



**EARLY SURVIVAL AND GROWTH
OF PLANTED AND SEEDED WHITE SPRUCE
AS AFFECTED BY SEEDBED TYPES
OCCURRING ON SCALPED STRIPS
PREPARED IN ASPEN STANDS, MANITOBA**

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by

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INTRODUCTION

Early survival and growth of seeded and planted white spruce (Picea glauca (Moench) Voss) are being studied on three seedbed types - mineral soil, mixed mineral soil and humus, and humus -- occurring on scalped strips prepared in a dense young aspen stand in the Interlake Area and in a moderately dense, mature aspen stand in the Whiteshell Provincial Park. In addition, the early survival and growth of seeded and planted jack pine (Pinus banksiana Lamb.) on the three seedbed types is being studied in the Interlake Area in co-operation with Mr. J. H. Cayford. For further details the reader is referred to the project plan (Waldron 1962) and the establishment report (Waldron 1964).

Mineral soil and humus seedbeds were generally readily available following the mechanical preparation of the scalped strips using a bulldozer and blade. However, mixed seedbeds had to be prepared using shovels and grub hoes and were usually 1/4,000 acre in size.

METHODS AND RESULTS

White Spruce

(A) Interlake Area

(i) Seeding 1964

In the spring of 1964, eighteen 1/8,000-acre circular regeneration quadrats

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were established on a moderately fresh (MR 2) site, forty two on a fresh to moderately moist (MR 3-4) site, and thirty on a moist to very moist (MR 5-6) site. The quadrats were set out in equal numbers on selectively chosen mineral soil, humus, and mixed mineral soil-humus seedbeds. Three hundred white spruce seed pelleted with Arasan, Endrin and aluminum flakes and testing 57.6 per cent viable, were sown on each quadrat on May 12. The seed was from the 1962 cone crop at the Riding Mountain Forest Experimental Area.

Soil moisture conditions on the moderately fresh to moderately moist sites were ideal; soils on the moist and very moist sites were saturated. During the early summer below normal precipitation fell, resulting in somewhat dry moisture conditions on the moderately fresh to moderately moist sites but in ideal moisture conditions on the moist and very moist sites.

Seedling counts were made on July 28 and August 24, 1964. Heights of the tallest two seedlings on each quadrat were determined in August.

Germination was highest on the moist and very moist sites, intermediate on the fresh and moderately moist sites and lowest on the moderately fresh site (Table 1). For all sites germination was highest on mineral soil seedbeds, intermediate on mixed and lowest on humus seedbeds.

As expected there was no significant difference in the average height of the tallest seedlings on either the three seedbeds or three sites.

(ii) Planting 1964

In the spring of 1964 a total of sixty white spruce were set out on a fresh (MR 3) site; sixty on a moderately moist (MR 4) site, and sixty on a moist to very moist (MR 5-6) site. In each site equal numbers of transplants were set out on selectively chosen mineral soil, mixed mineral soil - humus, and humus seedbeds. Planting was carried out on May 12, 1964 using the slit method of

Table 1

Per Cent Stocking and Average Number of Seedlings Per Quadrat
1964

Seedbed type	Moisture regime	Per cent stocking		Average number of seedlings per quadrat		Average height tallest two seedlings on each quadrat (in.)	Basis: number of 1/8,000-acre quadrats
		1964		1964			
		Summer	Autumn	Summer	Autumn		
Mineral soil	2	71.4	85.7	4.4	4.8	0.5	7
Humus	2	60.0	60.0	1.4	1.4	0.7	5
Mixed	2	33.3	83.3	2.5	2.8	0.6	6
All	2	55.6	77.8	2.9	3.2	0.6	18
Mineral soil	3 - 4	100.0	100.0	7.9	10.9	0.6	13
Humus	3 - 4	80.0	93.3	3.8	3.8	0.7	15
Mixed	3 - 4	78.6	92.8	4.7	6.8	0.6	14
All	3 - 4	85.7	95.2	5.4	7.0	0.6	42
Mineral soil	5 - 6	90.0	100.0	21.9	26.3	0.6	10
Humus	5 - 6	100.0	90.0	10.4	9.5	0.6	10
Mixed	5 - 6	100.0	100.0	31.4	33.1	0.6	10
All	5 - 6	96.7	96.7	21.2	23.0	0.6	30

planting. Description of the stock was as follows:

Number of transplants sampled	Average root length (in.)	Average height (in.)	Average root weight ¹ (gms.)	Average top weight ¹ (gms.)	Root/shoot ratio (by weight)
25	11.0	5.1	1.56	3.29	0.47

¹ Oven-dried at 105°C for 48 hours

Examinations were made on May 12 and November 17, 1964.

By the autumn of 1964 transplant survival was slightly lower on the moist and very moist sites; the mortality which occurred on the mineral soil and mixed seedbeds is attributed to excessive soil moisture at the time of planting (Table 2).

In addition to the above, twenty transplants were set out in the bottom of a furrow prepared with a Middlebuster plough on a moist to very moist (MR 5-6) site and twenty on the overturned ridge. Data are as follows:

Topographic position	Moisture regime	Average height at the time of planting (in.)	Transplant survival %		Basis: number of transplants set out
			1964 Spring	Autumn	
Ridge	5 - 6	6.6	100	95	20
Furrow	5 - 6	6.2	100	90	20
All	5 - 6	6.4	100	92.5	40

(B) Whiteshell Provincial Park

(i) Seeding 1964

In the spring of 1964, thirty 1/8,000-acre circular regeneration quadrats were established on a fresh (MR 3) site and thirty on a very moist (MR 6)

Table 2

Survival of White Spruce Transplants on Mineral Soil, Humus, and Mixed Seedbeds, 1964.

Seedbed type	Moisture regime	Average height at the time of planting (in.)	Transplant survival %		Basis: number of transplants set out
			1964		
			Spring	Autumn	
Mineral soil	3	6.9	100	100	20
Humus	3	6.7	100	95	20
Mixed	3	6.9	100	100	20
All	3	6.8	100	98.3	60
Mineral soil	4	6.3	100	100	20
Humus	4	6.7	100	100	20
Mixed	4	6.8	100	100	20
All	4	6.6	100	100	60
Mineral soil	5-6	7.2	100	85	20
Humus	5-6	6.5	100	100	20
Mixed	5-6	6.6	100	70	20
All	5-6	6.8	100	85	60

site. The quadrats were set out in equal numbers on selectively chosen mineral soil, mixed mineral soil-humus and humus seedbeds. Three hundred white spruce seeds, pelleted with Arasan, Endrin and aluminum flakes and testing 57.6 per cent viable, were sown on each quadrat on May 20. The seed was collected in 1962 at the Riding Mountain Forest Experimental Area.

Soil moisture conditions on the fresh sites were dry at the time of seeding and on the very moist site conditions were ideal. Subsequent rainfall improved moisture conditions on the fresh site but resulted in some flooding taking place on the very moist site.

Seedling counts were made on Sept. 22nd and Oct. 2nd.

Table 3

Per Cent Stocking and Average Number of Seedlings Per Quadrat
1964

Seedbed type	Moisture regime	Per cent stocking	Average number of seedlings/quadrat	Basis: number of 1/8,000-acre quadrats
		Autumn - 1964	Autumn - 1964	
Mineral soil	3	100	25.1	10
Humus	3	80	4.8	10
Mixed	3	100	21.3	10
All	3	93.3	17.1	30
Mineral soil	6	90	16.8	10
Humus	6	100	69.2	10
Mixed	6	100	33.3	10
All	6	96.7	39.8	30

Germination of white spruce seed was higher on the very moist site than on the fresh site (Table 3). On the very moist site germination was lowest on mineral soil, intermediate on mixed and highest on humus seedbeds. On the fresh site germination was lowest on humus and equally high on mineral soil and mixed seedbeds.

(ii) Planting 1964

In the spring of 1964 a total of sixty white spruce were set out on a fresh (MR 3) site, twenty on a moderately moist (MR 4) site and sixty on a very moist (MR 6) site. On the fresh and very moist sites equal numbers of transplants were set out on selectively chosen mineral soil, mixed mineral soil-humus, and humus seedbeds. On the moderately moist site transplants were set out on mineral soil seedbeds. Planting was carried out on May 20, 1964 using the slit method of planting. Description of the planting stock was as follows:

Number of transplants sampled	Average root length (in.)	Average height (in.)	Average root weight ¹ (gms.)	Average top weight ¹ (gms.)	Root/shoot ratio (by weight)
25	5.0	5.5	.22	1.29	0.17

¹ Oven-dried at 105° C for 48 hours.

Examinations were made on May 20 and September 21, 1964.

By the autumn of 1964 transplant survival was considerably lower on the very moist site than on the other two sites (Table 4).

The low survival on the mineral soil and mixed seedbeds is attributed to excessive soil moisture at the time of planting. Transplants set out on the humus seedbeds were located 3 - 4 inches above those set out on the other two seedbeds.

Table 4

Survival of White Spruce Transplants on Mineral Soil, Humus and Mixed Seedbeds
1964

Seedbed type	Moisture regime	Average height at the time of planting (in.)	Transplant survival (%)		Basis: number of transplants set out
			1964		
			Spring	Autumn	
Mineral soil	3	6.3	100	85	20
Humus	3	6.1	100	80	20
Mixed	3	5.8	100	100	20
All	3	6.0	100	88.3	60
Mineral soil	4	5.8	100	80	20
Mineral soil	6	5.5	100	25	20
Humus	6	6.0	100	100	20
Mixed	6	6.0	100	55	20
All	6	5.8	100	60	60

Transplant mortality on the other sites appeared to reflect normal planting mortality. A few of the transplants set out on humus seedbeds on the fresh site were killed when a nearby tree was uprooted.

Jack Pine

(A) Interlake Area²

(i) Seeding 1964

In the spring of 1964 a total of seventy 1/8,000-acre circular regeneration quadrats were set on very dry (MR 0) to moderately moist (MR 4) sites. On the very dry and dry sites, quadrats were established on mineral

² This section prepared by J. H. Cayford

soil and humus seedbeds while on moderately fresh, fresh, and moderately moist sites quadrats were also established on a mixed mineral soil-humus seedbed. Fifty seeds were sown on each quadrat between May 12 and 14 using seed that had been collected in southeastern Manitoba in 1962 and pelleted with Arasan, Endrin, and aluminum flakes in the spring of 1963. A germination test of the pelleted seed, conducted on blotters, indicated a viability of 96.5 per cent.

Seedling counts were made on July 27-28 and August 24, 1964. Heights of the tallest two seedlings on each quadrat were measured during the latter examination.

Most plots were stocked with the exception of those on mineral soil on the very dry site where stocking was 10 per cent in July and 0 per cent in August. Humus plots on this site were 50 per cent stocked. Apparently the gravel soil associated with this site was unfavourable to germination. The largest number of seedlings were located on humus seedbeds on the moderately moist site (Table 5).

The average height of the tallest seedlings did not differ appreciably by seedbeds. However, seedlings were smallest on the very dry site and tallest on the moderately moist site.

(ii) Planting 1964

In the spring of 1964 sixty trees were set out on moderately fresh to fresh sites (MR 2-3). The trees were located in twelve plots, each containing five trees. Four plots were located on mineral soil, four on mixed mineral soil and humus, and four on humus seedbeds. Trees were planted by the slit method, using tile spades. Stock was obtained from the Manitoba Department of Mines and Natural Resources Nursery at Hadashville and was of southern Manitoba origin. It was packed in a plastic bag for transport to

Table 5

Per Cent Stocking and Number of Seedlings Per Plot
(Jack Pine Sown in Spring 1964)

Seedbed type	Moisture regime	Per cent stocking		Number seedlings Per plot		Avg. ht. (ins.) Aug.1964	Basis: no. of 1/8,000 acre quadrats
		July 1964	Aug.1964	July 1964	Aug.1964		
Mineral soil	0	10	0	0.10	0	-	10
Humus	0	50	50	1.06	1.00	0.6	16
All	0	35	31	0.69	0.62	0.6	26
Mineral soil	1	60	80	1.60	2.50	0.7	10
Humus	1	50	75	0.75	1.00	0.7	4
All	1	57	78	1.36	2.07	0.7	14
Mineral soil	2	67	83	1.33	1.83	0.9	6
Humus	2	67	50	1.33	1.00	1.1	6
Mixed	2	80	80	1.40	2.00	0.9	5
All	2	70	70	1.35	1.59	1.0	17
Mineral soil	3	75	75	1.50	1.50	1.0	4
Humus	3	100	0	1.00	0	-	1
Mixed	3	75	75	2.75	2.25	0.9	4
All	3	78	67	2.00	1.67	0.9	9
Humus	4	100	100	5.67	6.00	1.2	3
Mixed	4	100	100	3.00	3.00	0.8	1
All	4	100	100	5.00	5.25	1.1	4

the planting area and was heeled-in prior to planting. Average planting stock measurements were as follows: root length, 7.9 inches; stem length, 4.6 inches; oven-dry root weight, 0.53 grams; oven-dry top weight, 2.03 grams; root/shoot ratio, 0.26.

The 1964 planting was done on May 12 and the height of each planted tree was measured and recorded. The trees were examined on November 17, at which time the condition of each was recorded.

Survival after one growing season averaged 93 per cent, with only 4 of the 60 seedlings dead (Table 6). There was little difference in survival on the three seedbeds; survival was better on the fresh site than on the moderately fresh site. About 90 per cent of the surviving trees had been browsed.

Table 6

Survival of 1964 Jack Pine Plantations - November 1964

Moisture regime	Seedbed			
	Mineral soil	Mixed	Humus	All
2	80.0	100.0	80.0	86.7
3	100.0	86.7	100.0	95.6
All	95.0	90.0	95.0	93.3

FUTURE WORK

All seeded quadrats and planted stock will be examined in the spring of 1964. Factors causing mortality will be assessed using the following seedling classification: healthy, sickly, healthy and sickly under leaves, healthy and sickly-frost heaved, dead under leaves, dead-frost heaved, and unknown. Other classes will be added if necessary. Browsing of planted stock will be noted. Survival counts of both seedlings and transplants will be made in the

autumn of 1965.

White spruce will be seeded and planted on mineral soil, humus, and mixed mineral soil-humus seedbeds in a young aspen stand in the Interlake area and in a mature stand in the Whiteshell Provincial Park in the spring of 1965. Seeding and planting of jack pine will also be carried out in the Interlake area.

REFERENCES

- WALDRON, R. M. 1962. Early survival and growth of planted and seeded white spruce as affected by seedbed type occurring on scalped strips prepared in aspen stands, Manitoba. Canada Dept. Forestry, For. Res. Br. Unpublished manuscript. Manitoba-Saskatchewan 62-17. 3 pp.
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