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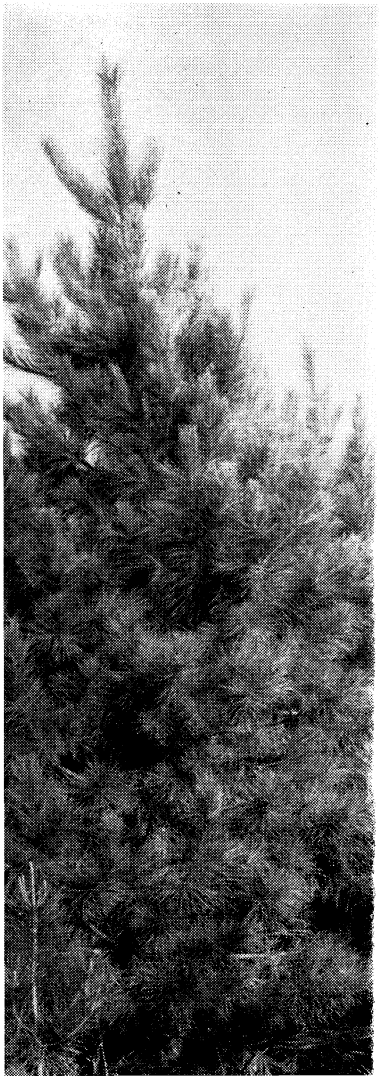
CEDAR AND PINE

as

FARM TREES

for

OKLAHOMA



OKLAHOMA AGRICULTURAL EXPERIMENT STATION

Oklahoma A. & M. College, Stillwater

W. L. Blizzard, Director Louis E. Hawkins, Vice Director

CONTENTS

Cedar and Pine as Farm Trees for Oklahoma

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Coniferous species have a special appeal for many people. Being evergreen,* they provide certain effective services not only during the growing season but during the winter months as well. Their ability to retain foliage the year around makes them of particular value in windbreaks and in ornamental planting.

This bulletin deals with several coniferous species which have been under observaton at the Oklahoma Agricultural Experiment Station for the past four to eight years. Some of these, native to Oklahoma, are well adapted to many sites in the States and have been in use for many years. Others have shown possibilities in Oklahoma; but, being relative newcomers, need to be tried further before definite recommendations can be offered for their use in farm planting.

This bulletin is based on observations reported in more detail in Technical Bulletin T-34. Most of these observations were made on two experimental plantings, one located about three miles north of Stillwater, the other about six miles west.

RED CEDAR

Eastern red cedar *(Juniperus virginiana)* is familiar to everyone in Oklahoma. It is well adapted to a variety of soil and moisture conditions and is the State's most widely used conifer. Both government and private nurseries have been growing red cedar from seed with various degrees of success. The two principal uses of red cedar seedlings at present are in afforestation and in commercial nurseries as the rootstock for grafting many ornamental varieties of Juniper.

The demand for locally grown seedlings of red cedar has far exceeded the supply in recent years, due to difficulties involved in germinating the seed and growing small seedlings.

* The only exception is the bald cypress, native of the southeastern part of the State

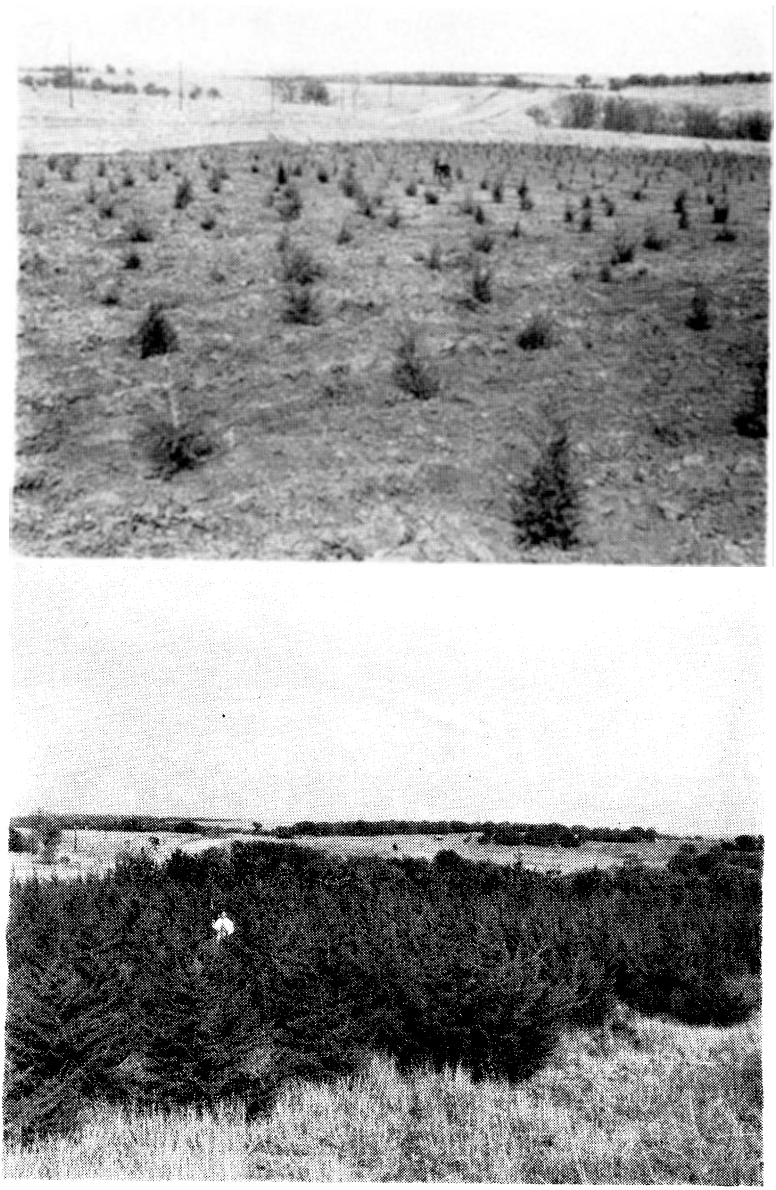

FIGURE 1.—Red cedar and Japanese red pine on thin light soil with a hardpan from 4 to 15 inches below surface. Top: One year after planting. Bottom: Seven years later; average height of red cedar, 7.1 feet.

Both seed and seedlings are very exacting in site requirements and need constant care. Both are highly susceptible to a number of unfavorable influences which often cause complete loss of the crop.*

Possibilities as a Short Rotation Crop

At the time the two experimental plantations of red cedar were set out, production of fence posts was the principal aim. Whether this aim can be realized on poor soil remains to be seen. Under unfavorable conditions many post plantations in Oklahoma have stagnated before the trees were big enough for use as posts.

However, the trials at this Station point to the possibility of commercal uses of the red cedar other than as posts or for the manufacture of various wood products. These uses do not require trees of large sizes and therefore a return can be realized in a relatively few years after the trees are planted.

Christmas Trees.—One such use is for Christmas trees, where trees four to six feet high are in greater demand than those of larger sizes. Harvesting trees of small sizes means not only an early return from the plantation, but also more complete utilization of land devoted to growing red cedar. Furthermore, small trees can often be grown on land where it is impossible, or at least extremely difficult, to produce trees that can be used for posts or lumber.

To what extent growing of red cedar for Christmas trade can be counted on for early cash return depends, of course, on the local market conditions. However, the experience in the trial plantation at Stillwater points to a possibility of deriving an early and substantial return from red cedar grown on land poorly adapted to other farm crops.

Nursery stock.—Another possible use of small red cedar is in landscape and ornamental plantings. For such use roots of young trees should be undercut occasionally (at least once in two years) to force the plants to form more compact and efficient root systems. Red cedar after reaching the age of three years should not be moved without a ball of dirt. At this Sta-

* Methods of producing seedlings of red cedar are fully discussed in Oklahoma Station Bulletin B-256.

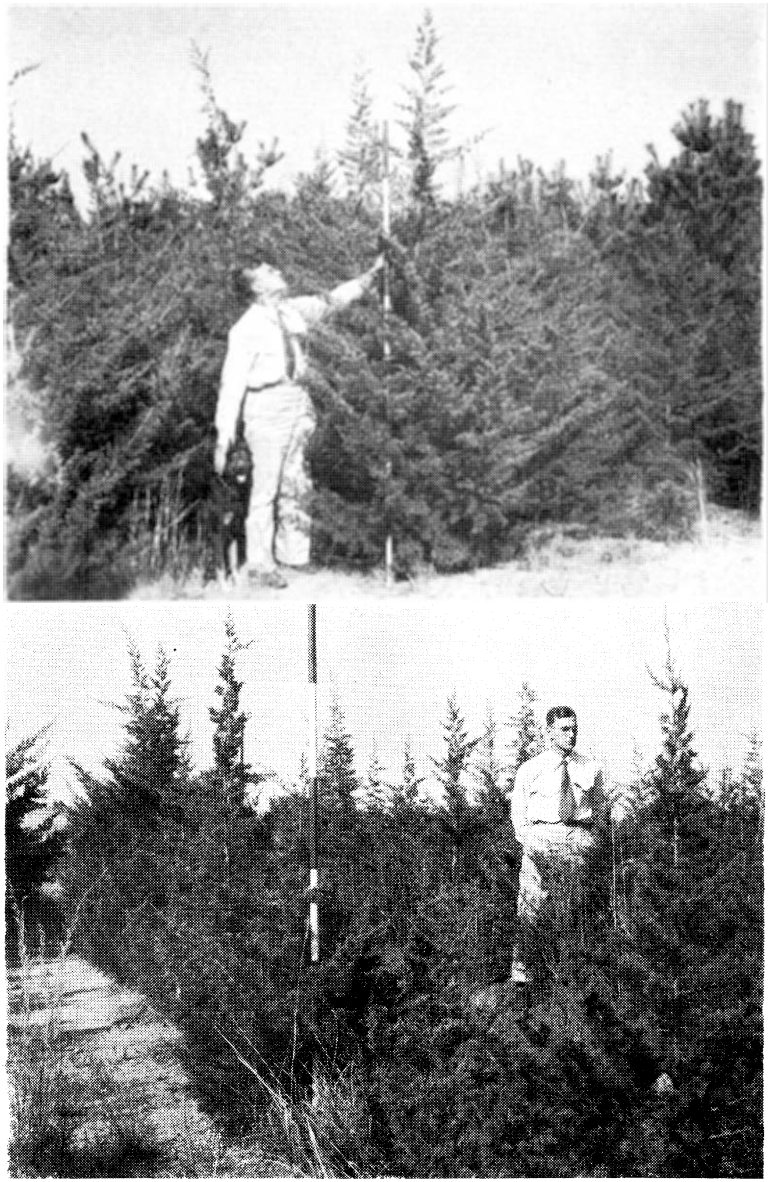

FIGURE 2.—A close-up of an 8-year-old plantation 6 miles west of Stillwater. Variation in the quality of soil is responsible for the difference in the height of red cedar. Top: The best part of the plantation; individual trees are from 9 to 14 feet tall. Bottom: On thin, eroded soil many trees are only 3 to 4 feet in height. All trees were planted the same day.

tion, transplanting bare-rooted three-year-old red cedar resulted in a loss of 64 percent of trees as compared with less than 20 percent loss of two-year-old trees. The planting was done in the field without watering. In ornamental planting, which is always followed by watering, the chance of survival undoubtedly would be increased.

Selling two-year-old transplants to propagators of ornamental plants presents another possibility of early return from growing red cedar.

Production Methods

Effect of Soil-type. — The plantation north of Stillwater was established in the winter of 1942-43 on very poor, thin soil with heavy subsoil. In anticipation of early harvest, two-year-old transplants were set at the rate of 4,100 trees per acre (3 feet apart in rows spaced 3½ feet apart). Trees which died were replaced the following spring. Annual replacement of dead trees was continued until 1945. Total survival among all trees planted in the course of investigation was approximately 80 percent. Growth was also satisfactory, considering the poor soil. Average height of trees after four years in the field was 56 inches, an average annual growth of 11 inches.

A definite relationship was found between the rate of tree growth and the clay content of the subsoil. Clay content of samples taken at depths of 18 and 36 inches in the plantation north of Stillwater ranged from 21 to 39 percent. Within this range, the best growth was found on lighter soils and the poorest on heavier soils. A similar relation between soil and tree growth was also found in the red cedar plantation west of Stillwater. At both locations, excessively heavy clay was detrimental to the growth of red cedar.

Red cedar produced satisfactory growth on very shallow (8 to 15 inches) light soil, underlaid by sandstone, in the plantation west of Stillwater. Growth was unsatisfactory only in places where the sandstone was within 4 to 6 inches of the surface. Under such conditions the trees grew in 8 years to an average height of less than 6 feet (a few are less than 4 feet

tall), while the average height of all red cedar trees within the plantation was over 7 feet, and the heights of 47 percent of trees were over 8 feet.

Another soil characteristic which showed a strong correlation with the rate of growth was its color. In the vicinity of Stillwater, the best growth of red cedar was found on red and reddish soils, while the poorest trees were located on soils of gray color.

Effect of Thinning. — After four years in the field, parts of the red cedar plantation north of Stillwater were thinned to see if reducing competition among the trees would increase the rate of growth of the remaining trees. In two years following thinning, no improvement in the rate of height growth has been noted. During the first season after thinning, the trees given more space (39.2 sq. ft.) added on the average only 14.6 percent to their heights, while those remaining at the original spacing of 3 x 3½ feet added 23.3 percent. During the second growing season, the rate of growth in height was about the same in thinned and unthinned parts of the plantation.

Approximately 170 three-and four-year-old trees were removed during thinning. Of these, 43 percent were grade 1 Christmas trees and 32 percent were grade 2. The two grades differed in form, density of foliage, and general appearance. The average height of grade 1 trees was 59.2 inches, and that of grade 2 was 51.8 inches. Percentage of trees of grade 1 could have been raised by judicial shearing of trees a year or two prior to harvest.

PINES

The pines of North America vary so much in their reaction to soil and climatic factors that no single statement can cover their environmental requirements. Some are found in the extreme north of this country and in Canada, others could not survive even reasonably mild winters of Oklahoma. Some require abundance of moisture and are commonly growing along the creeks, while the natural range of others is confined to semi-desert where few other plants are able to survive. Many species of pine require light well-drained soils;

some others can grow on heavy clay. The same high degree of variability is exhibited by pines in regards to their form, quality of wood, growth habit, and tolerance.

Four species of pines are native to Oklahoma. Of these, loblolly and shortleaf are of great commercial importance, constituting the principal source of locally produced lumber. Both are found in the eastern part of the State. The range of the western yellow (or ponderosa) and pinon pines extends from the west into the Panhandle. In Oklahoma neither of these two pines is of saw timber size and quality, though on more favorable sites, outside of this State, ponderosa pine constitutes one of the most important sources of commercial timber in the U. S.

Pinon pine is not being planted in Oklahoma. Ponderosa pine has been planted to some extent as a forest tree and an ornamental.

Six species of pine have been observed during the past eight years in the two forest plantations near Stillwater. The following discussion is based chiefly on those observations.*

Shortleaf Pine

Shortleaf pine *(Pinus echinata)* was tried in the experimental plantations at Stillwater partly to determine its adaptability to central Oklahoma, away from its natural range, and partly as a standard with which less familiar species could be compared.

In its natural range, in eastern Oklahoma, shortleaf pine is often found on extremely poor sites, on dry rocky land, in association with oak and hickory of poor quality. Its principal soil requirement appears to be in texture rather than in exact chemical composition. Although in Oklahoma shortleaf pine is found in the region of abundant precipitation, it is able to withstand considerable periods of dry weather.

* To persons used to dealing only with ornamental plants, some of the figures on survival and growth reported here will probably appear too low as compared with their personal experience with the same species. It should be remembered, however, that in forestry practice trees cannot be given the same care as trees planted as individual specimens. Forest trees are planted bare-rooted, and watering is seldom feasible. Conifers in general are highly susceptible to severe injury when their roots are exposed or left in contact with dry soil for any length of time. These were undoubtedly the principal causes of high mortality in the plantation, even when careful precautions were taken in protecting the roots during planting.

Many vigorous trees of this species can be found in shelterbelts and windbreaks in western Oklahoma. Good specimens can also be seen in ornamental plantings in many parts of the State.

Except on very unfavorable soil, shortleaf pine, once established, grows very rapidly unless attacked by insects or fungi. In recent years many shortleaf pines have been infested with the pine-tip moth, an insect prevalent throughout the State. This moth has caused considerable deformity and suppressed growth of many isolated trees as well as of those growing in forests and plantations. In mixed forests the injury is usually confined to small seedlings and saplings growing in the openings. In forest plantations (particularly pure plantations) practically every tree becomes infested and disfigured. In the Station's tree nursery at Stillwater, young shortleaf pines have added very little to their height in the last six or seven years, due to continuous infestation by the tip moth. Control of the moth is entirely possible,* but involves constant observation and care of the trees.

In the experimental plantation established six years ago north of Stillwater, shortleaf pine has surpassed all other trees in rate of growth, both in height and diameter. It now averages 11 feet high, as compared with 6 feet for Japanese red, 4 feet 10 inches for Austrian, and 3 feet 4 inches for ponderosa pines, despite the fact that pine-tip moth attack is more severe on shortleaf than on the others. In diameter, the largest individuals among the shortleaf pines are approaching four inches at the base.

In survival, shortleaf pine shows no significant advantage over the other species.

Except for its extremely high susceptibility to the tip moth, shortleaf pine would still be the most desirable pine for forest plantings in central and western Oklahoma, especially for shelterbelts and windbreaks, where heavy competition may endanger the very existence of slow-growing intolerant trees.

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* M. Afanasiev and F. A. Fenton: "Pine Tip Moth and Its Control in Oklahoma," *Jour. of Forestry* 45 (2): 127-128. 1947.

FIGURE 3.—Shortleaf pine made the most rapid growth of any of the six species observed, despite its growth in height being retarded by tip moths. These insects burrow into the stem near the tip, killing the tip bud and forcing a side branch to take the lead. Left: Five-year-old shortleaf pine on a good site reached a height of 10 to 11 feet. The tallest tree in the picture is six years old, and 14½ feet tall. Right: The average height of shortleaf pine was 11 feet after 6 years in the field.

Western Yellow Pine

Western yellow or ponderosa pine *(Pinus ponderosa)* has deep roots and is very drought resistant. It prefers well drained light soils although in its natural range it is found also on soils of heavy texture. Ponderosa pine has been used in both landscaping and shelterbelts in Oklahoma, but probably is more reliable for landscaping where it is less likely to be crowded. It is very intolerant of shade, which reduces its value in mixed plantings where other species are likely to outgrow it.

In the experimental planting near Stillwater, western yellow pine planted in 1942-43 survived better than any other species of the same age. However, it has also been the slowest grower. In six years in the field, western yellow pine has reached an average height of only 3 feet 4 inches.

This species proved to be hardy and only mildly susceptible to the tip moth.

Austrian Pine

Austrian pine *(Pinus nigra, var. Austriaca)* was introduced to this country from Europe many years ago and since then has established itself firmly as a valuable ornamental. Many trees of this species are found in Oklahoma.

Austrian pine grown as a specimen has a good form, attractive dark green foliage, and in Oklahoma seems to be relatively free of insect and fungus injuries. It has been used to some extent in windbreaks and shelterbelts in the western part of the State.

In the plantation near Stillwater, Austrian pine has the poorest survival rate of the six species tested. It stood fifth in growth rate, reaching an average height of 4 feet 10 inches during six years in the field.

Austrian pine is perfectly hardy. Within the plantation, growing among other species, it has been relatively free of pine-tip moth injury, though some injury from this source has been observed on a few ornamental Austrian pines in the city of Stillwater.

Scotch Pine

Most of what was said about Austrian pine also applies to Scotch pine *(Pinus sylvestris)*, another importation from Europe which has been accepted widely as one of the most attractive and desirable ornamental evergreens. There are sev-

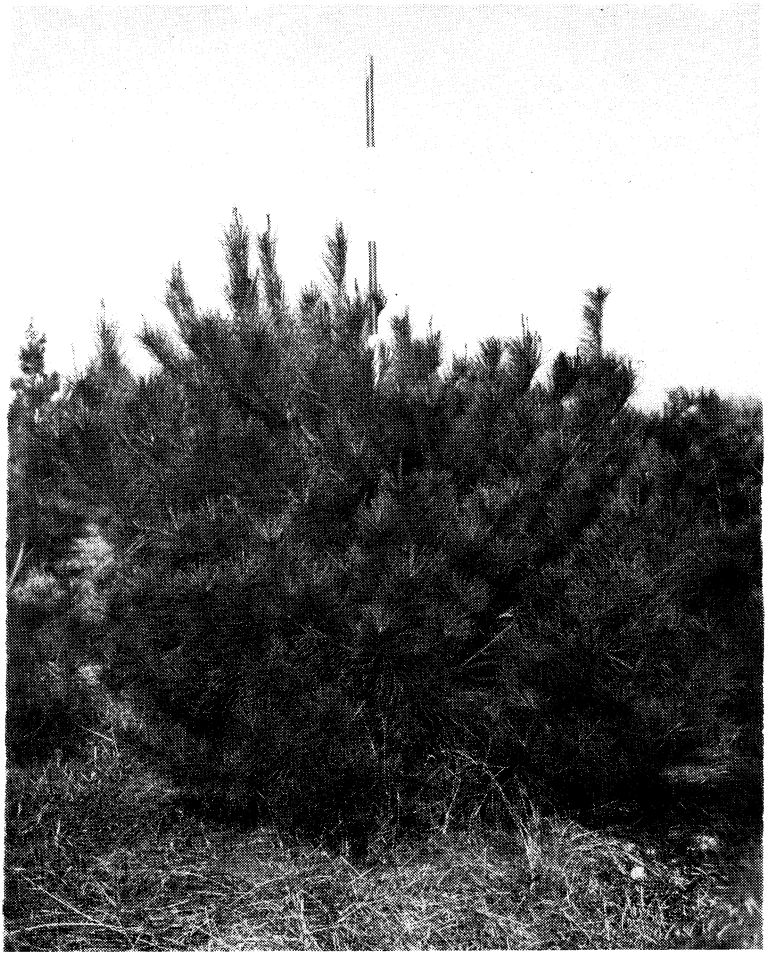

FIGURE 4.—Japanese red pine grows rapidly under Oklahoma conditions. Its bushy form makes it a poor source as fence post material, but suggests high protective value in shelterbelts and windbreaks. The weakest feature of this species is its susceptibility to injury by the pine-tip moths. The tree in the photograph is six years old.

eral varieties of Scotch pine in use, varying chiefly in the color of their foliage. Some are dark green; others have a definite bluish or silverish cast. Use of Scotch pine in forest plantations of Oklahoma has been very limited.

Observations on Scotch pine at this Station have been limited to one small lot, 97 trees, planted in the spring of 1945 as replacement for dead and missing trees in the experimental plantation. Survival during the first three years in the field was slightly lower than that of Austrian and shortleaf pines, but somewhat higher than of Western yellow pine, all planted in the same year. In that period of time, it has reached approximately the same height (2 feet 8 inches) as the Austrian pine of similar age.

Japanese Red Pine

Study of Japanese red pine *(Pinus densiflora)* was prompted by existence on Station land of a few specimen trees which appeared to be doing rather satisfactorily. This pine under Oklahoma conditions is a tree of poor form, often producing more than one stem and branching profusely. When young, many individuals of this species look more like a shrub than a tree. It is a poor producer of usable wood, but its bushy form suggests that it may have use in protective plantings.

Near Stillwater, Japanese red pine has compared favorably with other pines in its ability to survive. It has withstood temperatures as low as 15 degrees below zero. In rate of height growth it has exceeded Austrian, Scotch and Western yellow pines, reaching an average height of 6 feet after six years in the field.

Japanese red pine is highly susceptible to injury by the pine-tip moth, but has been damaged somewhat less than the shortleaf pine. The severity of moth injury is probably the same for both, but the Japanese red pine suffers somewhat less disfigurement because it is normally more branchy.

Since Japanese red pine is a relative newcomer to this State, final recommendations on its use in various types of plantings are not justified. However, judging by its behavior in

the six years it has been under observation, it merits further attention and study, particularly in regard to its use in windbreaks.

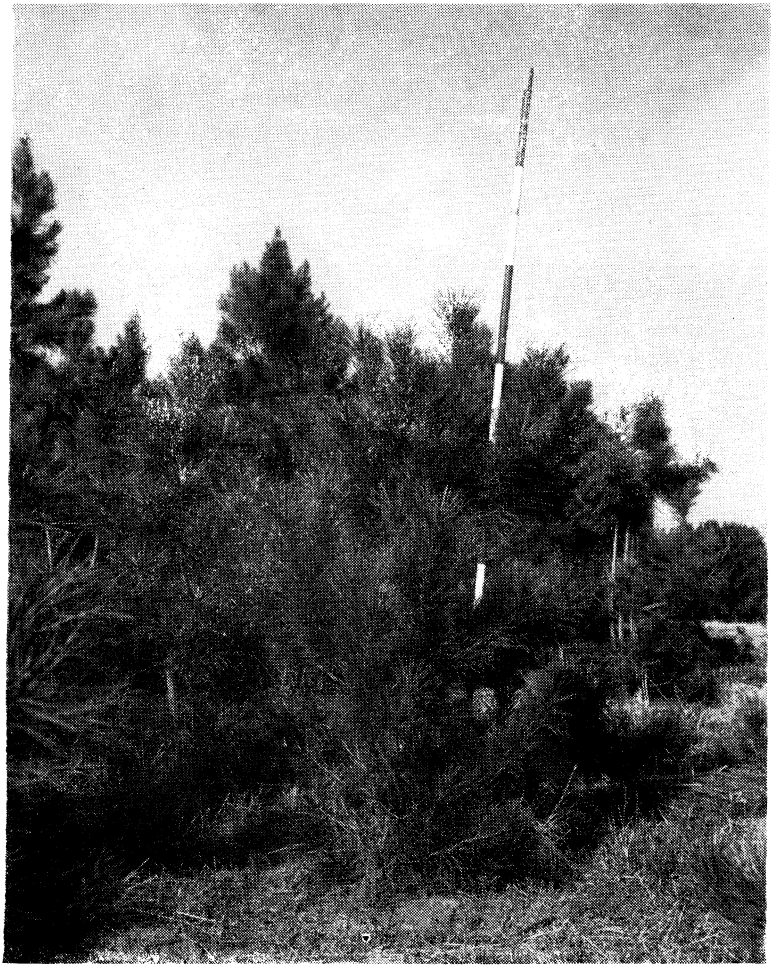

FIGURE 5.—Japanese black pine, despite its origin in a humid climate, has done remarkably well under central Oklahoma conditions. In rate of growth it exceeded all other pines in the plantation with the exception of shortleaf. It is much less susceptible to the tip moths than either shortleaf or Japanese red pines. Japanese black pine has better form than the Japanese red, although a few trees produced two stems of more or less equal size.

Japanese Black Pine

Japanese black pine *(Pinus thunbergii)* is another species which first attracted attention as a few individual trees* growing in the Station nursery. The natural range of this species centers in Japan, where it is an important timber tree. At Stillwater, it has done as well or better than most of the pines tested.

This species was planted in the spring of 1944 as two-year-old trees. At the end of five years, its survival was 87.3 percent, the highest of any species in the plantation.

Rate of growth of Japanese black pine has been exceeded only by the shortleaf pine. After five years in the field, it had an average height of 6 feet 5 inches as against 10 feet 5 inches for shortleaf of the same age.

Combination of high survival, fast growth, fair form, hardiness and relatively low susceptibility to the tip-moth makes the Japanese black pine highly promising for possible use in Oklahoma forest plantations. Although five years is too short a period on which to base final conclusions, this species appears at present to be a worthwhile subject for further study and a highly promising planting material for anyone willing to take a certain amount of risk.

* Identified originally by the Arnold Arboretum, (Jamaica Plains, Mass.).