SPROUT SINGLING IN NORTH ALABAMA HARDWOODS

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Abstract—Many commercial hardwood species grow quite well in northern Alabama and most regenerate by stump sprouts after harvest. The number of sprouts on a stump depends on several factors such as species and stump size. To determine if the practice of singling (removing all but the single best sprout from a stump) might be a means of accelerating the growth rate of one stem from each stump, 145 pairs of stumps were chosen at 4 different clearcut areas on a forest industry tract in Lawrence County, AL. For each pair of stumps, one randomly selected stump was "singled," while the other had no sprouts removed. Measurements taken 1 and 4 years later indicated that the sprouts of several species had very strong initial responses in diameter growth as a result of singling, especially the sprouts of the older stumps growing on moister sites.

INTRODUCTION

The extent of the forest land in northern Alabama is 2.28 million acres or 51 percent of the total land area. About 60 percent of the total forest area is of oak-hickory type (Hartsell and Vissage 2001). Many hardwood species sprout profusely from the stump following tree harvesting. In many north Alabama clearcuts, especially those on sites with northern exposure, these sprouts are an important source of forest regeneration (Dubois and others 1997). In this experiment the growth rates of single stump sprouts, liberated by cutting all but the best sprout on stumps, were compared with the growth rates of paired untreated stumps. The intent of the study was to test the hypothesis that single sprouts were more likely to have higher rates of growth than untreated sprouts.

SITES

In the fall of 1998, four clearcut areas were chosen for this study. They were all located on a forest industry tract in Moulton Valley just north of the William B. Bankhead National Forest (Lawrence County, AL). This area is part of the Appalachian Plateau Physiographic Province, Cumberland Plateau Section (NRCS 1995). The soil association is Decatur-Cumberland-Colbert-Robertsville (Soil Conservation Service 1959). At higher elevations, the soils of this association are well-drained, whereas in low-lying areas they are poorly to somewhat poorly drained. Two of the areas were harvested in 1991 and the other two in 1997. No data were collected prior to clearcutting. Chainsaws and skidders were used to clearcut the areas. Site descriptions were obtained from actual observations.

Area A had a 10 percent northwesterly slope with variable but generally shallow soils (4-12 inches deep) overlying limestone. Most of the stumps were ashes (*Fraxinus spp.*); the remaining stumps included red oak (*Quercus rubra* L.) and sweetgum (*Liquadambar styraciflua* L.). This site was clearcut 7 years prior to establishment of the experiment, and the resulting sprouts appeared to develop slowly. Area B had an irregular 30 percent slope, a northerly exposure, and fairly deep clayey soils overlying shist. About half of the stumps were maples (*Acer* spp.); the remaining stumps included chestnut oak (*Q. prinus* L.) and red oak. This site was also clearcut 7 years prior to the establishment of the experiment, but here the sprouts appeared to develop quickly, especially in coves (sites on the concave sections of the topography).

Area C was located on a bottomland site (5 percent slope) with deep clayey soils. Sweetgum was the dominant species; other stumps included maples, elms (*Ulmus* spp.), blackgum (*Nyssa sylvatica* Marsh.), and black cherry (*Prunus serotina* Ehrh.).

Area D was located on a tableland (upland) site with slopes of 0-5 percent and deep soils. This site was dominated by white oak (*Q. alba* L.) and chestnut oak. The remaining stumps were blackgum and maples. Areas C and D were clearcut 1 year before the establishment of the experiment. Sprouts appeared to develop quickly on both areas.

METHODS

Pairs of stumps were chosen at each of these four clearcut areas to facilitate paired comparisons. To be considered a pair, two stumps had to have the following characteristics in common: (1) species; (2) diameter of stump (within 20 percent); (3) similar number of sprouts; and (4) sprouts with similar heights. The distance between the paired stumps was no more than 30 feet in order to ensure that they were growing on similar sites and that they were easy to find for remeasurement.

One hundred and forty-five pairs of stumps were selected for these experiments (mid-winter 1998). The diameters of all stumps were measured, the number of sprouts on each stump was counted, and the diameters and the heights of the three largest sprouts on each stump were measured. Sprout diameter was measured to the nearest 0.1 inch at a height 2 inches above the sprout's point of contact with the stump and in the same direction as the stump's radius. One of the stumps of each pair was randomly selected for singling which involved removing all of the sprouts except

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the one in the highest competitive position based on height and form (generally the largest and straightest). The untreated stump of that pair had no sprouts removed.

A Stihl F5-108 brushcutter was used to cut the sprouts ≤ 2 inches in diameter. This machine had a circular saw on an extended arm (fig. 1). The Sthil F5-108 was comfortable to hold; the strap balanced the load evenly, and the machine could easily be operated all day (no crouching). However, because of the length of the extended arm, it was somewhat cumbersome to use where vegetation was thick, especially in the presence of vines. Also, sprouts ≥ 2 inches were difficult to cut with the F5-108 due to blade pinching, vibration, and engine slowing.

For sprouts ≥ 2 inches in diameter at the base, a Sthil 025 chainsaw was used (fig. 2). The chainsaw required more strength to operate over a long period, and was probably riskier to operate because the cutting parts were held much closer to the body. However, the chainsaw was far more maneuverable in thick brush and permitted cutting of sprouts flush with the stump. The chosen sprouts were marked with aluminum tags. They were also flagged to facilitate their relocation (fig. 3). The time spent selecting and removing sprouts and the time in transit between stumps were recorded (time in motion).

One year after treatment, the diameters of the selected sprouts of all 145 pairs of stumps were re-measured. Four years later, 69 pairs of stumps were relocated and re-measured. Growth was calculated for each sprout as the difference between the re-measured diameter (measured 1 and 4 years after the experiment initiation) and the initial diameter. Results were analyzed for each area by comparing the diameter growth means of the singled versus not-singled sprouts. Paired t-tests for heterogeneous variances, i.e. "Welch's approximate t," (Zar 1999), were used for such comparisons.

RESULTS

The growth response of 7-year-old singled sprouts was more than double the growth response of the not-singled sprouts (table 1). However, where the stumps were located on shallow soils (Clearcut Area A), sprout growth was slow; the average diameter only reached 3.7 inches. Such a site might generally be considered unproductive for forestry, and the practice of liberating sprouts probably would not be economical. By contrast, in the better site (Area B), the growth responses were the strongest both in terms of proportion and in terms of actual amount of diameter growth. Moreover, the possibilities of re-sprouts providing significant competition appeared to be minimal.

Growth response of sprouts that had been singled 1 year after clearcut was slightly more than the growth response of the not-singled sprouts. However, the strongest response was in the first year after singling these young sprouts. Four years after singling, the differences in diameter growth between singled and not-singled sprouts on the recent clearcut areas were almost negligible. A possible explanation for such a small difference is the heavy level of re-sprouting on the singled stumps. These re-sprouts probably diverted a large proportion of the water, nutrients and photosynthates that might otherwise have been translocated to the singled sprout. It seemed probable that these new sprouts would continue to compete with the singled sprout in future years.

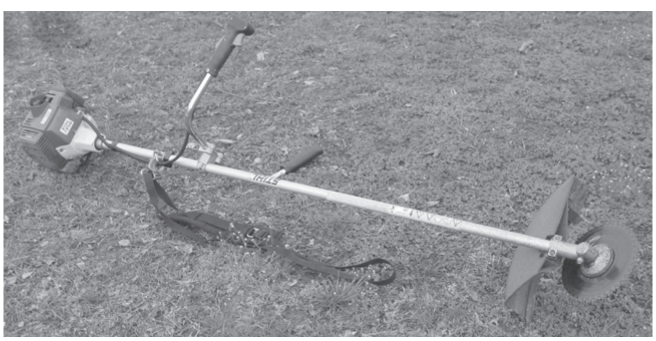

Figure 1—The Sthil F5-108 brushcutter.

Figure 2—The Sthil 025 chainsaw.

Figure 3—Singled sprouts.

Table 1—Average diameter growth of sprouts on singled and not-singled stumps 1 and 4 years after singling in the Bankhead National Forest, AL on sites A, B, C, and D

Area[a]	Singled average growth 1998–1999	Not-singled average growth 1998–1999	Difference 1998–1999	Singled average growth 1998–2002	Not-singled average growth 1998–2002	Difference 1998–2002
A	0.3	0.2	0.1	1.2	0.5	0.7[b]
B	0.7	0.3	0.4[b]	1.8	0.9	0.9[b]
C	0.7	0.4	0.3[b]	1.7	1.4	0.3
D	0.5	0.2	0.3[b]	1.2	1.0	0.2

[a] Site definitions: A = 7-year-old stumps, bottomland, shallow soil; B = 7-year-old stumps, upland, deep soil; C = 1-year-old stumps, bottomland, shallow soil; and D = 1-year-old stumps, upland, deep soil.
[b] $p < 0.05$.

Whether sprouts from singled stumps can continue to grow into merchantable stems at a faster rate than not-singled sprouts remains to be seen and will require future measurements of these stump pairs, especially in Area A. Also, there is the possibility of sprouts developing butt rot, caused principally by *Ganoderma lucidum* (Sinclair and others 1987) originating from stumps (Tainter and Baker 1996), that should also be examined at the time of harvest.

DISCUSSION

The results of this study indicated that the rate of growth of the largest sprout on a hardwood stump can be significantly increased as a result of singling. Other studies support this finding (Johnson and Rogers 1984, Lamson 1983). However, to get the strongest and longest-lasting response, the sprouts should be allowed to develop for a number of years before the singling takes place. In this experiment, it was evident that 7 years after clearcutting was adequate time to ensure that re-sprouting would be at a minimum (fig. 4). Liberating sprouts 1 year after clearcutting did not diminish re-sprouting capabilities; not only did the stumps produce numerous sprouts, but some of these sprouts were vigorous competitors with the liberated sprouts. The optimal time to conduct sprout liberations could not be determined from this study.

Liberated sprouts on 7-year stumps may have a growth advantage due to greater access to the established root system of the stump and due to less competition above ground. Therefore, one may deduce that these liberated sprouts will continue to have a growth advantage for several additional years. Further monitoring of the growth of sprouts in Areas A and B will allow us to ascertain the duration of the liberated growth advantage.

The decision to single depends on the financial returns to be expected at time of final harvest. We hypothesize that logs developing from singled sprouts will be larger in diameter and exhibit better form than the logs developing from sprouts on stumps that were not singled. Sprouts in Areas A and B could be followed through harvest and scaled to test this hypothesis.

Figure 4— Re-sprouting (left) on a 7-year-old stump.

Although the time and motion aspects of this study were not comprehensively studied, some comments are merited. Singling was conducted in the winter because temperatures were more comfortable for outdoor work, and the vegetation was more penetrable. In re-sprouted areas such as Area A, one worker using a chainsaw could single all hardwood stumps on 2-3 acres per day. If singling was done only in the concave areas on northerly exposures, only about 10-20 percent of the topography in an area such as the Moulton Valley falls into this category. In these areas, one worker could conceivably single sprouts on 10 to 15 acres of total terrain per day.

CONCLUSIONS

This study indicated that singling, performed at some optimal time following a clearcut conferred a significant increase in diameter growth rate to the principle sprout. If this growth differential can be maintained, and if the form and health of these singled sprouts are adequate at time of final harvest, then singling may prove to be an important tool for managing hardwood forests such as those found in northern Alabama.

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