

SENIOR THESIS

RESPECTFULLY SUBMITTED

TO

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BY

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SCHOOL OF FORESTRY  
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## COMPARISON OF 1-1 STOCK WITH 2-0 STOCK

The trees used in this experiment were measured and weighed for the following data; length of tops to the nearest one-fourth inch, diameter of stems, weights of tops, weights of roots.

The utmost care was taken in selecting locations to obtain areas, not only representative of the site desired, but also of uniform quality throughout. Areas having marked variations in soil, exposure, or density of brush were avoided. The trees of various classes were planted in rows of twenty-five, the classes alternating in each row in order to equalize the influence of any variation in site conditions within the plot. The quality of planting was as uniform as humanly possible; it being done by one person. Trees injured in shipping were discarded to eliminate inequalities.

The examinations were made in the fall of the year, the following classifications being made of the trees:

1. Healthy
2. Sickly--off colored or injured, but apparently having a chance to recover.
3. Dying--Those like the above but likely to die.
4. Dead

In making the examinations, trees killed by accidental causes such as falling snags, burral by animals, etc. were eliminated, for death was not due to difference of stock grades.



The causes of death or injury were:

1. Rodents
2. Terminal bud injury
3. Covered with dirt
4. Weeds
5. Drought
6. Stepped on
7. Too wet
8. Poor planting

The condition of the weather preceding, during, and after planting was noted and entered on the report covering the planting of the plot.



## S--PLANTING--COLUMBIA FOREST--WIND RIVER VALLEY

Working Plan for Outplanting Phase of Study of Root Development Produced by Pruning Seedlings in Place.

Four lots of root-pruned 2-0 fall sown Douglas Fir stock grown in densities of 40, 80, 120, and 160 per square foot, are available for planting this spring to test their suitability as planting stock in comparison with ordinary 1-1 fall sown transplant stock. These trees, together with a suitable quantity of transplant stock, have been dug, sorted, and heeled at the Wind River Nursery. There are 500 trees in each lot.

These are to be planted on two sites in the Wind River Valley, Columbia Forest, on a South and a West exposure. These aspects are chosen for they are the ones most commonly found on planting areas in this district. The planting on each site is to embrace 250 trees of each lot, planted on adjoining strips. Site conditions and quality of planting should be uniform, spacing 4' x 4' to reduce area, arranged 5 rows of 50 trees each for each lot.

The corners of the areas are to be marked by 4"x 4"x 6' cedar posts, properly labeled. The divisions of each area should be marked by small stakes at the beginning of each row, and each tree staked with the information given, number of tree and class, on each stake.

Subsequent Examination. Made later and condition of trees tallied by number in the classes of good, poor, and



dead, as to whether in open or shade major part of day, injuries from animals, falling snags, etc., should be recorded. Cause of dead trees should be determined if possible. Dead trees to be removed at each examination.

Installation Report of Plots. Planted on two sites designated as plots one and two. Approximately 150 trees in each of the four density classes of 2-0 stock. There were 300 trees of 1-1 stock in each plot. The trees were drier than was good for them, season far enough advanced that the terminal buds were opening, dry weather prevailed before, during, and after the planting; slope of plot number 1, P-1, is 50%-60%, soil very loose, hot, dry, and of volcanic ash type, and burned over last summer by the Pilot Knob fire.

Trees were spaced 4 feet apart, 50 to the row, and marked with a cedar stake painted white and numbered with black. Numbers ran from 1 to 150 in a separate series for each lot on each site. The division of each lot of stock is marked by larger stakes painted white and set at the beginning of each row.

Plot One

	No. of Rows	Stock Lot	No. Trees
A.	3.	1-1	144
B.	3	40	150
C.	3	80	150
D.	3	120	150
E.	3	160	150
A.	3	1-1	150



## Plot Two

	No. of Rows	Stock Lot	No. Trees
A.	3	1-1	150
B.	3	40	99
C.	3	80	150
D.	3	120	150
E.	3	160	150
A.	3	1-1	150

Plot two has south exposure, 30%-35% slope soil volcanic ash type, dry, hot, and loose, with considerable rock, and burned by the Pilot Knob fire in 1925.

Progress Report No. 1.--August 12, 1926.--Wind River Valley.

Plot examined June 17, 1926. Very noticeable difference in favor of 1-1 stock over all classes of 2-0 stock. Not only had more trees survived, but their general thriftiness was better.

Most of the dead trees among all classes died soon after planting, as is evidenced by the fact that they made no growth after planting.

The weather for a month after planting was very hot and dry, and most of the weaklings perished at that time. The last of May and the month of June were cool and showery and more than usually favorable for newly planted stock. This period was followed by sub-normal rainfall and an abnormally hot summer.

### Results of Examination.

1. Thrifty--Those making good growth since set out.



2. Satisfactory--Those making at least a little growth or holding their own.
3. Sickly--Those making no growth and most of them expected to not survive the summer.
4. Dead--Dead.

#### Summary of Plots One and Two

1-1 Stock 40 p.sq.ft 80 p.sq.ft. 120 p.sq.ft. 160 p.sq.ft.

Cond. of Trees	%	%	%	%	%
Thrifty	51.5	47.3	16	14	26.3
Satis.	34.	36.2	49.4	57.7	51.4
Sickly	9.1	10.7	24.3	18.7	16.
Dead	5.4	5.8	10.3	9.6	6.3
Total	100.	100.	100.	100.	100.

The height, growth, color of needles, and general thriftiness of 1-1 stock is much superior, which of course, cannot be shown in the tables.

Second Progress Report. Made October 19, 1926.

The mortality was higher than anticipated for the summer months, an average of less than 10% had died at that time, an additional 10% were sickly, making 25% which might be expected to perish during the summer months. Actually 756 out of 1740, or 43-1/3% perished, which probably is due to long drought period in the summer and an 8" to 9" rainfall deficiency in the spring.



Table No. 1. Plot One

Showing by number and percent the condition of seedlings in each class.

1-1 Stock 40 p.sq.ft. 80 p.sq.ft. 120 p.sq.ft. 160 p.sq.ft.

Cond. of Stock	No.	%	No.	%	No.	%	No.	%	No.	%
Thrifty	127	43.	62	42.	17	12.	8	5.	11	7.
Satis	63	22.	36	24.	45	30.	48	32.	41	27.
Sickly	17	6.	11	7.	24	16.	24	16.	9	6.
Dead	85	29.	41	27.	63	42.	70	47.	89	60.
Total	292	100.	150	100.	149	100.	150	100.	150	100.

Table No. 2. Plot Two

Thrifty	101	34.	35	36.	10	7.	7	4.	28	19.
Satis.	56	19.	21	21.	46	31.	39	26.	47	31.
Sickly	8	2.	8	8.	10	6.	16	11.	9	6.
Dead	135	45.	35	35.	84	56.	88	59.	66	44.
Total	300	100.	99	100.	150	100.	150	100.	150	100.

Table No. 3.

Showing in percent condition of stock in June and October, 1926

1-1 Stock 40 p.sq.ft 80 p.sq.ft. 120 p.sq.ft 160 p.sq.ft.

Cond. of Stock	J.	O.	J.	O.	J.	O.	J.	O.	J.	O.
Thrifty	52	39	47	39	16	9	14	5	26	12.
Satis.	34	20	36	23	50	31	58	29	52	30
Sickly	9	4	11	8	24	11	19	13	16	6
Dead	5	37	6	30	10	49	9	53	6	52
Total	100	100	100	100	100	100	100	100	100	100

This shows that the 1-1 stock is not as good as the 2-0



stock in survival. All other classes show a marked inferiority over the 1-1 stock in survival and thriftiness.

Table No. 4.

A comparison of the condition of the combined 1-1 stock with the combined 2-0 stock on both plots, expressed in percent.

	1-1 Stock	2-0 Stock
Condition of Stock	%	%
Thrift	39	15
Satisfactory	20	28
Sickly	4	10
Dead	37	47
Total	100	100

Number of trees in thrifty and satisfactory class to each one in sickly class.

Average for both plots.

1-1 Stock 40 p.sq.ft 80 p.sq.ft. 120 p.sq.ft. 160 p.sq.ft.

Cond. of Stock	%	%	%	%	%
Thrift	10.5	5.0	.8	.3	2.2
Satis.	5.3	2.9	3.2	2.2	4.8
Total	15.8	7.9	4.0	2.5	7.0

Third Examination Report. May 12, 1927.

Mortality during winter was low.

40 density show better survival than 1-1 stock, others very inferior to 1-1 stock.



Table No. 1. Plot One

1-1 Stock 40 p.sq.ft. 80 p.sq.ft. 120 p.sq.ft. 160 p.sq.ft.

Cond. of Stock	%	%	%	%	%
Thrifty	62	55	32	28	28
Satis.	6	11	17	14	9
Sickly	2	3	6	4	3
Dead	30	31	45	54	60
Total	100	100	100	100	100

Table No. 2. Plot Two

Thrifty	45	49	30	23	41
Satis.	7	11	12	11	11
Sickly	1	4	1	3	2
Dead	47	36	57	61	46
Total	100	100	100	100	100

Fourth Examination Report. November 16, 1928.

Table No. 1. Plot One

1-1 Stock 40 p.sq.ft 80 p.sq.ft. 120 p.sq.ft. 160 p.sq.ft.

Cond. of Stock	%	%	%	%	%
Thrifty	62	62	35	30	32
Fair	7	6	16	14	7
Sickly	1	1	2	1	1
Total Living	70%	69%	53%	45%	40%
Total Dead %	30	31	47	55	60



Table No. 2. Plot Two

1-1 Stock 40 p.sq.ft. 80 p.sq.ft. 120 p.sq.ft. 160 p.sq.ft.

Cond. of Stock	%	%	%	%	%
Thrifty	49	55	32	28	36
Fair	5	7	11	8	17
Sickly	0	0	0	3	1
Total Living	54%	62%	43%	39%	54%
Total Dead %	46	38	57	61	46

On this experiment the 40 stock apparently exceeds, in its ability to survive both good and bad conditions, any other class of stock including the transplanted 1-1 stock.

Table No. 3.

Showing in percent the comparative number of thrifty, fair, sickly, and dead seedlings in each class of stock combined for the two plots, for the examinations made in June and October, 1926, and May and November, 1927.

Cond. of Stock	1-1				40 p.sq.ft.				80 p.sq.ft.	
	Ju. 26	Oct. 26	May 27	Nov. 27	Ju. 26	Oct. 26	May 27	Nov. 27	Ju. 26	Oct. 26
Thrifty	52	39	54	55	47	39	53	59	16	9
Sickly	34	20	7	6	36	23	11	6	50	31
Dead	9	4	1	1	11	8	3	1	24	11
Tot. % Liv.	95	63	62	62	94	70	67	66	90	51
Tot. % Dead	5	37	38	38	6	30	33	34	10	49

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	80 p.sq.ft.			120 p.sq.ft.			160 p.sq.ft.			
Cond. of Stock	May 27	Nov. 27	Ju. 26	Oct. 26	May 27	Nov. 27	Ju. 26	Oct. 26	May 27	Nov. 27
Thrifty	31	34	14	5	26	29	26	12	34	34
Sickly	14	13	58	29	13	11	52	30	10	12
Dead	4	1	19	13	4	2	16	6	3	1
Tot. % Liv.	49	48	91	47	43	42	94	48	47	47
Tot. % Dead	51	52	9	53	57	58	6	52	53	53

In spite of the fact that the 1-1 stock shows a lower survival than the 40 stock, it seems to have made a better height of growth and noticeably surpasses the 40, 80, 120, and 160 in this respect.

Fifth Examination Report. November 23, 1928.

Table No. 1. Plot One

	1-1 Stock	40 p.sq.ft.	80 p.sq.ft.	120 p.sq.ft.	160 p.sq.ft.
Cond. of Stock	%	%	%	%	%
Thrifty	57	53	35	31	21
Fair	11	14	13	14	15
Sickly	2	2	5	5	2
Tot. % Alive	70	69	53	50	38
Tot. % Dead	30	31	47	50	62

Table No. 2. Plot Two

Thrifty	40	50	28	23	29
Fair	14	12	13	12	20
Sickly	0	0	2	4	5
Tot. % Alive	54	62	43	39	54
Tot. % Dead	46	38	57	61	46



This experiment has failed to reveal any consistent superiority of the 1-1 stock over some of the other classes, however, on extensive projects the 1-1 stock has shown a ~~dec~~ided superiority.



PLANTING--COLUMBIA FOREST--WIND RIVER VALLEY--EXPERIMENT 4

First Report. April 12, 1928.

Installation. Topog level or gently rolling; soil deep and sandy.

Ideal planting weather as it snowed and rained most of the time during planting and weather was cold until May 1st. The weather was clear from May 1st to 27th. The month of May from the 2nd to the 26th had no rain, high temperature, and low humidity. It was very unfavorable for newly set out seedlings.

First Examination Report. June 1, 1928.

Result of count of the two classes in percent.

Cond. of Trees	2-0 Stock	1-1 Stock
Healthy	28%	61.5%
Fair	46%	33. %
Sickly	21%	5. %
Dead	5%	0.5%
Total	100%	100. %

Second Examination Report. November 1, 1928.

Condition of trees expressed in percent.

Cond. of Stock	1-1 Stock	2-0 Stock
Healthy	70.5%	51.5%
Fair	19.5%	21. %
Sickly	7.0%	15. %
Dead	3.0%	12.5%
Total	100. %	100. %

The 1-1 stock still shows its superiority over the 2-0 stock. It has a more vigorous appearance and has made more growth than



The 2-0 stock. The extra cost of the 1-1 stock seems justified, as the 2-0 stock is spindly, scraggly, and varies more in size, it is harder to plant than the 1-1 stock.

Third Examination Report. October 28, 1929.

Results of the examination for this year and for two previous examinations in percent.

Cond. of Trees	2-0 Stock			4th Exam. 2-0
	Ju.1-'28	Nov.1-'28	Oct.28-'29	Oct.28-'29
Thrifty	28	51.5	62.0	66
Fair	46	21.0	12.5	10
Sickly	21	15.0	4.0	2
Tot. % Alive	95	87.5	78.5	78
Tot. % Dead	5	12.5	21.5	22

Cond. of Trees	1-1 Stock			4th Exam. 1-1
	Ju.1-'28	Nov.1-'28	Oct.28-'29	Oct.28-'29
Thrifty	61.5	70.5	82.5	87.0
Fair	33.0	19.5	8.0	4.5
Sickly	5.0	7.0	1.5	0.0
Tot. % Alive	99.5	97.0	92.0	91.5
Tot. % Dead	0.5	3.0	8.0	8.5

Eighteen 2-0, and ten 1-1 trees were dead. The cause for the death of any of these trees could not be determined, in spite of the fact that they were pulled out and an autopsy held over each one.

In the 4th examination it was found that some of the trees classed as sickly in previous examinations had established themselves and become thrifty.



PLANTING--COLUMBIA FOREST--COPPER CITY--EXPERIMENT 6

Installation Report.

Three plots about 1400 ft. elevation on East Fork of Lewis River.

Rock of equal amount on all sites and area burned over in fall of 1929.

First Examination Report. October 23, 1930.

The 80 and 120 classes showed a decided inferiority in survival, growth, and general condition as compared with the 1-1 stock. There is a slightly greater percent of thrifty trees and a lower percent of sickly trees in the 40 stock than in the 1-1 stock. The difference is noticeable to the casual observer, particularly the greater height growth made by the 40 stock during the past summer.

Summary of Plots One, Two, and Three

Cond. of Trees	1-1 Stock	40 p.sq.ft.	80 p.sq.ft.	120 p.sq.ft.
Thrifty	72.9	74.7	41.5	25.2
Fair	19.8	18.0	36.1	41.8
Sickly	2.0	1.0	5.9	11.3
Tot. % Alive	94.7	93.7	83.5	78.3
Tot. % Dead	5.3	6.3	16.5	21.7

The 40 stock is almost identical with the 1-1 stock in this experiment.



# Second Examination Report. October 23, 1931.

Class of Stk.	Survival 1930%	Survival 1931%	Mortality inc. for 1 yr.
1-1	94.7	90.8	3.9
40	93.7	92.0	1.7
80	83.5	78.4	5.1
120	78.3	71.8	6.5

## PLANTING--COLUMBIA FOREST--COPPER CITY--EXPERIMENT 8--1931

Class of Stock	Percent Survival Fall Oct., 1931
40-A	65.2
60-B	66.6
80-C	61.9
100-D	57.3
1-1-E	50.9

The tables reveal a decided inferiority in the survival of the 1-1 stock in comparison with the other classes of stock, which is contrary to what would be expected.

## Second Examination Report. September, 1930.

120	85	93	91	89
80	87	88	92	89
40	86	92	87	92
1-1	92	95	93	94

Apparently the 1-1 stock has the edge on the 2-0 stock in this experiment.



S--PLANTING--OLYMPIC FOREST--COOK CREEK AREA--EXPERIMENT 23

First Report. November 9, 1931.

Cond. of Stock	100 Stk.	80 Stk.	60 Stk.	40 Stk.	1-1 Stk.
Healthy	24.2	24.2	27.0	31.0	22.5
Sickly	24.2	24.2	24.7	37.0	21.0
Dying	21.2	23.9	20.6	19.0	20.0
Dead	30.4	27.9	26.7	23.0	36.5
Survival	69.6	72.1	73.3	77.0	63.5

The 1-1 stock has the poorest survival of all. This is due to an unexplained, heavy cropping by rodents. The 40 density has the highest survival in total number and in number of trees.

S--PLANTING--OLYMPIC FOREST--WEBB AREA--EXPERIMENT 18

First Examination Report. June, 1930.

Stock	Plot One	Plot Two	Plot Three	Average
120	99	99	not exam-	99
80	99	96	ined	98
40	99	99		99
1-1	98	91		99

Second Examination Report. September, 1930.

120	85	93	91	89
80	87	88	92	89
40	88	92	87	92
1-1	92	98	93	94

Apparently the 1-1 stock has the edge on the 2-0 stock in this experiment.



PLANTING--OLYMPIC FOREST--WEBB AREA--EXPERIMENT 22

First Report. October 26, 1931.

Grade	100 Stk.	80 Stk.	60 Stk.	40 Stk.	1-1 Stk.
Healthy	66.0%	72.5%	70.0%	85.0%	70.5%
Sickly	9.5	7.0	7.5	4.0	8.5
Dying	5.0	5.0	5.0	3.0	5.5
Survival	80.5	84.5	82.5	92.0	84.5

This indicates that it is probable that 2-0 stock has a survival ratio which will compare very favorably with 1-1 stock.

S--PLANTING--OLYMPIC FOREST--SNOW CREEK--EXPERIMENT 16

Planted April, 1928. First, second, and third examination results given below.

Cond. of Stock	2-0 Stk. 80 Den.			1-1 Stock		
	1928	1929	1930	1928	1929	1930
Healthy	60	37	66	77	48	80
Sickly	12	15	5	13	22	6
Dying	5	23	3	3	21	2
Tot. Alive	87	75	75	93	91	88
Tot. Dead	13	25	25	7	9	12

Average survival of 2-0 stock is 75%; for 1-1 stock it is 88%.

Difference of survival developed the first year.



## S--PLANTING--RAINIER FOREST--CISPUS--EXPERIMENT 11

## 2-0 Stock

Cond. of Stock	Spr. 1928	Fall 1928	Spr. 1929	Spr. 1930
Healthy	76.0	81.5	80.0	80.5
Sickly	15.5	5.5	1.5	.5
Dying	4.5	--	--	--
Dead	4.0	13.0	18.5	19.0

## 1-1 Stock

Cond. of Stock	Spr. 1928	Fall 1928	Spr. 1929	Spr. 1930
Healthy	95.0	94.5	93.0	94.0
Sickly	3.0	2.5	1.5	--
Dying	1.5	1.5	--	.5
Dead	.5	1.5	5.5	5.5

Annual growth, total height growth, ability to survive establishment period, as well as being easier to plant, favors the 1-1 stock.



## SUMMARY

Plots One and Two, planted in 1926 in the Wind River Valley, show a decided superiority of the 1-1 stock over the grades of the 2-0 stock in height growth, color of needles, and general thriftiness on the first examination report. The second examination made in October 1926 shows that the 1-1 stock is not as good as the 40 stock in survival. All other classes show a marked inferiority over the 1-1 stock in survival and thriftiness. The third examination made in May, 1927 showed the forty density better in survival than 1-1 stock, but the other grades of 2-0 stock were very inferior. The fourth examination report made in November, 1927, showed that the forty stock apparently exceeds in its ability to survive both good and bad conditions better than any other grade of stock, including the 1-1 stuff. However, in spite of the fact that the 1-1 stock shows a lower survival than the forty stock, it seems to have made a better height growth and noticeably surpasses the 40, 80, 120, and 160 stock in this respect.

This experiment has failed to reveal any consistent superiority of the 1-1 stock.

Plots on Wind River planted in 1928 show a decided advantage of the 1-1 stock over the 2-0 stock, both in lower mortality and in general condition of the trees.

Plots at Copper City planted in 1929 show that the



forty stock has the edge on the 1-1 stock in thriftiness and general condition.

The plot at Copper City planted in 1931 shows a decided inferiority in the survival of the 1-1 stock in comparison with the other classes of stock, which is contrary to what would be expected. This difference also showed up on the plot planted on the Webb Area of the Olympic Forest in 1931.

The plots planted on the Webb Area of the Olympic Forest in 1930 show that the 1-1 stock has the edge on the 2-0 stock.

The plots on the Snow Creek Area of the Olympic Forest, planted in 1928, show a decided superiority of the 1-1 stock over the 2-0 stock.

The plot on Mt. Hebo of the Siuslaw shows a decided superiority of the 1-1 over the 2-0 stock.

The plot on the Cispus River of the Rainier Forest shows that the annual growth, height growth, ability to survive establishment period, as well as being easier to plant, favors the 1-1 stock.

In conclusion, there are five plots which show a superiority of the 1-1 stock, three that show a superiority of the 2-0 stock, and one that failed to show any difference.