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REVIEW OF RESULTS TO DATE IN EXPERIMENTS 2, 4, 14, 15, 16

WHITMAN NATIONAL FOREST

Test of Species, Western Yellow Pine and Western White Pine in the Blue Mountain Region and Test of Season of Planting, Western yellow Pine and Western White Pine, in the Blue Mountain Region District 6.

Compiled from Forest Reports by Walter H. Leve, Forest Examiner.

Purpose and Plan of Experiments

In 1914, 1915 and 1916 a number of experimental plantations of western yellow pine and western white pine were established on certain logged-off and burned areas in the Douglas fir-larch type on the Whitman National Forest. These areas had been previously covered by a stand of Douglas fir, western larch, lodgepole pine, white fir and other true firs in varying proportions. One of the areas (the 1910 Burn) had been covered by a young lodgepole pine stand which was burned in 1910. Another, the Columbia Area, is on the upper edge of the type in what would probably have been called the transition type under the old classification. Various gradations of the Douglas fir-larch type are therefore represented.

Western yellow pine is occasionally found in this type but not usually in any amount. Where it occurs it is of excellent quality and is more valuable than the other species. Western white pine is not usually found in this type but is a more valuable species than those that occur there. Because of the fact that timber sales are being conducted in the Douglas fir-larch type it was desired to ascertain whether the cut-over areas could not be restocked with the more valuable yellow pine and white pine.

The experiments were made a test of season of planting as well as of species and therefore every precaution was taken to make the spring and fall plantations that were to be compared with each other perfectly parallel cases. The stock, all of which came from the Wind River Nursery, was identically the same in each series, as to source of seed, treatment in the nursery, age, etc. The spring and fall sites in each series were parallel and the planting was done either by the same man or under his direct supervision.

The number of trees planted is as follows: fall 1914 – yellow pine 1750, white pine 1950; spring 1915 – yellow pine 600, white pine 600; fall 1915 – yellow pine 300, white pine 500; spring 1916 – yellow pine 300, white pine 500.

Discussion of Results

Results to date are shown in Table I.

Although it is, of course, too early to arrive at any definite conclusion as far as a test of species is concerned, a glance at the table will show that there has been considerable variation in results. Survivals vary all the way from 8 to 98 per cent for yellow pine and from 8 to 100 per cent for white pine after the second or third growing season. The heavy losses in some of the plots can be directly attributed, however, to extraneous factors such as destruction by gophers, porcupines and other rodents and trampling by cattle and sheep. If the areas had been thoroughly poisoned for rodents previous to planting and then had been closed to stock, results would undoubtedly have been considerably better. It will be noted that in eight cases, four for each species, there is shown a survival of over 90 per cent.

On the areas that were examined in 1919 reports show that the trees were in nearly all cases thrifty. The yellow pine seems to be making a more rapid growth than the white pine. Apropos of the relative merits of the two species the following is quoted from Supervisor Evans' annual planting report of December 22, 1916: "thus far the yellow pine seems to be better acclimated than the white pine, the latter taking on a very bushy form with several leaders to each small tree." For all the strips examined in June 1916 the average survival for yellow pine is 48 per cent and for white pine 38 per cent. Mr. Kummel in a letter to the Supervisor, dated December 13, 1919, covering the latest examinations of these areas, says: "Still more striking, however, is the difference in current growth; whereas yellow pine is making a current height growth of two to five inches in most cases, very few of the white pine exceed one inch and the majority only one-half to three-quarter inches. This great difference in current height growth coupled with the greater mortality among the white pine makes it appear probable that the white pine will make a less favorable showing than yellow pine."

Considering results shown in Table I from the standpoint of a test of season of planting, it will be seen that in eleven out of seventeen sets the greater percentage of survival was in the spring planted strips. However, if we take the series separately we find that in every case in the 1914-1915 series survival in the spring planted strips exceed that in the fall planted strips, usually by a considerable amount, while in the 1915-1916 series, out of eight sets, five show a greater survival in the fall planting.

TABLE 1: Test of western yellow pine and western white pine in Douglas fir-larch type in Blue Mountain Region. Table shows results at latest examinations. (Underscored entries are the higher in each set).

Designation	Series	Date of last Examination	No. of elapsed growing seasons	No. of Trees Examined	Stock Age	Stock Source of Seed	Description of Site Altitude	Aspect	Soil	Ground Cover	Survival Per Cent Yellow Pine Fall	Yellow Pine Spring	White Pine Fall	White Pine Spring	Remarks
Exp. 2 Columbia Str. 22 & 24	1914-1915	September 1917	3	100 each	1-1-1	Crater	5,500	E	Light volcanic ash	Thin brush grass & weeds			61	<u>79</u>	Somewhat protected
Exp. 2 Columbia Str. 26 & 28	1915-1916	October 1919	4	100 each	1-1-1	Wenatchee	5,500	E	Light volcanic ash	Thin brush grass & weeds			<u>71</u>	61	Part of spring plot in swamp, plants drowned.
Exp. 2 Columbia Str.23 & 25	1914-1915	September 1917	3	100 each	1-1-1	Crater	5,900	N	Light volcanic ash	Scattered brush			57	<u>80</u>	Site exposed.
Exp. 2 Columbia Str. 27 & 29	1915-1916	October 1919	4	100 each	1-1-1	Wenatchee	5,900	N	Light volcanic ash	Scattered brush			<u>62</u>	37	Site exposed; subject to drying
Exp.4 Old Burn Strs. 10 & 11	1914-1915	June 1917	2	100 each	1-1-1	Y. Whitman	5,500	N	Light volcanic ash	Scattered brush	68	<u>98</u>	68	<u>100</u>	
Exp. 4 Old Burn Strs. 12 & 13	1915-1916	June 1919	3	100-12 50-13	Y-2-1 W-1-1-1	Y. Whitman W.Wenatchee	5,500	N	Light volcanic ash	Scattered brush	54	<u>96</u>	<u>98</u>	88	Loss due to rodents and stock grazing
Exp.14 Big Flat Strs. 1 & 2	1914-1915	June 1919	4	100 each	1-1-1	Y. Whitman W.Crater	5,200	SE	Sandy loam	Grass, weeds & abies reproduction	10	<u>26</u>	12	<u>14</u>	Heavy Loss due to rodents and sheep
Exp.14 Big Flat Strs. 3 & 4	1915-1916	June 1919	3	100-3 50-4	Y-2-1 W-1-1-1	Y. Whitman W.Wenatchee	5,200	SE	Sandy loam	Grass, weeds & abies reproduction	32	<u>36</u>	8	<u>12</u>	Damaged by rodents and sheep
Exp.15 1910 Burn Strs. 1&2	1914-1915	June 1917	2	50 each	1-1-1	Y. Whitman	5,000	SE	Sandy loam	None	16	<u>92</u>	--	88	Rodents large cause of loss
Exp.15 1910 Burn Strs. 3 & 4	1915-1916	June 1919	3	100-3 50-4	Y-2-1 W-1-1-1	Y. Whitman W.Wenatchee	5,000	SE	Sandy loam	None	<u>72</u>	60	<u>46</u>	24	Damage caused by rodents and grazing.
Exp.16 Watertrough Strs. 1 & 2	1914-1915	June 1917	2	50 each	1-1-1	Y.Whitman W. Crater	4,800	N	Sandy loam	Grass & weeds	8	<u>96</u>	32	<u>96</u>	Heavy loss in fall planting due to winter killing

Because there are so many extraneous factors which accumulate from year to year, such as, particularly in the case of these experiments, destruction by rodents and trampling by stock, a better comparison of spring and fall planting would probably be obtained by a tabulation of the results at the end of the first growing season which has been done in Table II.

TABLE II

Comparison of Survival, Spring and Fall Plantations, End of First Growing Season

		Per cent Survival			
		Yellow Pine		White Pine	
Designation	Series	Fall	Spring	Fall	Spring
Exp. 2, Strips 22 & 24	1914-15			74	94
Strips 26 & 28	1915-16			94	96
Exp. 2, Strips 23 & 25	1914-15			85	99
Strips 27 & 29	1915-16			81	97
Exp. 4	1914-15	72	100	74	100
	1915-16	72	96	100	100
Exp. 14	1914-15	54	98	42	88
	1915-16	82	88	74	92
Exp. 15	1914-15	22	92	–	92
	1915-16	86	88	88	92
Exp. 16	1914-15	20	100	48	100

An examination of this table shows that although the spring plantations show a greater survival in almost every case than those established in the fall, in the 1914-15 series the difference between the fall and spring plots is large while in the 1915-16 series the difference is usually not very great. In the 1914-15 series the survival in fall plots runs as low as 20% while in the 1915-16 series it is as high as 100%.

Of course it is obvious that in the results in Table II the fall plantations have endured the rigors of one winter season while the summer plantations have not. It might be considered, therefore, that a comparison of results at the end of equal periods, such as one summer and one winter, would afford a more accurate basis from which to draw conclusions. A comparison of survival at the end of one year is possible in the 1915-16 series in all plots except Experiment 2, but the times of examination were not so correlated as to permit it in the 1914-15 series. The nearest approach to it in the latter is at the end of one year in the fall plots and one and a half years in the spring plots. This discrepancy in time is not material, however, since in every case in this series the survival in the spring plots after one and one half years was greater than that in the fall plots after only one year. The effect is, therefore, merely to minimize the contrast rather than to reverse it.

A comparison on the above basis;--one year in the 1915-16 series and one year for fall and one and one half years for spring in the 1914-15 series is shown in Table III. Experiment 2 is not used in this table owing to the data being incomplete.

TABLE III

Comparison of Survival at Equal or Almost Equal Periods.
(Starred entries 1 ½ years, all others 1 year. Underscored entries are the higher of each set.)

		Yellow Pine		White Pine	
Experiment No.	Series	Fall	Spring	Fall	Spring
4	1914-15	72	98*	74	100*
	1915-16	72 (sheep)	96	100	92
14	1914-15	54	76*	42	68*
	1915-16	82	68	74	80
15	1914-15	22	92	–	88*
	1915-16	86	72 (rodents)	88	72 (rodents)
16	1914-15	20	100*	48	96*

A study of this table shows that while in the 1914-15 series, spring leads in each of the seven tests, it does so in only two of the six tests in the 1915-16 series. Moreover, one of these two tests – Experiment 4, 1914-15 yellow pine, must be disregarded because the greater part of the loss in the fall plot was caused by sheep. In this series, therefore, fall leads really in four out of five tests. It will be noted, though, that in the 1914-15 series spring leads in survival per cent by a margin averaging 42 while in the 1915-16 series fall leads by an average of only 9. The latter difference would have been smaller still had it not been for damage caused by rodents in the spring plots in Experiment 15.

From whatever angle the results are viewed it can be seen then that there is a very marked superiority of spring over fall planting in the 1914-15 series while there is little difference between spring and fall planting in the 1915-16 series. A glance at the tables will show that there is little difference, also, between the spring plantations of the two series.

As all factors of seed, treatment in nursery, age, method of planting, etc. were the same for each series, and as soil and site conditions were the same in each experiment, or group in each experiment, the only factor besides weather which might have influence results is the condition of the trees on arrival at the planting site due to differences of treatment occurring during transportation from the nursery. An examination of the original data in the case shows that in the fall of 1914 the stock was in excellent condition at the time of planting, yet it was the plantations of this season which showed the greatest loss. In the spring of 1915 planting was delayed by late lying snow, and the stock was heeled in for a considerable time after receipt from the nursery. When planted the buds had made considerable advanced growth. This might be considered an unfavorable factor, yet the plantations of the spring of 1915 did as well as any. In the fall of 1915 the stock was reported as being received in a dried out condition, yet it is in the 1915-16 series that the results in the fall plantations were equal if not superior to those of the spring plantations in which the stock was received in good condition. Results of the experiments cannot then be explained by the condition of the stock on arrival at the planting sites, as these conditions would tend rather to minimize the variations between the fall plots of the different years than to cause them.

This leaves weather the only factor which has not been considered. The original reports of the experiments show that in the fall of 1914 a severe cold spell followed almost immediately after planting and before a protecting blanket of snow had fallen. Weather Bureau reports describe the weather as the "coldest and driest December in the last 25 years". In the spring of 1915 the weather following planting was cool and quite favorable to a plantation just establishing itself. On one of the areas it snowed during the next few days following planting. The winter of 1915-16 was characterized by a very heavy fall of snow which came early and remained late. In the spring of 1916 the weather was cloudy and rainy at the time of planting and during the period immediately following. The summer was also moist.

The weather then, was favorable to planted stock for every season during which these experiments were initiated except the fall of 1914, when it was very unfavorable. During severe cold, dry weather, such as occurred in December 1914, excessive transpiration takes place with no chance for the roots to obtain moisture from the frozen ground. It is, of course, particularly difficult for trees which have been newly planted and which have not established their roots to withstand this condition. That many of the trees planted in the fall of 1914 which were not killed during the winter were so weakened that they died the following summer is shown by the mortality in these plantations during the summer of 1915. A comparison of the tallies of the examinations of that year shows that it was the weak rather than the strong plants which perished.

Cool, moist weather following planting operations in the spring is quite favorable to planted stock because it allows the roots to become established without rapid transpiration taking place. Experiments with western yellow pine and Douglas fir in other parts of the district show that in cases where spring plantations have been followed by extensive dry periods the mortality has been heavy. This is borne out also by results in extensive plantations.

It is apparent, then, that the severe loss in the plantations of the fall of 1914 was due to winter killing caused by the severe cold spell following planting. The excellent results in the plots established during the other three seasons was due largely to the fact that favorable weather followed planting. If a severe drought had followed planting during either spring, heavy mortality would undoubtedly have occurred in the plantations of that season.

These experiments furnish interesting data on other points in addition to the main features of test of species and season of planting. One of these is rodent injury. On two of the experiments, Nos. 14 and 15, this was severe. The injury consisted in biting off of the stem by gophers or ground squirrels. The interesting feature is that the damage occurred to a greater extent in the winter than in the summer. Out of a total of 22 instances on both areas where it is mentioned as having occurred in winter it is classed as severe in 19, while in a total of 15 instances where it occurred in summer it is in no case classed as severe. Exact figures cannot be given as it was not always possible to identify the injury conclusively. Neither species seems to be more susceptible than the other nor does either season of planting. The injury is noted as occurring during each winter since the establishment of the plots.

Another feature brought out by these experiments is that advance growth before planting does not necessarily increase mortality. As already mentioned the trees in the spring plots in the 1914-15 series were delayed in planting by late lying snow and their buds had made considerable growth before planting. In the 1915-16 series the spring planting was completed before growth commenced. The average summer mortality in each series is given in Table IV. The fact that the advanced growth stock suffered an average loss of only 2.5% and 5% respectively for each species indicates the absence of any injurious consequences due to this

factor. It is thought, however, that if warm dry weather had followed the planting of this advanced growth stock the results would have been somewhat different.

TABLE IV

Effect on Mortality of Advanced Growth Before Planting

	Mortality Per Cent			
	Western Yellow Pine		Western White Pine	
Experiment	Advanced Growth 1914-15	No Advance Growth, 1915-16	Advanced Growth 1914-15	No Advanced Growth 1915-16
4	0	4	0	0
14	2	12	12	8
15	8	12	8	8
16	0	–	0	–
Average	2.5	7	5	4

Conclusions

1. Although it is too early to arrive at definite conclusions, results so far indicate that western yellow pine is adapted to the Douglas fir-larch type in the Blue Mountain region and makes a thrifty growth. Western white pine does not seem to make as favorable a showing and there is a question probably as to whether it would be a good species to plant in this type.

2. Weather conditions immediately following planting are the controlling factor in the success of either fall or spring planting. During three of the seasons in which plots were initiated in this experiment the weather was favorable to the establishment of planted stock and the plantations were successful. During only one of the seasons, the fall of 1914, weather unfavorable to the establishment of planted trees followed planting, and there was a heavy loss. Experiments and results on extensive plantations on other Forests in the District show that where extensive periods of dry sunny weather follow planting in the spring there is also a heavy loss.

   The greatest losses to fall plantations, as shown by this experiment and corroborated by experiments and extensive plantations on other Forests in the District occur during cold dry spells which come before sufficient snow has fallen to protect the trees from excessive transpiration.

   If data were available for spring and fall plantations made every year during an extended period of years, so that an average of weather conditions and the results caused by them might be worked out, definite conclusions could probably be arrived at as to which season is the better for planting, but with experiments extending over two years only, no such conclusions are possible. It would be difficult to arrive at any definite settlement of this question by the consultation of weather records, especially in this case, as the nearest place where records have been kept over any extended period is at Baker, which is in the sage-brush desert at a considerably lower elevation than these experiments and has from one-third to one-half the rainfall. It would be necessary for data to include snow depths, both for fall and spring, because in the spring late-lying

snow often delays the planting period, as shown in these experiments in the case of those established in the spring of 1915.

If any further experiment along this line should be initiated, it would be necessary, in order to obtain accurate results, to have such experiments closed to stock grazing.

3. Rodent injury is probably the more prevalent and more severe in winter than in summer.

4. Advanced growth before planting in the spring does not necessarily occasion heavy mortality.

References

Other reports which have a bearing on the subjects treated herein are as follows:

RS, Fp, 102-C: Test of Season Planting Western White Pine in the Blue Mountain Region – Julius F. Kummel.

RS, Fp, 161-C: Best Season for Planting Douglas Fir on the Eastern Slope of the Cascades – Walter H. Leve

RS, Fp, 101-C (f): Test of Season of Planting of Western Yellow Pine . . . in Coast Range – Walter H. Leve.

RS, Fp, 102-A: Preliminary Report – Test of Western White Pine In the Blue Mountains – J. F. Kummel and W. H. Leve.

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