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**HARDY TREES AND SHRUBS FOR
WESTERN KANSAS**

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TABLE OF CONTENTS

| | PAGE |
|---|--------|
| INTRODUCTION..... | 5 |
| SELECTION OF SPECIES..... | 5 |
| PREPARATION OF THE SOIL..... | 7 |
| PLANTING TREES AND SHRUBS..... | 7 |
| The planting plan..... | 7 |
| When to plant..... | 8 |
| Methods of planting..... | 9 |
| The slit method—The post-hole-digger method—The hole method— | |
| Planting evergreens..... | 9, 10 |
| Pruning at planting time..... | 11 |
| Spacing of trees and shrubs..... | 11 |
| Source of planting stock..... | 12 |
| CARE OF TREES AND SHRUBS..... | 12 |
| Cultivation..... | 12 |
| Protection of newly-planted stock..... | 13 |
| HARDY SHRUBS..... | 14 |
| The barberries—Silver buffalo berry—Caragana—The coralberry | |
| and snowberries—Peking cotoneaster—The dogwoods—The elders— | |
| The Forsythias or goldenbells—The honeysuckles—Indigo bush—The | |
| lilacs—The mock oranges—The plums—The privets—Redbud or | |
| Judas tree—Russian olive and silverberry—The spireas—Sumac— | |
| The tamarix—Deciduous shrubs of minor importance—Evergreen | |
| shrubs..... | 14-19 |
| CLASSIFICATION OF SHRUBS..... | 21 |
| Shrubs for trimmed hedges..... | 21 |
| Shrubs for flowering hedges..... | 21 |
| Shrubs for planting in partial shade..... | 21 |
| DECIDUOUS TREES..... | 21 |
| Cottonwood—The elms—Green ash—Hackberry—Honey locust—The | |
| poplars—Russian mulberry—Russian olive—Black walnut—Decidu- | |
| ous species of minor importance..... | 21-27 |
| CONIFERS FOR WESTERN KANSAS..... | 27 |
| Eastern red cedar—Chinese arborvitæ—Austrian pine—Ponderosa pine— | |
| Scotch pine..... | 27, 28 |
| TREES AND SHRUBS FOR SOUTHWESTERN KANSAS..... | 30 |
| SUMMARY..... | 31 |



TREES AND NURSERY PLANTINGS IN WESTERN KANSAS

The top panel shows a view of the Fort Hays nursery looking north from the station elevator. The nursery office, packing room, and greenhouse are shown in the foreground. Various nursery plantings may be observed back of the building. In the background is the timber of Big creek and in the distant background may be seen the water tower and other structural elevations in the city of Hays.

The lower panel of the picture presents an excellent specimen of Russian olive, a tree well adapted to western Kansas plantings. This specimen is located on the Fort Hays Agricultural Experiment Station grounds.

HARDY TREES AND SHRUBS FOR WESTERN KANSAS¹

E. W. JOHNSON

INTRODUCTION

The growing of trees and shrubs in western Kansas has always been a perplexing problem. The first extensive attempts at forest-tree planting started with the enactment of the Timber Claim Act. From 1873 to 1891 the homesteader could secure title to a quarter-section of land by planting 10 acres to forest trees and maintaining this area for a period of eight years. Some of these plantings were maintained after the required time, but a large number were abandoned, and the results of such abandonment are very evident in many sections of western Kansas. Many of the settlers extended their timber-claim plantings to include trees and shrubs for ornamental use, using material that was known to be successful in the eastern part of Kansas or other states. As a result a very large number of both trees and shrubs have been planted in the past, but the unfortunate situation is that only a relatively small part of this material survived. These failures proved to be a detriment to future tree and shrub plantings, inasmuch as the new farmers, upon inspection of these old plantings, too often decided that trees and shrubs could not be grown successfully in this section.

The fact that climatic conditions in western Kansas are unfavorable to the growth of many species of trees and shrubs is appreciated, but a study of the early plantings and the results of experiments made at the Fort Hays Agricultural Experiment Station show that success with trees and shrubs is possible if the following factors are given careful consideration: (1) Selection of species, (2) preparation of soil, (3) planting, and (4) care. In many instances the damage to tree and shrub plantings resulting from drought, severe hail, snow, or sleet storms, can be avoided to a considerable degree by the proper selection of species and by using proper cultural practices.

SELECTION OF SPECIES

Many of the plants native to eastern Kansas and neighboring states have been tried again and again in western Kansas with failure as the result. Plants growing thriftily at an altitude of 1,000 feet or less, with an annual precipitation of about 35 inches, fail to survive at an altitude ranging from 2,000 to 3,500 feet, and an annual rainfall of 14 to 22 inches. Very often the eastern plants would survive the early summer or perhaps the entire growing season, but would succumb to the hot, dry winds of late summer,

1. Contribution No. 15 from the Fort Hays Agricultural Experiment Station, Hays, Kan. The author was formerly forest nurseryman at the Fort Hays station, which is a branch of the Kansas Agricultural Experiment Station.

the drying winds and dry soil of the winter, or the action of alternate freezing and thawing. The solution of this part of the planting problem, that of selecting the proper species, lies in the appreciation of the fact that only native species and those having the power to adjust themselves to a wide range of climatic conditions should be selected. With this in mind, the Fort Hays Agricultural Experiment Station began the testing of trees soon after its establishment in 1901, and started similar work with shrubs in 1922.

Adequate testing requires that trees and shrubs be grown in any given locality over a long period of time so they will be subjected to the various conditions that might be possible. This means that the work carried on over any one decade cannot be used as a final criterion of the behavior of any particular tree or shrub, but merely as a measure of what would happen again under the same series of conditions. The suggestions given in this bulletin are based on such results only, and no attempt is made to predict what might result under different conditions. An example of the fallacy of such predictions is the behavior of the very popular Chinese elm. The oldest Chinese elm in western Kansas was planted at the Fort Hays station in 1912, as a two-year-old. This tree had, until the spring of 1931, made a very vigorous growth, had not suffered any serious winter injury, and was apparently free from insect attacks. The blizzard of March, 1931, the most severe recorded over a period of 68 years, and the late freezes of 1932 resulted in considerable tip injury and the rupturing of some of the branches on this Chinese elm. Hundreds of trees of this species in Kansas suffered this same type of injury, and a large number were entirely killed. In many cases the rupturing of the bark made an ideal entrance for boring insects, causing additional losses in the Chinese elms. This example is an extreme case, but it is used to show how the results obtained over almost two decades have to be qualified.

The location of the planting site must be given careful consideration. Certain species might make a vigorous growth on bottom-land sites having natural protection or planted in the protection of a forest-tree windbreak, but this same species planted within a radius of a mile might prove to be a failure on an exposed site. Protection from the prevailing winds is one of the essentials for the successful growing of a major part of the shrubs in western Kansas.

In working out a planting plan for the farmstead the first consideration should be that of securing wind protection. On a high exposed site, windbreaks should be planted both north and south of the area to be protected. The north windbreak should be planted far enough from the border of the protected area so that drifting snow will not be deposited directly in the center of the service yard or around buildings. If an old windbreak is already present adjacent to the protected area, then a snow-trap should be planted 75 to 100 feet to the north of it. The snow will be deposited between the snow-trap and the windbreak and make an ideal location for the farm garden, from the standpoint both of receiving more than the average amount of winter moisture and of being protected from undesirable south winds during the growing period.

HARDY TREES AND SHRUBS

7

PREPARATION OF THE SOIL

Soil preparation is often considered too late when planting and, as a result, severe losses are experienced. Trees and shrubs should never be planted in sod or in newly-turned sod. The sod should be plowed two years in advance of planting. If it is plowed only one year in advance of planting and a dry season should follow, the soil will not be in the proper condition for planting. Summer fallowing should be done carefully so that the soil will receive every possible benefit. The only exception to the rule of not planting in sod is, of course, when individual trees or shrubs are used in the yard. In this case the benefits usually derived from cultivation must be secured by irrigation. In all cases, however, the sod within a radius of from 3 to 6 feet of the plant should be removed, and the soil given a thorough spading. It would be well to remove the sod and spade the soil for such individual specimens a year in advance of the planting date. These areas can be watered several times in advance of the planting so a reserve moisture content will be available.

The soil adjacent to the farm house very often is composed, in part at least, of earth removed from the basement while construction was under way. A shrub requires a comparatively small amount of ground area, but from this area it is necessary to remove all questionable soil and replace it with good, fertile soil if vigorous growth is to be secured.

PLANTING TREES AND SHRUBS

THE PLANTING PLAN

Planting of the farmstead should not be started until a definite planting plan has been made. This plan need not be elaborate, but should be drawn to scale and show the relative position of all buildings, drives, walks, and fences. The next step in making the plan is to indicate the location of windbreaks, showing the species to use, distance apart, and the total number of plants in each windbreak. The third step is the locating of lawn trees, the groups of trees for screen and border plantings, and the selection of the species to be used. Several trees should be planted near the southeast and southwest corners of the house in order to provide shade to those parts of the house during the summer. These should be planted not closer than 15 feet, using deciduous species.

The next problem in making the planting plan (fig. 1) is the locating and selecting of shrubs. A few shrubs should be planted at the entrances and corners of the house to soften the sharp lines of the doors and walls. Large buildings often require heavy banks of shrubs at the corners, while the average small home needs only a few shrubs. Ugly, exposed foundations may need screening with shrubs. Shrubs should also be used in hedge fashion or in groups to define boundaries or screen undesirable views. It should always be kept in mind that too heavy planting will ruin the desired effect.

Trees planted in regular row fashion directly in front of the house may develop into a good forest, but such a planting is not good landscaping. All good outlooks should be left open.

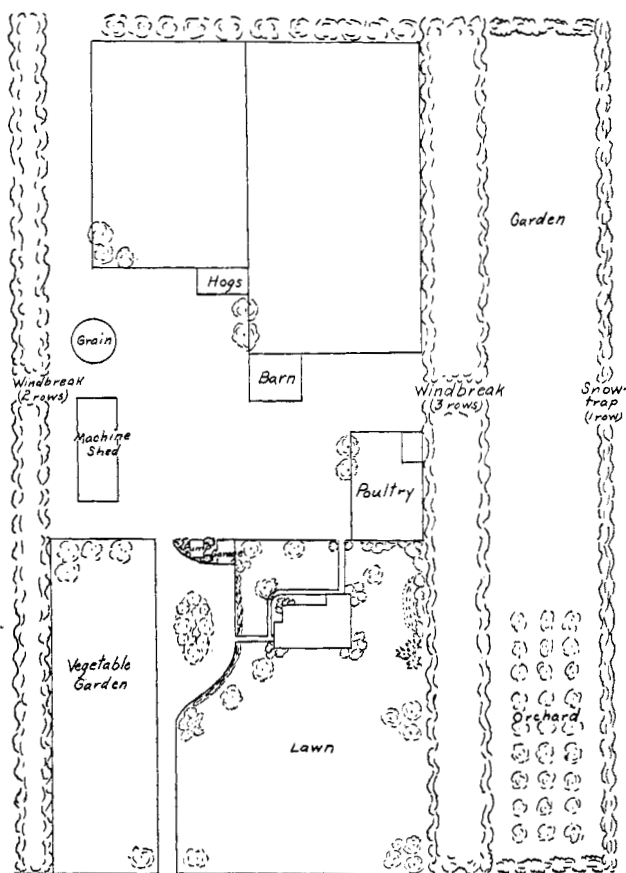


FIG. 1.—A planting plan designed for a western Kansas farmstead having an east front.

WHEN TO PLANT

In western Kansas planting of trees and shrubs should be done in the spring only. The usual dry fall and winter weather prohibits successful fall planting. When very dry spring weather is experienced it will be necessary to water all newly-planted material at regular intervals, even those trees that are considered hardy. If the plants are received from the nursery during dry, windy weather, they should be heeled in in a trench in a shed, rather than planted under such conditions. The trench should be dug deep enough that

HARDY TREES AND SHRUBS

9

all of the roots and part of the tops can be covered with earth. Fine soil should be packed firmly around the roots, which should be watered thoroughly. Heeling in should also be practiced if the plants are received during freezing weather. In this case, the tops should be entirely covered so that frost injury will not result. If the plants are exposed in transit and are received in a frozen condition, they should be thawed out gradually. Exposure in transit, resulting in drying out or freezing, is one of the major causes of disappointment in the survival of plants. Nurseries are not responsible for such exposure, but usually receive the blame, and replacement from such causes is one of the factors that must determine the cost of the plant materials. The most satisfactory method to use is to call for the plants at the nursery, take them to the planting site, and plant within 24 hours of digging from the nursery row.

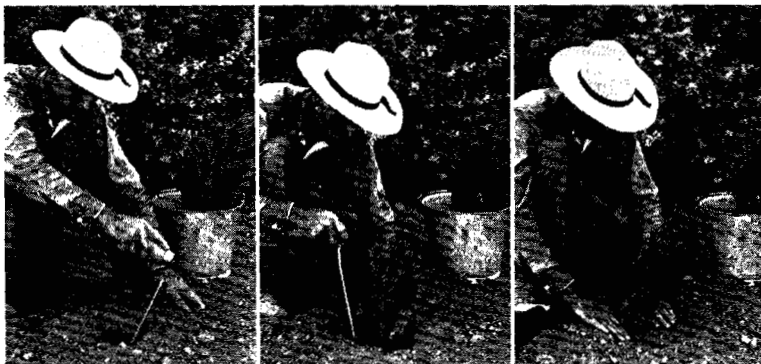


FIG. 2.—Planting seedlings by the slit method, showing (from left to right) the making of the hole by inserting the dibble and moving it backward and forward; the setting of the seedling in place; and the tamping of the soil firmly, leaving a shallow depression for watering.

METHODS OF PLANTING

The Slit Method.—When large numbers of seedling trees are planted this method is fast, and satisfactory if proper care is used. (Fig. 2.) A V-shaped hole is made in the ground by inserting a spade or dibble and moving it backward and forward. The root of the seedling is placed in this slit and the hole closed by inserting the tool about 2 inches back of the hole and pressing the soil against it. In using this method the soil should be pressed in firmly at the bottom of the V-shaped hole. No air pockets should be left. A small depression should be made around each seedling so watering can be done immediately after planting. After the water has been absorbed the rest of the hole can be filled with a mulch of loose soil.

The Post-hole-digger Method.—The use of a post-hole auger in making holes is suggested when planting seedlings that have a

comparatively long root, system. This method is especially adapted to rather sandy, open soils. On sites having a heavy soil, where it is desirable to fill in around the root system with a more porous soil, the hole method should be practiced in preference to either the slit or post-hole-digger method.



FIG. 3.—A balled and burlapped red cedar ready for transplanting. This method is recommended for evergreen trees more than 12 inches in height.

The Hole Method.—This method must be used on all plant materials other than seedlings. The hole must be dug larger than is necessary so there will be plenty of space for the root system. The roots should never be cramped in a planting hole. Trees or shrubs should be set about 2 inches deeper than the original nursery level. When filling in earth around the roots, well pulverized soil should be tramped in firmly. As with the seedlings, a depression should be left around the plant so it can be watered thoroughly.

Planting Evergreens.—

Small seedling evergreens can be planted by either the slit or hole method. The hole method is always slightly better than the slit method as it is not so likely to result in any crowding of the root system. Evergreen roots are sensitive to exposure to the sun or wind and must be handled accordingly. Upon opening a bundle of evergreen seedlings, the roots should be placed in a pail containing a thin mixture of clay and water. The planting should

be done directly from this pail. Large evergreens must be handled balled and burlapped only. Figure 3 shows a red cedar that has been balled and burlapped. When planting this type of material, the burlap should never be removed from the ball of earth. The burlap will soon decompose and does not interfere with the growth of the roots if the soil is washed in closely against it.

PRUNING AT PLANTING TIME

When plants are dug in the nursery row, some of the roots are necessarily left in the ground. This disturbs the balance of the tops and the root system. To restore this balance it is desirable to remove some of the top growth. With deciduous trees the best way to balance the top is to remove some branches entirely, rather than lose the characteristic form of the tree by cutting back all of the branches and the central stem. (Fig. 4.) Shrubs can be cut back one-half to one-third, depending upon the character of the shrub,



FIG. 4.—A deciduous tree before being pruned (left) and after being pruned (right) for transplanting. The tree shown is a Chinese elm.

and will recover and grow into shape quickly. Some authorities advocate cutting back of shrubs to the ground when transplanting. Bruised or broken roots should always be cut back. Specimen evergreens do not need pruning when planting, as nearly all of the roots are intact in the ball of earth in which they are burlapped.

SPACING OF TREES AND SHRUBS

Trees.—For windbreak planting in western Kansas a spacing of from 4 to 8 feet in the row can be used when only a single row is planted. When several rows are planted, the spacing should be 6 to 8 feet apart in the row and the rows 12 to 16 feet apart, depend-

ing upon the amount of available moisture and the type of cultivator that will be used. Using a five-tooth cultivator permits of close spacing, while the use of a tractor and one-way plow requires wide spacing. Individual specimen trees in the yard should be planted 20 to 35 feet apart, according to the species used. Large-growing trees, such as the elms, must be spaced 35 feet apart for specimen planting, while small-growing trees, such as the Russian olive, need be spaced only about 20 feet apart. When planting evergreen groups, the individuals should be spaced closer, depending upon the habit of growth.

Shrubs.—Small, low-growing shrubs can be spaced 2 to 4 feet apart when planted in groups. Tall, wide-spreading plants, such as the honeysuckles, need a spacing of from 4 to 10 feet for best development. In hedge planting, privets should be spaced about 12 inches apart for single-row hedge, and large-growing material such as caragana, cotoneaster, and tamarix can be spaced 12 to 18 inches apart.

When using shrubs for foundation planting they should not be planted too close to the walls. A space of 18 to 36 inches is needed, depending upon the ultimate size of the shrub. Too close planting will result in a one-sided habit of growth. Evergreen shrubs require a spacing of from 4 to 6 feet for wide-spreading material, such as the Savin or Pfitzer junipers. Evergreens should be planted at least 3 feet from walls.

SOURCE OF PLANTING STOCK

The logical procedure to follow when selecting the nursery from which to purchase stock is to secure the plants from a location having similar conditions to those on the planting site. Whenever possible secure the stock from a nearby nursery where it has been raised from seed collected locally.

CARE OF TREES AND SHRUBS

Success with trees and shrubs can be assured only when the plants are given proper attention. Observations of plantings show that the major number receive more or less care for a few years and are then expected to shift for themselves, which results in the unsightly condition of so many plantings. Such plantings injure not only the property on which they are located, but tend to discourage additional plantings by those who are interested in a farm beautification program. Ornamental plantings that have been neglected soon produce the opposite effect to that intended, being eyesores rather than things of beauty.

CULTIVATION

Windbreaks and shelterbelts must be regularly cultivated if a reasonable rate of growth is expected. The type of tool may vary from the one-way disk with tractor power to the old-fashioned one-horse cultivator. The latter tool is very effective because of its

flexibility, and finds considerable use in many plantings at the Fort Hays Agricultural Experiment Station. During dry seasons it is always profitable to water each individual tree in the windbreak. This may require considerable labor in large plantings, but it pays in vigorous growth and the satisfaction derived therefrom.

Shrubs in western Kansas must always be watered at regular intervals during the growing season to insure growth and blooming. Following each irrigation the soil should be cultivated to prevent weed growth and baking of the surface soil. An important rule usually overlooked is: One cannot raise trees, shrubs, chickens, pets, and farm animals all on the same ground with any degree of success as far as the trees and shrubs are concerned. All animals must be fenced out of shrubberies and tree plantings. This is one phase of farm beautification that must always be kept in mind.

PROTECTION OF NEWLY-PLANTED STOCK

Nearly all deciduous trees and a few conifers are subject to injury from rabbits. Species such as the Chinese elm are especially subject to such injury. The greatest damage by rabbits is done during the winter, but it would be well to protect the trees as soon as they are planted. For deciduous trees the protectors to be used may be made from strips of veneered wood, screen wire cloth, roofing paper, or heavy building paper. They should be 18 to 24 inches long. The protectors should be wrapped loosely around the stem, and secured with twine or very fine wire. Baling wire should never be used.



FIG. 5.—A transplanted evergreen protected from south winds by a burlap screen.

A very effective rabbit repellent that can be painted on the stems of trees is now available. It consists of sulphur and linseed oil and can either be purchased from hardware dealers or be prepared at home. This repellent has not been entirely satisfactory in several sections of the Great Plains region, but has been effective in the vicinity of Hays. The formula for this repellent can be secured from the station.

Small evergreens growing in the nursery row usually have considerable protection from the wind and always have shade due to being planted close together. When these are transplanted to the farm this protection is lost, and often they are not able to withstand

the direct exposure to wind and sun. Newly-planted evergreens should, therefore, be given some artificial protection. The best and cheapest method to use is to place a shingle or board on the south side of every tree. By using a long shingle or board and placing it at an angle so the top of the board is directly over the top of the seedling, protection from the strong rays of the midday sun can be secured.

Large specimen evergreens can be protected from the wind by driving two stakes in the ground on the south side of the plant' and stretching burlap between them. This protection, illustrated in figure 5, should be used until the plant becomes established.

HARDY SHRUBS²

The Barberries.—The Japanese barberry, *Berberis thunbergi*, is a small shrub that can be used in the vicinity of Hays for foundation planting and low hedges bordering walks drives and gardens. It is subject to winter injury on exposed sites, requiring a rather dense shade for best development. It is not recommended for general planting west of Ellis county except on well-protected sites. The holly barberry, *Berberis illicifolia*, is a medium-sized shrub having spiny-toothed leaves. The holly-like leaves and the fact that they persist throughout the winter make this shrub unusual. It has been growing successfully at Hays since 1925, and warrants further trial in western Kansas. It can be used both for specimen and hedge planting. Red leaf barberry, *Berberis thunbergi* var., has been tested several times at Hays and found to be too tender for western Kansas planting.

Silver Buffalo Berry.—This buffalo berry, *Sheperdia argentea*, is a tall, open-growing shrub that has made a rapid growth at Hays. It has a silvery foliage similar to that of the common Russian olive, and can be used in the same relative position in the landscaping plan—for bold positions in front of shrubbery masses. This species will withstand extremes of cold and drought and is especially recommended for the northern half of western Kansas.

Caragana.—The caragana or Siberian pea tree, *Caragana arborescens*, is a large-growing shrub of upright form adapted to use in mass plantings or for ornamental hedges. It has found considerable use in the northern Great Plains region, and can be used successfully in the northern half of western Kansas. It makes a valuable low windbreak or snow-trap.

The Coralberry and Snowberries.—The coralberry, *Symphoricarpos vulgaris*, and the western snowberry, *Symphoricarpos occidentalis*, are found growing naturally along streams in western Kansas, and are adapted to ornamental plantings. Both are low-growing shrubs that can be used for foundation planting or as foreground plants in border or mass plantings. The western snowberry has attractive white berries borne in clusters, and the coralberry bears

2. The nomenclature in this bulletin is that used in "Standardized Plant Names."

small red fruits along the branches. The fruits persist until late in the winter. The common snowberry, *Symphoricarpos racemosus*, is more decorative than the western snowberry and is the one used by most nurserymen. Both the coralberry and the snowberries are of the suckering type and should be dug up occasionally and the new divisions transplanted. Rather severe pruning in early spring will encourage the branching and fruit production of this group. The snowberry makes its best development in shade, while the coralberry can be used in shade or sun with equal results. These species are entirely hardy in western Kansas.

Peking Cotoneaster.—The Peking Cotoneaster, *Cotoneaster acutifolia* is a tall-growing shrub valuable for its dark green, glossy foliage and black berries. It can be used in mass plantings combined with other shrubs, in screen plantings, or as a clipped hedge. It is supposed to be a sun-loving plant, but, it has made a satisfactory growth in full shade on the Fort Hays station grounds at Hays. A seven-year-old plant that has been growing in full shade has made a height growth of 68 inches and has a spread of 62 inches.

The Dogwoods.—The coral dogwood, *Cornus alba sibirica*, makes a tall growth having bright coral-red stems. The Bailey dogwood, *Cornus baileyi*, has stems that are of a slightly lighter red color. It is of the more spreading type, a four-year-old plant having a height growth of 42 inches and a spread of 72 inches. The golden-twig dogwood *Cornus stolonifera* var., has attractive bright yellow stems. It is subject to occasional killing-back and is not recommended for general planting. The roughleaf dogwood, *Cornus asperifolia*, makes a dense, upright growth with young stems having a reddish-brown color, and the older wood having a gray bark. It is used mainly for its foliage effect. In western Kansas the dogwoods cannot be depended upon to produce the bloom and fruit that are characteristic of the genus in the eastern states. Only during very favorable springs have blossoms and fruit been produced at Hays.

The Elders.—The American elder, *Sambucus canadensis*, is a tall-growing shrub suitable for use in mixed shrubberies. It produces large sprays of white flowers, followed by dark purple fruits that are used in making jams and jellies. The cutleaf elder, *Sambucus canadensis acutiloba*, is similar to the American elder, but has a finer-textured foliage, making it more desirable for ornamental plantings. Both species are hardy at Hays.

The Forsythias or Goldenbells.—Of the Forsythias, four kinds have so far made a satisfactory growth at Hays—the border Forsythia, *Forsythia intermedia*; showy border Forsythia, *Forsythia intermedia spectabilis*; weeping Forsythia, *Forsythia suspensa*; and the fortune Forsythia, *Forsythia suspensa fortunei*. The Forsythias are rather loose, open-growing shrubs that have a place in mass plantings. In the eastern part of the state the Forsythias are noted for their wealth of bright yellow, bell-shaped flowers that are borne

in early spring, but in western Kansas they bloom only during very favorable springs.

The Honeysuckles.—The Tatarian honeysuckle, *Lonicera tatarica*, and varieties of it have been used in western Kansas plantings for many years. They are used mainly for specimen and screen plantings, making large shrubs. They should be allowed plenty of space for development, a seven-year-old bride honeysuckle, *Lonicera tatarica grandiflora*, having made a height growth of 7 feet with a spread of 5½ feet, the same-aged rosy Tartarian honeysuckle, *Lonicera tatarica rosea*, measuring 4 feet in height with a spread of 4 feet. They can be kept to a smaller size by pruning out the old canes at the base during the dormant season. Other honeysuckles that are growing successfully in the testing blocks are the Morrow honeysuckle, *Lonicera morrowi*, and the Amur honeysuckle, *Lonicera maacki erubescens*.

Indigo Bush.—The indigo bush, *Amorpha fruticosa*, is native to western Kansas where it is found growing along stream beds. It is a tall-growing shrub that can be used in masses of shrubbery. Severe pruning back will keep this species more compact in form, and cause it to bloom more heavily. The small, violet-purplish flowers that are produced make it valuable in heavy plantings. It is hardy throughout western Kansas.

The Lilacs.—Of the lilacs so far tested at Hays the Chinese lilac, *Syringa chinensis*, the Persian lilac, *Syringa persica*, and the common lilac, *Syringa vulgaris*, are hardy. The first two named are being used in preference to the common lilac, inasmuch as they do not sucker so freely. In western Kansas the common lilac too often grows to a height of only about 4 feet with a spread of 10 or more feet. Measurements of six-year-old Chinese lilacs show a height of 64 inches with a top spread of 52 inches and basal measurement of 16 inches, while with the common lilac of the same age the height is 54 inches, with a top spread of 56 inches and a basal measurement of 56 inches. Both the Chinese and Persian lilacs can be used for unclipped hedges as well as for specimen or mass plantings. Like other flowering shrubs in western Kansas, the lilacs will bear flowers only during favorable spring seasons.

The Mock Oranges.—The hardiest species in this genus that have been tested at the Hays station are the sweet mock orange, *Philadelphus coronarius*, the big scentless mock orange, *Philadelphus grandiflorus*, and the virginal mock orange, *Philadelphus sp.* (Fig. 6). The sweet mock orange, often called syringa, produces an abundance of white flowers that have an orange-like fragrance. The big scentless mock orange, as its name indicates, produces large flowers that do not have a fragrance. The virginal mock orange is one of the newer varieties and, unlike the other two named, bears large clusters of flowers several times during the growing season instead of having only one period of bloom. All of these varieties make a rapid growth and will develop into large bushes. A six-year-old sweet mock orange measures 5 feet in height with a spread

of 40 inches, the same-aged big scentless mock orange measures 70 inches in height with a 36-inch spread, while the virginal mock orange measures 54 inches in height with a spread of 30 inches. All of these mock oranges need protection from wind for their best development in western Kansas.

The Plums.—The tall-growing purple-leaf plum, *Prunus cerasifera pissardi*, can be grown successfully on protected sites in western Kansas. Its purple-leafed foliage makes it a valuable shrub for use at prominent points in border plantings or as a specimen. The western chokecherry, *Prunus demissa*, is native to western Kansas. It can be used for screen or border plantings where a tall, wide-spreading effect is desirable. The fruit of this species and the native sandhill plum, *Prunus angustifolia watsoni*, is widely used for making preserves and jellies. The sandhill plum does not make a desirable ornamental shrub because of its sprouting habit, and sandhill plum thickets should be located only on sites where this characteristic will not be objectionable.

The Privets.—The most promising privets for western Kansas planting are the Amur privet (northern strain), *Ligustrum amurense*, and the Thompson hybrid privet, *Ligustrum* sp. The latter has been making a vigorous, bushy growth, and while it suffered some injury during the winter of 1930-'31, it has made a remarkable recovery. The leaves persist until late in the winter, making it desirable for hedge planting. The Amur privet has been growing successfully at Hays for 8 years, and like the Thompson privet, suffers some injury during severe winters, but recovers readily on favorable sites. Both of these privets are used mainly for ornamental hedges, but can be used in mass plantings where a dark green foliage effect is desired. The Amur privet is being used as far west as Tribune and the Thompson privet is growing successfully as far west as Colby. For hedge purposes the privets should be spaced 12 inches apart and should be planted about 3 inches deeper than the original nursery level if a dense hedge is to be developed. They must be clipped at regular intervals during the early part of the growing season. Too heavy clipping late in the growing season is likely to result in weakening the plants. Other privets that have made a fair showing in the testing blocks at Hays include the European privet, the Iboya privet, and the Regel privet.

Redbud or Judas Tree.—Redbud, *Cercis canadensis*, can be grown as a small tree or as a large shrub. It makes an attractive specimen plant as it bears a profusion of small pink flowers early in the spring before other trees or shrubs show any signs of new growth. Some winter injury has been found in plants raised from eastern seed, but those raised from seed collected at Hays have proved to be hardy. The redbud requires protection when planted in the extreme western portion of the state.

Russian Olive and Silverberry.—Russian olive, *Elaeagnus angustifolia*, can be used as a tall shrub, a low-growing specimen tree (frontispiece), or in a windbreak. Its silvery foliage makes it valu-

able for bold positions in group plantings or as a specimen. When properly pruned it also can be used as a medium-height hedge. It produces a mass of small yellow flowers that have a peculiar intense fragrance, followed by small olive-like fruits that persist until late in the fall. It is entirely hardy at Hays. The silverberry, *Elaeagnus argentea*, is a tall-growing shrub having a silvery foliage similar to the Russian olive. It is hardy at Hays and can be used throughout the northern half of western Kansas.

The Spireas.—Of the many species and varieties of spirea so far tested at the Fort Hays station, the common Vanhoutte spirea (fig.



FIG. 6.—(Upper) Tamarix sheared to various forms and sizes.
Lower left: Virginal mock orange specimen in the testing block, Fort Hays Agricultural Experiment Station.
Lower right: Vanhoutte spirea in full bloom.

6) *Spircea vanhouttei*, is by far the hardiest. Its graceful form, handsome foliage, profuse flowering habit, and hardiness make it the leading shrub for specimen, group, and hedge planting in western Kansas. Other species and varieties that are being tested at the station include the Anthony Waterer, Froebel, Korean, Bridal wreath, and Thunberg. A few of these can be grown in western Kansas when properly protected from wind and given winter protection, but cannot be recommended for general planting. Many of the low-growing types of spirea have proved to be subject to chlorosis.

Sumac.— The common smooth sumac, *Rhus glabra*, can be used in shrubberies where it is valuable for the dark green color of the foliage during the summer, the scarlet color it assumes in the fall, and the velvety clusters of red fruit that persist throughout the winter. Because of its habit of root suckering it must be used sparingly, as it will tend to crowd out adjacent shrubs. The smooth sumac is native to western Kansas.

The Tamarix.— Several species and varieties of tamarix can be grown successfully in western Kansas. The Amur tamarix, *Tamarix pentandra* var., and the Odessa tamarix, *Tamarix odessana*, are valuable for specimens, ornamental hedges, or combined with other shrubs in groups or masses. The African tamarix, *Tamarix africana*, is considered hardy in this section, but has suffered some winter injury during severe seasons. Tamarix is among the few kinds of shrubs that can be grown in western Kansas without wind protection or artificial irrigation, provided that clean culture is practiced. When used as a snow trap or a low windbreak the plants should be spaced 3 to 4 feet apart, while for ornamental hedges (fig. 6) the spacing should be about 2 feet apart in the rows. Tamarix can readily be propagated from cuttings. When used as specimens they should be cut back to the base every few years, because of their rapid growth. Tamarix develop a very vigorous root system that tends to drain the adjacent area of nutrients, so they cannot be recommended as a windbreak for gardens where only a limited amount of ground is available. A space of about 20 feet should be allowed.

Deciduous Shrubs of Minor Importance.— A large number of deciduous shrubs other than those listed above have been tested at the Fort Hays Agricultural Experiment Station, and of this group the following have been selected as having limited use in western Kansas: Common buckthorn, glossy buckthorn, European cranberry bush, cutleaf chaste-tree, lilac chaste-tree, Nanking cherry, shrubby cinquefoil, common hoptree, Lemoine mock orange, common nine-bark, and service berry. Several of these have been tested for only a few years but show promise of having desirable characteristics, and are recommended for minor use to those interested in having a larger number of species and varieties in their shrubberies.

Evergreen Shrubs.— Evergreen shrubs have only recently been used for planting on the farmstead. They have a place in home ground plantings, but should be used with care. A few evergreen shrubs placed in their proper relative position with deciduous shrubs are all that are necessary for a foundation planting of the average home. They can also be used to advantage in prominent positions in shrubberies, or as foreground plants in evergreen tree groups. All of the evergreen shrubs mentioned here are classed as intolerant, so they should not be planted in heavily shaded sites.

The Junipers.— Savin juniper, *Juniperus sabina*, and the Pfitzer juniper, *Juniperus chinensis pfitzeriana*, are shown in figure 7. Both are low-growing. Taller-growing junipers that can be used for

foundation plantings or as specimens are the Cannart red cedar, *Juniperus virginiana cannartii*, the silver red cedar, *Juniperus virginiana glauca*, and the common eastern red cedar, *Juniperus virginiana*. The Cannart cedar has a compact form with dark green leaves, and the silver cedar has an attractive blue-green foliage. These do not assume the red-cast to their foliage that is characteristic of the common eastern red cedar during the winter months. All of the above junipers are hardy in western Kansas.



FIG. 7.—A foundation planting of evergreen shrubs. The low plants in the foreground, reading from left to right, are Savin juniper, Mugho pine, Pfitzer juniper, Pfitzer juniper, Savin juniper, and Mugho pine. The tall evergreens are eastern red cedar, Cannart red cedar, Chinese arborvitae, and silver red cedar.

The Arborvitae.—Arborvitae cannot be considered as being entirely hardy in western Kansas. Of the many species and types tested at Hays, the Chinese arborvitae, *Thuja orientalis*, is the only one that can be classed as being even semi-hardy. On well-drained sites this species makes a desirable specimen or sheared hedge. Excessive watering seems to encourage a chlorotic condition. The compact type Chinese arborvitae continues to be used as a specimen, but this type is very subject to winterkilling. The red cedar and low-growing forms of junipers should be used in preference to the arborvitae (See Chinese arborvitae, page 27.)

Mugho Pine.—The Mugho pine, *Pinus montana mughus*, is a dwarf-growing pine that is adapted to use in the foreground of foundation and mass plantings, as shown in figure 7.

CLASSIFICATION OF SHRUBS

SHRUBS FOR TRIMMED HEDGES

| Scientific Name | Common Name |
|-------------------------------------|--------------------|
| <i>Caragana arborescens</i> | Siberian pea-tree |
| <i>Cotoneaster acutifolia</i> | Cotoneaster |
| <i>Elæagnus angustifolia</i> | Russian olive |
| <i>Juniperus virginiana</i> | Eastern red cedar |
| <i>Ligustrum amurense</i> | Amur privet (noru) |
| <i>Tamarix odessana</i> | Odessa tamarix |
| <i>Tamarix africana</i> | African tamarix |
| <i>Tamarix pentandra</i> var..... | Amur tamarix. |

SHRUBS FOR FLOWERING HEDGES

| Scientific Name | Common Name |
|--|---------------------------|
| <i>Lonicera tatarica</i> | Tatarian honeysuckle |
| <i>Philadelphus coronarius</i> | Sweet mock orange |
| <i>Philadelphus grandiflora</i> | Big scentless mock orange |
| <i>Philadelphus</i> var. <i>virginal</i> | Virginal mock orange |
| <i>Spiræa vanhouttei</i> | Vanhoutte spirea |
| <i>Syringa chinensis</i> | Chinese lilac |
| <i>Syringa persica</i> | Persian lilac |

SHRUBS FOR PLANTING IN PARTIAL SHADE

| Scientific Name | Common Name |
|--|--------------------|
| <i>Berberis thunbergi</i> | Japanese barberry |
| <i>Cornus alba siberica</i> | Coral dogwood |
| <i>Cornus baileyi</i> | Bailey dogwood |
| <i>Cotoneaster acutifolia</i> | Peking cotoneaster |
| <i>Ligustrum</i> (in variety)..... | Privets |
| <i>Rhus glabra</i> | Smooth sumac |
| <i>Sambucus acutiloba</i> | Cutleaf elder |
| <i>Sambucus canadensis</i> | American elder |
| <i>Spiræa vanhouttei</i> | Vanhoutte spirea |
| <i>Symphoricarpos occidentalis</i> | Western snowberry |
| <i>Symphoricarpos racemosus</i> | Common snowberry |
| <i>Symphoricarpos vulgaris</i> | Coralberry |

DECIDUOUS TREES

Cottonwood.—The cottonwood, *Populus sargentii*, is the most rapid-growing tree species native to western Kansas. It requires considerable moisture for development and must be confined to bottom-land sites. When planted in waste land along creeks it will furnish a permanent supply of fuel for farm use. Its rapid growth is shown in a grove of 28-year-old cottonwoods on a bottom-land site at Hays. These measure 13 inches in diameter with an average height of 55 feet. When used as shade trees only staminate trees, those that do not bear "cotton," should be planted. These can be raised from cuttings secured from trees that do not produce cotton.

The Elms.—The native American elm, *Ulmus americana*, makes a slow growth on upland sites in western Kansas, but continues to be one of the most valuable ornamental trees for permanent plantings. Like other species native to this section, it is found growing

only along streams, usually being the predominating species. Along Big creek in Ellis county (see frontispiece) there are specimens measuring 3 to 4 feet in diameter with a crown spread of about 100 feet. Under clean cultivation on bottom-land sites it makes fairly rapid growth. Measurements of three-year-old seedlings on such a



FIG. 8.—*Left*: An eight-year-old Chinese elm showing the results of cold injury received during the spring of 1931. Note injured areas on the main trunk.

Right: An eleven-year-old Chinese elm on the Fort Hays station grounds measuring 13 inches in diameter with a height of 35 feet.

site show a height of 5½ feet. The Chinese elm, *Ulmus pumila*, had until 1931 been classed as a desirable deciduous tree for western Kansas planting. It is very drought-resistant, is adapted to various types of soil, and will withstand winter conditions with the exception of storms such as the March blizzard of 1931, the most severe of its kind recorded in 68 years. During this storm many Chinese elm trees were killed outright, some were tipped back, and others were damaged by a rupturing of the stem. Injuries of this type are shown in figure 8 (left). It should be appreciated that the Chinese

HARDY TREES AND SHRUBS

23

elm was not the only forest tree species that suffered injury during the storm of March, 1931. Species such as the common American elm, which is considered as being very hardy, suffered considerable injury in several cases.

The oldest Chinese elm in western Kansas was planted in 1912,



FIG. 9.—A “corky type” Chinese elm, 10 years old, measuring 5 inches in diameter with a height of 18 feet. Compare this type with the one shown in figure 8 (right). The corky type Chinese elm has shown considerable resistance to winter injury and insects and should be more widely used.

and due to its comparatively recent introduction, there is still a question as to whether it will be long-lived in this section. It surpasses all other species in rate of growth when planted on exposed upland sites, and is recommended at least as a temporary tree both for windbreak and ornamental use. The Chinese elm shown in figure 8 (right) is 11 years old, was grown from seed, and measures 13 inches in diameter with a height of about 35 feet. This specimen

also illustrates the low-forking habit of the species. Forks of this nature are subject to splitting, which can be avoided by pruning the trees to one central stem while young and allowing only those branches that have a wide angle of departure from the main stem to develop.

Another "Chinese elm," sometimes referred to as the Siberian elm or corky Chinese elm, has been growing successfully at Hays since 1923. This strain differs from the *Ulmus pumila* in having corky-ridge bark, very rough leaves, and is comparatively slow-growing. It did not suffer any winter injury during the winter of 1930-'31, as did the *Ulmus pumila*, and promises to be a desirable tree for both windbreak and ornamental plantings. The *Ulmus pumila* starts new growth early in the spring, while the corky type of Chinese elm does not start growth until later in the spring, making the latter type less susceptible to injury by late spring freezes. Figure 9 shows a 10-year-old corky Chinese elm that measured 5 inches in diameter with a height of 18 feet.

Green Ash.—The green ash, *Fraxinus lanceolata*, is native to western Kansas that was used extensively in some parts of this

section during the Timber Claim period. Many of these timber claim plantings are still standing, the trees having made a slow, persistent growth, and, in spite of the injuries caused by borers, continue to survive and give valuable shelterbelt protection. Many of the ash trees in these timber claims that are located on exposed upland sites, and were planted from 1880 to 1890, now measure only 4 to 6 inches in diameter. Green ash trees on the station grounds that were planted in 1912 on favorable bottom-land sites now measure 14 inches in diameter with a height of about 30 feet.



FIG. 10.—Isolated hackberry on Fort Hays Agricultural Experiment Station grounds.

Hackberry.—The hackberry, *Celtis occidentalis*, is native to western Kansas,

and like practically all other native trees in this section, is found growing only along streams. It can be grown successfully on bottom-land sites, but makes a very slow growth and requires considerable attention when planted on upland sites. The hackberry de-

velops a pleasing form and deserves a place in permanent plantings as an ornamental. The tree shown in figure 10, located on bottom land, is about 18 years old, and has a diameter of 15 inches with a height of 40 feet.

Honey Locust.—The honey locust, *Gleditsia triacanthos* is another species that was used extensively in early plantings, but has lost its popularity because of the borer. Observations of early plantings of the honey locust show that, the greatest loss due to the borers is on sites where the trees have been neglected and are



Fig. 11.—White poplar. The silvery leaves of the white poplar make it a valuable specimen tree.

not making a thrifty growth because of competition with weeds and grass. On favorable sites under clean cultivation this species will withstand a wide range of weather conditions and make a good growth. Its planting is recommended if it can be given good care.

The Poplars.—The Norway poplar, *Populus sp.*, has been used extensively in some localities in western Kansas because of its rapid rate of growth. It is short-lived and should be used only as a temporary tree. Poplars are subject to sun scald. To prevent this the trees should not be headed too high while young. Removing too many of the side branches permits the strong rays of the sun to injure the stems. The white poplar, *Populus alba*, usually

called the silver poplar, makes an attractive ornamental tree and can be used as a temporary windbreak. It is comparatively short-lived and has a tendency to sprout from the roots when the soil around the base of the tree is disturbed. When planted in sod and irrigated, as shown in figure 11, there is practically no sprouting. Its silvery foliage makes it a valuable specimen tree. Like the Norway poplar, the silver poplar requires considerable moisture for best development and cannot be recommended for dry, upland sites. The Lombardy poplar has been tested repeatedly at Hays and proved too short-lived to warrant its use.



FIG. 12.—A black-walnut grove along Big creek in Ellis county.

Russian Mulberry.—The Russian mulberry, *Morus alba tatarica*, has a limited use in western Kansas, being suitable for planting on protected sites and those having sufficient moisture. On exposed upland sites the Russian mulberry is subject to winterkilling. On favorable sites it is a valuable species for fence-post production, the wood being durable in contact with the soil. Selected trees that do not bear fruit can be used for specimen planting. This species can also be used as a hedge, responding readily to close clipping.

Russian Olive.—The Russian olive, *Elaeagnus angustifolia*, is one of the most valuable species available for windbreak planting in western Kansas. It is a low-growing tree (frontispiece) making a bushy form if allowed to grow naturally, as in a windbreak. It is drought-resistant, will withstand low temperatures, and is one of the few species that can be planted safely on exposed upland sites. For windbreak planting Russian olives should be spaced 6 to 8 feet apart, with the rows 8 to 12 feet apart, depending upon the site.

The Russian olive is also desirable for specimen planting or in mixture with other species.

Black Walnut.— The black walnut, *Juglans nigra*, is native to eastern Kansas and can be grown on favorable sites in the western half of the state. Here it usually makes a slow growth, although an exceptional row of three-year-old trees was found on an upland site in Cheyenne county. These trees measured from 8 to 10 feet in height. A more typical growth is shown in figure 12, the trees being about 23 years old with a diameter of from 4 to 5 inches and a height of over 30 feet.

Deciduous Species of Minor Importance.— Other species of deciduous trees that are of minor importance in western Kansas include the following: Ailanthus, *Ailanthus altissima*; western catalpa, *Catalpa speciosa*; coffee tree, *Gymnocladus dioica*; black locust, *Robinia pseudacacia*; soft maple, *Acer dasycarpum*; bur oak, *Quercus macrocarpa*; and Osage orange, *Toxylon pomifera*. Some of these species can be used on certain sites in western Kansas, but are not recommended for general use.

CONIFERS FOR WESTERN KANSAS

The use of evergreens in farm plantings is highly recommended. Many of the early plantings consisted of several species of deciduous trees along with a few pines or red cedars. On several sites so planted no evidence of the deciduous species exists to-day except a few dry stumps, while the evergreens have persisted and have withstood attacks of grasshoppers, hail, and drought.

Eastern Red Cedar.— The eastern red cedar, *Juniperus virginiana*, is the only conifer native to western Kansas. (Fig. 13.) It is the hardiest evergreen that can be used either for ornamental or windbreak plantings. It responds to shearing and will develop a dense hedge when properly pruned. The red cedar makes a fairly rapid growth and should be used where permanent screen or border plantings are desired. When planted in windbreaks it offers a year-long protection. The trees in the windbreak shown in figure 14 were planted 6 feet apart in the row and allowed to grow unpruned. Red cedar is a host plant to the red cedar apple fungus, and should not be planted within 1 mile of apple orchards. This factor can be overlooked in western Kansas since apples are not grown on a commercial scale.

Chinese Arborvitae— The Chinese arborvitae, *Thuja orientalis*, has a very limited use in western Kansas. Individual specimens can be found growing in almost every county in western Kansas, but this species is subject to winter-injury and cannot be recommended for general planting in the western part of the state. On favorable sites it makes an ideal hedge, ornamental tree, or windbreak, but cannot be considered as a dependable species for permanent plantings. The hedge shown in figure 14 was planted in 1919 and has been sheared annually. The trees shown in figure 14 are of the

same age, but were pruned from the base to develop an upright form. For screen or group plantings they should be allowed to grow naturally.

Austrian Pine.—The Austrian pine, *Pinus nigra*, is an introduced species that has proved to be hardy in western Kansas. It makes a comparatively bushy growth and has abundant dark green foliage that makes it desirable as a specimen tree as well as for wind-

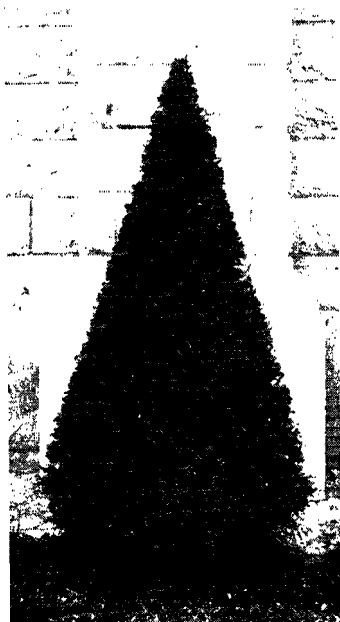


FIG. 13.—A native red cedar used as a specimen in a foundation planting.

break and shelterbelt, plantings. The specimen shown in figure 15 was planted on the Fort Hays station grounds in 1904 and has a basal diameter of 12 inches with a height of 30 feet. During favorable growing seasons the Austrian pine has made from 16 to 18 inches of height growth. This species can be safely used throughout the western part of Kansas.

Ponderosa Pine.—The ponderosa pine, *Pinus ponderosa*, also called western yellow and bull pine, has been brought in from its native site in the Rocky mountains, and has proved to be hardy at Hays and in all of western Kansas. The ponderosa pines shown in the wind-break in figure 16 are 28 years old and have an average height of 25 feet with a basal diameter of 8 inches. These are planted on an upland site at the Fort Hays Agricultural Experiment Station. This species can also be used for specimen planting or in mixture with other conifers in groups. Like

other pines, the ponderosa pine makes a slow growth the first few years after planting. After it becomes established it makes a favorable rate of growth, six-year-old plants making an average height growth of 12 inches during the season of 1932.

Scotch Pine.—The Scotch pine, *Pinus sylvestris*, is distinct from other pines in having orange-brown colored bark on young growth. The common type is inclined to have an irregular, spreading crown, while the Riga type tends to have a more symmetrical upright form. This latter type is making satisfactory growth at Hays, but is not considered so desirable for general planting in western Kansas as the Austrian and ponderosa pines.



FIG. 14.—*Top:* A red-cedar windbreak on the Fort Hays station grounds.

Middle: A Chinese arborvitæ hedge bordering the entrance drive at the Fort Hays nursery. Austrian pines are in the background.

Bottom: Chinese arborvitæ pruned as upright trees. These are of the same age as those shown in the panel above them, but have been pruned from the base instead of being sheared as a hedge.

TREES AND SHRUBS FOR SOUTHWESTERN KANSAS

The climatic and soil conditions peculiar to the extreme southwestern portion of Kansas warrant listing the plant materials that can be used in this area. Of the shrubs mentioned in this circular, the following have a place in southwestern Kansas plantings: Coral-



FIG. 15.—A specimen Austrian pine on the Fort Hays station grounds.

berry, honeysuckle, indigo bush, lilac, mock orange, privet, spirea, and tamarix. The planting of shrubs should not be attempted until sufficient windbreak protection has been secured.

Deciduous and coniferous tree species that are recommended for southwestern Kansas include: Cottonwood, American elm, Chinese elm, corky type Chinese elm, hackberry, honey locust, Russian mulberry, red cedar, Austrian pine, and ponderosa pine.



FIG. 16.—A ponderosa-pine and red-cedar windbreak located on an upland site at the Fort Hays Agricultural Experiment Station.

SUMMARY

1. The factors that must be given careful consideration to insure success with trees and shrubs in western Kansas are: The selection of species, preparation of soil, planting, and care.

2. There are only a limited number of species of trees and shrubs that can be raised successfully in western Kansas. The plant list should be limited to those species that are known to be hardy.

3. Windbreaks or shelterbelts should not be planted in sod or newly-turned sod ground. Careful soil preparation always pays for itself in terms of vigorous growth.

4. Exposure of seedlings and transplants to wind and sun while planting will result in a low percentage of survival.

5. Trees and shrubs should be planted slightly deeper than the original nursery level and the soil should be tramped firmly about the roots.

6. All ornamental trees and shrubs should be cut back when transplanting.

7. Irrigation is necessary for all shrubs if a good growth and bloom are to be expected. Newly-planted trees on exposed sites should be watered during periods of drought.

8. Regular cultivation must be practiced to conserve the limited moisture by preventing weed growth and at the same time keeping the soil in a good state of tilth so that it will be receptive to moisture.

9. A planting plan should be made and carefully followed.

10. An important fact to remember in farm beautification is that trees, shrubs, chickens, pets, and farm animals cannot all be raised on the same ground with any degree of success as far as the trees and shrubs are concerned.