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TENTH YEAR REMEASUREMENTS OF PLANTING TRIALS WITH PONDEROSA PINE

by

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52, 572 and 597

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TENTH YEAR REMEASUREMENTS OF PLANTING TRIALS WITH PONDEROSA PINE (E.P.'s 552, 572, and 597)

Between 1950 and 1960, approximately 3,820 acres were planted with Ponderosa pine in the East Kootenay with an average survival of 23.2 percent. It was hypothesised that the poor survival was due primarily to soil moisture deficiences, and planting trials were initiated in 1960 to investigate this hypothesis. The results of these trials (E.P.'s 552, 572, and 597) were reported in Research Note 41 (4).

The trials consisted of a pilot project (E.P. 552) which, in terms of survival, rapidly eliminated certain techniques. Two further projects tested variants on the remaining techniques (E.P. 572, 597). The survivals after two or three growing seasons were reported in Research Note 41 (4).

This report investigates the heights after 10 to 12 growing seasons. In this remeasurement, every tree identifiable by treatment was measured to the nearest decimeter. Lack of survivors from individual planting stock - site preparation combinations, resulted in combined measurements within the site preparation treatment. This hindered overall data analysis, since the grouped data had to be regarded as missing data and analysis performed "around" it.

When the project was planted the stock was divided into "large" and "small" grades, these grades being randomly assigned to either the start or finish of each line. As all markers had disappeared, the two grades could not be reliably separated.

Research Note 41 also reports on E.P.'s 550, 551, and 560 which were conducted in the Kamloops District. These projects are not reported here.

LOCATION OF THE TRIALS

For a description of the areas involved see Research Note 41. Figure 1 is a map showing the location of the trials.

RESULTS

Due to seven years of neglect, disturbance by cutting for initial powerline right-of-way marking, and a natural gas line, it was decided that any attempted assessment of survival would provide results of questionable reliability. As Research Note 41 paid little attention to height growth, this factor is examined here. Summarized results are shown in Tables 1-3, with detailed results in the Appendices.

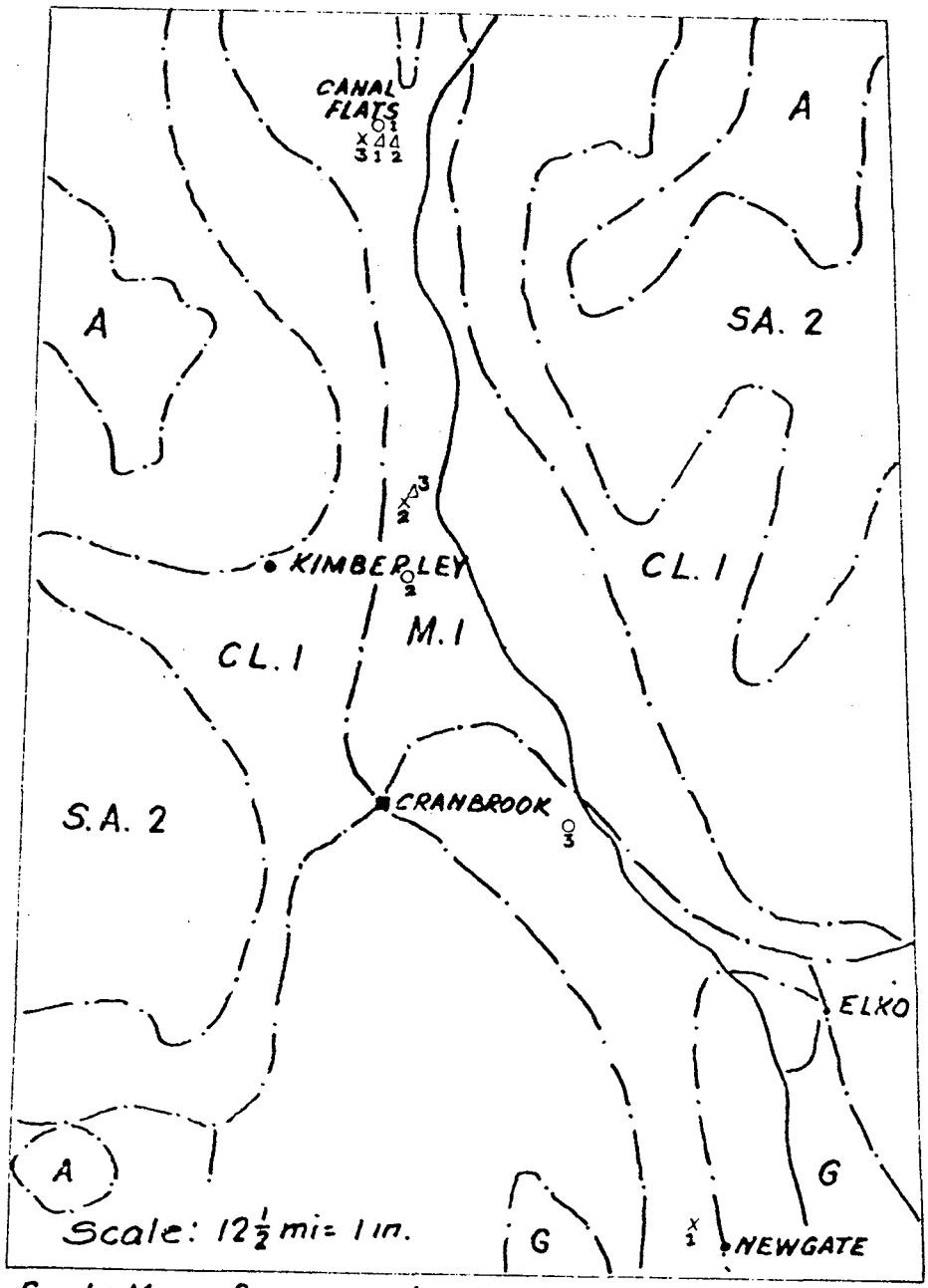

Fig. 1 : Map of area studied showing major forest regions (after Halliday and Rowe) and location of trials. X : 1960 trials - E.P. 552
Δ : 1961 trials - E.P. 572
o 1962 trials - E.P. 597

TABLE 1

EFFECT OF SITE PREPARATION ON HEIGHT

	Furrow	No Furrow	
E.P. 552[1.]	22.5*	16.0	no analysis made

	Skogscultivator	Plough	Blade
E.P. 572[2.]	13.8	17.2	19.5

	Screef	Skogscultivator	Plough	Blade
E.P. 597[3.]	11.2	12.4	12.8	15.4

Nb * Heights in decimeters.

1. Heights after twelve growing seasons.
2. Heights after eleven growing seasons. Deschutes fireline plough excluded.
3. Heights after ten growing seasons. Block 2 (McGinty Lake excluded).

All differences underlined are not significant unless otherwise stated.
For details see Appendix A.

TABLE 2

EFFECT OF SEEDLING CLASS ON HEIGHT GROWTH

	Height in decimeters				
	1+1	2+0	2+1	3+0	1+2
E.P. 572	14.0	15.8	18.7	-	18.8
E.P. 597	-	14.7	14.8	15.3	15.7

N.b. E.P. 572 data is minus Deschutes treatment, heights after eleven growing seasons.

E.P. 597 data is minus Screef treatment, heights after ten growing seasons.

Differences underlined are not significantly different.

TABLE 3

EFFECT OF NURSERY SOIL AMENDMENTS
ON HEIGHT GROWTH

Treatment	Height (in dm)
Sawdust	19.7
Peatmoss	20.2
Litter	21.4
Mycorrhiza	21.7
Control	22.2
Tankage	24.4
Topsoil	24.6
Stable Manure	24.8
Average	22.5

N.b. Heights after twelve growing seasons, on furrowed plots only.

No statistical analysis was attempted.

All data was subjected to analysis of variance, followed by examination of treatment means by a Duncan New Multiple Range Test. All analyses were to the 95 percent level.

SITE PREPARATION

a) Method

The initial survival of the first trial (E.P. 552) indicated that intensive site preparation, furrowing with an angled "cat" blade or a tractor and plough, was effective in producing significantly improved survival. After twelve growing seasons, survival difference is reflected in height growth difference (Table 1). Subsequent trials using alternative methods of site preparation also produced significant differences in height due to intensive site preparation. In general, greater growth is associated with the method of site preparation producing the most intensive site disturbance. In all instances, an angled "cat" blade produced the greater height growth.

To a certain extent, height difference is also a reflection of the degree of browsing. The hedge-row effect resulting from close spacing and good survival of the furrowed stock has apparently excluded browsing animals, improving height growth. Research Note 41 indicated that initial height growth of the furrowed stock was greater than non-furrowed stock.

The first trial (E.P. 552) also investigated the use of shingles to shade the planted seedlings, plus the advantages of a screef versus no screef. Survival was improved by any treatment that reduced the dessicating conditions. Shading reduced the transpirational stresses, and a screef reduced vegetative competition for moisture; both giving significantly better survival than notch planting with no screef or shade. These survival differences are still reflected in the heights after twelve growing seasons (Appendix A).

It is interesting to note that treatment combinations having poor survival (not separated by treatment - assessed as a group), also had the poorest height growth.

b) Season

It was reasoned that sloughing from a freshly turned furrow might smother newly planted seedlings. Accordingly, in the second trial (E.P. 572), an investigation was made of site preparation in the Fall and Spring prior to planting (Appendix B). After eleven growing seasons, there was no significant difference between the heights of seedlings planted in either Fall or Spring prepared furrows.

SEEDLING CLASS

No examination was possible on the effect of seedlings graded into "large" and "small", only the effect of seedling classes could be examined (Table 2, Appendix C). In the second trial (E.P. 572), stock three years old on planting was consistantly taller than stock planted at two years, and the difference was significant. In the third trial (E.P. 597), the difference was not significant. The overall results from the two trials (E.P. 572, 597) was confusing, and variations in nursery stock, seedlot effects, plus annual variations in seedling quality made definite conclusions difficult.

NURSERY SOIL AMENDMENTS

If the heights resulting from the various nursery soil amendments in E.P. 552 are arranged in order of magnitude (Table 3), the list resembles third year survival data. The same amendments that increased survival relative to the control, tankage, topsoil, and manure, also increased height growth, mycorrhizae being the exception. However, it is felt that the influence of nursery amendments on heights is minor when compared to that of site preparation. In addition, the amendments are only applicable to the now defunct East Kootenay Nursery.

DISCUSSION

All these trials were conducted in the Montane (M1) Forest Region (7) as shown in Figure 1. This region is characterized by summer drought, with lack of soil moisture being the major limiting factor to seedling establishment. Research Note 41 (4) indicated conclusively that any measure taken to increase the amount of available soil moisture increased seedling survival. More intensive measures gave better survival. Removal of vegetative competition by furrowing with a tilted "cat" blade or plough resulted in better survival than large screefs produced by a Skogscultivator; and the Skogscultivator, gave better survival than hand screefing. Shading to reduce transpirational losses gave results comparable to hand screefing.

The principal indication was that a major reduction of vegetative competition resulted in improved survival. A further improvement in survival can be achieved by using larger, well balanced planting stock. The effect of site preparation to reduce vegetative competition of brush and grass and improve survival of Ponderosa pine is further documented by others (1, 2, 3, 5, 6, 9).

Improved height growth of Ponderosa pine resulting from reduction of vegetative competition, has been reported at 3 years (5, 8), 5 years (2), and 10 years (3). Larson (5) points out that emphasis should not be placed on early height growth measurement, as the majority of the early growth of Ponderosa pine occurs in the roots. Reassessment of these projects (E.P. 552, 572, 597) has produced similar results. The greater the site disturbance prior to planting, the greater the height after ten to twelve years. A wide furrow made by an angled "cat" blade was most effective and a hand screef was least effective.

To a certain extent, improved height growth on the machine prepared plots can be attributed to a reduction in browsing due to the hedge-row nature of these plots compared with hand prepared plots. The individual trees of the hand prepared plots allowed (and still allow) more browsing, thus reducing height growth. However, it is difficult to say how much difference can be attributed to browsing.

Observation of other planting projects with low survival has shown, in many cases, no measurable growth for the first few years. Root growth continues, but aerial growth is characterized by leader die-back followed with sprouting lower down the stem. With minimal photosynthetic tissue, the seedling is unable to build up the necessary metabolic reserve for "normal" growth the following season. The cycle continues until some external factor such as overtopping, smothering, a drought year, or a mild moist season decides whether the seedling dies or achieves sufficient metabolic reserve for improved growth. Thus, from observation of other planting projects, it is highly probable that height difference between the furrowed and non-furrowed plots is not exclusively due to the difference in browsing.

After consideration of site preparation, other variables seem minor. Three year stock produced taller trees than two year stock, but only in one project (E.P. 572). Evidence from other projects suggests that using sturdy transplant stock for difficult sites is a sound practice. Over-weighing any generalized statement about nursery classes should be an appreciation of seedlings in good condition, with a compact fibrous root system and a balanced root/shoot ratio. As shown in E.P. 552, nursery soil amendments can help produce suitable stock but they are only one of many available nursery techniques.

In summary, the treatments producing improved survival also improved growth. Improved survival was obtained by 1.) Reduction of moisture stress by reduction of vegetative competition. Apparently, the more intensive the reduction the better! and 2.) Use of seedlings with a good fibrous root system and high metabolic reserve.

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APPENDIX A

EFFECT OF SITE PREPARATION ON HEIGHT

E. P. 552

Treatment	Block 1	Block 2	Block 3	Average
	Newgate	TaTa Cr.	Findlay Cr.	
Furrow	26.2	22.1	19.3	22.5
Shaded	9.3	25.2	14.1	18.3
Mattock	12.0	24.9	9.9	17.1
Scalp	-	24.5	10.4	15.1
Grouped	13.9	19.9	10.7	14.5
Average Unfurrowed	12.5	23.6	11.0	16.0

E. P. 572

Treatment	Block 1	Block 2	Block 3	Average
	Findlay Cr.	Findlay Cr.	TaTa Cr.	
Blade	19.5	15.6	23.3	19.5
Plough	15.5	13.3	22.6	17.2
Skogscultivator	11.7	10.8	18.9	13.8
Deschutes	16.4	13.2	-	
Average	15.7	13.3	21.6	

E. P. 597

Treatment	Block 1	Block 2	Block 3	Average
	Findlay Cr.	McGinty Lk.	Wardner	
Blade	14.5	18.9	16.3	16.6
Plough	12.0	19.6	13.7	15.1
Skogscultivator	11.6	16.1	13.3	13.7
Screef	9.8	14.7*	12.5	
Average	12.0	-	14.0	

*Value excluded from anova since it contains "grouped" data. Treatment and Block averages are thus not available.

APPENDIX B

EFFECT OF SEASON OF SITE PREPARATION

	Height in dm. after eleven growing seasons					
Treatment	Block 1		Block 2		Block 3	
	Fall	Spring	Fall	Spring	Fall	Spring
Blade	18.9	20.1	15.2	16.1	21.4	25.2
Plough	14.9	16.1	13.7	13.0	21.6	23.6
Skogscultivator	10.3	13.2	10.4	11.2	18.6	19.2
Deschutes	-	16.4	-	13.2	-	-

APPENDIX C

EFFECT OF SEEDLING CLASS ON HEIGHT GROWTH

E.P. 572 (excluding Deschutes)

	Height in dm after eleven growing Seasons		
Seedling Class	Block 1	Block 2	Block 3
1+1	13.5	10.6	17.8
1+2	17.9	14.9	23.8
2+0	13.7	12.7	21.0
2+1	17.2	14.9	23.8

E.P. 597 (excluding Screef)

	Height in dm after ten growing seasons		
Seedling Class	Block 1	Block 2	Block 3
2+0	12.6	18.2	13.1
3+0	12.4	18.9	14.5
1+2	13.2	19.1	14.9
2+1	12.6	16.7	15.0

APPENDIX D

EFFECT OF NURSERY SOIL AMENDMENTS
ON HEIGHT GROWTH

Treatment	Heights (in dm)		
	Block 1	Block 2	Block 3
	Newgate	TaTa Cr.	Findlay Cr.
Sawdust	22.4	14.8	18.1
Peatmoss	21.9	21.9	19.0
Litter	23.6	24.0	19.2
Mycorrhiza	26.0	18.1	19.0
Control	27.3	20.1	17.4
Tankage	27.5	24.2	20.5
Topsoil	29.4	23.0	20.4
Stable Manure	30.2	21.2	20.0
Average	26.2	22.1	19.3

Nb. Height after twelve growing seasons, on furrowed plots only.