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A TEST OF SILVICULTURAL PRACTICES DESIGNED TO SECURE
REPRODUCTION IN PARTIALLY-CUT MIXEDWOOD STANDS
IN THE B-13a SECTION OF ALBERTA.

(Project A-58)

by

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Calgary, Alberta

March, 1963.

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Progress Report 1962-1963

A TEST OF SILVICULTURAL PRACTICES DESIGNED TO SECURE REPRODUCTION IN PARTIALLY-CUT MIXEDWOOD STANDS IN THE B-18a SECTION OF ALBERTA.

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INTRODUCTION

The purpose of the project is to obtain adequate white spruce regeneration by the combined use of partial cutting, scarification, aspen sucker control and broadcast seeding on three major sites - Dry Upland, Moist Transition and Wet Bottomland.

Partial cutting was carried out in 1953. Scarification was completed on three 10-acre blocks on each site in August 1959. Aspen were poisoned on 5-acre split plots in September 1959. Nine $\frac{1}{4}$ milli-acre seed spots were tallied in 1960, 1961, and 1962. Further seed spots were sown in the fall of 1960, 1961, and 1962 on fresh scarification as a control to evaluate the rate of deterioration of seedbed receptivity on the original scarified ground. This report describes the field work carried out during the summer of 1962 and presents the analysis of the data.

METHODS

Assessment

White spruce germination and survival

In 1962 the survival of the 3-year-old white spruce seedlings, sown in 1959, on nine $\frac{1}{4}$ milli-acre quadrats on each site was tallied in

June and in September. Germination and survival of first year seedlings, sown in 1961, on the fresh scarification and on the old, 1959, scarification were tallied every two weeks approximately. Coloured plastic toothpicks marked the seedlings. Rainfall, and maximum temperatures at ground level were observed at each tally date at a station on each site.

Seed supply

Percentage cone-bearing live-crown length was estimated on a $\frac{1}{2}$ -chain strip traversing one 10-acre plot on each site. All white spruce stems on a strip were tallied. In addition, detailed examination of cones on a total of five felled trees on the 90-acre study area were made. Notes were made of insect and fungus damage and of percentage filled seed in the sampled cones.

Scarification 1962

Fresh scarification, using hand tools, was carried out adjacent to the original quadrats. Nine $\frac{1}{4}$ milliacre quadrats on fresh scarification on each of the three sites, and nine on the originally scarified (1959) areas were fall-sown with 50 white spruce seed. Comparison of germination and survival on these quadrats will be used to assess deterioration of the receptivity of the original scarified seedbed in 1963.

RESULTS AND DISCUSSION

Spruce germination and survival

Three-year-old seedlings, 1959 fall seeding

The survival of the three-year-old 1959 seedlings on the original machine-scarified area, is given for each site in Table 1, together with per

cent mortality for the 1961 and 1962 growing seasons. Moist-site quadrats support the greatest number of seedlings. Wet-site quadrats are well stocked and when flooded quadrats are excluded from the assessment, stocking is much higher. Dry sites, with a mean stocking of 6 seedlings per $\frac{1}{4}$ milliacre quadrat support a satisfactory level of 3-year-old seedlings. Heavy summer rainfall, amounting to 14 inches during the period May 1st to September 6th and favourable maximum temperatures, shown in Figure 1 resulted in low seedling mortality and good height growth.

Flooding of scarified quadrats was extensive and for short periods included some dry site quadrats. Wet weather and poor access conditions to the experimental area prevented the assessment of flooding frequency and distribution, but it is estimated that flooding would be a source of

TABLE 1. SURVIVAL OF 1959 SEEDLINGS AND GROWING SEASON MORTALITY FOR 1961 AND 1962.

(based on 9 quadrats per site)

YEAR	1961		1962	
SITE	Number of Survivors	Per cent Survival	Number of Survivors	Per cent Survival
DRY	91	82.7	56	93.0
MOIST	954	89.6	354	95.2
WET	402	82.4	222	84.5
TOTAL	1447		632	

FIGURE 1. Rainfall and Maximum Temperature

Smith, 1962 Growing Season.

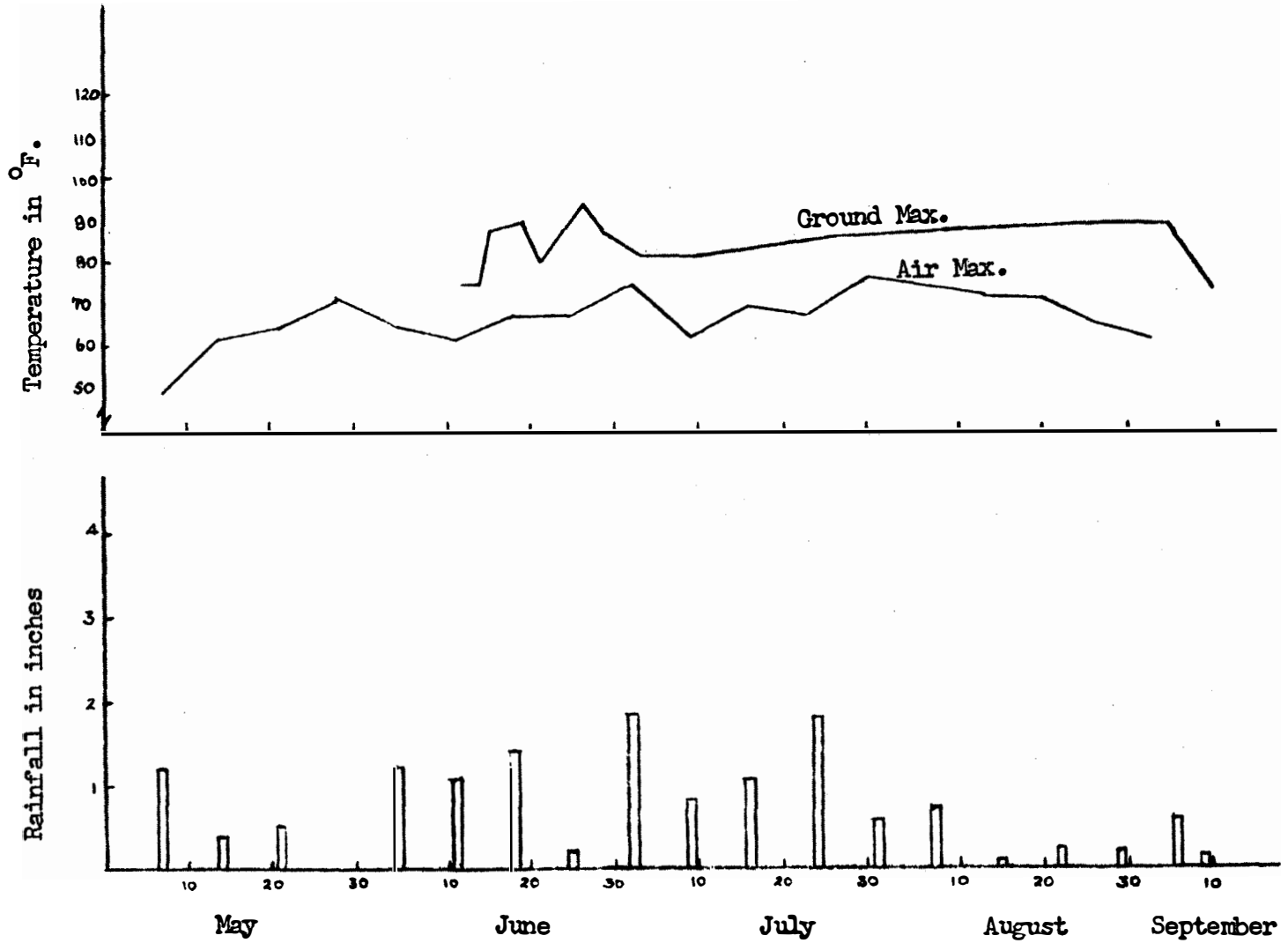


TABLE 2. SURVIVAL OF ONE-YEAR-OLD SEEDLINGS ON FRESH AND OLD
SCARIFICATION FOR THE 1962 GROWING SEASON

(based on 9 quadrats per treatment)

SEEDBED	OLD SCARIFICATION		FRESH SCARIFICATION	
SITE	Number of Survivors	Per cent Survival	Number of Survivors	Per cent Survival
DRY	4	44.4	76	59.8
MOIST	40	80.0	188	66.9
WET	15	69.6	39	42.9
TOTAL	59		303	

mortality on moist and wet sites for this growing season.

Seedling survival data for the third growing season and for the second growing season (1961 data) were compared and analyzed. Since the actual numbers of surviving white spruce seedlings on each site is of primary interest to the success of the scarification operation, both numbers of survivors and per cent survival are compared for each treatment using the analysis of variance presented in the Appendix. Number of survivors was significantly affected by site and growing season. Most site quadrats supported the greatest number of seedlings. Seedling numbers were significantly lower on all sites in 1962 than in 1961. Per cent survival was effected by site but not growing season. It is anticipated that per cent survival will be as high or higher in the fourth growing season as seedlings become well established.

One-year-old seedlings, 1961 fall seeding.

Stocking values on nine $\frac{1}{4}$ -milli-acre quadrats per treatment for 1-year-old seedlings are presented in Table 2. Moist-site quadrats support the greatest number of seedlings. Dry-site quadrats support more seedlings on fresh scarification than wet-site quadrats. This may be because of abundant moisture supply on dry sites on the one hand and a high degree of flooding affecting 30 per cent of wet-site quadrats on the other.

Analysis of variance for per cent survival and number of survivors is presented in the Appendix. Per cent survival was affected by site but not by seedbed. Numbers of survivors were affected by site and by seedbed. Moist site quadrats supported the greatest number of seedlings and examination of a just significant interaction showed that fresh scarification supported significantly higher numbers of seedlings than the original scarification on dry-and moist-site quadrats but not on wet-site quadrats. The fresh scarification was the more receptive seedbed.

Seed supply

There was only a very poor seed crop for white spruce in the Lesser Slave Lake region in 1962. There were good seed years in 1959 and 1961. Only a few trees in the district carried cones in 1962 and on the experimental area, average cone-bearing live-crown length for all trees was less than 5 per cent. Cones showed evidence of worm infestation, about 30 per cent of cones being affected. Damaged cones were almost completely empty. The survey of cone crop on the study blocks showed that only a few trees, 17 per ~~cent~~ acre carried cones. Seed supply estimates for the three sites over the past four years are presented in Table 3.

TABLE 3. WHITE SPRUCE SEED SURVEY

SITE	Percent cone-bearing live-crown			
	1959	1960	1961	1962
Dry	16	5 approx.	22	less than 5
Moist	17	5 approx.	25	less than 5
Wet	18	5 approx.	31	less than 5

FUTURE WORK

A regeneration survey to assess the status of white spruce seedling establishment on the total 90-acre study area is planned for 1963. Broadcast seeding of scarified spots on a split-plot basis will be carried out as outlined in the project plan. The annual tally of seeded $\frac{1}{4}$ milliacre quadrats will be made to determine the deterioration of the 1959 seedbed. Account will be kept of cone crop, rainfall, and maximum ground temperature during the growing season. The results of this remeasurement and of the tallies to date will be published in 1964.

Calgary, Alberta, March 1963.

J. C. Lees

APPENDIX

Analysis of Variance

1. Second and third year white spruce per cent survival
(percentages were transformed to angles)

Source of Variation	Degrees of Freedom	Sum of Squares	Variance	"F" Ratio
Sites	2	70.9	35.5	6.3 **
Years	1	2.6	2.6	0.46 N.S.
Sites X Years	2	4.2	2.1	0.38 N.S.
Error	48	267.4	5.6	
Total	53	345.1		

2. Second and third year white spruce number of survivors

Source of Variation	Degrees of Freedom	Sum of Squares	Variance	"F" Ratio
Sites	2	37,839	18,919.5	7.24 **
Years	1	12,301	12,301.0	4.71 **
Sites X Years	2	9,565	4,782.5	1.83 N.S.
Error	48	125,485	2,614.2	
Total	53	185,190		

3. Per cent survival of white spruce seedlings on old and fresh scarification.
(percentages were transformed to angles)

Source of Variation	Degrees of Freedom	Sum of Squares	Variance	"F" Ratio
Sites	2	13,344.0	6,672.01	10.42 **
Seedbed	1	304.7	304.70	0.48 N.S.
Sites X Seedbed	2	1,119.5	559.75	0.87 N.S.
Error	48	30,735.8	640.33	
Total	53	45,504.0		

4. Number of survivors of white spruce seedlings on old and fresh scarification.

Source of Variation	Degrees of Freedom	Sum of Squares	Variance	"F" Ratio
Sites	2	979	489.5	9.27 **
Seedbed	1	1,102	1,102.0	20.88 **
Sites X Seedbed	2	434	217.0	4.11 *
Error	48	2,534	52.8	
Total	43	5,049		

** $p \leq 0.01$

* $p \leq 0.05$