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Effects of Stock Type and Planter Experience on the Time Required to Plant Loblolly Pine Seddlings

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EFFECTS OF STOCK TYPE AND PLANTER EXPERIENCE ON THE TIME REQUIRED TO PLANT LOBLOLLY PINE SEEDLINGS

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ABSTRACT

Inexperienced workers planted container-grown and bare-root seedlings of loblolly (*Pinus taeda* L.) on a rocky, upland site near Batesville, AR in a comparison of planting speed and survivability. Planting-speed depended on the type of seedling planted and the amount of planting experience. Significantly less time was required to plant an acre with container-grown than bare-root seedlings. Experience increased the consistency and speed of planting for both seedling types.

INTRODUCTION

Seedling planting speed varies with the number of seedlings to be planted per acre, physical site factors, and conditions that impede the movement of workers on the site. Physical site factors include terrain (slope and roughness), soil type and soil moisture. Factors that impede worker movement on a site include the tree tops and limbs left from harvest, as well as stumps, holes and ruts. Experience of the planting crew has been recognized as one of the most significant factors in planter productivity. When inexperienced crews are employed, a "start-up" period or time of reduced planting productivity is present. This occurs while workers are learning the job, organizing themselves into effective crews and generally getting up to speed physically.

Recently, large scale production of container-grown seedlings has made their use operationally feasible. Additionally, Guldin (1982) reported that some crews in the south were able to plant 25% more container-grown then bare-root seedlings per man-day. This was done by using plug-shaped dibbles. Planting speed for bare-root seedlings was reported by Kluender *et al.* (1985) and Izlar (1980). This paper presents: 1) the planting speed and survival of bare-root and container-grown seedlings planted by inexperienced workers, 2) probable time required to plant an acre in the Ozark Highlands under good conditions, and 3) the variability of planting rate.

METHODS

Container-grown seedlings were grown approximately five months in Styroblock® containers (No. 8) prior to planting. Bare-root (1-0 stock) seedlings were grown as normal planting stock. Both seedling types were grown by the Arkansas Forestry Commission at the Baucum Nursery in North Little Rock. After planting, bare-root seedlings averaged 7.4 inches and container-grown seedlings 6.2 inches in height.

The selected study site was located on Waugh Mountain, six miles northwest of Batesville, AR. The study design consisted of 13, 0.4 acre plots in each of three randomized blocks. One-half of each plot was planted with bare-root or container-grown seedlings resulting in 39 pairs of observations.

Inexperienced workers performed the planting operation. All seedlings were planted in mid-March when moderately warm temperatures, and adequate soil moisture existed. Also, at that time, there was minimum risk from deep freezing of roots in the soil. Container-grown seedlings were planted with special dibbles designed for the number eight Styroblock® container. Bare root seedlings were planted with KBC planting bars and standard dibbles.

Planting crews consisted of eight workers. Workers planting bare-root seedlings carried their own planting bags with seedlings. Container-grown seedlings were slightly more difficult to handle and required two of the eight team members to act as seedling handler serving six planters.

At the beginning of the observed planting period, each worker started planting a row by himself. When a worker came to the end of a row, he moved to the next free row and began planting again, without a break. Near the end of a plot, workers all worked on the last row together. When a plot was finished, workers proceed to the next plot without a break. Time to plant a complete plot was recorded and the recorded time subsequently expanded to a planting-speed per acre.

Workers planted seedlings eight feet apart in rows spaced at eight foot intervals (680 seedlings per acre). Planting quality was constantly checked. Workers were recalled to improperly planted trees to plant them correctly. After several such recalls, quality of planting ceased to be a problem. In addition, a stocking check was conducted at one year to insure that there was not excessive mortality attributable to poor planting technique and that seedlings were planted as prescribed.

An F test was run on the ratio of planting-speed variance from the first and second, and the second and last third of the planting-speed observations. This was done to determine if planting-speed variance decreased significantly as experience was gained.

An analysis of variance (ANOVA) was used to test for differences in planting-speed by planting stock type as workers gained experience. The dependent variable, planting-speed, was modeled as a function of the planting stock type (seedling type), with acres planted (experience) as a co-variate.

Toward the end of the observed planting time it became apparent that a consistent planting rate has been reached. When this occurred the last four observations, which had little variation between them, were averaged, to obtain a sustainable planting-speed.

RESULTS

Average planting-speeds for both seedlings types are presented in Table 1. Average planting-speed for the container-grown seedlings was slightly faster than the bare-root seedlings, but the variance of the container-grown seedlings was slightly higher than the bare-root. However, for both seedling types, as the number of acres planted increased, the number of hours required to plant an acre decreased (Fig. 1). This increase in planting-speed can be attributed to learning the psycho-motor skills required to do the job of planting, and "getting in the swing" of manual labor. Also, variability in planting speed for both container-grown and bare-root seedlings decreased as more acres were planted. This was due to better organization of the planting crews,

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Table 1. Bare-root and container-grown planting speed expressed as average man-hours required to plant one acre

SEEDLING STOCK	MEAN	MINIMUM	MAXIMUM	STD DEV	N
BARE ROOT	9.75	5.75	13.88	1.68	39
CONTAINER	8.48	5.66	13.50	1.81	39

as well as increased planting experience with time.

The stocking check at the end of the first year revealed that 94.4% of the bare-root and 97.5% of the container-grown seedlings had been properly placed and had lived. Although there was only a 3.1% difference in stocking level between the two seedling types, the difference was significant at the 0.05 level (Duncan's Mean Separation). The extremely high stocking check results indicated that both seedling types had been planted correctly and at the proper spacings.

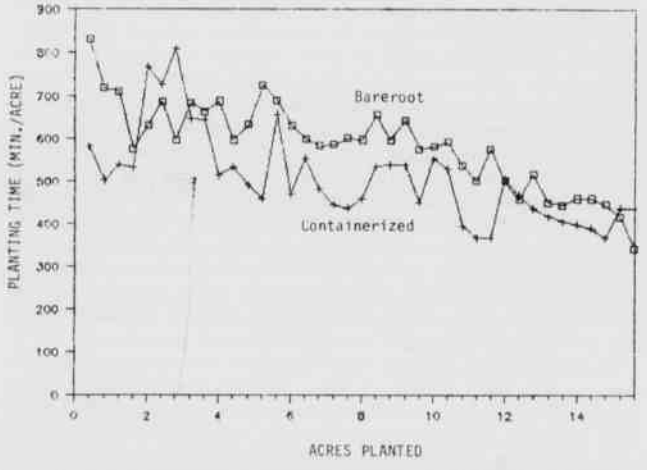

Figure 1. Time required to plant one acre with bare-root or containerized loblolly pine seedlings.

The greatest decrease in planting-speed variation came between the first and second thirds of observations for the bare-root stock. Planting-speed variance decrease for the container-grown seedlings occurred less quickly, and extended for a longer period. The variance decrease for both planting methods was significant at the 90% level. In summary, high variance in planting-speed can be expected in the earliest part of a planting operation, but after a period of time, variance in planting-speed will decrease significantly and a reasonably smooth rate of planting can be expected after workers learn the job.

The analysis of variance (ANOVA) showed that only planting method (seedling type) and acres planted (experience) were significant at the 0.05 level.

The average estimated sustainable planting-speed was 6.95 hours per acre for bare-root seedlings and 6.52 hours per acre for container-grown seedlings. The estimated sustainable rate was reached after the crews had planted about 6.5 acres per crew, or 0.8 acres on an individual basis.

APPLICATION

The average time required to plant an acre of bare-root seedlings in this study was slightly higher (9.75 hours per acre vs. 7.93 hours per acre) than reported by Kluender *et al.* (1985). However, the post-training sustainable planting-speed from this study (6.95 hours per acre) was below that reported by Kluender *et al.* (1985).

The "learning curves" for planting bare-root and container-grown seedlings presented here are results that apply to crews with no prior experience in tree planting. Such a condition is likely to occur when a consultant or landowner employes casual laborers to plant small acreage on non-industrial tree farms or possibly on larger holdings. How fast a worker acquires planting skills will vary with terrain, soil type, climate, and abilities of laborers. The estimated sustainable rates that individuals can achieve will vary with the same factors that influence the learning curve.

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