But production factors must be weighed

Siberian Elm Seedling Development Enhanced by Wider In-Row Spacing

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An in-row spacing of 29 seedlings per linear foot produced the maximum number of usable 2-0 trees of Siberian elm in density trials at a North Dakota nursery. Large quantities of this species are planted annually in single- and multiple-row shelterbelts in the Great Plains. The study described in this note teas undertaken to determine what spacing in the row yields the largest number of 1-0 and 2-0 trees of premium grade, crud to gage the of feet of density on caliper and height growth.

Seedling density is known to affect caliper and height growth of deciduous seedlings (1, 2,3). Much experience on deciduous stock culture is available from the Great Plains nurseries. Summarizing the practices used in 20 nurseries. Engstrom and Stoeckler (1) recommended a seedling stand of 5 to 10 per linear foot after early season losses. They noted that the range of densities producing the largest number of premium grade seedlings varies according to species, length of the growing season. Precipitation, soil texture and fertility, and whether 1-or-2 year stock is to he grown. In the Northern Plains, species requiring 2 years can be grown in denser stands than those requiring only 1 year. Present nursery practice allows for 2 years in North Dakota, although in some years, 1-year seedlings are usable.

Methods

The density -holy was installed in regular production areas of spring-sown Siberian elm (Ulmus pumila L.) at the Lincoln-Oakes nursery, Bismarck, N. Dak. in 1966, 1967, and 1970. Eight replications of 4-foot row segments were hand-thinned to five densities ranging from 2 to 20 seedlings per linear foot. These levels of stocking were equal to one to eight plants per square foot at the 36-inch-between-the-row spacing used in the nursery.

The seedlings were evaluated in place after one growing season, and after lifting as 2-year-old plants. Trees 16 or more inches in height with stem calipers of 7/32-16/32 inch-stock specifications currently in use for windbreak planting in North Dakota-were graded as usable. The plots were watered and cultivated the same as bile remainder of the compartment.

Results

Wider spacing produced larger 1-year and 2-year seedlings. Seedling caliper (and height to a lesser extent) increased proportionately with spacing (table 1). Die average calipers of the various treatments were significantly different from each other at the 1 percent level. The differences in average height were significant also, particularly at the extremes of spacing (table 1).

The maximum production of usable 1-0 seedlings ranged from 1.4 per linear foot in 1966 to 4.1 in 1970. Insufficient caliper rather than height was the principal cause of degrade.

The effect of within-row spacing on seedling development was most pronounced during the second growing season. The unthinned check plots with a density of 29.1 trees per linear fort had the largest number of usable trees-an average of 10.5 for the 1967. I968, and 1971 crops. However, there were 18.6 trees at this close spacing that did not meet the minimum caliper requirement (table 1). Oversize trees were produced at the two widest spacings.

Discussion and Conclusions

The regulation of seedling density along will not result in a satisfactory

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TABLE 1.—*Effect of within-row density on the size (1968 crop) and grade (1967, 1968, 1971 crops) of 2-0 seedlings*

Seedlings per linear foot	Average caliper	Average height	Grade[1] Oversize	Usable	Undersize	Total
	32d inch	*Inches*		*Per linear foot*		
2	17.1[2]	42.0	0.8	1.3	0.1	2.2
4	13.4	39.5[3]	0.5	3.6	0.2	4.3
10	12.0	38.3	0.1	6.6	1.4	8.1
15	11.2	38.0	0.1	7.6	3.1	10.8
20	9.6	35.1	0.0	8.9	6.4	15.3
Check	6.8	28.4	0.0	10.5	18.6	29.1

[1]Usable seedlings are 7-16/32 inch in caliper and 16 inches or more in height. Trees are oversize if caliper exceeds 16/32.

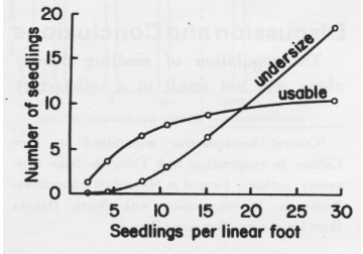
[2]All means significantly different at 1 percent level (Duncan's Multiple Range Test).

[3]Heights within the brackets are not significantly different at 1 percent level.

yield of usable seedlings at age 1. The largest number achieved-4.1 per lineal foot in 1970-is less than half the long-term average yield of nine seedlings at age 2 in this nursery. This lower level of production is much too small to justify production costs.

The average production of usable trees at age 2 levels off at densities of 25 to 30 per linear foot (fig. 1). At these densities, the number of undersize trees is rising rapidly.

Figure 1.—Effect of spacing on the grade of 2-year-old Siberian elm seedlings.



Although present rates of seeding are yielding 10.5 usable trees per linear foot, nurserymen must weigh other considerations than just the maximum number of usables. These include the need for excessive stock grading, the economical use of seed, and the problem of cull tree disposal-all of which contribute to rising production costs. The need for more precise seeding equipment to hold densities within acceptable limits is indicated.

A seeding rate that results in row densities of 15 to 20 trees per linear foot at age 2-0, while producing slightly fewer usables, will result in economies in overall production costs.

Literature Cited

1. Engstrom, H.E. and J.H. Stoeckler 1941. Nursery practice ofr trees and shrubs suitable for planting on the prairie plains. U.S. Dep. Agric. Misc. Publ. 434, 159p.
2. Sluder, Earl R. 1964. Quality of yellow-poplar planting stock varies by mother tree and seedbed density. USDA For. Serv. Tree Planters' Notes No. 65.p. 15-19.
3. Taft, Kingsley A., Jr. 1966. Wider nursery spacing produces larger northern red oak. USDA Forest Service Tree Planters' Notes No. 79, p.7.

News & Reviews

(Continued from p. 24)

Salt Damage Reported

Sacramento (Calif.) Bee reports the Forest Service says a year of research has shown that highway salt has done significant damage to thousands of trees in the Lake Tahoe basin. Research was carried on by PSW, which reports the problem has been recognized in the East and in Europe, but work in Berkeley may he the first of its kind in the West. USDA Forest Service spokesman says a report on the study will he released in about 2 months.

Cultural Techniques For Growing Containerized Seedlings

Dr. Peyton W. Owston. Plant Physiologist at the Pacific Northwest Forest and Range Experiment Station (PNW) in Corvallis, recently delivered a paper with this title. "Pete" has packed a lot of useful information plus a bibliography on 10 printed pages. Copies can be obtained by writing:

Forestry Sciences Laboratory
3200 Jefferson Way
Corvallis, Oregon 97331

(From *Forestation Notes. P.N.W.* Station)

Link To Cause of Tree Decay?

A nitrogen-fixing bacterium isolated by Oregon State University and 1i.5. Forest Service scientists is a prime suspect in the cause of decay in damaged trees. Dr. Ramon J. Stiller and Dr. Harold J. Evans of the University believe the newly found bacteria may feed a fungus that causes interior decay of the tree. If they are proved to be the culprit, the next step is to find an inhibitor to prevent their growth.

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