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Coniferous Windbreak Species and Spacing Tests at the Big Spring Field Station

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SUMMARY

Results obtained thus far in the conifer species and spacing test at the Big Spring Field Station indicate that an effective farm or ranch windbreak can be developed by using a single row, or two or more rows, of Arizona cypress or Eastern red cedar.

For a single row planting to give partial protection from southerly summer winds, a row of Arizona cypress spaced 12 feet apart is adequate. The west and north windbreaks should have two or three rows, with two rows of Arizona cypress or one row each of the Arizona cypress and Eastern red cedar.

If a three-row planting is desired, the row nearest the buildings can be Eastern red cedar with Arizona cypress in the other two rows. In such plantings, a spacing of 12 feet should be used between trees in the rows, and the rows spaced 24 feet apart. This wide interval between rows is a practical spacing because of the increased use of heavy farm machinery for cultivation of the planting.

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Windbreaks serve a useful purpose on most farms on the Southern Plains for protection of the farmstead buildings and livestock against winds which are so prevalent and at times severe. To be most effective, the windbreak should be located on the north, west and south sides of the farmstead area, since these are the directions from which the prevailing winds occur. It should be located 75 to 100 feet from buildings and service areas to allow sufficient air circulation during the summer and to avoid competition to landscape plantings in the residential area. On terrain that permits, the windbreak should be planted on the contour.

The purpose of the test reported here was to determine what coniferous species and spacing should be used under the soil and climatic conditions of the Southern Plains.

ESTABLISHMENT

The coniferous species and spacing test was started in the spring of 1932 in cooperation with the Southern Great Plains Field Station, Woodward, Oklahoma. The original planting consisted of: Arizona Cypress (*Cupressus arizonica*); Eastern red cedar (*Juniperus virginiana*); Oriental arborvitae (*Thuya orientalis*) Rocky mountain juniper (*Juniperus scopulorum*); Ponderosa pine (*Pinus ponderosa*); and Austrian pine (*Pinus nigra*). Between-row spacings of 12 and 24 feet and within-row spacings of 6 and 12 feet were used for each species.

The plant materials initially were set out bare-rooted, but replacements were potted. They were watered at the time of planting. No further supplemental irrigation was given. Plantings were made on an area of relatively deep Amarillo clay loam soil which has been kept free of weeds by cultivation.

Trees in adjoining rows were set opposite each other, and were not staggered.

RESULTS AND DISCUSSION

Table 1 gives the annual precipitation during 1932-57. The average for the period was 17.84 inches. During the severe drouth of 1951-56, it was only 12.88 inches. In 1952, 9.20 inches were recorded and in 1956 a total of only 8.06 inches of moisture was received. The average annual precipitation for 58 years, 1900-57, was 18.36 inches. There were 16 years during the life of the planting when less than the long-term average annual precipitation occurred. These years show the relatively dry conditions under which four of the six species were able to survive.

The percentage survival of the four remaining coniferous species is given in Table 2. Two

TABLE 1. ANNUAL PRECIPITATION AT THE BIG SPRING FIELD STATION, 1932-57

Year	Precipitation, inches	Year	Precipitation, inches
1932	34.25	1946	13.03
1933	11.29	1947	12.94
1934	12.09	1948	12.47
1935	25.95	1949	18.09
1936	22.25	1950	20.75
1937	14.84	1951	12.16
1938	21.32	1952	9.20
1939	15.45	1953	13.05
1940	16.13	1954	18.42
1941	31.62	1955	16.39
1942	23.68	1956	8.06
1943	14.24	1957	23.14
1944	17.79	Average	17.84
1945	25.31		

TABLE 2. EFFECT OF SPACING ON SURVIVAL OF CONIFERS AT BIG SPRING, AUGUST 1958

Species	Spacing, feet				
	6 x 12	6 x 24	12 x 12	12 x 24	Average
	— — — Percent survival — — — —				
Arizona cypress	62.5	75.0	78.1	81.3	74.2
Eastern red cedar	56.3	71.9	90.6	90.6	77.4
Oriental arborvitae	62.5	100.0	9.4	65.6	59.4
Rocky Mountain juniper	0.0	21.9	12.5	46.9	20.3

TABLE 3. EFFECT OF SPACING ON HEIGHT OF CONIFERS AT BIG SPRING, AUGUST 1958

Species	Spacing, feet				
	6 x 12	6 x 24	12 x 12	12 x 24	Average
	— Average height, feet and inches —				
Arizona cypress	26-11	26-0	21-0	23-5	24-4
Eastern red cedar	22- 1	23-1	20-7	20-3	21-6
Oriental arborvitae	17- 9	18-4	15-7	17-0	17-2
Rocky Mountain juniper	——	7-9	6-10	9-0	5-11

of the species, *Pinus ponderosa* and *Pinus nigra*, have practically been eliminated as a result of severe drouth. Since there is a proposal to remove the planting to widen a major cross-country highway, the 1932-58 data are summarized here although no species has reached maturity. In August 1958, their general condition was rated: Arizona cypress, very good; Eastern red cedar, good; Oriental arborvitae, fair; and Rocky Mountain juniper, poor. While the actual survival of red cedar was 3.2 percent greater than with Arizona cypress, the latter species showed considerable more vigor.

The wider spacing (12 × 24 feet) in the Arizona cypress shows a marked survival advantage over the close spacing (6 × 12 feet). Only a slight difference occurred between the 12 × 24 and the 12 × 12-foot spacings. In the red cedar block, survival in the 12 × 12 and the 12 × 24-foot spacings were identical, and both were considerably better than the 6 × 12-foot spacing. Survival of Oriental arborvitae and Rocky Mountain juniper in the various spacings were erratic. With both of these species, the average survival percentage was too small to draw definite conclusions.

Table 3 gives the average heights of the trees in the various spacings. The 6 × 12 and the 6 × 24-foot spacings averaged slightly greater height growth with Arizona cypress, Eastern red cedar and Oriental arborvitae than the 12 × 12 and the 12 × 24-foot spacings. The 6 × 12-foot spacing with Rocky Mountain juniper was a failure; the 6 × 24-foot spacing had a slight height advantage over the 12 × 12-foot spacing; but in neither of these was survival as great as in the 12 × 24-foot spacing.

Arizona cypress is the most valuable of the conifers tested when condition, density and height data are considered. Data given in Progress Report 1177 show that during the first 8 years, this species averaged 26 inches of height growth per year. For the first 14-year period, the trees averaged 17 inches per year. For the entire 1932-58 period, the trees averaged 12 inches of annual height growth.

In West Texas, this species should not be planted bare-rooted, but should be handled potted, canned or balled and burlapped. There is considerable variation in seedlings, and local plantings should be made with seed from selections that have been growing in the immediate area for a number of years.

Eastern red cedar rates next to Arizona cypress in vigor and rate of growth in these tests. During the first 8 years, red cedar made an average growth of 20 inches per year. For the first 14-year period, the average annual height growth was 15 inches. For the entire 1932-58 period, the trees averaged 10 inches of height growth per year. This species is more readily established bare-rooted than Arizona cypress, but for the best results it should be handled potted, canned or balled and burlapped.

Oriental or Chinese arborvitae has made a rather open, many-stemmed tree in this spacing test. This has reduced its effectiveness as a windbreak. It would make a fairly good border row species in a three-row windbreak, where the other rows were Arizona cypress or red cedar. Chinese arborvitate is the easiest to transplant of all of the conifers so far tested at Big Spring. The species grows readily from seed and can be handled successfully bare-rooted, even when 18 to 24 inches in height. For the first 8 years, the species averaged 18 inches of annual height growth. During the first 14 years, the average annual height growth was 11 inches, while for the entire 1932-58 period the height growth also averaged 11 inches annually.

Rocky Mountain juniper made a fair showing in its juvenile stage during the better growing seasons. During the drouth of 1951-56, the mortality rate increased rapidly until at the present time only a 20 percent survival is recorded. This low percentage survival would not justify the planting of this species under dryland conditions.

Ponderosa and Austrian pines were almost complete failures in this test.

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