

Graded Northern Red Oak Planting Stock: Dimensions and Outplanting Performance

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Data on the initial stem diameter and height growth of graded 1 + 0 and 1 + 1 northern red oak stock (*Quercus rubra* L.) are presented. If shoot clipping or prescribed burning is to be used after planting, grading of stock appears to be of little use. *Tree Planters' Notes* 39(4):33-35; 1988.

Northern red oak is a valuable hardwood with a range extending over much of eastern North America. In Ontario, the species occurs on many site types, but at the northern part of its range it is most often found in dry ecoclimates on shallow-to-bedrock sites, on soils derived from glacial till. Good growth of red oak can be expected on these sites, in the absence of strong competition from sugar maple (*Acer saccharum* Marsh.) and American beech (*Fagus grandifolia* Ehrh.). However, regeneration of red oak stands is a problem in that acorns are a preferred food source for squirrels, and deer exert a strong browsing pressure on any recently established stems. The problem is compounded in the absence of fire, which often acts as a control upon competition.

With management foresters

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from the provincial Ministry of Natural Resources, I have initiated tests of a variety of silvicultural techniques to enhance the regeneration of red oak, generally following the prescriptions suggested by Johnson (2). We incorporated herbicide and burning treatments to control competition into a replicated (blocks = 3) shelterwood and underplant system using 1 + 0 and 1 + 1 red oak stock. (Each "cell" within a treatment received 64 trees at 2-m by 2-m spacing.) Due to the variability in size and quality of red oak stock obtained from the nursery, we felt it necessary to grade, measure, and apportion the stock to the treatment "cells" in order to avoid bias to one type, size or class of stock. The following information on initial dimensions of this graded stock may be of use to forest managers who deal with the regeneration of red oak forests.

Materials and Methods

Northern red oak stock was obtained in the spring of 1986 from the Ontario Ministry of Natural Resources Midhurst Nursery, near Barrie, Ontario (Ontario Site Region 6E). The 1 + 0 stock was initially planted with 8 cm between acorns and 14 cm between drills. It was lifted in the fall of 1985 and overwintered in cold storage. The 1 + 1 stock was transplanted by

hand to a 45-cm by 45-cm spacing and lifted in the spring of 1986. Neither stock was root pruned. Stock was grown in a loamy, medium-fine sand of moderate fertility (data on file, Midhurst Nursery) and a pH of 6.8.

Before outplanting, stock was graded according to the criteria of Stroempl (5). This four-grade system is similar to that used by Johnson (1), but it also takes into account stem form and the health of buds and roots in addition to seedling size. Seedlings of grades 1 to 3 are considered acceptable for planting; grade 4 seedlings are culled. Stem diameters were measured with a vernier-scale caliper at 2 cm above the root collar (root collar diameter, RCD). Seedlings were then outplanted according to the experimental design described in the Introduction. Planters were instructed on depth and method of planting; operational heights (ground to tallest shoot) were then recorded. Further information on treatment effects upon subsequent growth and survival of outplanted oaks is presently being compiled.

Results and Discussion

Even the 1 + 1 stock obtained from Midhurst Nursery failed to reach the minimum root collar diameters recommended for planting by Stroempl (5), 8 mm, and Johnson (1), 10 mm (table

1). In fact, both the 1 + 0 and 1 + 1 stock used here would be classified by Johnson and others (3) as "small" 1 + 0 stock. This may reflect year-to-year or geographic variation in climatic conditions at the nursery. Of more interest is the fact that very little variation occurs in stem diameter or height (table 1) for either the 1 + 0 or 1 + 1 stock between grades, possibly because of the emphasis of the grading system on stem form, or because of the small size of the stock itself. This is true for stem diameter even when grade 4 cull stock is considered (table 1). Thus, if clipping (3) or prescribed burning (4) is to be used to enhance single-shoot growth, then it is probably not necessary to grade red oak stock beyond removing culls. This is partially confirmed by field observations on the growth of the outplanted 1 + 0 and 1 + 1 red oak stock (table 2).

In comparing 1 + 0 and 1 + 1 red oak stock, it might appear from the data on stem diameters that it is not worthwhile to transplant 1 + 0 stock. However, although stem diameter is only slightly larger in the 1 + 1 stock (table 1), regardless of grade, it is enough to place the older stock marginally in the "large" seedling class (RCD basis) of Stroempl (5). (The 1 + 0 stock is only slightly above the range given by Stroempl (5) for "small"

Table 1—Stem diameter at 2 cm above root collar and initial height after outplanting (ground to tallest shoot) of 1 + 0 and 1 + 1 northern red oak nursery stock, by grade

	Root collar diameter (mm)		Initial height (cm)	
	1 + 0	1 + 1	1 + 0	1 + 1
Grade 1				
Mean ± SE	6.8 ± .07	7.6 ± .19	22.5 ± .5	50.8 ± 1.2
Range	4.8–10.3	4.5–12.3	12–46	26–70
N	182	68	177	66
Grade 2				
Mean ± SE	6.6 ± .06	7.8 ± .10	24.5 ± .4	46.4 ± .6
Range	4.1–10.9	4.4–13.7	10–55	25–80
N	322	264	310	268
Grade 3				
Mean ± SE	6.7 ± .06	7.8 ± .11	25.9 ± .9	42.6 ± .6
Range	4.2–10.3	4.3–13.8	13–63	21–67
N	321	245	83	240
Grade 4*				
Mean ± SE	6.5 ± 0.9	—	—	—
Range	4.3–10.2	—	—	—
N	130	—	—	—

*Not acceptable under Stroempl's system of grading (6), included for information only.

Table 2—Dominant shoot growth for the 1987 growing season in 1 + 0 and 1 + 1 northern red oak nursery stock, by grade

	Mean shoot growth ± SE (cm)		
	1 + 0	1 + 1	Difference
Grade 1	24.2 ± 3.1	40.7 ± 7.8	16.5
Grade 2	22.8 ± 2.1	36.9 ± 3.0	14.1
Grade 3	36.6 ± 6.1	31.0 ± 3.7	- 5.6

Seedlings were underplanted in spring 1986 beneath a residual stand of tolerant hardwoods. These hardwoods resulted from a shelterwood cut (fall 1985) that removed 50% of the basal area of the timber at the site.

stock.) The height data presented in table 2 give a better illustration of the added effect of an extra year in the nursery; the 1 + 1 stock is approximately twice as high as the 1 + 0 stock. This is indicative, too, of the generally larger root systems found on the 1 + 1 stock. This is an important criterion to con-

sider, especially if root pruning is contemplated as suggested by Johnson (1). It is also likely that seedlings with large root systems and a minimum diameter of 8 mm (5) will be better able to withstand the effects of prescribed burning.

The beneficial effect of using the larger 1 + 1 stock, even in a

situation where burning or clipping is not considered, can be seen in table 2. Although variation in 1987 dominant shoot growth occurred between grades, the added year in the nursery appears to have substantially enhanced field performance, at least in terms of height growth. This is true for both grade 1 and grade 2 stock.

Regardless of assigned grade, many seedlings suffer top mortality and dominance is often assumed by a rapidly growing branch initiated at a lower lateral bud. To avoid poor stem form, operational clipping or burning should be considered. This statement must be qualified by the fact that very little is known about the minimum size of stem diameter required to withstand an operational burn. This is an important consideration because the mortality of red oak seedlings in a burn is directly related to root collar temperature (2). Of course, in a competition-free situation where burning or clipping is not contemplated, stem form is of utmost importance and stock should be graded at the nursery. This assumes a correlation of seedling stem form with stem form at a later age, a likely event barring major browse or environmental (e.g., ice) damage. If grading is undertaken, the recommendations of

Stroempl (5) should be followed; particular attention should be paid to the quality and size of terminal buds.

The grading system employed in this study was derived principally from a morphological grading system for 2 + 0 red oak stock. The study discussed here employed 1 + 0 and 1 + 1 stock, mainly because of availability. Morphologically, both stock types fit the criteria described by Stroempl (5) quite well, although, possibly because of transplanting (1 + 1), there were seedlings in all grades that went below the cull size specified by Stroempl (5), which is 4.5 mm. In Ontario nurseries, transplanting red oak is used primarily to enhance root growth; to obtain maximum root development and RCD, 1 + 2 stock is usually grown. However, even with 1 + 1 stock, increased height growth is possible (table 2), but decreased or reduced diameter growth may be noticed. Thus, the minimum cull diameter given by Stroempl (5) may be too high when 1 + 1 (or 1 + 0) stock is being considered. Due to cost and the reduced growth associated with transplanting, 2 + 0 red oak stock that has been undercut to increase root fibrosity (1) may be a more desirable stock type.

Forest managers dealing with red oak stock in Ontario and similar climatic zones can expect good survivorship of red oak seedlings that are planted carefully. Older, larger stock is preferred; it should be graded and culls discarded at the nursery if shoot clipping or burning after planting will not be considered. If either of these is contemplated, grading may be of little benefit.

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