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SEEDSPOTTING THREE SPRUCE SPECIES ON PRESCRIBED BURNS

by
J. Richardson

FOREST RESEARCH LABORATORY
ST. JOHN'S, NEWFOUNDLAND
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CANADIAN FORESTRY SERVICE
DEPARTMENT OF FISHERIES AND FORESTRY
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Introduction

Balsam fir (Abies balsamea (L.) Mill.) in Newfoundland is subject to severe attack by the balsam woolly aphid (Adelges piceae Ratz.) and so far no satisfactory method has been found to control this insect. If control is not possible, and if pulpwood yields are appreciably reduced, it may become necessary to introduce aphid-resistant species. In consideration of this possibility an experiment was started in 1963 to determine if advance growth of fir on cut-overs could be eliminated by prescribed burning and if the seedbeds thus created could be successfully sown with spruce.

Three species of spruce (black spruce (Picea mariana (Mill.) B.S.P.), red spruce (P. rubens Sarg.) and sitka spruce (P. sitchensis (Bong.) Carr.)) were seedspotted in the fall of 1963 immediately after burning which successfully eliminated the fir (Wilton 1966). The first of three scheduled remeasurements of the seeding trial was conducted in August, 1968, five years after establishment.

The Experimental Areas

The experiments were established at Norris Arm in central Newfoundland and at Fishel's Brook in western Newfoundland. The former is about one-mile east of Norris Arm, north of and close to the Trans Canada Highway. The

terrain has a ten percent slope to the north. Parent material is a well-drained till with abundant rocks and stones. On this has developed a podzol profile with one to two inches of sandy A₂ and a red-brown sandy-loam B horizon. Prior to burning the organic mantle was on the average four inches deep. At the time of remeasurement it averaged three inches.

The present vegetation is dominated by three-to-four-foot-tall pin cherry (Prunus pensylvanica Lf.) with scattered eight-foot aspen (Populus tremuloides Michx.) and occasional six-foot-tall bushes of alder (Alnus rugosa (Du Roi) Spreng. var. americana (Regel) Fern.), white birch (Betula papyrifera Marsh.) and Sorbus sp. On the ground there are scattered Dicranum moss patches, some Epilobium angustifolium L., raspberry (Rubus sp.), pearly everlasting (Anaphalis margaritacea L.) and patches of dead or dying Juncus sp. Near the south edge of the block Cornus canadensis L. is abundant. Stocking of natural black spruce seedlings is estimated to be about 30 percent.

The experiment at Fishel's Brook is reached by a woods road running south from the Trans Canada Highway about nine miles west of the St. Georges intersection. It is about 50 feet north of the road at a point 2.5 miles from the highway on a four percent south-facing slope which had been logged in 1962. The soil has developed on a well-drained deep fresh till with a loamy texture. Its podzol profile has a one to two inch thick grey-colored A₂ horizon. Rooting occurs freely throughout the profile and there are few stones. The organic mantle averaged six inches

deep before burning; it now averages five inches deep.

Presently the site supports a fairly dense vegetation of four-foot-tall cherry, birch and elderberry (Sambucus pubens Michx.) The ground cover consists of Cornus canadensis, Clintonia borealis (Ait.) Raf., raspberry and dying moss. There is no natural regeneration.

The Burns

At both Norris Arm and Fishel's Brook the prescribed burning was conducted in early September, 1963, during a period of low fire danger index and high slash hazard index (Williams 1963). The fire at Norris Arm completely consumed the slash but only partially burned the duff. At least three inches of unburned duff were still present throughout (Squires 1963). The results of the burning at Fishel's Brook were very similar: slash was consumed but little impression was made on the depth of the organic mantle. It appears that the duff and humus were too wet to sustain fire at either location.

Experimental Design

The two experiments are similar in design and differ only in minor aspects of species arrangement. Each consists of an area measuring 50 feet by 150 feet, subdivided into 10 plots each containing three lines of ten seedspots at five foot intervals. One line in each plot was allocated at random to each of the three species.

Both areas were seeded in late October, 1963. On each seedspot the ground was loosened by scuffing with the foot, ten viable seed were deposited within a radius of six inches and then pressed down firmly. No further treatment was applied. The red spruce seed was collected in 1961 in western Nova Scotia, the sitka spruce seed was collected in 1959 from the Skeena River Valley 25 miles north of Terrace, B.C; the source of the black spruce is unknown.

The species arrangement at Fishel's Brook is shown in Figure 1, and at Norris Arm in Figure 2. Arrangements were to have been identical but an error in seeding occurred at Norris Arm. This error makes statistical analysis of the Norris Arm data invalid.

Remeasurement

In August, 1968, the first complete remeasurement was carried out on both areas. Every stocked seedspot was examined and the following information collected: species, number of seedlings, height of tallest seedling, maximum growth in 1967. Brief notes were made of the seedbed and vegetation associated with each spot.

Difficulties were encountered in locating and correctly identifying the species at Norris Arm and in distinguishing natural black spruce seedlings. As a result a check was carried out in May, 1969, and results from that examination are used in this report.

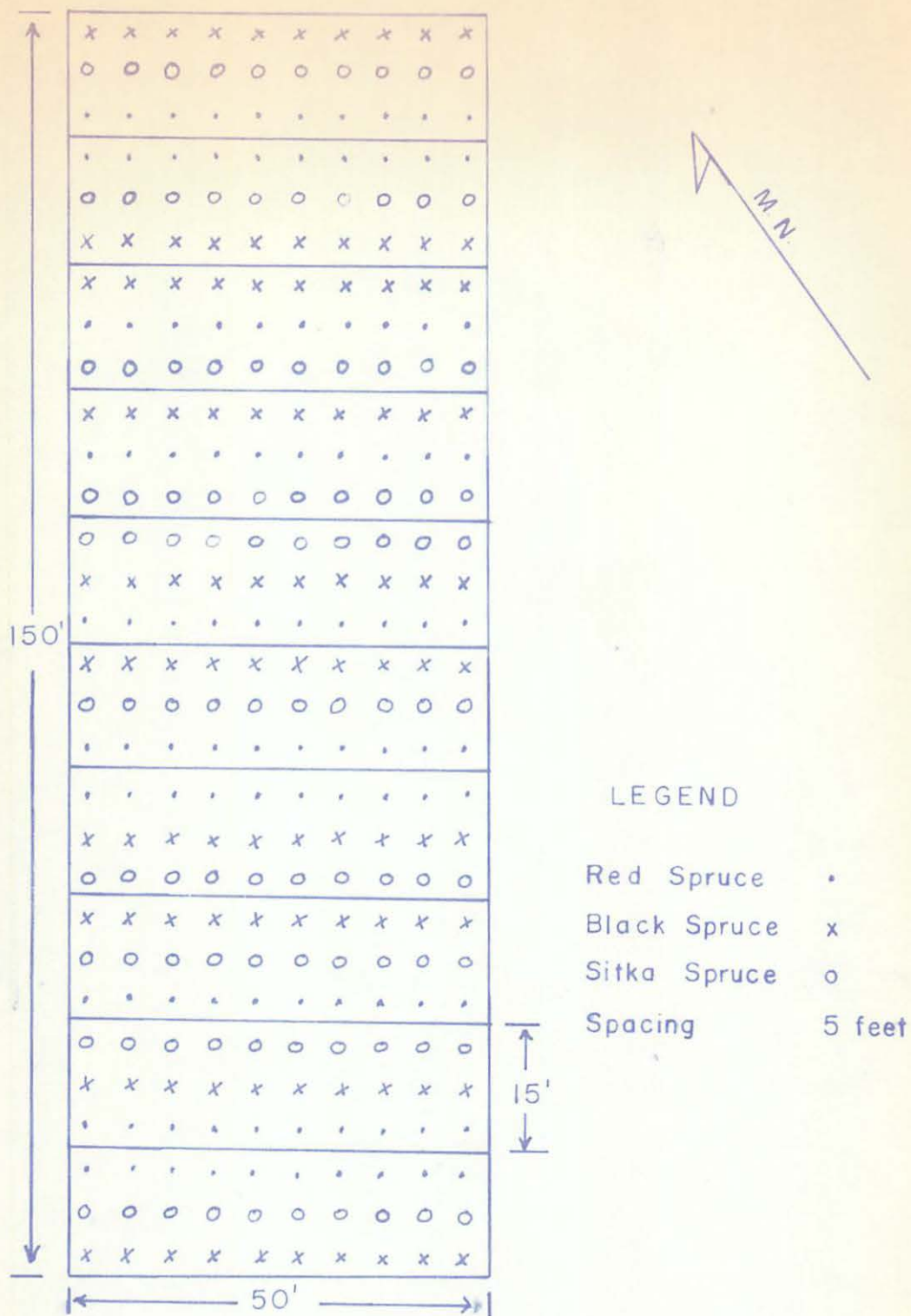


FIGURE 1 SEEDING DIAGRAM

FISHEL'S BROOK, WESTERN NEWFOUNDLAND

SCALE 1" = 20'

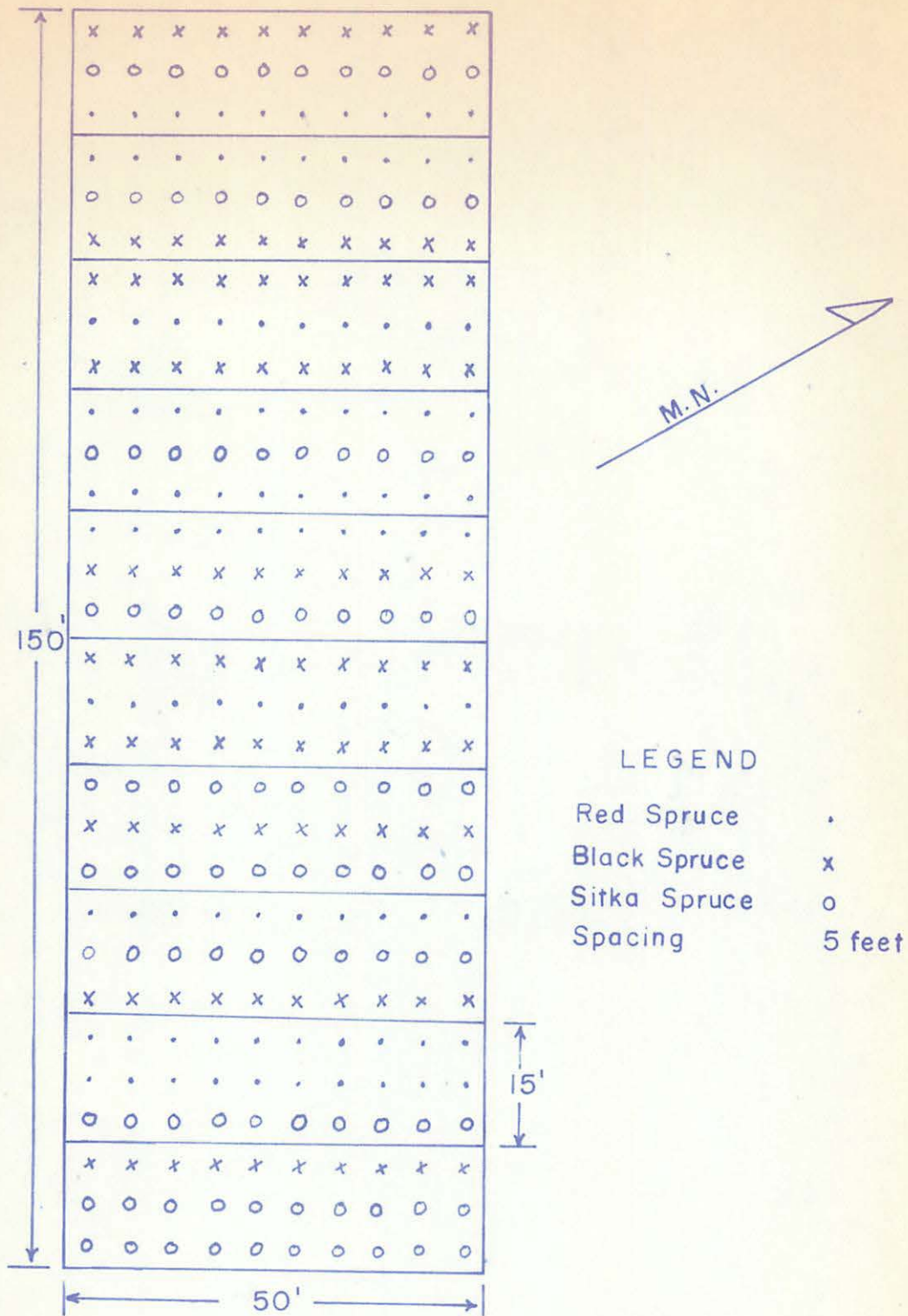


FIGURE 2 SEEDING DIAGRAM

NORRIS ARM, CENTRAL NEWFOUNDLAND

SCALE 1" = 20'

Results

Table 1 shows the stocking, average number of seedlings per spot and height growth of the three species at Norris Arm. As noted above, statistical analysis is not possible, but it appears that red and sitka spruce are very much superior to black spruce in stocking and numbers of seedlings, while sitka spruce surpasses the other two in height growth.

Table 1

Results of Seedspotting Three Spruce Species at Norris Arm

<u>Species</u>	<u>Percentage stocking</u>	<u>Average number of seedlings per spot</u>	<u>Average height Tallest Seedling/spot (inches)</u>
Black spruce	15	1.1	9.2
Red spruce	37	2.1	9.0
Sitka spruce	37	2.3	10.8
Average	30	2.0	9.7

Table 2 shows the stocking, average number of seedlings per spot and height growth of the three spruces at Fishel's Brook. Statistical analysis revealed that red spruce stocking was very significantly (one percent level) less than that of sitka, and significantly (five percent level) less than that of black spruce. Differences in stocking between sitka and black spruce were not significant. Similarly, differences between species in number of seedlings per spot were not significant.

Because of the low stocking of seedspots statistical comparisons of height growth are not possible. However, black spruce is clearly superior both in average height and average 1967 growth. Sitka spruce growth is slightly better than that of red spruce.

Table 2

Results of Seedspotting Three Spruce Species at Fishel's Brook

Species	Stocking (percent)	Average number of seedlings per spot	Tallest seedling per spot	
			Average height (inches)	Average 1967 growth (inches)
Black spruce	25	1.4	13.8	4.7
Red spruce	10	1.2	7.2	2.2
Sitka spruce	30	1.3	9.4	3.0
Average	22	1.3	10.8	3.5

Discussion

Stocking was not satisfactory in either area for any of the species. At Norris Arm, however, with the addition of the natural black spruce regeneration the overall stocking there might be considered adequate.

In both areas sitka spruce has the best stocking, although in height growth it is surpassed at Fishel's Brook by black spruce. In general, western Newfoundland has a more favourable climate, with a longer growing season than central Newfoundland. On the other hand, the difference in elevation (Fishel's Brook 500-600 feet, Norris Arm 250 feet)

may have more than offset the basic climatic difference, so that the hardier black spruce was able to grow taller at Fishel's Brook.

It seems likely that the greater depth of humus at Fishel's Brook was an important factor in producing the lower overall stocking figures on that area. However, it is believed that the humus was too deep on both areas for satisfactory regeneration of any of the spruces involved. Both red and sitka spruce germinate and survive poorly on thick duff due to the unfavourable moisture conditions. Black spruce will germinate satisfactorily on a variety of sites, but on a thick organic mantle moisture relations may become critical in dry years (U.S.D.A. 1965). While the first growing season after sowing was wetter than normal, the following summer (1965) had 30 percent less rainfall than normal at Gander.

Conclusion and Recommendations

Of the three spruces tested, sitka spruce produced the best stocking at both Fishel's Brook and Norris Arm, and the best height growth at Norris Arm. Black spruce produced the best height growth at Fishel's Brook.

On similar sites it is concluded that mechanical scarification or more complete burning will be needed to alter or reduce the depth of raw humus and create seedbeds suitable for the establishment of spruce. Sitka spruce is suitable for lower elevations and other areas of more favourable climate. Black spruce is to be preferred for higher elevations and more extreme climates.

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