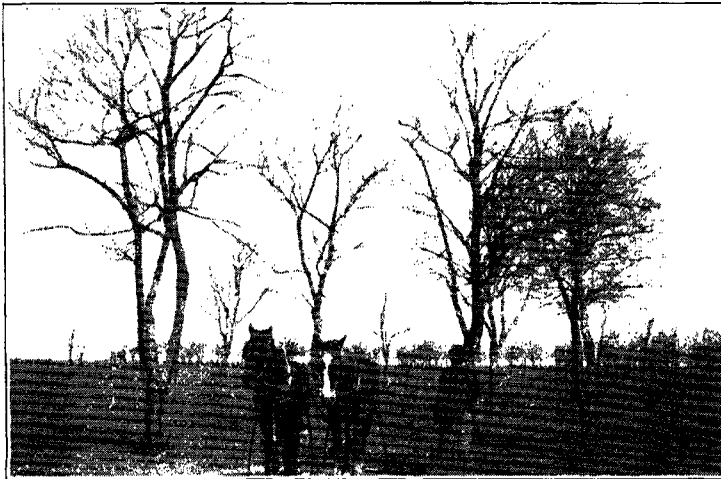


PLATE 12. Black locust at Dodge City Station.

mend black locust for planting. Most plantations made in Kansas have shared the fate of the one at Ogallah, and this otherwise valuable species has been on the list of undesirable trees. It is a pleasant task to note at Dodge City the first encouragement for the owners of black locust plantings, and going from Dodge City west and south we have seen a number of plantings that confirm the opinion that black locust trees are likely to prove of ultimate profit to the planter. At Dodge City are a number of good trees, many still showing the effect of the borer's ravages, which have for a number of years been rapidly recovering from the injury, and are now strong, sturdy trees. A number of these trees at Dodge City are nearly thirty feet high and a foot in diameter at three feet from the ground.

In the city park at Anthony are a number of specially good black locust trees. They have evidently outgrown any injury



PLATE 13. Black locust, Anthony city park.

by borers and demonstrate the possibility of this species when well grown and free from insect injury. Some of these trees are fifty feet high, eighteen inches in diameter two feet from the ground.

Not many of the plantings made in accordance with the provisions of the timber culture or "tree-claim" act have added to the forest area of Kansas, but a few have been visited which by their success and the possible weight of their influence upon future plantings have certainly achieved what the authors of the bill hoped the law could accomplish.



PLATE 14. Black locust, McCauley timber claim.

The McCauley timber claim, about forty miles southwest of Dodge City, is one of these. The first plantings were made of cottonwood cuttings and box elder seedlings and were not successful. Black locust seed was planted in nursery rows, and the trees thus grown were used to replace the cottonwood and box elder. They made good growth for a few years, but were afterwards badly injured by the borers. Ten years ago the owners decided to cut it to the ground and found the posts and poles considerably worm-eaten, but they were so much in demand that the ten acres netted them nearly one hundred dollars per acre. The value of the fuel secured was considered equal to the cost of cutting. The brush was burned to check as far as possible the increase of the borers.

After ten years growth this plantation is in a most promis-

ing condition. The owner estimates the posts and poles as much superior to the cutting made ten years ago and the condition of the trees is all that could be desired. Many of them have a height of twenty-five feet and a diameter of three and a half inches.

A mile east of the McCauley timber claim is a plantation made in 1882 and still owned by Mr. Benj. Haywood. The ten acres consists for the most part of cottonwood and black locust. The soil is specially favorable for tree growth, being a rich sandy loam, and the trees have made a very creditable growth. A number of the cottonwoods are eighteen inches in diameter at four feet from the ground, and twelve inches in diameter at the height of twenty-five feet. Many are seventy feet high.

The black locusts have evidently outgrown the injury in-



PLATE 15. Haywood timber claim.

flicted by insects during their early years, and the grove contains many fine trees of this species. A number measure over forty feet in height. Many would yield good poles twenty-four feet long, and a few good thirty-foot poles might be cut. Many average six inches in diameter and the best are eight inches through at four feet from the ground.

HONEY LOCUST.

Of all the species tested in many parts of western Kansas, the honey locust is the most conspicuous success.

Its rate of growth is only moderate, but the rate is main-

tained for many years. A large proportion of the trees planted have good form, and they are strong in stem and branch, not often injured by wind or ice storms.

At the Ogallah Station a considerable number of honey locusts have been planted in the older groves and along the woods, and where given good care the records are very satisfactory. Many of these trees have reached a height of twenty feet and a diameter of five inches in fifteen years.

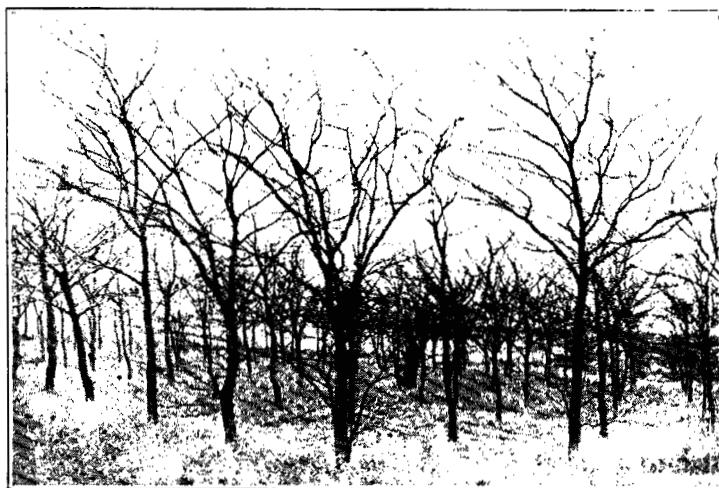


PLATE 16. Honey locust at Ogallah Station.

In a demonstration block planted eighteen years ago and neglected for so long a time that the buffalo sod had gained a secure foothold the honey locust has made a very creditable growth. The best trees have reached a height of twenty-three feet and a diameter of six inches. At Dodge City the honey locust trees have done very well indeed. Some few trees have been the victims of some over-zealous pruner. Robbed of the foliage that nature had provided to protect the trunks, the hot sun has scalded the bark on the south and west sides of the tree. After the bark has been scalded borers find conditions favorable for their development and a few trees of this species, usually fairly free from such injury, have been killed by the combination of too heavy pruning, sun-scald and borers. The greater number of the honey locust trees at Dodge City have made very satisfactory growth. The best trees are thirty-five



PLATE 17. Honey locust at Dodge City.

feet high, and twelve inches in diameter. They are handsome, graceful trees, good specimens of this very desirable species.

OSAGE ORANGE.

The Osage orange is equally as hardy and resistant to all forms of tree troubles as the honey locust. It is not as rapid in growth, nor so certain to make trees of good form, but its value for posts, poles and fuel is widely appreciated. In spite of its faults it is well toward the top of the list of trees for localities where conditions are somewhat unfavorable for trees. The thorns and the habit of sprouting are its faults, and, while serious ones, they are readily overlooked by the planter who must first of all ask the question, "Will it live?" At Ogallah the Osage orange has lived up to its reputation. In the demonstration block, in spite of sod and at least one fire, over 120 of the original trees or strong sprouts from them are still vigorous. Fifty of these average over ten feet high and two and a half inches at three feet from the ground. The best are



PLATE 18. Osage orange at Ogallah Station.

fourteen feet high and three and a half inches in diameter. At Dodge City the Osage orange trees have been more fortunate. Located near a field that has evidently produced some corn husks, and more Russian thistles, the rows have been well mulched and the soil has blown into the mulch until the trees now stand in a ridge or bank from two to four feet high. A number of these trees are nineteen feet above the bank and four inches in diameter. They are valuable for many purposes, but too handsome and useful as trees to be sacrificed for any purpose, however important.

Occasional specimens have been noted in many trying localities that attest the hardiness and resistance of this species. The trail between Johnson City and Richfield passes an old hedgerow that, after being deserted for many years and browsed by live stock in severe winters, has a number of trees which show a very creditable growth. On the site of Fort Hays are a few Osage orange trees that were evidently conveniently located to serve as hitching posts. They are scarred and deformed, but after years of neglect they have repaid a little care by making a very fair growth.

At Garfield a row of Osage orange planted thirty years ago along the Santa Fe railroad presents a most valuable object lesson in the possibilities of this species as a windbreak and in the production of posts. A considerable number of posts have been cut in former years, and at present 1000 posts, many of

them twelve inches in diameter, could be cut from 500 yards of this hedge. The value of such a windbreak, twenty-five feet high, is not easily computed if it surrounds a garden or fruit plantation.

BLACK WALNUT.

At Ogallah the black walnut shows the greatest variation in growth and success of any species. In the demonstration block, on the north side of the farm, the trees have been a total failure. Unable to endure the neglect, the encroachment of the buffalo grass and a fire, but five poor little trees are yet alive; the largest of these is only six feet high and one and a half inches in diameter. On the east line of the place, near the southeast corner, stand a few walnut trees where the nuts were planted twenty-five years ago by Mr. C. C. Yetter, the owner of the adjoining farm. They have benefited by the accidental mulch blown about them and by the soil which has drifted into the mulch from the adjoining fields.

These trees show in marked degree the form best suited for their survival — widespreading tops, which shade the trunk and the soil about it. The measurements of these twenty-one trees show quite strikingly the adaptability of trees to the conditions in which they grow. The spread of the tops is very much greater in proportion to their height than in trees of the same species under similar conditions in eastern Kansas. Where three or more trees are sufficiently close to protect the middle one, the middle tree runs up higher and puts less of its growth into protecting branches, but for the greater number, standing quite a distance apart, it has been a case of "each for himself." Of a number of black walnut trees observed in eastern Kansas, the proportion of height to spread of branches in trees which stand alone is about two in height to one in spread. These trees at Ogallah are very nearly equal. Some have a spread of branches considerably greater than their height. One tree of this row, ten inches in diameter at three feet from the ground, is but sixteen feet high, but has a spread of twenty-two feet. The best tree in the row has a diameter of fifteen inches, is thirty and one-half feet high, with a spread of twenty-four feet. The averages of the twenty-one trees in this row are: Diameter, nine and three-tenths inches; height, twenty and one-tenth feet; spread, nineteen and two-tenths feet. These figures may not mean much to persons who are

accustomed to think of black walnut trees as forest giants, but anyone who has had experience in growing trees on high plains feels inclined to salute these squatty specimens as "squatter sovereigns"; and when one sees them bear a few bushels each of nuts and sees the satisfaction that the children of the short grass derive from a nutting party, and how a part of the nuts are saved for seed, he appreciates how great a power for good a few well-grown trees may be. For they are well grown—so well for their locality that they may well serve many coming generations of Kansans as models, and point the importance of taking the pains to plant the seed and care for the tree in the location in which it is to stand with its blessing and benediction for future generations. A few miles from the Dodge City Station a plantation of walnut trees standing where the nuts were planted has been making very satisfactory growth. The location is a favorable one, the slope of a ravine or draw that is rather steep for general farming, such a place as occurs on hundreds of farms all over the state, and which would be much more valuable and productive of much more good if planted to trees than in foders or grains. This plantation has not been thinned, and considerable resemblance to forest condition has been reached in a surprisingly short time. The trees are in rows six feet apart and stand quite thickly in the row, shading the ground and preventing in great measure the growth of grass and weeds. In eight years these trees have



PLATE 19. Walnuts near Dodge City.

reached an average diameter of two inches at the ground and an average height of twelve feet. Some careful thinning would make this a very handsome grove in a few years' time.

The value of this planting of the seeds where the trees are to stand has been noted in Bulletin 120 of the Kansas Experiment Station, and for the more trying conditions of western Kansas it is especially recommended. All the nut trees form very strong tap roots. In the forest tree nursery work of the Kansas Experiment Station seedlings of hickory have been noted as making during the first season's growth a height of six inches, while the root reached a depth of thirty-six inches. With such habits of growth it is small wonder that the transplanting of these trees when they have attained a height of four or five feet usually results in failure and disappointment. Unless the tap root is cut and the formation of lateral roots induced while the tree is very young, it is useless to attempt to transplant a nut tree by ordinary methods.

A few miles north of Plainville, in Rooks county, is a planting of bur oak which is making an admirable fight against the encroachment of the prairie. Their vigor is doubtless due to the fact that their tap roots have reached deep down into the soil and are able to supply the tops with sufficient moisture to endure any degree of drought.

HACKBERRY.

The hackberry has not been very extensively planted, but the few trees at Ogallah sustain the reputation of the species for hardiness and vigor. These trees show a wide variation in form, some showing the symmetry and vigor of the eastern form, while others have the dwarfed appearance often noted in the hackberry trees in canyons of southwestern Kansas and northwestern Oklahoma. The eastern form seems not less successful than the western, the best trees measuring sixteen feet high and four inches in diameter, while the best of the western form are but twelve feet high and three and a half inches in diameter. The success of this species has been so general that it is quite certain that its planting will prove satisfactory and profitable.

ELM.

The white or American elm is generally hardy and its success has been very general. Its rate of growth is not rapid, but regular, and the adaptability of the species to conditions is

not excelled by any tree yet tested. The widespreading low-topped form is most common, and the grower who attempts to prune western Kansas elms into an imitation of the Connecticut elms is certain to find that even this hardy species may be ruined by sun scald and insects.



PLATE 20. White elm at Ogallah Station.

The elms in the demonstration block at Ogallah have been somewhat favored in their location, having been set in a slight depression in the high prairie. This slight difference shows with remarkable distinctness, the trees in the waterway being much larger and better than the trees upon the slope, the gradation being readily noticed. Twelve trees are above twenty feet in height and five inches in diameter, the best being twenty-five feet high and six inches in diameter. Occasional specimens have been noted in many parts of the state, and in every case where the trees have had even fair care a high degree of success has been attained. At Offerle, on high prairie soil, white elms have attained a diameter of eighteen inches, a spread of forty feet and a height of thirty feet. For shade and street trees the white elm is especially desirable.

COFFEE BEAN.

The coffee bean has proved able to adapt itself to a wide variety of soils and conditions. In eastern Kansas it is usually found near streams, but occasionally climbs to the higher parts of ravines and sometimes to the high upland. It has not been generally planted, but has succeeded in nearly every case where



PLATE 21. Coffee bean at Dodge City Station.

tested. At Ogallah the best trees are nine feet high with a diameter of three inches, and the trees show a vigor that is most encouraging. At Dodge City a greater number have been planted. The best are eighteen feet high and four inches in diameter. In a number of localities in the Arkansas valley its growth has been very satisfactory indeed, and it adds pleasing variety to lawn and park plantings.

RUSSIAN MULBERRY.

The success of the Russian mulberry has been quite varied, so much so that it is difficult to draw conclusions as to the wisdom of including it in a list for general planting. In northern Kansas it has been injured very frequently in severe winters. Young trees making vigorous growth have been killed back to the ground in many instances, and upon older trees the young wood is sometimes killed. The trees nearly always make a good recovery, but unless carefully trimmed they present an unkempt appearance, which is unpardonable in a lawn or street tree. At Ogallah the mulberry is very poor. A few have reached post size, but its behavior there will not warrant its being recommended for northern Kansas.

At Dodge City the mulberry has succeeded much better. Even the best trees branch near the ground and are thick-topped and shrubby owing to their having been winter injured, but in spite of this their growth has been such as to make them of considerable value for posts and poles. The best

trees at Dodge City Station branch near the ground. Some of the best measure twenty-four feet high, and several individual trees would each produce a half dozen good posts and as many more stakes.

In the southern counties of the state Russian mulberry seems much less liable to winter injury. At Ashland, in Clark county, the courthouse square furnishes a very good illustration of the possibilities of this species for posts and poles. A row 400 feet long, now eighteen years old, would cut nearly 200 posts and as many fair stakes.



PLATE 22. Russian mulberry at Ashland.

The fruit is not of high quality, but is often used when other fruits are scarce, and as it ripens with the cherries and raspberries it seems to attract many birds from the more valuable fruits, and it is frequently planted in the windbreaks about fruit plantations with this end in view. The need of some careful selection and breeding of this species is clearly indicated. The species is quite readily grown from cuttings and the better individuals may be propagated and the uncertainty which attends the planting of seedlings be avoided.

The desirability of the mulberry as a street and lawn tree is lessened by the fact that the fruit attracts flies and birds, and causes the sidewalks beneath them to be in a very unclean con-

dition, and as the fruiting season lasts a month or more the nuisance is a serious one.

The fact that the Russian mulberry is generally dioeciously flowered makes it possible to avoid the fruit nuisance when this species is desired as a shade tree. By using cuttings from staminate flowered trees of desirable form and vigor a considerable degree of uniformity may be secured. At the fair grounds at Anthony, Kan., may be found a very fine illustration of the desirability of the "male mulberry" for shade and ornament. The trees are sufficiently uniform to make the appearance of the rows very pleasing and the rate of growth has been especially good, trees set four years ago having attained a height of fourteen feet and a diameter of four inches.



PLATE 23. Male mulberry at fair grounds, Anthony.

While most of the Russian mulberry trees are more or less irregular in form and many are decidedly crooked and ill-shaped, an occasional tree is sufficiently symmetrical and handsome to suggest the possibility of securing a uniform type by propagating from them by means of cuttings. One of the most handsome trees seen in southwestern Kansas is a mulberry tree, perfect in form and symmetry, on the farm of Jas. Lewis, about midway between Bluff City and Anthony.

One mulberry tree at Glover park, Bluff City, planted in 1888, has obtained the height of forty feet, a spread of forty-two feet, with a diameter of twenty inches two feet from the



PLATE 24. Mulberry tree in Harper county.

ground, from there into five branches which aggregate three feet in diameter.

THE AILANTHUS.

The ailanthus, sometimes called "Tree of Heaven," is not of much value for any purpose, but its success is encouraging to tree lovers. At Ogallah the trees have evidently been killed back frequently and are poor specimens, but at Dodge City a number have made very fair growth and are now fairly good trees, twenty feet high and eight inches in diameter at three feet. The tropical appearance of the young trees when making a vigorous growth is quite effective and they have some value for park planting. The heavy masses of seed give the trees a striking appearance in summer, particularly when in ripening they assume a pink tinge unlike that of any other tree growth. The staminate blossoms, however, emit a strong odor which many persons find very disagreeable, and the pollen, produced in large quantities, is objectionable.



PLATE 25. Ailanthus at Dodge City.

RUSSIAN OLIVE.

The Russian olive while not a large tree is desirable on account of its hardiness and adaptability to trying conditions. The best one at Ogallah is twelve feet high, branches low, and with its soft, silver-gray foliage makes a very attractive tree picture. For lawn planting it is a very desirable addition to the list of hardy species, and when planted in groups near Osage, ash or other species with dark green leaves makes a very striking contrast.

COTTONWOOD.

The cottonwood and other species of the poplar group have not been particularly successful when planted upon the heavy soil of high prairies. At Ogallah and at Dodge City the poplar group is represented by a few dying trunks from which a few sprouts are growing.

At the Hays Station the young cottonwoods have made a very strong growth during the few years since planting, and furnish protection for species that succeed best in partial shade. Along the creek bank and in ravines where the soil is always moist the cottonwood is very valuable, producing in some cases very good sawlogs in twenty-five years. In sandy soils the cottonwood succeeds very well, and all along the valley of the Arkansas and its tributaries the cottonwood is making forests more rapidly than any other species. At Dodge

City, Garden City, and in fact wherever these trees have been planted in the valley, very good results have been recorded.

The trees in the Dodge City park were planted about twenty years ago. They now stand thirty feet apart and have reached a height of seventy to seventy-five feet with an average diameter of eighteen inches at four feet from the ground. Most of them branch low, but they make a very good form for groves for public gatherings.

Another planting noted about six miles southwest of Garfield, Pawnee county, about thirty years old, is a most excellent windbreak. The trees are planted in a double row, and in one stretch 225 feet long 77 trees have attained a height of seventy-five feet and a diameter of twelve inches at four feet, and would make very fair logs.

The ease with which the cottonwood grows from cuttings marked it as the poor man's tree and it was very widely planted by the early settlers. When located near a well or a watering place it always made the most of an occasional watering and produced trees of considerable size in a short time. A few settlers who systematically watered a row of these trees have been rewarded by a rapid growth that in a few years produces fine trees.

Wherever the soil is moist and somewhat sandy the cottonwood will make very fair returns, at present prices of lumber. Barrels for apples and sweet potatoes, crates for fruit and vegetables are needed in ever increasing numbers, and cottonwood lumber must be depended upon to supply a large part of this demand.

For park plantings the cottonwood should be grown from cuttings in order that the cotton nuisance may be avoided, and as it is the only species that can produce a large tree in a quarter century its value as an ornamental species is not easily overestimated. The cottonwood has been the pioneer tree; even on upland its growth has made the success of longer lived species possible, and on valley soils it has produced shade, fuel and sawlogs in less time than any other species in any locality where freezing weather occurs. It is worthy the regard of every tree lover and deserves a place in song and story not less honorable than the oak.

OTHER SPECIES.

The LINDEN, or *Basswood*, is represented at the Ogallah Station by a single stunted specimen. At Kinsley, Edwards county, six very fine specimens were noted which have made a height of thirty-five feet in twenty-five years. They are evidently very much at home and show every indication of being well adapted to their location.

The RED (or *Slippery*) ELM is not often found, but when set it has proved the equal of the white elm in hardiness and vigor. Its greater value should prompt tree growers to use this species more widely for western planting.

A single SYCAMORE at Ogallah has made but poor growth, but it is rather surprising that it has survived so long on high, dry land with but little care. Many fine sycamore trees have been observed in towns in the Arkansas valley, particularly at Great Bend and Hutchinson, and it is believed that this handsome tree is worthy of more extended trial. Several other less important species have been observed to be attaining fair success, among them are redbud, *Sophora*, persimmon, ironwood and China berry.

BOX ELDER and SOFT MAPLE make a rapid growth and on moist, rich soils often make fine trees. The wood becomes brittle as the trees age and injury from the wind is very common. On high dry soils they have been short-lived, and are not recommended for upland planting.

CATALPA.

No tree has been the subject of so much discussion as the catalpa. Any mention of this genus should first distinctly set forth the fact that there are several species which, while quite similar in general characters, differ widely in adaptability to conditions and more in rate of growth and value.

The species of value is native in southern Indiana and Illinois, and is capable of enduring severe winter weather without injury; it also excels in rate of growth, form of tree and value for use any other species of the genus *Catalpa*.

The southern catalpa, now known to the botanist as *Catalpa catalpa*, formerly as *Catalpa bignonioides*, and the Japanese species *Catalpa kœmpferi*, seem to hybridize readily with the hardy catalpa, and the hybrids vary in size, form and value.

In the early years of catalpa enthusiasm these facts were not widely known and many plantings have been the cause of untold disappointment as well as great financial loss. Many of these trees have been seriously injured in severe winters and later made but slow, uneven growth. Others have been hardy but made only low shrubby growth. Moreover, the hardy catalpa when planted on dry or poor soil has not made a very successful growth, so that the general information concerning the catalpa is not very definite.

On good soils the hardy catalpa has been a very profitable and very satisfactory tree, producing a crop of posts and poles in from seven to ten years, and then renewing itself from the sprouts or coppice growth, sometimes producing a second crop in less time than that required for the first crop.

The catalpa trees planted at Ogallah and Dodge City were evidently the inferior species, and the soil and location being unfavorable for the catalpa the trees at these Stations are practically valueless.

So general is the interest in the catalpa and so urgent the need of general information that the following extracts from Bulletin No. 108 of the Kansas Experiment Station are reprinted here.

The genus *Catalpa* belongs to the family of the BIGNONIACEÆ. Of the six species, two, *C. catalpa* Karst. and *C. speciosa* Ward., are native to North America. Following are the botanical descriptions of the American species :

Catalpa catalpa (Linn.) Karsten.

Bignonia catalpa Linnæus, Spec. Pl., ed. 1, 11,622 (1753).

Catalpa bignonioides Walter, Flora Caroliniana, 64 (1788).

Catalpa cordifolia Moench, Meth. 464 (1794).

Catalpa ternifolia Cavanilles, Desc. Pl. 26 (1802).

Catalpa syringæfolia Sims, in Bot. Mag. XXVII, t. 1094 (1808).

Catalpa communis Du Mont de Courset, Bot. Cult., ed. 2, III, 242 (1811).

Catalpa catalpa Karsten, Deutsch Fl. 927 (1882).

“Flowers in many-flowered, crowded panicles; corolla thickly spotted on the inner surface. Fruit slender. Leaves slightly acuminate.

“A tree, rarely sixty feet in height, with a short trunk, sometimes three or four feet in diameter, and stout, elongated brittle branches, which form a broad head and dichotomous branchlets. The bark of the trunk varies from a quarter to a third of an inch in thickness, and is light brown tinged with red on the surface, which separates in large, thin, irregular scales. The branchlets, when they first appear, are green shaded with



PLATE 26. *Catalpa catalpa* Karst., Manhattan, Kan., showing characteristic scaly bark.

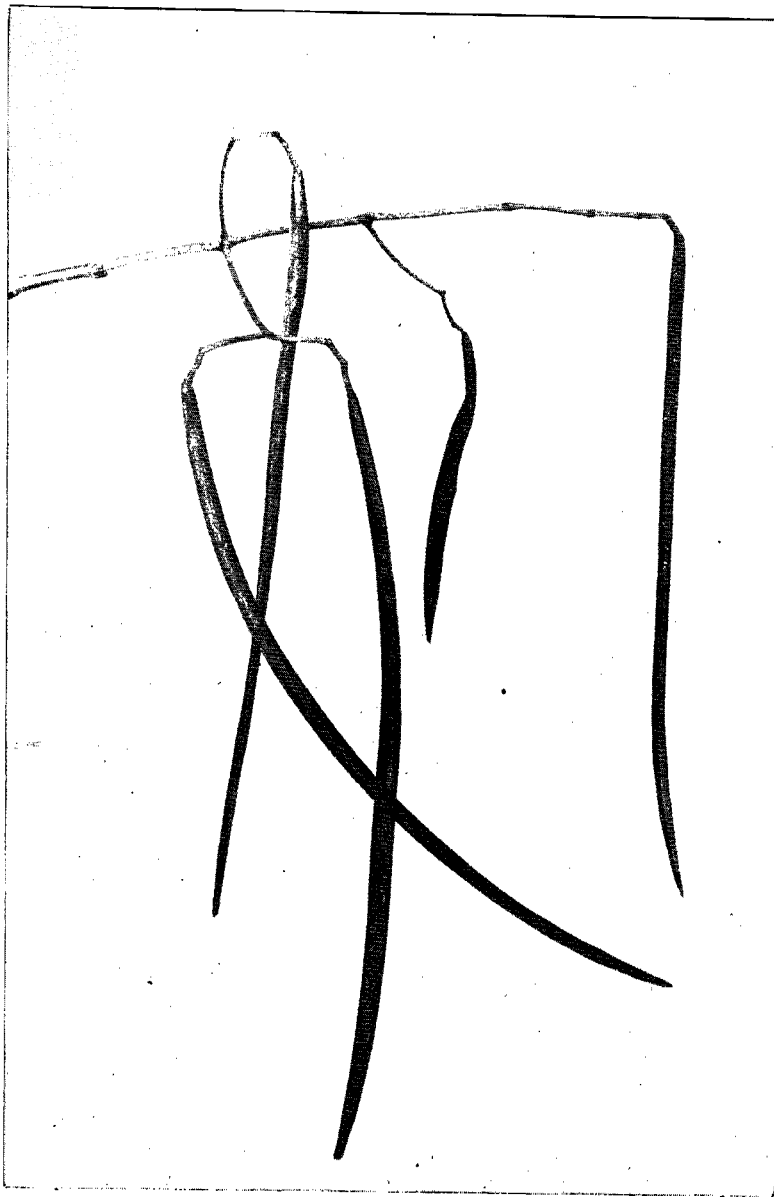


PLATE 27. *Catalpa catalpa* Karst. (*C. bignonioides* Walt.) Fruiting branch, one-third natural size.

purple, and slightly puberulous. During their first winter they are thickened at the nodes, lustrous light orange color or gray-brown covered with a slight glaucous bloom, and marked with large, pale, scattered lenticels, the outer layer of the thin bark separating easily from the bright green inner layer. The leaf-scars, in which appear a circle of conspicuous fibro-vascular bundle scars, are large, oval, and elevated, and do not entirely disappear until the third or fourth year, when the branches are reddish brown, and marked with a network of thin, flat, brown ridges. The branch continues to grow throughout the summer, the end dying in the autumn, without forming a terminal bud, and appearing during the winter as a black scar by the side of the upper axillary bud. The axillary buds are minute, globose, and deeply immersed in the bark, with several pairs of chestnut-brown, broadly ovate, rounded, slightly puberulous and loosely imbricated scales; those of the inner ranks are accrescent, and when fully grown are bright green, pubescent, and sometimes two inches in length. The leaves are opposite and in threes, broadly ovate, rather abruptly contracted into slender points, or sometimes rounded at the apex, cordate at the base, and entire or often laterally lobed. When they unfold they are coated on the lower surface with a pale tomentum, and are pilose on the upper surface; and at maturity they are thin and firm, light green and glabrous above, pale and pubescent below, five or six inches long and four or five inches broad, with stout, terete petioles five or six inches in length, prominent midribs and primary veins arcuate near the margins, connected by reticulate veinlets, and furnished in their axils with clusters of dark glands. They smell disagreeably when bruised, and turn black and fall to the ground after the first frost of the autumn. The flowers, which appear from May in the South to July in New England, are produced in compact, many-flowered panicles eight or ten inches long or broad, with light green branches tinged with purple, and are borne in slender pubescent pedicels half an inch in length. The calyx is half an inch in length, and green or light purple. The corolla is white, with a broad, campanulate, flat tube, and spreading limb, which, when it is expanded, is an inch and a half wide and nearly two inches long; it is marked on the inner surface on the lower side with two rows of yellow blotches following the parallel lateral ridges or folds, and in the throat and on the lower lobes of the limb with crowded conspicuous purple spots. The stamens and the style are slightly exerted. The fruit, which ripens in the autumn, hangs in thick-branched, orange-colored panicles, and remains on the trees without opening during the winter; it is six to twenty inches long, a quarter to a third of an inch thick in the middle, with a thin wall, which is bright chestnut-brown on the outside and light olive-brown and lustrous on the inside, and in the spring splits into two flat valves before finally falling; the partition is thin and light brown. The seed is about an inch long, a quarter of an inch wide, silvery gray, with pointed wings, terminating in long, pencil-shaped tufts of white hairs.

"*Catalpa catalpa* is usually supposed to be indigenous on the banks of the rivers of southwestern Georgia, western Florida, and central Alabama and Mississippi. The hardiness of this tree, however, in severe climates like that of New England, would indicate an origin in some colder and more elevated region, and it is possible that the catalpa trees which now

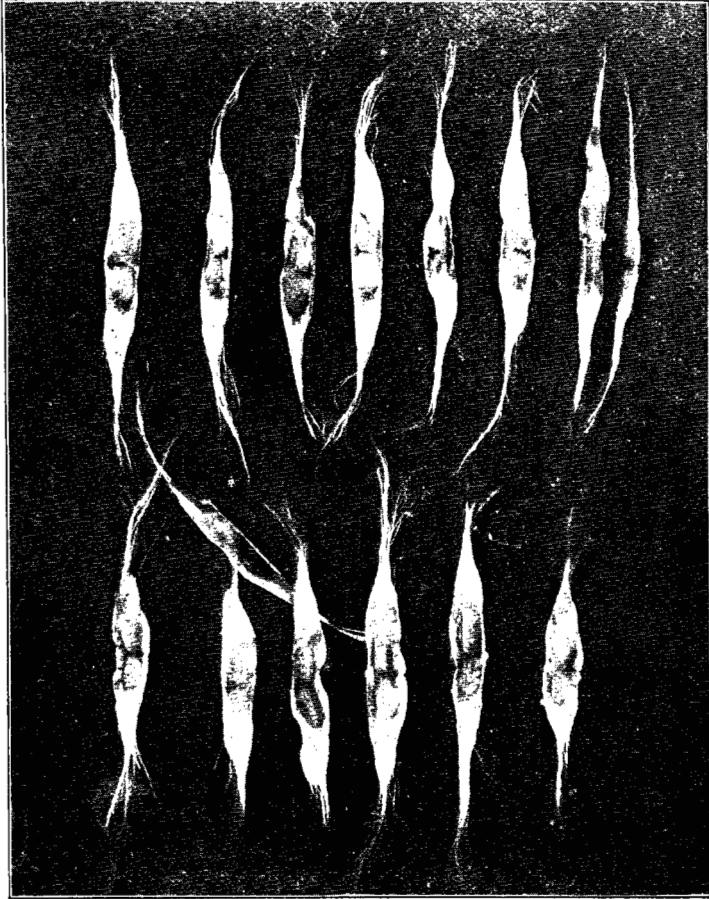


PLATE 23. *Catalpa catalpa* Karst. (*C. bignonioides* Walt.) Seeds, natural size.

appear to be growing naturally in the Southern states are the offspring of trees carried there by man.

"The wood of *Catalpa catalpa* is soft, not strong, coarse-grained, and very durable in contact with the soil, with numerous obscure medullary rays and rows of large open ducts clearly marking the layers of annual growth; it is light brown, with lighter colored, often nearly white sapwood, composed of one or two layers of annual growth. The specific gravity of the absolutely dry wood is 0.4474, a cubic foot weighing 27.88 pounds. It is used, and highly valued, for fence-posts, rails and other purposes where durable wood is needed.

"The bark, which contains tannin and an amorphous bitter principle, has been occasionally used, as well as the seeds, in decoctions for the treatment of bronchitis, and in homeopathic practice." ("The Silva of North America," Charles Sprague Sargent, vol. VI, p. 86.)



PLATE 29. *Catalpa speciosa* Ward, Manhattan, Kan., showing characteristic deeply furrowed bark, not peeling off in scales, as in plate 26.

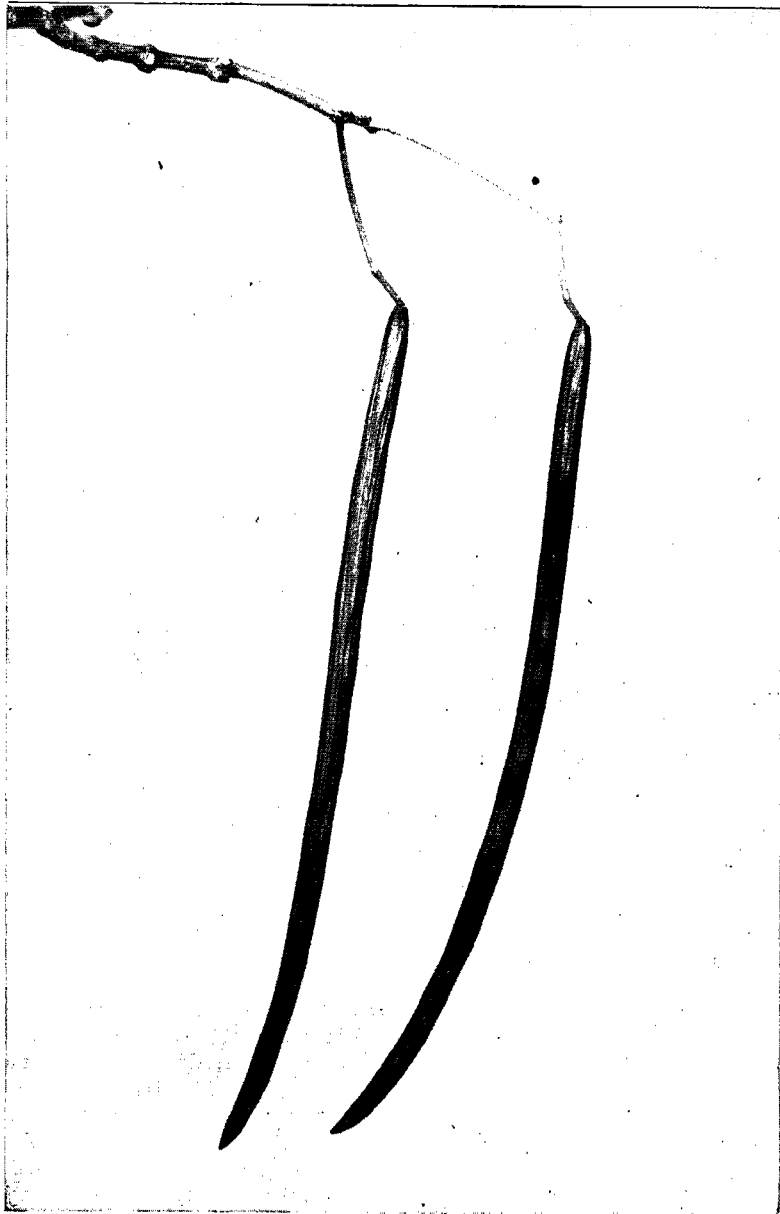


PLATE 30. *Catalpa speciosa* Ward. Fruiting branch, one-third natural size.

Catalpa speciosa Warder.

Catalpa cordifolia Jaume, in Nouveau Duhamel, II, t. 5 (1802), not Moench (1794).

Catalpa bignonioides Lesquereux, in Owen's 2d Rep. Arkan. 375 (1860), not Walter (1788).

Catalpa speciosa (Warder, in Hort.) Engelm., in Bot. Gaz., vol V, 1 (1880).

"Flowers in few-flowered, open panicles; corolla inconspicuously spotted. Fruit stout. Leaves caudate acuminate.

"A tree in the forest occasionally 120 feet in height, with a tall, straight trunk, rarely four and a half feet in diameter, and a narrow, round-tipped crown of slender branches; usually smaller, although often a hundred feet high, and when grown in open situations rarely more than fifty feet in height, with a short trunk and a broad head of spreading branches. The bark of the trunk is three-quarters of an inch or sometimes nearly an inch thick, brown tinged with red, and broken on the surface with thick scales. The branchlets are stout, and when they first appear are light green, often tinged with purple, and covered with scattered pale hairs; during the first winter they are light orange color or reddish brown, covered with a slight bloom, and marked with many pale, conspicuous lenticels, and with the elevated oval leaf-scars, which are a quarter of an inch long and display a circular row of large fibro-vascular bundle scars; in their second and third years the branches grow darker and the leaf-scars and lenticels nearly disappear. The end of the branch dies in the autumn without forming a terminal bud, and during the winter appears as an elevated circular scar close to the upper axillary bud. The buds are minute, globose, partly immersed in the bark, and covered with loosely imbricated chestnut-brown ovate scales, keeled on the back and slightly apiculate at the apex; those of the inner ranks are accrescent and at maturity are foliaceous, obovate, acute, gradually narrowed below a sessile base, many nerved, with dark veins pubescent on the lower surface, and sometimes nearly two and a half inches long and three-quarters of an inch broad. The leaves are opposite or in threes, oval, long-pointed, cordate at the base, and usually entire or furnished with one or two lateral teeth; when they unfold they are pilose on the upper surface and covered on the lower and on the petioles with pale or rufous tomentum, which soon disappears, and at maturity they are thick and firm, dark green above and pale and covered with soft pubescence below, especially along the stout midribs, and the principal veins marked in their axils with large clusters of dark glands. They are ten or twelve inches long, seven or eight inches broad, and are borne on stout terete petioles four to six inches in length. They turn black and fall after the first severe frost of the autumn. The flowers, which appear late in May or early in June, are borne on slender purple pedicels, furnished near the middle with one or three branchlets, and are produced in open, few-flowered panicles five or six inches long and broad, with green or purple branches marked with orange-colored lenticels, the lowest being often developed from the axils of small leaves. The calyx is purple and divided at the base into two ovate pointed apiculate divisions. The corolla is white, with a broad conical oblique tube nearly



PLATE 31. *Catalpa speciosa* Ward. Seeds, natural size.

an inch long, often marked externally with purple spots near the base, and internally on the lower side with two bands of yellow blotches which follow two parallel lateral ridges, and with occasional purple spots spreading over the lobes of the lower lips of the limb, which, when the flower is fully opened, has a vertical diameter of nearly two inches and a horizontal diameter of two and a half inches. The filaments, which are marked near the base with a few oblong purple spots, are slightly exerted, and rather longer than the slender glabrous style. The fruit is eight to twenty inches long and one-half to three-quarters of an inch in the middle, with a thick wall, which towards spring splits into two concave valves; the partition is thickened in the middle and nearly triangular in section. The seed is an inch long and a third of an inch broad, with a light brown coat, and wings which are rounded at the ends and terminate in a fringe of rather short hairs.

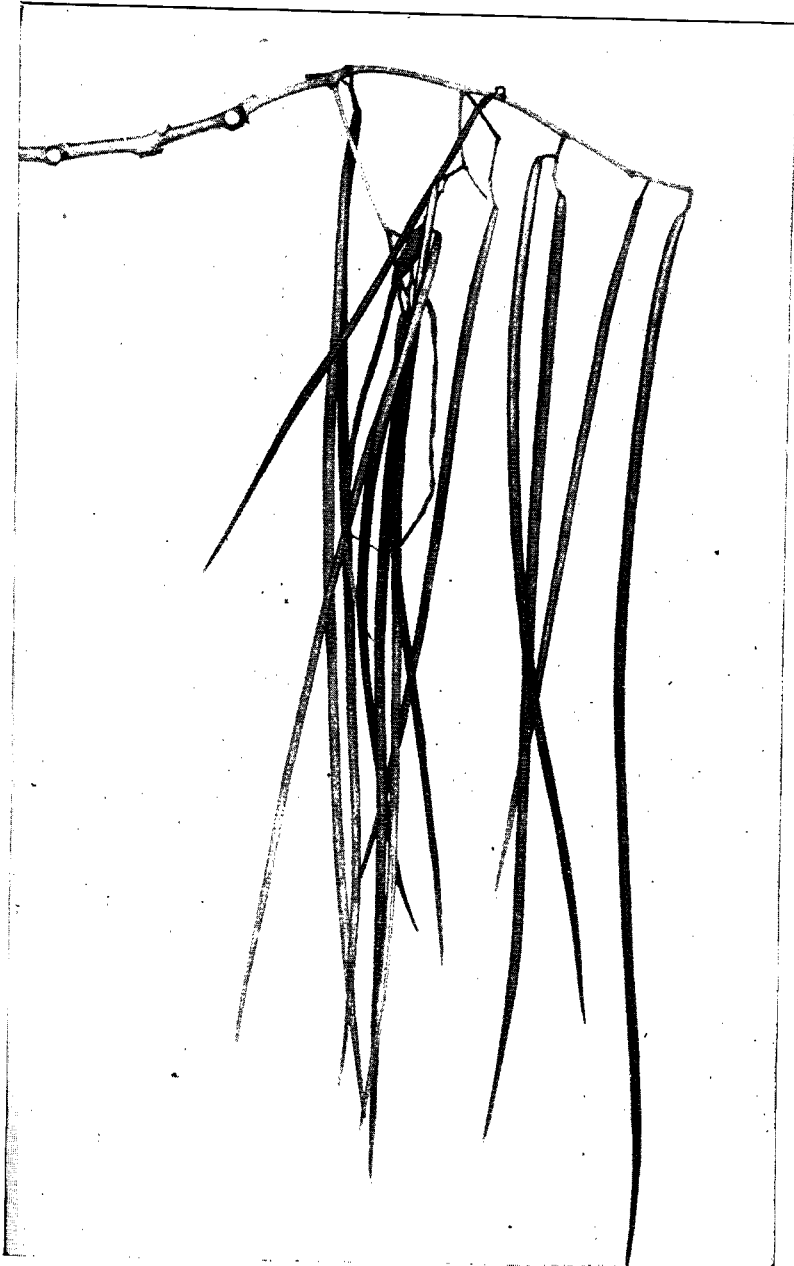


PLATE 32. *Catalpa kœmpferi* Sieb. & Zucc. Fruiting branch, one-third natural size.

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"*Catalpa speciosa* inhabits the borders of streams and ponds and fertile, often undulating bottom lands, and is distributed from the valley of the Vermilion river, in Illinois, through southern Illinois and Indiana, western Kentucky and Tennessee, southeastern Missouri and northeast Arkansas; through cultivation it has become naturalized in southern Arkansas, western Louisiana, and eastern Texas. In southern Illinois and Indiana, where it probably grew to its largest size, the western catalpa was formerly extremely abundant." ("The Silva of North America," Charles Sprague Sargent, vol. VI, p. 89.)

In addition to the native species, there is quite frequently to be found in cultivation the Japanese species, *Catalpa kampferi* Sieb. & Zucc., in ornamental grounds, between which and the American species there appear to be numerous hybrids. The long, very narrow pods, borne in very thick clusters, and the low habit of growth, render this tree easily distinguishable. The latest botanical description of *C. kampferi*, published by Sir Joseph Hooker in the *Botanical Magazine*, is as follows:

"A middle-sized tree, twenty-five to thirty feet high, with spreading, rather brittle branches and copious foliage; main branches stout; shoots green, smelling disagreeably when bruised; leaves about six inches long and broad, of a bright pale green color, with brown glandular spots at the junction of the nerves, broadly ovate, base rounded or cordate, margin sinuate or three-lobed, the lateral lobes short, terminal, tapering to a fine point, surfaces pubescent at first, then glabrous above, smooth or roughish beneath; petiole two to five inches long, round; nerve axils pubescent. Panicle terminal, erect, as long as the leaves, narrow or broad; rachis with small brown petioled leaves at the base; flowers two or three together at the ends of the branchlets of the panicle, horizontal or drooping, pale yellow, sprinkled with minute red spots within; calyx very small, lips rounded. Corolla campanulate, three-quarters of an inch long, mouth oblique, upper lip short recurved, lower spreading; lobes all rounded with crisped margins; in many of the flowers a small recurved, tongue-shaped appendage to the corolla occurs on the corolla tube near its base above. Capsule a foot long and one-third of an inch in diameter, cylindrical, straight, smooth, brown; seeds compressed, velvety, produced at each end in fine, silky hairs."

There seem to be intergrading forms between the two American species of catalpa. Whether these variants are ecological in character, assuming *C. catalpa* to be indigenous, or whether, by means of occasional early-blooming individuals of the Southeastern or occasional later-blooming individuals of the Western or hardy catalpa, hybrids have arisen between the two forms, it is on present evidence impossible to say. It is certainly true that intermediate forms exist. To the practical

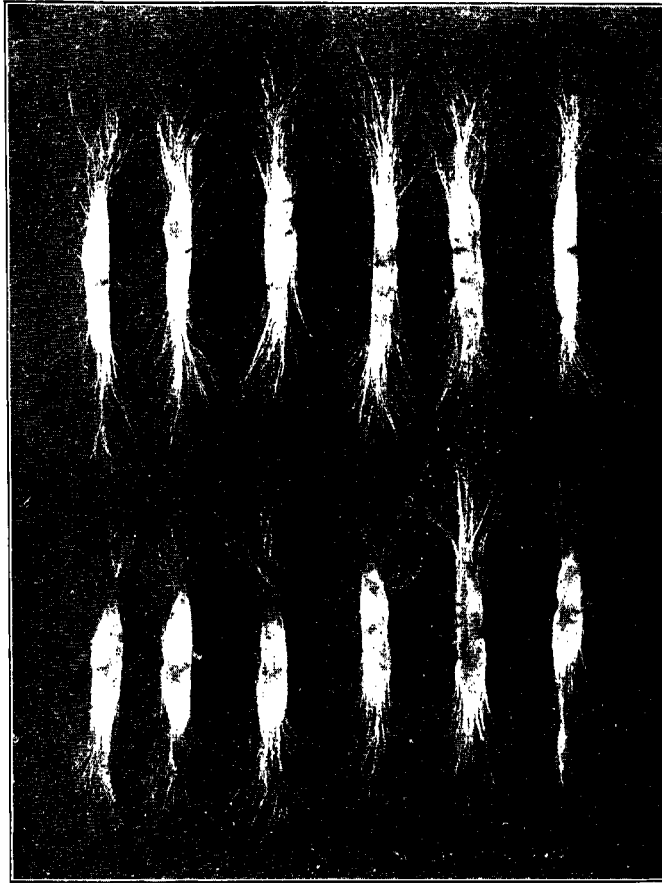


PLATE 33. *Catalpa kœmpferi* Sieb. & Zucc. Seeds, natural size. This particular tree possibly a hybrid with one of the American species.

planter the essential thing is to avoid *Catalpa kœmpferi*, *C. catalpa*, or their hybrids, or the so-called hybrids of *C. catalpa* and *C. speciosa*, and so far as possible to confine his forest to trees most near to the best type of *Catalpa speciosa*. Great carelessness is said to exist in the trade in the matter of distributing pure seed of *C. speciosa*. For the benefit of prospective catalpa growers without special botanical knowledge, a few salient characters may be seized upon to distinguish the species in question. In the first place, the fact that *C. speciosa* blooms about two weeks earlier than *C. catalpa*, bears larger and showier flowers, fewer in cluster, will usually be a safe

distinguishing feature. It cannot be too strongly urged upon catalpa planters to grow their own trees from seed. By this means the danger of obtaining the undesirable species is greatly lessened, since careful study of the seed characters offers an additional safeguard. If the prospective grower gathers his own seed, it will be well to obtain it from mature trees, if possible, since the bark characters offer striking contrasts in the two species. The bark of *C. catalpa* is scaly, peeling off in short strips, much as does that of the wild cherry. *Catalpa speciosa*, on the other hand, like the ash or the box elder, has furrowed bark, not separating from the trunk in scales. Plates 29 and 30 show quite well these contrasting characters. While the pods of the hardy catalpa are usually longer, larger and straighter than those of the Southeastern species, this is not an invariable rule. The seeds of *Catalpa speciosa*, however, are quite readily distinguished from those of *C. catalpa*, in the fact that they are wider, have usually a more pronounced notch between the wings, and the tips of the latter are fringed with a brush of hairs which stand squarely out from the wings and are not drawn into narrow points (plates 34 and 35). *Catalpa kœmpferi* and its hybrids have the hairs on the seeds arranged much as in *C. speciosa*, but the seeds themselves are so much smaller and narrower that no confusion is possible (plate 36).

CATALPA PLANTATIONS AT THE AGRICULTURAL COLLEGE.

The earliest planting of catalpa by the Agricultural College was made in 1872. The trees were a part of a mixed planting made on the old College farm. Prof. E. Gale, in a report made to the State Board of Agriculture, and published as a part of the Transactions of the State Board of Agriculture, 1872, page 430, says in regard to the soil: "The land selected for this purpose was that least adapted to the cultivation of cereals or root crops of any now broken up on the College farm. This selection, all things considered, was thought best, for it is, in general, this quality of soil—the high, gravelly and broken ridges—which should ultimately be planted to forest." Speaking of the planting as a whole, he says: "As was anticipated, the growth of the young trees has not been as vigorous upon this soil as it would have been upon lower and richer land, but still abundantly sufficient to give the most encouraging promise

of future success." Speaking of the growth of the catalpa, in this planting, he says: "The catalpa has made a growth of from twelve to twenty inches from seed."

In part II of the Fifth Biennial Report of the State Board of Agriculture, 1885-1886, page 159, in "Notes from the Experimental Tree Planting at the Agricultural College," Prof. E. A. Popenoe says regarding the catalpas planted in 1872: "*Catalpa speciosa*. On poor gravelly clay soil, planted much more closely than the white ash, not thinned, excepting by the removal here and there of trees for posts. Stand about twenty-five feet in height, and have an average circumference of about fifteen inches; the largest trees twenty-two inches at four feet from the ground. Trunks more likely to fork or carry large branches below than those of white ash."

It will be noted from the foregoing quotations that the catalpas, even on this exceedingly poor soil, were being cut for posts when not more than thirteen years from planting. Having been planted so long before the establishment of the Experiment Station, accurate records are wanting. Some posts have been cut nearly every season; in 1901 sixty-five were cut from this planting. It is evident from the information available that the ground has paid as high a rental as good land has paid in farm crops. The trees have not renewed from sprouts as readily as have the trees on lower, richer land, but have done fairly well in this respect. At this date, November, 1901, nearly thirty years from planting, and with good rent for the past sixteen years, this plat of ground of about three-fourths of an acre contains 350 trees, which would cut at least 610 good posts. This does not represent all the value of this planting, for the soil is evidently very much better than when the trees were planted. The leaves have given texture to the soil, which now shows some considerable humus in its composition. The ground is now practically under forest conditions, and seedlings of box elder, mulberry, elm, ash, oak and red cedar are found growing among the catalpas. Plate I shows one of the best of the trees now growing in this planting; it is twelve inches in diameter and over thirty-five feet high. Some idea of the growth of underbrush and young trees may be had from the same plate.

In the spring of 1888 the horticultural department of the Experiment Station planted about two and sixth-tenths acres

of the old College farm to catalpas. The soil of this plat, while not so decidedly poor as that of the planting of 1872, is very thin, and is underlaid by a hard, poor subsoil. Plantings were made four feet by two feet, four feet by four feet, and four feet by eight feet. All were given good, clean cultivation for two years. The third season the trees set eight feet by four feet were cultivated; those set closer were large enough to make cultivation difficult. The ground was well shaded and fairly well covered with leaves, so the lack of cultivation did not seem to affect their growth. Each season the trees were trimmed to prevent their branching too low for the formation of good posts. Results show that the time required for trimming was well spent.

In the rows set four feet by two feet, many of the trees died or were cut out within a few years after planting, before the wood was of any value. Subsequent thinnings gave wood and stakes enough to pay for the work. This planting, for the last eight or nine years, has been practically a four-by-four-foot planting. The trees which were removed seemed to have little effect in causing a taller, straighter growth, the trees in the four-feet-by-two-feet block showing little difference in height and somewhat less in diameter; in other words, the additional trees were of no benefit, but, on the contrary, were a detriment. In a part of this planting where the trees had been left at the original distances until 1900, the trees in one of the four-foot rows had more than twice the amount of posts and wood as the trees two feet apart.

Comparing the plantings originally 4 x 4 and 4 x 8, the thinner plantings have given the best results. Ten rows, 4 x 4 feet, 117 feet long, contained 251 trees having 85 good posts. Ten rows, 8 x 4 feet, 117 feet long, grew 228 trees, having 280 good posts. The trees in the wider rows have a greater height and diameter, the average diameter in the planting 4 x 8 feet apart being slightly under six inches; in the rows, 4 x 4 feet apart the average diameter is nearly four and one-fourth inches. The average height is about the same, eighteen feet.

In some cases, where trees were thinned by cutting off just above the ground, the new shoot from the stump made such a straight, rapid growth that the cutting back seemed to secure the formation of straighter posts. As might be expected, the second-growth posts grow to a suitable size for use in less

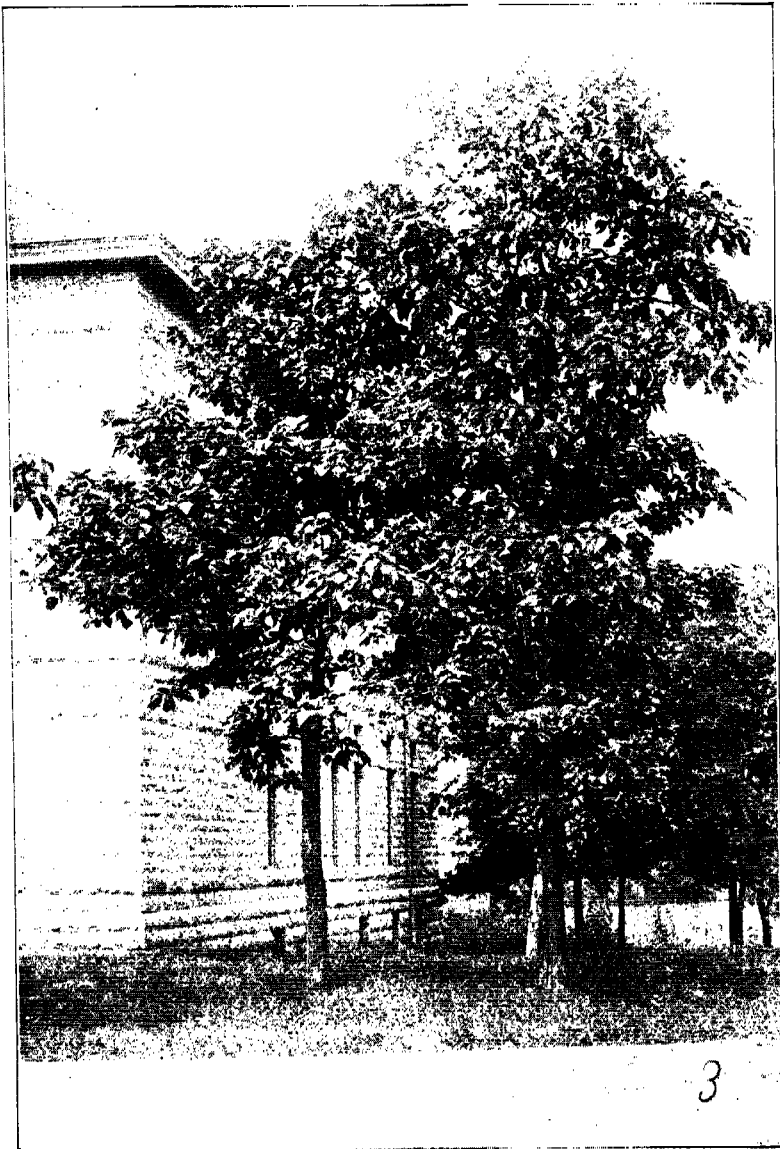


PLATE 34. Catalpas used for shade trees at Agricultural College.



PLATE 35. Golden catalpa on Agricultural College campus.

time than was required for the first growth of trees. The comparative value of the first and the second growths for posts is a subject for further observation.

Catalpas have been used for shade and ornamental trees on the College campus, around the buildings, and in the clumps and belts. Given a sufficient amount of room, in a good soil, the catalpa trees have made a fairly rapid growth, and usually have made pleasing, symmetrical form. The foliage, while not especially heavy, is sufficient for good shade, and the blossoms add to its appearance in their season. Plate 34 shows a clump of catalpas near the Domestic Science building. The soil is of only medium quality, and the trees are of a very good size for fourteen seasons' growth.

Plate 35 shows a very fine specimen of the Golden catalpa; the tree is graceful and symmetrical, rather heavier in foliage than most of the trees of this species. It is 36¼ feet high, 15 inches in diameter at two feet from the ground, and 13½ inches at four feet from the ground. The yellow tint is quite conspicuous in the early part of the season, but is much less so after midsummer. Young trees show the yellow shade much more than the older ones.

Specimens of the Purple-leaved catalpa have been grown on the College campus. The purple tint is much more conspicuous in the younger trees, and with these the colors are most vivid in the early part of the season. The specimens grown here have been grown on a soil of medium quality, and have made but a moderate growth, inclining to be shrubby. Probably the best results in the way of foliage would be secured by cutting back severely and growing as shrubs.

The Japanese catalpa, *Catalpa kaempferi*, has made rather a low, shrubby growth on the College campus. It presents a fine appearance when in bloom, carrying a heavy load of flowers. In the fall, after the leaves are fallen, it presents a rather unique appearance, the large number of slender pods giving the branches a drooping effect.

A number of Teas' hybrid catalpas were set in the timber belts on the College campus. These have been somewhat variable in form and growth, but have, on the whole, made good growths and fine trees.

Some of the trees set in a cooperative experiment with the division of forestry, Department of Agriculture, are evidently

of the Southern species, *Catalpa catalpa*. They were killed to the ground in February, 1899, and have been seriously injured by cold in other seasons. Doubtless much of the dissatisfaction with the catalpa has been caused by the setting of other species than *speciosa*.

Posts set ten years ago in the Experiment Station vineyard are still in very good condition, and there is no doubt that they merit the general favor in which they are held. The wood not suitable for posts makes very fair fuel. It burns readily and lasts well for so light a wood. Plate 36 shows the cross-section of a catalpa planted in 1880 and cut in 1900. Plate 37 shows the section of a board cut from the same tree. The trunk made a board eight feet in length, the width of that shown in the plate. When cut, this was a fine, healthy tree, with a spread of at least twenty-five feet. The best development of the belt in which it grew demanded its removal.

Trees of suitable size for sawing have been used by the mechanical department for various purposes. Mr. W. L. House, foreman of the College wood-working shops, says in regard to the catalpa wood: "It has a beautiful grain, polishes easily, and takes a fine finish. It has sufficient strength for the various kinds of cabinet work, and is desirable in every way for this purpose. For wide surfaces it joins nicely, matching the grain easily. It works easily, either with the lathe or with hand tools, and is, in every respect, a valuable wood for the finisher and cabinet-maker."

Nursery Notes.

Seedlings of the catalpa are easily grown. No difference has been noted in the vitality of seed gathered in the fall and stored in a dry, cool place and in that which had hung on the trees until spring. Good stands have been secured by planting in rows of suitable width for cultivation, dropping the seeds quite thickly in the row and covering rather shallowly, about one inch deep. Plantings made when the ground is in good, warm condition have succeeded better than plantings made very early or very late. On good soil and with good care, the growth of catalpa seedlings has been from one to five feet the first season. One-year-old trees are best for planting. In the planting of 1888, yearling trees have made posts as soon as two-year-old trees. The yearling trees are easily set by

laying off the rows with a plow or lister, followed by a little work with the spade, care being taken to firm the soil well when the tree is put in position. Setting in the spring is usually most successful, and should be done before the buds are much swollen. As with all trees that are being transplanted, care must be taken to prevent drying. If the roots be exposed for only a few minutes to the sun or drying winds, the chances for success may be seriously reduced.

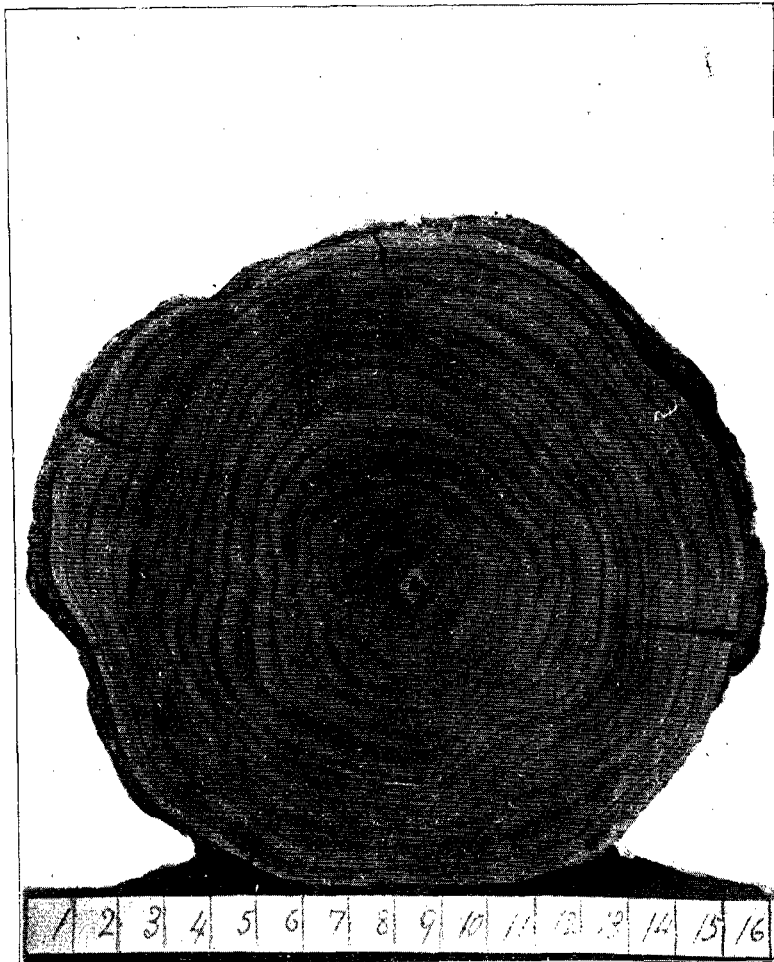


PLATE 36. Cross section of catalpa grown on Agricultural College campus.



PLATE 37. Section of board from catalpa tree grown on Agricultural College campus.

Conclusions.

The catalpa plantings made by the College and the Experiment Station have given encouraging results. On very poor soil the catalpas have been a paying crop. Almost any other cropping of this land would have reduced its fertility, while the crop of tree has unquestionably been beneficial, both by preventing washing and by the addition of some humus.

On good soil the growth has been proportionately better. The trees have made a more rapid and vigorous growth, producing trunks of suitable size for posts in from seven to ten years, and in twenty years trees have grown to a size sufficient for heavier uses, or for lumber for finishing or cabinet work.

The most desirable distances for planting probably vary somewhat for different soils and locations. Rows eight feet apart, with the trees five or six feet apart in the row, would seem, from our observations, to be a good distance for general planting. With the rows eight feet apart, corn or some other rowed crop may be planted for at least one season.

Good clean cultivation should be given for several years. Attention should be given to trimming the trees, to avoid low branching.

Cutting back to the ground usually secures a rapid growth of smooth straight wood.

The young trees are easily raised, transplant readily, grow rapidly, and endure extremes of drought, heat, and cold.

PRESENT WORK AT THE DODGE AND OGALLAH FOREST STATIONS.

In addition to the work incident to the collection of data concerning the natural and artificial forest resources and possibilities of Kansas, the Stations at Dodge City and Ogallah have been maintained. Their equipment has been increased by the purchase of teams and implements and the plantings of forest trees put into condition to prevent any future injury from fire and to enable them to make the best of the conditions under which they are growing. In other words, the purpose now is to give these trees, that are expected to furnish encouragement and object lessons for future planters, a fair chance and a "square deal" by maintaining effective fire guards and such soil conditions as seem best for the securing of the forest conditions under which they may succeed. The breaking up of the sod has been the first requisite, and in future the conditions needed for the conservation of soil and moisture will be maintained so far as is possible.

Plantings of shade-enduring species will be undertaken where the trees are too few to furnish shade for the protection of soil and stem. Species which have demonstrated their ability to succeed will be most used and in numbers which will

furnish a basis for accurate estimates of their rates of growth and their general value.

Demonstrations in other agricultural lines authorized by the legislature have been begun. The possibility of preparing soil for trees by the use of preceding crops is the main object undertaken, but the value of the cowpea in furnishing a protein feed for localities where other legumes have not been introduced was incidental to its use in preparing soil for tree purposes. A comparison of the value of milo maize, both dwarf and standard varieties, with the Kafir corns, was begun and will be continued.

The season was less favorable at the Dodge City Station, but good crops of fodders were obtained. Demonstrations of the value of improved seed wheat are also under way on land not yet required for the work with trees.

The wholesale distribution of seedlings undertaken by these Stations in the past has not been productive of the good intended. The evil of setting poorly handled trees in poorly prepared soil has been discussed in this report, and it is not proposed to continue this evil. The nursery efforts will be in the direction of ascertaining means of producing trees which are best adapted to western Kansas conditions and ascertaining the added value and the feasibility of the planting by general farmers of seeds where the trees are to stand.

Trees grown by these Stations will be used in demonstrations made in cooperation with individuals, school districts, counties and towns, and careful investigation will be made as to the preparation of the soil and adaptation of trees for the several locations.

It is the hope of the State Experiment Station that through the office of state forester the facts concerning tree growth and the probabilities of success with the various species may be so widely disseminated that a much greater degree of success may attend future efforts in tree planting. It is certain the proper preparation of soil and correct selection of species should precede any planting.

There are many localities, particularly in central Kansas, where plantations for post and pole purposes are as nearly certain to produce very good profits as are any agricultural investments. The office of state forester will attempt to advise prospective planters concerning the adaptation of species to

soils and locations and as to the best methods of soil preparation. When possible, planting plans will be prepared showing the details of distance and proportion of species. It is not considered advisable to undertake to make plans for areas smaller than two acres, but all possible advice and help will be given regardless of the area under consideration. Advice concerning public grounds will be undertaken and plans prepared for the planting of trees for school grounds. It is believed that many districts in the state can well afford to add a few acres to the school grounds for the planting of a demonstration wood lot. This should be particularly true of districts where consolidated schools are maintained. An acquaintance with trees, their requirements and their values, is an essential part of a well balanced education and furnishes a means of mental growth as well as a fund of useful information.

A grove of well-grown trees is a valuable possession for any municipality, providing a location for public gatherings and adding in many ways to the comforts and amenities of life in country and town. Such a plantation has a financial as well as a landscape value, and in years to come a grove of good timber will be a valuable resource for any owner.

In or near many towns there are areas of varying size, ravines or low land, that are now unsightly spots but which might be transformed into bits of woodland that would add charm to the landscape and in time to the wealth of the community.

On many farms there are ravines forming along the lines of drainage that if planted to trees might produce posts, poles and fuel for the farm and at the same time check the force of the water and lessen the amount of good soil that washes down the creek to increase the delta of the Mississippi and the expense of the deep waterway project. Good citizenship should demand that the owner of land protect it, conserve and increase its resources, as he would have the state and the nation protect and improve the public domain. To help in this work of making Kansas utilize all of her acres to the best possible purpose, to make the ravines, hillsides and bends of the streams produce crops for which they are best suited and by which they may add to the wealth and welfare of their owners and the state, is the object of the office of state forester.

Acknowledgment is due Mr. H. C. Cooper, who was in charge

of the Dodge City Station until July, 1909 for his effective work in improving the conditions at that Station; to Mr. F. J. Turner, who, as foreman of the Ogallah Station, has done very efficient work in improving the conditions for the tree plantations there, and in carrying out the directions for the demonstration work. Acknowledgment is also due Assistant Christian Jensen, who has been in charge of the Dodge City Station since July, 1909, for very efficient service in the management of that Station, and also in the collection of data concerning tree growth in western Kansas, and in preparing plans for various courthouse plantings and for the Reformatory at Hutchinson.