Is It Possible To Detect Cull Trees Within 1 Year After Planting?

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On November 20, 1980, after a severe spring and summer drought, 100 low-vigor and 100 high-vigor seedlings in a plantation were selected and observed through spring 1982. The low-vigor seedlings had slower height growth and later spring bud break. There were no significant survival differences.

After a severe drought, first-year plantation survival may be marginal or insufficient to produce a satisfactory commercial return. On the other hand, stocking density following drought may be adequate, but many seedlings surviving drought may have suppressed growth in later years. This study sought to quantify such observations.

Materials and Methods

Following the severe drought of 1980, 100 seedlings that appeared to have low vigor and 100 seedlings that appeared to have high vigor were flagged for reference in a plantation established during the previous winter on a well-drained sandy loam site at the Palustris Experimental Forest in central Louisiana. Weeds and brush were bush-hogged and disked before planting at a 2- by 2-foot spacing. The seedling roots were mycorrhizal at the time of planting.

On November 20, 1980, 100 low-vigor and 100 high-vigor loblolly pine seedlings were flagged and their heights were measured. A low-vigor seedling was defined as chlorotic and having small or no branches, short secondary needles, and a small terminal bud. High-vigor seedlings were characterized as having green foliage with larger branches, long secondary needles, and a large terminal bud.

Results and Discussion

At the time of selection, the mean height of the low-vigor seedlings was 24.2 centimeters and the mean height of the high-vigor seedlings was 28.8 centimeters. These differences were small, but statistically significant at the $p \leq 0.05$ level of confidence. By August 30, 1981, the mean height and standard error of the more vigorous seedlings was 57.1 ± 10.73 centimeters, but the mean height and standard error of low-vigor seedlings was only 36.6 ± 6.98 centimeters. These differences were statistically significant at the $p \leq 0.01$ level of confidence. Thus, the vigorous seedlings had grown 55 percent more than the low-vigor seedlings in the same growth period (table 1). This represented a 91.3-percent increase in height growth for the vigorous seedlings and a 51.2-percent increase in height growth for the low-vigor seedlings.

On February 20, 1981, the seedlings were surveyed for bud break. All of the vigorous seedlings had broken bud (table 2), but only six of the low-vigor seedlings had broken bud. Most of the vigorous seedlings had also developed a flush of growth and an apparently strong bud. The low-vigor seedlings had not only failed to break bud, but, except for six seedlings, they had also retained all original low-vigor characteristics from November 20, 1980. Four of the low-vigor seedlings appeared dead, but all of the high-vigor seedlings were still living. However, all low-vigor seedlings had begun growing by March 13.

Observations were repeated in February 1982. Of the four seedlings that had previously appeared dead, two had survived. By February 20, 67 percent of the seedlings classified as vigorous in November 1980 had begun to grow, but only 9 percent of the low-vigor seedlings had initiated terminal bud break. By March 11, 93 percent of the high-vigor and 53 percent of the low-vigor seedlings had broken bud (table 3). Mean height of the two groups of seedlings had not changed since November 20, 1981; both sets of seedlings were effectively dormant between November 20, 1981, and February 22, 1982.

Perhaps the most interesting and important point is that on November 20, 1980, on consideration of foliage color, secondary needle length, and bud and branching characteristics, two classes of seedlings that would perform differently could be distinguished. This prediction was restricted to two groups of seedlings, but the prediction was surprisingly accurate; and the suppressed seedlings as of November 1980 continued to be less vigorous

in 1982. Perhaps with more intensive quantification of seedlings and seedling vigor analysis, it may be possible, after the first growing season, for the plantation manager to estimate accurately the number of suppressed trees in a plantation. This information may be used to determine whether the plantation should be replanted even though the overall survival percentage is acceptable for minimum reforestation criteria.

Table 1.—*Second-year growth of low-vigor and high-vigor seedlings*

	Mean heights of seedlings (with standard errors)		
Seedling class	November 20, 1980	August 30, 1981	Height increase
	---------- Cm ----------		%
Low vigor	24.2 ± 4.54a[1]	36.6 ± 6.98a	51.2
High vigor	28.8 ± 4.38b	57.1 ± 10.73b	91.3

[1]Data sets followed by different letters indicate a statistically significant difference at the $p \leq 0.05$ level.

Table 2.—*Percentage of surviving loblolly seedlings and percentage of surviving seedlings that had broken dormant buds on February 20, 1981 (100 low-vigor and 100 high-vigor seedlings were compared.)*

Seedling class	Date	Surviving	Bud break
		---------- % ----------	
Low vigor	2-20-82	96	6.2a[1]
	3-15-82	96	100
High vigor	2-20-82	100	100b
	3-15-82	100	100

[1]Data sets followed by different letters indicate a statistically significant difference at the $p \leq 0.05$ level.

Table 3.—*Percentage of surviving loblolly seedlings and percentage of surviving seedlings that had broken dormant buds on February 22, 1982, and March 11, 1982*

Seedling class	Date	Surviving	Bud break
		---------- % ----------	
Low vigor	2-20-82	98	9.2a[1]
	3-11-82	98	53.0a
High vigor	2-22-82	100	67.0b
	3-11-82	100	93.0b

[1]Data sets followed by different letters indicate a statistically significant difference at the $p \leq 0.05$ level.