Comparison of the Summit Precision Seeder with the Oyjord Seeder[1]

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Abstract.--The Summit Precision Seeder was compared with the Oyjord Seeder at five Forest Service nurseries, using nine conifer species and 26 seedlots. Results varied with seed characteristics, but the Summit did not prove to be a big improvement over the Oyjord. Plots oversown and thinned to target spacings produced less clumping and fewer gaps between seedlings but showed little improvement in seedling size and cull rates over either seeder.

BACKGROUND

Uniform spacing between seedlings is important to the successful and efficient operation of forest tree nurseries. The value of tree seed continues to increase due to dwindling amounts of some seed sources, growth of genetically improved seed, and an increased emphasis on nondestructive seed collection from high quality stands and trees. In the nursery, discarding cull seedlings is becoming more and more costly. Through more uniform spacing of trees, nursery managers hope to better utilize precious seed supplies, reduce the proportion of nonshippable trees, and produce a more uniform seedling size that could possibly improve field performance.

To obtain more uniform spacings between seedlings in the nursery bed, we must achieve a more precise and consistent placement of the seed during sowing.

Most of the Forest Service, U.S. Department of Agriculture, nurseries in the western United States sow seed with a Love/Oyjord seeder (fig. 1). The Oyjord seeder was developed in Norway in the early 1970s. It was tested by the Forest Service's Equipment Development Center at Missoula, MT, in 1975. Lott and Lowman (1976 and 1978) and Lott and Casavan (1978) reported that the Oyjord was simple, reliable, well designed and constructed, and versatile.

Although Lott and Lowman (1976 and 1978) found the Oyjord seeder to be clearly the most accurate of eight seeders tested at that time, the Oyjord is not a precision seeder. Average seed spacings were close to targets, but the actual placement of the seed was random and therefore not evenly spaced. Boyer and others (1985) said that the Oyjord gave a high proportion of doubles, had variable spacing, and varied in the number of seeds per 0.6 m row. However, it gave narrow drills to facilitate lateral root pruning, was easy to calibrate, is capable of sowing seed lots with low germination rates, and has a higher operation speed than other seeders.

The Summit Precision Seeder (fig. 2) was designed and manufactured in New Zealand. Lafleur (1987), Boyer and others (1985), and Huber (1985) have all tested the precision seeder. The Summit Seeder performed well but still did not achieve perfect spacing. The Summit Seeder also gives narrow drills but is easier to calibrate than the Oyjord, does not waste seed at the ends of the seedbeds, and provides control of seed depth. Disadvantages include its slow speed, the necessity for high germination seed, and its price.

The Summit Precision Seeder works using a vacuum sowing head, which places seeds individually in seven rows. It works especially well with large seeded species. Machine travel speed is important to the accuracy of the Summit. As speed increases, accuracy decreases. Seed

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Figure 1--The Oyjord Seeder.

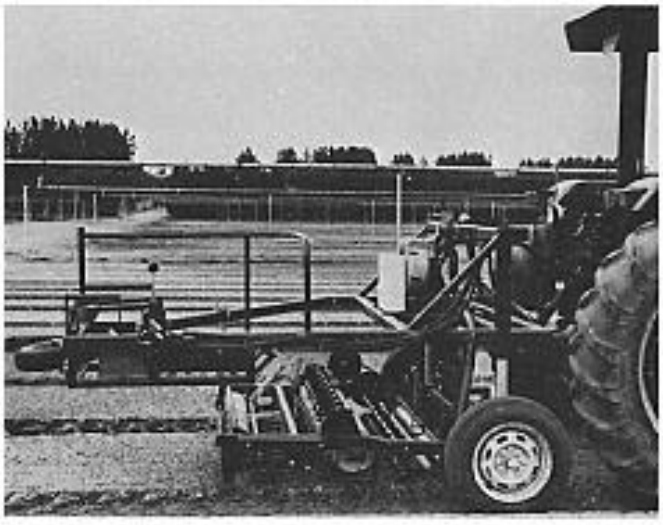

Figure 2.--The Summit Precision Seeder.

spacing is controlled by changing drive sprockets, so the closer the desired spacing, the slower the seeder will move to do its task properly.

The primary objective of this study was to compare seed placement by the Summit Precision Seeder with that of the Oyjord seeder. We also wanted to compare seedlings sown by the two seeding machines with seedlings grown at the same density but at precise spacing. This was done at five Forest Service nurseries, each with different soils and weather conditions. We used seed of nine species. Our interest was in seed delivery performance, seedling emergence and the uniformity of seedling spacing in relation to seed placement, the resulting seedling morphological characteristics, and the number of shippable trees per unit area of bed.

MATERIALS AND METHODS

Sowing of all 26 seedlots chosen for this study took place in the spring of 1985. The five Forest Service nurseries which participated were Coeur d'Alene Nursery, Coeur d'Alene, ID; Lucky Peak Nursery, Boise, ID; J. Herbert Stone Nursery, Central Point, OR; J. W. Toumey Nursery, Watersmeet, MI; and Wind River Nursery, Carson, WA. The study was a cooperative effort between the nurseries, the Missoula Equipment Development Center, and the U.S. Intermountain Research Station, Forest Service.

The Summit Precision Seeder was calibrated to sow at the same rate as each nursery's target rate for the Oyjord seeder for a given seedlot. Seeds were covered with aluminum powder before sowing to make them readily visible and facilitate smooth flow through the seeder.

We tested the seeders using seed from nine conifer species. Douglas-fir (Pseudotsuga menziesii var. menziesii and var. glauca [Beissn.] Franco) (coastal and inland varieties) was sown at three nurseries. Engelmann spruce (Picea engelmannii Parry) and ponderosa pine (Pinus ponderosa Dougl. ex Laws) were each sown at two nurseries. White spruce (Pices glauca [Moench] Voss.), noble fir (Abies procera Rehder), jack pine (Pinus banksiana Lamb.), lodgepole pine (Pinus contorta var. latifolia Engelm.), red pin (Pinus resinosa Ait.), and western larch (Larix occidentalis Nutt.) were each sown at one nursery (table 1).

Four species were sown at Lucky Peak Nursery three at Coeur d'Alene and J. W. Toumey, two at J. Herbert Stone, and only noble fir at Wind River (table 1).

Each species at s nursery was treated as a separate test. Within each test, two seedlots were sown. The first had a germination rate near 95 percent; the second had a germination rate between 75 and 85 percent. Within each of three blocks, six plots were arranged randomly. The six plots consisted of three treatments replicated two times for both seedlots: (1) seed sown using the Summit Precision seeder calibrated to the target spacing, (2) seed sown using the Oyjord seeder calibrated to the target spacing, and (3) seed oversown using the Oyjord seeder and hand thinned to the target spacing after seedling emergence.

All plots were six m long and a 1-in buffer separated the plots. Within each plot there were three 0.5 m sample plots. After sowing, a meter stick was laid along side each row in a sample plot, and the position of every seed was recorded in millimeters. As soon as the measurements were made, the seed was covered.

Five weeks after sowing, the oversown plots were hood thinned to the target spacing. Afterward, actual positions of the seedlings were measured on all sample plots.

At three of the nurseries, several measurements were taken at lifting time. Each sample plot was measured separately, and all were graded and counted by an experienced grader. Grading specifications were set by nursery

Table 1.-- Actual and target seed densities for the Summit and 0yjord Seeders using nine tree species at five nurseries. Significant differences are indicated by "* *" ($\alpha = 0.1$) and "*" ($\alpha = 0.5$). "NS" indicates no significant difference.

Species	Nursery	Seeds per foot of row			Significance
		Summit	Oyjord	Target	
		---(seeds/ft of row)---			
Douglas-fir	CDA	19.8	18.9	20.6	ns
	LPN	14.5	25.8	22.9	**
	JHS	12.9	12.8	17.5	ns
Engelmann spruce	CDA	16.2	20.9	20.6	**
	LPN	18.0	23.3	21.9	**
White spruce	JWT	29.4	22.8	29.4	*
Noble fir	WRN	11.7	24.2	21.9	**
Jack pine	JWT	21.9	14.0	18.8	**
Lodgepole pine	LPN	14.4	18.0	19.9	**
Ponderosa pine	LPN	11.6	18.9	18.1	**
	JHS	11.4	11.6	16.2	ns
Red pine	JWT	20.4	14.3	17.9	**
Western larch	CDA	22.6	22.0	20.6	ns

Nursery coding: CDA – Coeur d'Alene; JHS – J. Herbert Stone; JWT – J.W. Toumey; LPN – Lucky Peak; WRN – Wind River

personnel and were unique for each species and nursery. For all sample plots, we measured total number of trees lifted, number of trees meeting specifications, and number of nonshippable trees. From each sample plot, 10 trees were randomly elected for morphological measurements: top height, stem caliper, top dry weight, and root dry weight.

RESULTS AND DISCUSSION

Data summaries and analyses are presented in tables 1 through 6. Within some of the tests mean values appear to show obvious differences. However, in a few cases the variation in the data is so great that means that are visually different are not statistically different.

Seed Placement

Seeding Rates

Overall, both machines sowed less seed than the target rates. The Oyjord was under by an average of 1.5 seeds per foot of row, and the Summit was under the target by an average of 3.4 seeds when we combine all the data from all the nurseries (table 1).

When evaluated by the average number of seeds per foot of row, the Oyjord seeder was more consistent than the Summit seeder. Of the 13 tests sown, the Oyjord was within 20 percent of the target in nine of them. The Summit seeder was within 20 percent of the target in only six tests. However, the number of seeds per foot of row, expressed as a percentage of the target, was inconsistent. In fact, table 2 shows that there

Table 2.--Percentage of target seed densities obtained using the Summit Precision Seeder and the Oyjord Seeder. Tests are grouped by Nursery: Coeur d'Alene (CDA), Lucky Peak (LPN), J. Herbert Stone (JHS), J. W. Tourney (JWT), and Wind River (WRN). Species code: Douglas-fir (DF), Englemann Spruce (ES), western larch (WL), lodgepole pine (LP), ponderosa pine (PP), white spruce (WS), jack pine (JP), red pine (RP), and noble fir (NF). Significant differences are indicated by "**" ($\alpha = 0.1$) and "*" ($\alpha = 0.1$). "NS" indicates no significant differences.

Nursery	Species	Summit	Oyjord	Significant
		(% of target)	(% of target)	
CDA	DF[1]	96	92	ns
	ES	79	101	ns
	WL	110	107	ns
LPN	DF[1]	63	113	**
	ES	82	106	**
	LP	72	90	**
	PP	64	104	**
JHS	DF	74	73	ns
	PP	70	72	ns
JWT	WS	100	78	*
	JP	116	74	**
	RP	114	80	**
WRN	NF	53	111	**

[1] Inland variety of Douglas-fir.

is more consistency within the nurseries than within species. At Coeur d'Alene, both machines sowed close to the target. At J. Herbert Stone, both machines sowed about the same but were almost 30 percent below target. At Lucky Peak and Wind River, the Oyjord sowed close to the target but, the Summit sowed significantly fewer seeds. At J.W. Toumey, the Summit sowed close to the target and the Oyjord significantly fewer.

Reasons for the differences were not identified, but we suspected several factors. The Summit's accuracy is speed sensitive, and some of the tractors were more difficult to regulate than others. Though speed is not as important for the Oyjord, the machine must be properly calibrated and set up. Where both seeders delivered the same number of seeds but missed the targets, the seed calculations or weight measurements may have been incorrect.

Seed Deltas

A Seed delta is a calculation used by the manufacturers of seed sowers to evaluate seeder operation. It measures the consistency of sowing rates between rows for a length of seedbed. The seed delta is figured through a simple equation:

$$S.D. = \frac{\text{Maximum seeds/row - Minimum seeds/row}}{\text{Mean seeds per row}} \times 100$$

The only information required is the actual seed delivery rates for each row of the seedbed for a given length, in this case the 0.5-m sample plots. The higher the variability in number of seeds delivered between sample rows, the higher the seed delta.

From table 3 we see that seed deltas varied greatly between species and nurseries. In only five of 13 tests were there significant differences between the two seeders ($\alpha = 0.05$). Twice, the Summit Precision Seeder had a higher mean seed delta. The Oyjord produced a higher mean seed delta in three tests. This would suggest that there is little difference between the consistency of the seeders.

Seed Spacing

Definitions of important seed spacing terms are:

Doubles - seeds (or seedlings) closer than half the average spacing.

Blanks - seeds (or seedlings) spaced greater than 1.5 times the average spacing.

Singles - between seed (or between seedling) distances of 0.5 to 1.5 times the average spacing.

Seed Deltas-calculations used to evaluate consistency between rows.

Average number of seeds can be misleading. More helpful, table 3 summarizes the seed spacing figures for the two seeders. Rows sown with the Oyjord seeder had more doubles, seeds closer than half the average spacing, in seven out of 13 tests. However, in two of the three tests at the J. W. Toumey Nursery we found opposite results. Here, the Summit seeder produced more doubles. There was no difference in doubles at the J. Herbert Stone Nursery and in one test each at the J. W. Toumey and Coeur d'Alene.

The blank space results were similar to the "doubles" analysis (table 3).

The most important measurement of seed placement is the mean number of seeds that met the target spacing. Neither the Summit Precision Seeder nor the Oyjord Seeder is consistently more accurate in placing single seed in these tests (table 3).

Seed Characteristics

We observed some relationships between seed characteristics and the performance of the seeders. The Summit Precision Seeder seemed to show improvement over the Oyjord when large, symmetrical, and rounded seeds were sown. When small or angled seed was used, the Summit sower had problems in placing one seed at a time consistently.

Of the seeds tested in this study, the spruces were the smallest and white spruce was much smaller than the moderately sized Engelmann spruce. Black spruce seed at the J.W. Toumey Nursery was so small that it could not be successfully sown by the Summit Precision Seeder. The western larch was also small. Ponderosa pine seed was the largest, and for that reason produced the best spacing. Lodgepole pine seed was smaller than the ponderosa, red pine was smaller yet, and jack pine had the littlest seed of the pine species. Douglas-fir seed was large but variable in shape. The coastal variety planted at the J. Herbert Stone Nursery was much more triangular in shape than the more rounded seed of the inland variety at Coeur d'Alene and Lucky Peak. The angular shape caused the Oyjord to perform better than the Summit. Noble fir seed was large, but it was also resinous, sticky, and often had pieces of

Table 3.--Seed spacing measurements on plots sown by the Summit Precision and the Oyjord Seeders. See text for definitions of blank spaces. double seeds, single seeds, and seed deltas. Values separated by a * indicate a significant difference between seeders at $\alpha = .05$. ** indicates $\alpha = .01$. NS indicates not statistically different at the 95 percent level of confidence. See table 1 for nursery codes.

Species	Nursery	Blank spaces			Double spaces			Single seeds			Seed deltas		
		Summit		Oyjord	Summit		Oyjord	Summit		Oyjord	Summit		Oyjord
		(mean #/ft of row)			(mean #/ft of row)			(mean #/ft of row)			(no units)		
Douglas-fir	CDA	4.5	ns	4.8	6.6	*	8.8	8.5	**	7.0	35	**	64
	LPN	3.0	**	6.9	5.2	**	9.9	6.1	*	9.7	46	ns	47
	JHS	5.3	ns	5.9	9.2	ns	10.4	12.0	ns	9.8	100	ns	50
Engelmann spruce	CDA	2.4	**	5.4	4.7	**	8.2	4.4	ns	8.2	133	**	45
	LPN	3.8	**	5.9	5.9	**	9.0	7.9	ns	8.8	58	ns	70
White spruce	JWT	7.3	ns	6.0	11.3	ns	9.2	11.8	**	8.4	78	ns	78
Noble fir	WRN	3.0	**	7.0	5.0	*	11.5	4.7	*	7.6	141	ns	112
Jack pine	JWT	5.3	**	3.3	7.1	*	5.6	9.4	**	5.1	78	*	95
Lodgepole pine	LPN	2.8	**	4.4	4.1	**	7.0	7.3	ns	6.9	96	*	67
Ponderosa pine	LPN	2.2	**	4.7	3.1	**	7.0	5.9	*	7.5	53	ns	55
	JHS	4.1	**	8.1	5.6	ns	7.4	12.9	**	9.3	47	ns	52
Red pine	JWT	4.7	**	3.4	6.5	*	5.7	9.0	**	5.3	51	**	83
Western larch	CDA	5.5	ns	5.5	8.6	ns	8.6	8.6	ns	8.3	61	ns	58

wing still attached. This created clumping problems in both seeders, especially the Summit.

Seedling Mapping

Five weeks after sowing we mapped the location of all established seedlings. Overall, the hand-thinned plots showed a lower seedling density than both the Summit and the Oyjord Seeder plots (table 4) and therefore a greater mean distance between seedlings. The exceptions to this were the Engelmann spruce tests (Coeur d' Alene and Lucky Peak) and the Douglas-fir (J. Herbert Stone) in which there were no significant differences and the noble fir test (Wind River) in which the Summit Seeder produced a lower density and wider average spacing. We could not include two tests in our analysis of seedling location: at Lucky peak the ponderosa pine seedbed was next to a shelterbelt that harbored seed-eating birds, and the Douglas-fir seedlot, with an expected 95 percent germination rate, simply failed to germinate at the expected rate.

In every case the hand-thinned treatment produced fewer blank spaces and fewer double seedlings than the Summit and Oyjord Seeders. However, there were even a few blank spaces in the hand-thinned plots where seeds were not sown or did not germinate. This shows that even the hand thinning was not precise.

The thinned plots also had more well-spaced seedlings (singles) in eight tests. In the three tests at J. W. Toumey Nursery, however, the hand-thinned plots did not have the most: in white spruce where there was no difference, and jack and red pine where the Summit Precision Seeder produced more. In most of the tests there is little difference between the number of blanks, doubles, and singles on plots sown by the two seeders, even less difference than the seed data showed.

Seedling Grade and Morphology

After two years, eight of the 13 tests were lifted and graded. At that time there were no differences in seedling height for any of the sowing treatments (table 6). At lifting time there were only two cases Out of eight where mean seedling caliper (table 5) and total dry weight (table 6) differed between treatments: Engelmann spruce and lodgepole pine, both grown at Lucky Peak. In both instances, mean seedling caliper and total dry weight were less on plots sown by the Oyjord Seeder than the Summit Precision Seeder and hand-thinned plots.

Cull rates and number of shippable trees show a lack of overall trends except that the plots sown with the Oyjord Seeder produced as many or more trees that met specifications on the grading table compared to the Summit Precision Seeder and the hand-thinned plots (table 6).

CONCLUSIONS

The placement of seed by the Summit Precision Seeder and the Oyjord Seeder varied with each species and nursery. In general, the Oyjord was successful in coming close to target densities. However, the seeds were not evenly spaced. On the other hand, the Summit Seeder placed the seed at more evenly spaced intervals and seemed to be an improvement over the Oyjord when the seeds were large and rounded. The Oyjord plots tended to have more blank spaces and more clumping of seeds, but this was not the case at the J.W. Toumey Nursery where the seeds were smaller and seed placement results were just the opposite. Likewise, seed delta calculations failed to prove one seeder to be superior over the other.

Table 4--Seedling spacing measurements on plots sown by the Summit Precision Seeder, Oyjord seeders and hand-thinned. See text for definitions of blank spaces, double seeds. single seeds. A set of values followed by * indicates a significant difference between seeders at $\alpha = 0.05$. ** indicates $\alpha = 0.01$. NS indicates not statistically different at the 95 percent level of confidence. See table 1 for nursery codes.

		Seedling density				Blank spaces				Double seedlings				Single seedlings			
	Nursery	Summit	Oyjord	Thinned		Summit	Oyjord	Thinned		Summit	Oyjord	Thinned		Summit	Oyjord	Thinned	
		--(seedlings/ft of row)--				--(seedlings/ft of row)--				--(seedlings/ft of row)--				--(seedlings/ft of row)--			
Douglas-fir	CDA	15.0	16.7	9.9	**	3.0	3.9	1.1	**	5.3	7.0	0.5	**	6.5	6.2	7.8	**
	JHS	11.5	11.3	8.8	ns	4.7	5.6	2.2	**	8.7	9.0	0.8	**	10.7	8.7	14.1	*
Engelmann spruce	CDA	12.4	17.1	9.7	ns	2.0	4.1	1.1	**	6.0	6.7	0.4	**	4.3	6.8	8.0	*
	LPN	11.1	12.2	8.2	ns	2.0	3.4	0.9	**	4.3	6.1	0.3	**	4.6	5.3	6.5	*
White spruce	JWT	15.9	14.3	7.2	**	3.6	3.5	0.9	**	7.5	6.8	0.5	**	5.2	4.4	5.3	ns
Noble fir	WRN	5.4	12.7	6.8	**	0.7	3.0	1.0	**	2.5	6.2	1.0	**	1.7	3.9	4.4	**
Jack pine	JWT	14.8	10.1	6.3	**	3.3	2.2	0.9	**	5.5	4.4	1.1	**	6.2	3.4	3.8	**
Lodgepole pine	LPN	10.6	13.3	8.6	**	1.8	3.1	1.0	**	3.6	5.4	0.4	**	4.9	4.9	6.6	*
Ponderosa pine	JHS	8.5	10.0	8.3	**	3.3	5.1	2.2	**	4.8	7.3	1.3	**	8.7	8.0	12.7	**
Red pine	JWT	14.1	10.9	6.8	**	3.5	2.5	0.9	**	4.9	4.7	0.7	**	5.9	3.7	4.8	**
Western larch	CDA	17.5	16.2	10.1	**	4.1	3.9	1.1	**	6.2	6.3	0.4	**	7.2	6.2	8.1	**

Table 5--Seedling Heights end Calipers for Summit Precision Seeder Oyjord Seeder, and hand-thinned plots. A set of values followed by * indicates a significant difference at $\alpha = 0.05$. ** indicates $\alpha = 0.01$. See table 1 for nursery codes.

		Mean seedling heights-2nd year				Mean seedling caliper			
	Nursery	Summit	Oyjord	Thinned		Summit	Oyjord	Thinned	
		---(in cm)---				---(in mm)---			
Douglas fir	CDA	17.9	16.6	16.0	ns	3.4	3.4	3.6	ns
	LPN	--	--	--	ns	2.8	2.8	3.0	ns
	JHS	29.5	29.9	30.8	ns	6.6	6.3	6.5	ns
Engelmann spruce	CDA	18.6	18.9	19.0	ns	3.8	3.4	4.1	ns
	LPN	5.9	5.2	5.4	ns	3.4	3.1	3.5	*
Lodgepole pine	LPN	19.3	18.9	19.0	ns	5.4	4.7	5.6	**
Ponderosa pine	JHS	22.2	22.6	22.5	ns	6.9	6.5	7.1	ns
Western larch	CDA	38.3	37.0	36.1	ns	4.0	3.9	4.2	ns

When seed was small such as white spruce or angled on one end such as coastal Douglas-fir, the Summit's vacuum system had problems in picking up and placing just one seed at a time. This is why several of the species showed little difference between the two seeders. The Summit Seeder also had difficulty in sowing the resinous and sticky noble fir seed at Wind River Nursery.

In most cases there was not much difference between seedling density with the two seeders. However, the plots that were oversown and hand thinned produced fewer seedlings per unit area, fewer blank spaces, less clumping of seedlings, and generally more well spaced seedlings. The performance of the two seeders in meeting seedling target spacings varied with species, but overall there was little difference.

Even though seedbed spacing can have great effects on seedling morphology, in none of the tests were the spacing differences large enough to have an effect on seedling heights after two years of growth. In only two tests were there differences in caliper and seedling dry weight.

Both times the Oyjord plots produced seedlings with mean caliper and dry weights less than the other two treatments.

Seedbed density and spacing did not affect the percentage of total trees that met grading specifications. In fact, Oyjord plots, which often had the poorest seedling spacing, produced as many or more shippable seedlings per unit area than the other two treatments in all of the tests.

Seedling spacing is a function of seed placement and seedlot germination. This complex problem and the way it influences seedling growth and morphology depend on many factors. Many of these factors were not measured in this study. It appears that the differences in seedling spacings were not great enough to change the seedling morphology. Even when we hand thinned plots to specified seedling spacings, we did not greatly reduce the cull rates and total shippable seedling production per unit area dropped.

Table 6. --Seedling dry weights and grades for Summit Precision Seeder. Oyjord Seeder and hand-thinned plots. A set of values followed by * indicates a significant difference at $\alpha = 0.05$. ** indicates $\alpha = 0.01$. NS indicates no significant difference at the 95 percent level of confidence. See table 1 for nursery codes.

		Total seedling dry weight				Shippable seedlings				Mean number of shippable trees			
	Nursery	Summit	Oyjord	Thinned		Summit	Oyjord	Thinned		Summit	Oyjord	Thinned	
		---(grams)---				---(percent of total)---				---(#/ft^2)---			
Douglas fir	CDA	4.12	4.16	4.52	ns	74	72	74	ns	54	51	33	**
	LPN	1.35	1.33	1.41	ns	64	56	55	ns	6	10	7	--
	JHS	16.53	14.07	14.75	ns	47	65	85	ns	35	43	46	--
Engelmann spruce	CDA	5.42	4.15	6.34	ns	72	79	78	*	38	60	33	*
	LPN	1.89	1.49	1.76	*	59	64	64	ns	12	14	7	*
Lodgepole pine	LPN	10.81	7.52	11.30	**	69	76	79	**	15	24	15	**
Ponderosa pine	JHS	13.24	11.65	13.93	ns	37	45	40	ns	11	15	11	--
Western larch	CDA	3.62	4.03	4.58	ns	73	75	81	ns	35	35	24	**

The results of this study emphasize some of the major underlying problems that must first be solved if we desire evenly spaced and morphologically consistent seedlings. A machine that can place seed exactly where we would like loses its value quickly as the germination rate of our seed goes down. Even a precise and consistent seeder using a high germination seedlot is of little value if we have not determined the optimum morphological characteristics of the seedlings we are growing and the spacing that will produce those results.

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