Comparison of Planting Tools for Containerized Seedlings: Two-Year Results

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Three planting tools—a planting tube, a bar, and a dibble—were evaluated for planting errors with containerized seedlings. Bar planting resulted in a significantly greater percentage of seedlings being planted too shallow than did planting with either of the other two tools, whereas the planting tube had a significantly greater percentage of trees planted too deep. There were also significant differences between the tools in percentage of packing errors. None of the planting errors were severe enough to affect survival after 2 years, but high mortality due to drought may have masked planting error effects. Survival differences were found between the planting sites because of drought, but were unrelated to type of planting tool. Tree Planters' Notes 40(2):22-24; 1989.

Containerized tree seedlings have been used in Minnesota since 1967. Ontario tubelins—$^{9}/_{16}$—3-inch tubes—were first used, and planting was done mostly with a blunt-tipped dibble or rod. Several years later, when paperpots, bookplanters, and Styroplugs were introduced, the primary tool was the Finnish Potiputki, from which a number of other planting tool innovations were developed. These were designed to increase planting speed, minimize planters' fatigue by allowing planting from an

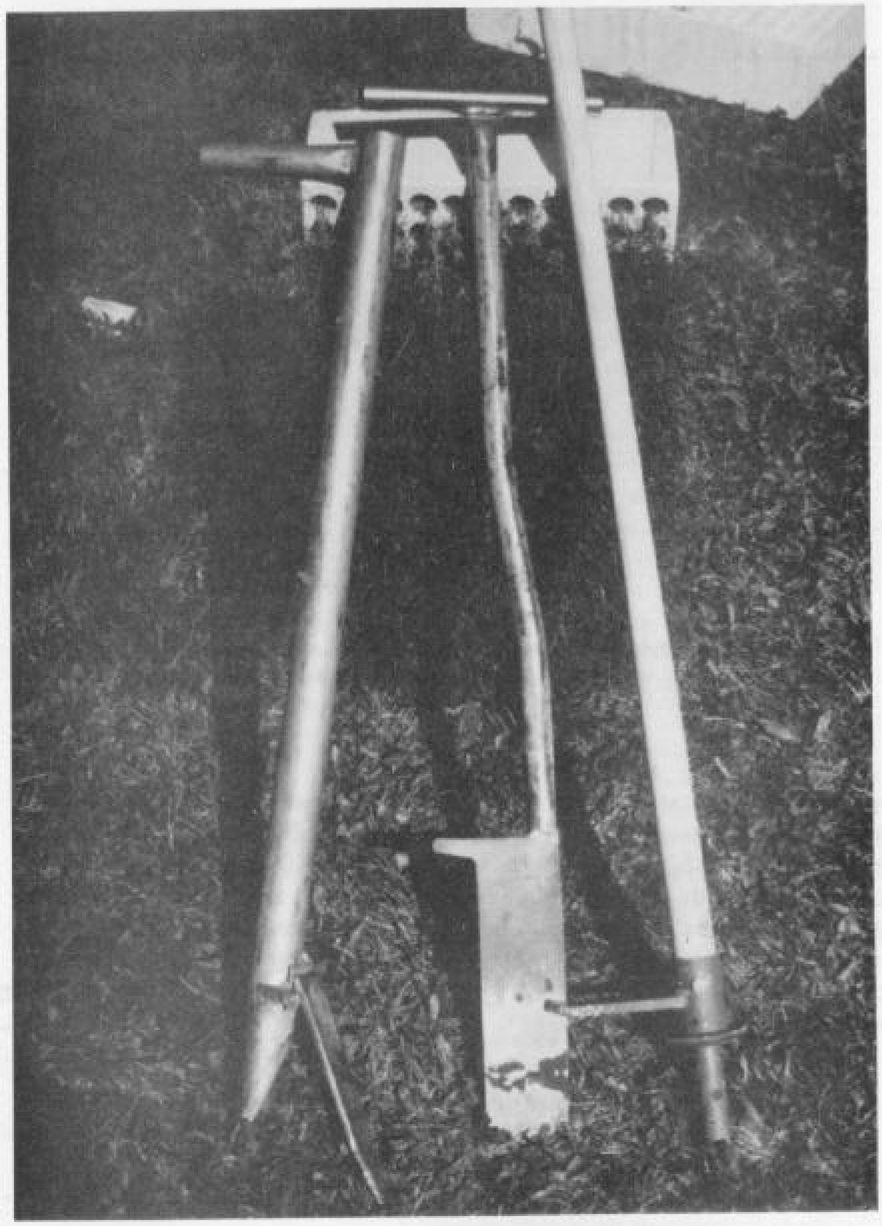

Figure 1—*The three planting tools used in the study* **(left to right):** *planting tube, bar, dibble.*

upright position, and improve the quality of tree planting.

In 1984, the St. Louis County (Minnesota) Department of Land Investment began using containerized seedlings for reforestation. A tube-type tool designed by Moorhead Manufacturing was used to plant nearly a half-million Styro-4A seedlings in 1985. During 1986, it was noted that seedlings planted with this tool were often too shallow and loosely packed. This problem was partly attributed to the larger diameter of the planting tube (1¾ inches) in relation to that of the Styro-4A seedling (about 1 inch). Because of these problems, an operational trial was set up to evaluate the original tool and several others. This paper summarizes results of planting error determination and first-year and second-year survival. A follow-up survey, including height growth, will be made after four growing seasons.

Materials and Methods

Three tools were evaluated: a round **dibble-**type bar, 5¼ inches long and 1 inch in diameter, with a blunt end; a flat **bar**, 10 inches long, such as is normally used for bareroot stock; and the original planting **tube** used in 1985 and 1986 (fig. 1). Three planting sites were selected with various soil textures: (1) gravelly, very fine sandy loam; (2) sandy loam; and (3) coarse sandy loam. At each site, four rows were randomly selected to serve as blocks. Each tool was then used to plant 25 seedlings in each row. The same personnel who normally carry out planting operations were used for these experiments. The seedlings were classified after planting for planting depth and packing around the seedling. The following classifications were used.

Planting depth:

Correct = root collar at mineral soil surface.

Shallow =root collar ½ inch or more above mineral soil surface.

Deep = root collar more than ½ inch below soil surface.

Seedling packing:

Good =root system remains firmly packed after a tub on the seedling's foliage.

Fair = root system is partially dislodged by a tug on the seedling's foliage.

Poor = seedling is lifted from planting hole by test tug.

Survival was determined after the first and second growing seasons. Arc sine transformation and two-way analysis of variance were used to analyze the data.

Results

Soil type did not significantly affect the percentage of planting errors in this study, so data were pooled over sites during analysis of the study results.

The percentage of seedlings planted too shallow was 5% higher with the planting bar than with either the dibble or the planting tube. However, this is probably no greater than the amount of variation that might occur with any planting tool. The percentage of seedlings planted too deep was from 10 to 12% higher with the planting tube than with either of the other two tools. This is a substantial difference and is seemingly related to the design of the tool. This is probably a result of the larger than needed hole made by the planting tube, both in depth and diameter (table 1).

The percentage of seedlings classified as well packed was significantly lower with the planting dibble than with the bar but neither varied from the planting tube in this category. The poorest packing was with the planting tube and planting dibble, but these did not significantly vary from the planting bar. Again the variation between the three tools was of little consequence regarding poor packing (table 2).

Table 1—*Percentage of planting depth errors by tool*

Planting tool	Percent of errors		
	Correct depth	Too shallow	Too deep
Dibble	68 a	2 a	30 a
Bar	66 a	7 b	27 a
Tube	58 a	2 a	40 b

Means within a column followed by the same letter do not differ significantly at the 0.10 level.

Table 2—*Percentage of packing errors by tools*

Planting tool	Percent of errors		
	Good packing	Fair packing	Poor packing
Dibble	69 a	26 a	5 a
Bar	85 b	14 b	1 a
Tube	78 ab	18 ab	4 a

Means within a column followed by the same letter do not differ significantly at the 0.10 level.

Table 3—*Percentage survival by tool type and site*

Planting tool	Site	Percent Survival	
		First-season survival	Second-season survival
Dibble	1	95 b	36 b
	2	99 a	74 a
	3	100 a	68.5 a
Bar	1	93 b	45 b
	2	98 a	83.8 a
	3	99 a	73 a
Tube	1	95 b	40 b
	2	100 a	81 a
	3	100 a	71.8 a

Means within a column followed by the same letter do not differ significantly at the 0.10 level.

The type of planting tool did not significantly affect survival after two growing seasons (table 3). There was no relationship between either planting depth or degree of packing and survival. However, any effect of these factors was likely masked by a drought during the second growing season, which greatly reduced seedling survival. Precipitation was 8.4 inches below normal for that growing season, and seedling survival was affected on all three sites. Site 1 (gravelly, very fine sandy loam soil) was significantly lower than either site 2 or 3.

These results are not necessarily revealing regarding impact of planting tool selection and planting errors relating to seedling survival. However, with the current high cost of artificial regeneration, namely tree planting, it is imperative that we reduce planting errors and use the tool most suitable for the assigned task. We should strive to maintain high standards on those aspects of regeneration that we can control, such as planting stock quality and proper seedling placement.