This article was listed in Forest Nursery Notes, Summer 2007

63. Comparison of planting bar and hoedad planted seedlings for survival and growth in a controlled environment. Adams, J. C. and Patterson, W. B. IN: Proceedings of the 12th biennial southern silvicultural research conference, p. 423-424. USDA Forest Service, Southern Research Station, General Technical Report SRS-71. Kristina F. Connor, ed. 2004.

COMPARISON OF PLANTING BAR AND HOEDAD PLANTED SEEDLINGS FOR SURVIVAL AND GROWTH IN A CONTROLLED ENVIRONMENT

John C. Adams and William. B. Patterson[1]

Abstract—In the Western Gulf Region of the United States, the traditional tool for planting loblolly pine (*Pinus taeda* L.) has been the dibble (planting bar). In the past decade an increasing number of acres have been planted with the hoedad. In areas where both tools were and are used, discussion about the superiority of one tool over the other for survival and subsequent growth have been on-going. This study was initiated to determine if the seedlings survived and grew better when planted with one tool or the other, when other planting variables were minimized. Survival, first- and second-year height, groundline diameter, first-year root weight, and first and second-year growth was found to be the same. There were no differences between the dibble and hoedad, and these were not different from the check, which was a planting hole made with a posthole digger. Planting failures using these tools can probably be traced to improper planting technique or improper handling of the seedlings prior to planting and not the tool in use.

INTRODUCTION

In the last 10 years in the United States approximately 27.2 million acres or an average of 2.7 million acres per year, were planted with trees. In 1996, 11 states planted more than 100,000 acres. All but two of these states were in the southern region of the country. Of these, the Western Gulf States of Alabama, Mississippi, Louisiana, Texas, and Arkansas planted 876,000 acres (Moulton and Snellgrove 1997). The majority of these acres were planted to conifers and most were planted with loblolly pine (*Pinus taeda* L.). The traditional hand planting tool in this region has been the dibble, also called a planting bar. However, a small but increasing number of acres are being planted by crews using the hoedad, a planting tool commonly used in the western states and in mountainous areas. In areas where both planting tools are used, there are questions about the effectiveness of one over the other in planting, survival and growth of seedlings. Planting crews using the hoedad claim better survival, better planting technique, faster planting, and better growth. Crews using the dibble have the opposite opinion. Foresters using these crews have mixed opinions about the effectiveness of the two planting systems.

The objective of any planting technique is to place a seedling in the ground with a minimum root distortion and in a manner to obtain good soil/root contact. There are a number of studies that address these two important issues (Adams and Vidrine 1989; Brissette and Barnett 1988; Gruschow 1959; Hay and Woods 1974; Lantz and others 1988; Woods 1980). The purpose of this study was to determine if there were any differences in survival and early growth between seedlings planted correctly with the hoedad and with the dibble.

METHODS AND PROCEDURES

A uniform group of commercially grown loblolly pine seedlings was selected for this study. Seedlings were randomly assigned to one of three treatments. Treatment one was planted with a dibble, treatment two was planted with a hoedad, and treatment three was planted with a manual type posthole digger. Seedlings planted with the posthole digger were considered a check or an optimum planting technique because the hole was made large with vertical cuts and little or no compaction on the sides of the planting hole. The seedlings were then placed in the hole, and the hole was back filled with soil. The dibble and the hoedad planted seedlings were planted essentially as outlined by Smith and others (1997) and are considered compression or modified-compression planting techniques, respectively. Seedling spacing was 38 x 38 cm.

The planting site was an abandoned nursery bed (not used for 3 years) containing a sandy loam soil. The bed was prepared by removing the grass cover and roto-tilling the bed. No fertilizer was added. The bed was divided into eight blocks with three randomly assigned treatments and seven seedlings per treatment. Seedlings from a bag containing 1,000 seedlings were sized into 3 groups. The largest and smallest size groups were eliminated and the seedlings for the study were chosen at random and assigned to treatments at random from the middle size group. The design was a randomized complete block. Grass and weed control were manually applied during the first year. Water was added once during the initial year during a period of extreme drought. In the second year, no weed/grass control was done nor additional water added.

Measurements for height and groundline diameter were taken 1 week after planting. At the end of the first growing season height and groundline diameter were again taken, and three seedlings from each treatment/block were removed and the roots excavated. The roots were washed, dried and weighed. At the end of the second growing season, groundline diameter and height were taken on the remaining trees. First-year growth was determined by calculating the difference between the initial measurements at planting and measurements at the end of the first year, and the second-year growth was determined by calculating the difference between the first growing season and second growing season measurements. Analysis of variance was done using a SAS statistical program (SAS 1985).

[1] Professor and Assistant Professor, School of Forestry, Louisiana Tech University, Ruston, LA, respectively.

Citation for proceedings: Connor, Kristina F., ed. 2004. Proceedings of the 12th biennial southern silvicultural research conference. Gen. Tech. Rep. SRS–71. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 594 p.

Table 1—Initial, first and second year measurements for height, groundline diameter, and dry root weight for loblolly pine seedlings planted with three planting tools[a]

	Initial measurements		First year measurements			Second year measurements	
Treatment	GLD	Height	GLD	Height	Rt Wt	GLD	Height
	mm	*cm*	*mm*	*cm*	*g*	*mm*	*cm*
Dibble	0.49	26.44	16.94	79.23	29.45	34.50	190.0
Hoedad	0.48	27.46	16.48	77.64	30.46	33.30	185.1
Posthole	0.50	27.42	17.62	80.16	31.14	32.81	184.2

GLD = groundline diameter; Rt Wt = dry root weight.
[a] There were no significant differences among treatments at α = 0.05.

RESULTS AND DISCUSSION

Seedling measurements taken at planting time were nonsignificant and indicated that there were no differences among the different treatments (table 1) and blocks. Thus the sizing of seedlings and treatment assignments were effective, and initial seedling size was not a factor in the analysis for the growth variables.

Survival was 97 percent with mortality equally distributed among the treatments. All measurements for height, groundline diameter, and root dry weight at the end of the first year, and height and groundline diameter at the end of the second year were nonsignificant (table 1). Calculated growth (table 2) was also nonsignificant for all treatments during the two growing periods. There were no trends in the data, and the values among the treatments for each variable were essentially the same.

These data show that seedlings planted using proper technique with either the dibble, hoedad or posthole digger will produce equal results. The only observed difference among the three treatments was in the shape of the root systems that were excavated. The root systems from seedlings planted using the posthole digger had a more symmetrical root development with the first-order lateral roots developing in all directions from the taproot. The root systems from the seedlings planted with the dibble had a flattened root development on two sides with the lateral roots growing away from the compacted soil on the compression sides of the planting hole. The hoedad-planted root system was intermediate in that the root was flattened on one side, the side compressed by the blade, with the lateral roots uniformly extending 180 degrees from the compressed side of the planting hole. These morphological differences in root development had no effect on the survival and growth, above and below ground, of the loblolly pine in this study. This root distortion may not be persistent as the tree continues to grow. When the seedlings were excavated at the end of the first growing season some lateral roots were beginning to break through the compressed sides formed by the planting tools.

Table 2—Ground line diameter and height growth of loblolly pine seedlings planted with tree planting tools[a]

	Growth 1st year		Growth 2d year	
Treatment	GLD	Height	GLD	Height
	mm	*cm*	*mm*	*cm*
Dibble	16.45	52.79	17.56	110.77
Hoedad	16.00	50.18	16.82	107.36
Posthole	16.84	52.72	15.46	103.84

GLD = ground line diameter.
[a] There were no significant differences among treatments at α = 0.05.

CONCLUSIONS

Poor field results with either the dibble or hoedad as a planting tool are not the result of the tool in use but rather the technique used or more likely the manner that the seedlings were handled prior to and during the planting operation. Human nature to take the easiest path often results in improper seedling management such as wind exposure of roots, short root pruning and improper seedling placement (depth and position) by the tree planters. The result is poor seedling performance.

Resource managers responsible for planting should look at storage, planting technique and handling of seedlings rather than the instrument used to make the hole when trying to determine the cause of failures in planting operations.

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Proceedings of the 12th biennial southern silvicultural research conference

Author(s): Connor, Kristina F., ed.

Date: 2004

Source: Gen. Tech. Rep. SRS-71. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 600 p.

Station ID: GTR-SRS-071

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