

SILVICULTURAL ASPECTS OF INTERMEDIATE CUTTINGS

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ABSTRACT. Correct timing of the first thinning in mixed oak stands depends largely on the composition and condition of the stands and on available markets for small wood products. Delaying first thinnings in high-quality seedling-origin stands until a long, straight, clear bole has developed is of primary importance in assuring high quality of the final crop trees. However, many of our present stands, particularly those of sprout origin, need improvement work; and improvement cuttings or thinnings should be started as soon as a commercial operation is possible. Growth response in diameter after thinning is usually a gradual process. Older oaks seldom show spectacular changes in diameter growth rate after release.

THINNING

TO THIN OR NOT to thin? This is the question. There appear to be two conflicting views about the place for thinnings in the management of even-aged, pole-stage oak stands. One view, expounded by European foresters, is that oak stands should be kept tightly closed, except for early light cleanings, until after full height growth is attained. This would place the first commercial cutting in the young-timber stage, thus precluding the use of thinnings in pole-size oak stands. According to European silviculturists, stands should be kept in this dense condition until age 40 or 60, to allow long, straight, clear boles to develop.

The other view, adopted, or at least practiced, by many American foresters, is that our stands should be entered as early as possible to make needed intermediate cuttings. Often these cuttings are made just as soon as enough merchantable material can be removed to carry out these operations at a

break-even point or at a profit. In these early commercial thinnings, cull trees left from the previous rotation are removed, and the stand is generally put in good order—or at least as good shape as the stand permits!

Why this apparent conflict between European recommendations and our actual field practice in the eastern United States? Is it because we ignore European experience, when we know that they have raised excellent stands of oak for centuries? Actually, if we examine the situations influencing each philosophy, we find that our thinking is not in conflict. There is a place for both philosophies, each under the proper stand conditions.

Most European oak stands are far different in composition, character, and condition than our eastern American oak stands. Their stands are of seedling or seedling-sprout origin, well-stocked, and either pure or mixed with a few desirable associates. When seedling stands do not develop in this way, Euro-

pean foresters, with their more abundant and cheaper supply of labor, use a light cleaning or a series of light cleanings to make certain that the stand reaches pole-stage in relatively fine condition.

Occasionally we encounter similar high-quality stands in American forests, which have developed through some fortuitous circumstance. Where such stands occur, most American foresters are reluctant to open these stands up until full height growth has been attained. These occasional superior oak stands will yield high quantities of quality sawlogs and veneer bolts.

However, most of our oak stands are not of this high quality and give little hope of quality development without aid through silvicultural treatment. Many of our stands are of sprout origin, often 100 percent sprout. Here early removal of those stems that show the greatest tendency to develop heartwood rots from the old stump seems extremely important. In addition, our oak stands are often diverse mixtures of both desirable and less desirable oaks, heavily interspersed with low-value hardwoods that threaten to suppress and crowd out the few desirable stems. Other problems confounding the management of these stands are past ground fires, disease, uneven stocking, and vines.

Thus we feel that most of our oak stands should be molded as soon as merchantable cuttings can be made, to improve composition, eliminate the undesirable sprouts, adjust spacing, and improve bole form. Available markets in each area determine just how early this first thinning can be made; but the earlier it is carried out, the better the final stand will be. Here in West Virginia we often enter oak stands at age 25 and remove as much as one-third of the basal area per acre for pulpwood.

CLEANINGS

Forest managers often wish that they had a larger budget that would allow them to carry out cleanings in their seedling-and-sapling-stage hardwood stands. Actually the need for cleaning is often difficult to assess, and no general statement can be made that every young oak stand will benefit from a

sorting over of individual stems early in the rotation. Superficially it would seem that all stands would benefit from cleaning, but certain recent evidence indicates that in many oak stands desirable changes in composition and stocking take place naturally without the help of expensive cleaning operations.

GROWTH RESPONSE AFTER INTERMEDIATE CUTTINGS

Growth response is often given as the prime motive in thinning pole-size stands. Recent measurements in oak stands that have received previous partial cuttings cause us to question whether the magnitude of response for oaks, and for many other hardwoods, is as great or dramatic as we learned in our silvicultural textbooks. Perhaps much that has been written about growth response has been based on experience with southern pines and other extremely responsive species.

An unpublished study of white oak response, conducted 8 years after a 40-year-old stand was thinned, showed no significant increase in diameter growth, regardless of the tree's vigor prior to thinning.

In another study where northern red oaks had been heavily released by selection and shelterwood cuttings, the diameter growth rate of trees on lower- and middle-third slopes showed no change during the 7 years after release. Released red oaks on upper-third slope positions had a small but significant increase in annual diameter growth. However, unreleased controls on the same site showed a small but significant decrease in diameter growth during this same period (attributed to the same amount of wood fiber being distributed over an increasingly larger girth). Thus it was concluded that there had been a small increase in wood production for oaks since the partial cuttings (fig. 1).

If we assume that response to release, in terms of diameter growth, depends initially on the tree increasing its photosynthetic surface and establishing a more extensive root system (a slow process for most oaks), then oak response in diameter growth would be a gradual process, better demonstrated by long-term studies.

We have just completed a 15-year summary of 40 one-acre research plots at the

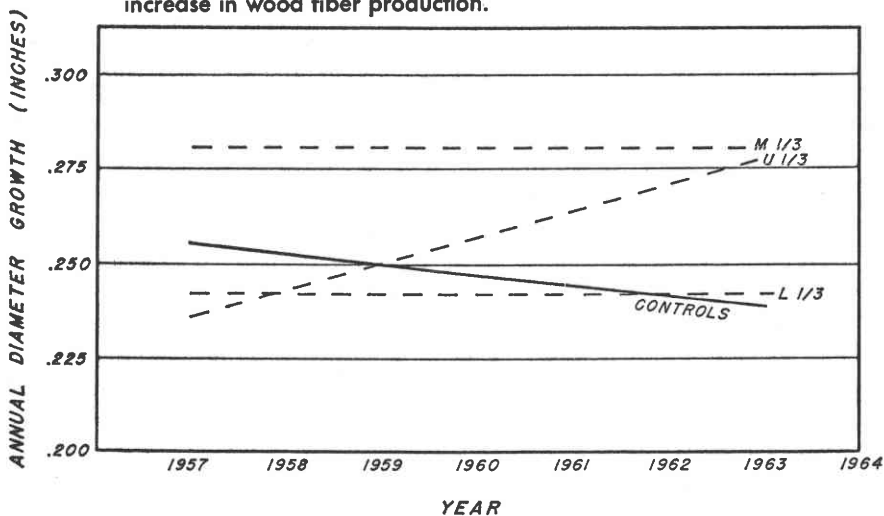
West Virginia University Forest. Twenty-four of these plots were established on oak sites. Half of these experimental areas received a cleaning during the sapling stage, at 15 years of age. This cleaning adjusted spacing, favored the better species, and removed poorly formed stems. Other plots had no cutting until 10 years later, age 25, when a commercial thinning was made. Analysis of plot data indicated that the cleaned plots had only a slight improvement in composition over the plots where the cutting, performed as a commercial operation, was delayed.

On the better oak sites, whether cleanings were used or not, yellow-poplar and northern red oak outgrew the other species and dominated the stand. Our conclusions for these good sites were that if the cleaning could be made at a profit for firewood, it was justified; however, if the cleaning had to be made at a direct cost, as an investment, then the slight improvement gained through this operation was not justified. At present, it is difficult to tell which plots had the cleanings and which had this work done later through thinnings.

On the drier oak sites, northern red, black, white, and chestnut oaks competed successfully with the less desirable species. However, where scarlet oak was abundant in young stands, its exceedingly rapid growth allowed it to crowd out more desirable oaks. Thus we felt that the cleanings on the drier oak sites were justified where scarlet oak made up a considerable percentage of the mixture, if other desirable oaks were present that could be favored. Northern red oak appeared well able to compete with all other species except scarlet oak, and automatically dominated many sites where it was originally a major component.

Cleanings may also be necessary, if the management policy favors white oak over the red oaks. In certain areas, particularly where the soils are derived from limestone, white oak of exceptional quality develops; and white oak brings a premium price. In mixed oak stands—such as the white oak—red oak—hickory type—white oak, because of its slower height growth, often falls into the lower crown classes early in the life of the stand. During the sapling stage, cleanings

Figure 1—A comparison of the diameter growth rate of the controls and the released red oaks during the period 1957-63. Although the middle- and lower-third slope oaks did not show an increase in annual diameter growth, they did not decline during this period, suggesting an annual increase in wood fiber production.



can effectively discourage the faster-growing oaks and increase the proportion of white oak permanently.

Another situation under which cleaning is often needed, and where the need is evident early in the rotation, is where mature oak stands, which had an understory of oak seedlings, were clearcut to allow this understory to form the nucleus of the new stand. If the crown canopy of the mature stand was kept tightly closed during the latter part of its rotation, the oak understory seedlings are of low vigor, and their recovery rate after exposure is slow. Low-vigor oaks are easily identified by their lack of a vigorous leader, and by their flat or umbrella-shaped tops. When low-vigor oaks make up the majority of the young stand, response to release is slow, often requiring 3 to 5 years.

Our studies, however, showed that most low-vigor oaks will recover a good growth rate. During this recovery period, red maple, sassafras, blackgum, black locust, and various shrubs and small trees may grow rapidly and resuppress these oaks before they have regained a competitive growth rate. Many of our stands of poor species, occupying former oak areas, have gained control of the site in this manner. A well-timed cleaning can often mold the composition on such sites and assure that oak will dominate the next crop.

EPICORMIC BRANCHING

Most hardwood foresters are concerned about epicormic branching. This condition appears to be stimulated after opening the stand through intermediate cuttings, particularly after thinning. Often epicormic branching is given as the reason for withholding thinnings. In extremely high-quality stands, I agree that this is a valid reason for delaying thinnings for many years—at least until late in the rotation, when the defect caused by these branches will occur only in the superficial wood.

Many recommendations have been made about how to reduce epicormic branching after thinning. Hardwood thinning patterns that leave only strong upper-crown-class trees are favored. Certain species are known to be especially prone to epicormic branch-

ing; and when thinning, where a choice of species is possible, often those known to produce the most epicormic branches are removed. Light thinnings and low thinnings have been favored, because there seems to be a direct correlation between thinning intensity, crown disturbance, and epicormic branching.

Recently, genetic differences have been identified as a major factor in determining the number of epicormic branches produced after thinning. Evidently within a species some individuals have a proclivity for producing epicormic branches, while others produce few or none. Most trees that feather out heavily after thinning give some indication of this tendency in the number of epicormic branches present on the bole before the stand is opened up.

During the past few years I have used the number of epicormic branches on the bole as a guide in marking in pole-size oak stands, to determine which trees to leave and which to cut. Observations after cutting seem to support this method of restricting epicormic production. Trees with no epicormic branches before cutting generally have few after cutting, and these few shoots are restricted to the area immediately below the crown. Those oaks that have many epicormic branches before cutting feather out very heavily after exposure, and these branches are distributed over a great length of the bole.

Epicormic branching evidently cannot be eliminated entirely, but whether to withhold intermediate cuttings for this reason seems to be clearly a question of choosing the lesser of two evils. If the thinning will generally improve the composition and form of the remaining trees, and will yield sufficient income to offset the degrading effect from "controlled" epicormic branching, then thinning must be considered the lesser of two evils.

LIBERATION CUTTING

One intermediate cutting that should play a more prominent role in oak management—and one that costs relatively little yet can have a profound effect on the development

of the new stand—is liberation cutting. Old cull trees left from previous logging operations often tower above our young second-growth oak stands. With each passing year these standards expand their crowns and do increasing damage to the developing stand beneath. With our presently available herbicides, these cull trees can be removed easily and inexpensively.

The tree injector offers the most promise for this work, because injecting does not weaken the tree at the point where the herbi-

cide is applied. Injected trees rarely break off at the point of injection. Trees treated in this way remain standing after death and disintegrate gradually on the stump, causing little or no damage to the young stand beneath, as the twigs, limbs, and finally the bole come down piecemeal. Of all the intermediate cutting, it appears that more good can be done throughout a forest with judicious investment of limited funds for liberation cutting, than from any other improvement operation.

