STUDIES ON SPRUCE PLANTATIONS AT GREEN TIMBERS

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INTRODUCTION

The Sitka spruce weevil, Pissodes sitchensis Hopk., is a serious pest of Sitka spruce, Picea sitchensis (Bong.) Carr., reproduction and plantations in coastal British Columbia. Attacks have been so severe that attempts to grow Sitka spruce in commercial plantations, with the exception of the Queen Charlotte Islands and the west coast of Vancouver Island, have practically ceased. This is serious from the forestry standpoint as it is sometimes desirable to restock natural sites with spruce.

Use of other spruce species or genetic crosses of Sitka spruce with other species is being considered. The species or crosses, to be satisfactory, would have to show adequate resistance to, or have ability to recover from, spruce weevil attack as well as maintain desirable growth and wood qualities.

A series of spruce seed lots obtained by the B.C. Forest Service from eastern Canada and Europe in 1955 was planted out at Green Timbers for observation. These spruce plantations were made available to the authors in 1960 when the current studies on the Sitka spruce weevil were initiated. The primary purpose was to determine any apparent resistance to spruce weevil attack.

No results have been obtained to date regarding Sitka spruce weevil attack, but preliminary information obtained on tree growth and mortality during the first five years should be of interest to foresters.

METHODS

Thirteen lots of seed received by the B.C. Forest Service in 1955 were sown at Green Timbers nursery that year. A severe frost in the fall resulted in heavy mortality to seedlings in five lots. The origin of the stock, which was planted out in the spring of 1957 as 2-0 stock, is shown in Table 1. No records were available on the Sitka spruce other than that it was native B.C. stock.

The trees were originally established in Plantation 50, but due to expansion at the nursery were moved in the spring of 1962 to Plantations 22 and 25 (see map).

The plots have been examined annually each spring since they were established. All trees are tagged. Records include height of trees, length of terminal growth, tree mortality, and incidence of spruce weevil attack (Table 2).

RESULTS AND DISCUSSION

Frost Damage

Seedlings of five seed lots suffered severe frost damage the first year they were planted in the seed beds. P. glauca was most heavily damaged; seedlings from four lots, all from Ontario and Quebec were so reduced in numbers that there were not enough survivors for planting out. No figures are available on seedling mortality. Three other lots of P. glauca, one each from Ontario, Quebec and Denmark, survived in sufficient numbers to be planted out. One lot, F-10, was not included in the spruce weevil study plots as it was not planted out with the other lots.

One lot of P. abies from West Hazen, Germany, was severely damaged. Two other lots, F-15 and F-16, from Poland and Germany survived in sufficient numbers to be planted out.

Effect of Transplanting

Transplanting of seedlings often results in loss of growth and even mortality until the young trees become re-established. When these studies were started in 1960 the plot trees had been planted out for three years so figures on initial mortality were not available. The annual measurements and examinations provided records of growth and survival since 1960 and of the effects of transplanting in 1962.

Tree mortality from 1960 to 1962 was light, but the shock of transplanting had an immediate effect on growth in 1962. The average length of leader growth was reduced significantly in all plots, and trees with no measurable leader growth were very numerous (Table 2).

Tree mortality was most conspicuous in 1963; in five plots all the losses attributed to transplanting occurred in this year. Recovery from shock began in 1963 as shown by the increase in leader growth and a reduction in the number of trees with no leader growth. Average leader growth was significantly greater in 1963 than the previous year, but because many of the larger trees died the average tree height remained about the same as in 1962. One exception was P. glauca, F-9, where mortality of many small trees resulted in the largest increase in average tree height.

Tree growth in 1964, as indicated by leader length approximated that of 1960 and 1961. Average leader growth in most plots approached and in three plots exceeded the growth in 1960 and 1961. Maximum leader growth increased in all plots, and with one exception was the best recorded for five years. There was no terminal growth on a number of trees in 1964, but the number was greatly reduced compared with 1962, and in most cases with 1963.

Tree Growth by Plots

The rate of tree growth is of prime importance in studying introduced tree species or genetic crosses. Although the transplanting in this experiment reduced the information available, comparisons can still be made as all trees are the same age and received the same treatment.

Seedling growth in the eight plots was rated on a numerical basis for average height of trees, maximum height of trees, average leader growth, and maximum leader growth (Table 3). The plot with the best growth was rated 1, second 2, and so on for the eight. The total rating indicates the comparative rate of growth for the different plots. The lower ratings indicate the largest or fastest growing trees. The same comparative ratings can be obtained by using average tree height and average leader growth for each plot.

P. glauca (F-18) from Jutland, Denmark, has shown the best growth, closely followed by P. sitchensis from B.C. and P. sitchensis x glauca (F-20) from Lundsgard, Denmark. P. sitchensis x glauca (F-21) from Jutland, Denmark, placed fourth in the rating due mainly to a high rating for maximum tree height and leader growth.

An unexpected result was the poor growth of P. sitchensis x glauca (F-19) from Jutland. The good growth demonstrated by the same crosses from Lundsgard (F-20) was not evident in this cross. The different seed lots indicate the crosses were of different origin, and suggests that the characteristics of the parent trees are important in the quality of seeds and trees. Another cause for difference could be in the treatment or handling of the different lots. The marked differences indicate the importance of maintaining complete and accurate records on the origin and handling of seeds for experimental purposes.

Of two groups of P. glauca those from Denmark rated first, whereas lot F-9 from Vankleek Hill, Ontario, rated seventh. It should be noted that four out of six lots of seedlings from Quebec and Ontario were severely damaged by frost in 1955, while the lot from Denmark survived. This suggests that P. glauca from eastern Canada could be unsuitable as a commercial species in British Columbia.

Spruce Weevil Attacks

To date only one tree has been attacked by the spruce weevil. This was a native Sitka spruce, 4.0 feet tall in 1963, and attacked in the spring of 1964. Information on incidence of spruce weevil attack in the different lots should be forthcoming in the next few years as tree height and leader growth in all plots is in the size class preferred by the weevil.

SUMMARY

Seedlings of P. glauca from Quebec and Ontario were the least resistant to frost damage.

All tree species responded in a similar manner to transplanting. Most trees have recovered after three years, and growth rate in 1964 was equal or superior to growth rates in 1961 the last year before transplanting.

On the basis of these studies P. glauca and P. sitchensis x glauca from Denmark show sufficient promise to be considered as candidates for commercial plantations. Growth of P. sitchensis from B.C. compares

favourably with any of the other lots.

P. glauca from Ontario and Quebec, and P. abies have not demonstrated acceptable growth rates in these studies.

The relative susceptibility of the different lots to spruce weevil attack should become apparent in two to four years. This could be a major factor in the selection of species or hybrids for further experiments.

ACKNOWLEDGMENTS

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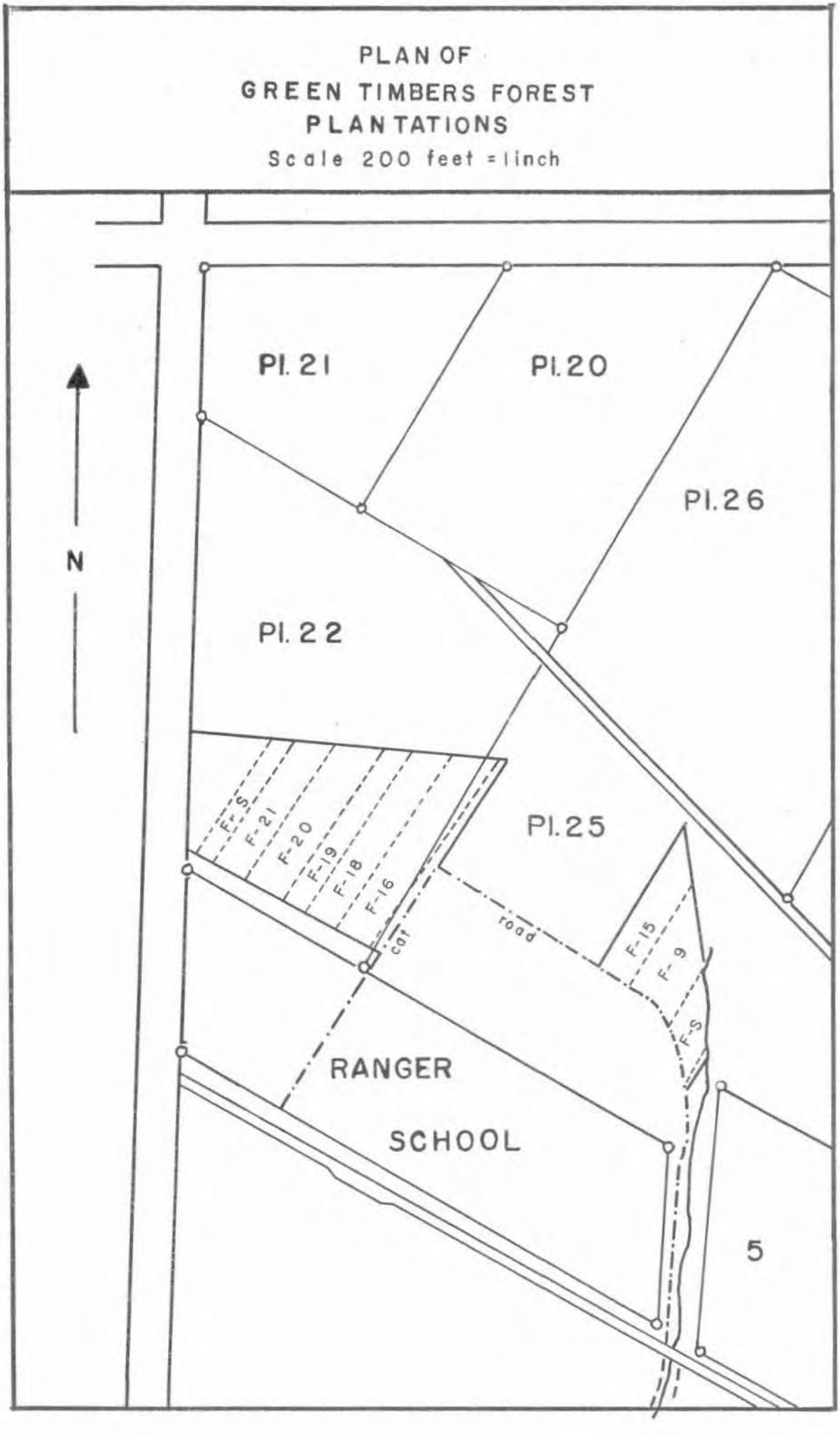
PLAN OF
GREEN TIMBERS FOREST
PLANTATIONS
Scale 200 feet = 1 inch
N
Pl. 21
Pl. 20
Pl. 26
Pl. 22
Pl. 25
F-5
F-21
F-20
F-19
F-18
F-16
cart
road
F-15
F-9
F-5
RANGER
SCHOOL
5

Table 1

Origin of spruce seed lots planted at Green Timbers in 1955.

Seed lot	Species	Collected at
* F-9	P. glauca	Vankleek Hill, Ontario
* F-10[1/]	P. glauca	St. Zeon, Quebec
F-11	P. glauca	St. Maurice, Quebec
F-12	P. glauca	Essa, Ontario
F-13	P. glauca	Trois pistoles, Quebec
F-14	P. glauca	Mattawa, Ontario
* F-15	P. abies	Istebena, Poland
* F-16	P. abies	Schwartswald, Germany
F-17	P. abies	West Hazen, Germany
* F-18	P. glauca	Jutland, Denmark
* F-19	P. sitchensis x glauca	Jutland, Denmark
* F-20	P. sitchensis x glauca	Lundsgard, Denmark
* F-21	P. sitchensis x glauca	Jutland, Denmark
* F-S[2/]	P. sitchensis	British Columbia

* Lots survived the 1955 frost sufficiently to enable plots of each species to be planted out.

1/ F 10 - This lot not included in spruce weevil study plots.

2/ Planted out as a control. No locality record on seeds.

Table 2

Growth records and tree mortality of spruce lots planted at Green Timbers, B.C., as 2-0 stock in 1957. All trees were replanted in new plantations in 1962.

Plot no.	Year	No. trees	Av. ht. (ft.)	Max. ht. of trees	Leader growth (in.) Av.	Leader growth (in.) Max.	No. trees died	Av. ht. of dead trees (ft.)	No. trees with no leader growth
F-9	1960	87	1.6	3.5	3.9	17.5	0	-	3
	1961	84	1.7	4.0	3.1	9.0	3	0.9	4
Picea	1962	80	1.8	4.3	1.3	6.0	4	1.0	28
glauca	1963	63	2.2	5.3	3.4	13.0	17	1.1	10
	1964	57	2.8	7.0	6.2	19.5	6	1.3	5
F-15	1960	71	2.2	3.9	6.7	18.0	0	-	1
	1961	71	2.6	5.0	7.6	17.7	0	-	1
Picea	1962	70	2.8	5.3	1.4	8.8	1	3.5	35
abies	1963	49	3.0	6.2	2.5	15.8	21	2.5	17
	1964	48	3.6	7.8	6.1	23.0	1	2.3	12
F-16	1960	89	2.0	3.5	5.6	13.5	0	-	1
	1961	89	2.4	4.0	6.4	15.0	0	-	1
Picea	1962	89	2.8	4.3	1.6	8.0	0	-	28
abies	1963	71	2.7	4.2	1.2	9.0	18	2.3	27
	1964	71	3.1	5.5	4.7	19.5	0	-	6
F-18	1960	68	2.4	4.6	8.6	20.0	0	-	0
	1961	68	3.1	5.8	9.9	18.0	0	-	0
Picea	1962	68	3.3	5.3	1.9	8.0	0	-	25
glauca	1963	53	3.4	5.5	2.4	11.0	15	3.7	11
	1964	53	4.1	7.3	10.0	29.0	0	-	6
F-19	1960	39	1.4	2.2	3.5	7.4	0	-	1
	1961	39	1.7	3.5	5.0	13.0	0	-	2
Picea	1962	38	1.8	3.1	1.1	3.8	1	1.3	11
sitchensis	1963	28	1.9	3.4	1.3	5.5	10	1.9	6
x glauca	1964	27	2.2	4.2	4.2	15.0	1	1.3	7
F-20	1960	95	2.4	4.8	7.1	24.0	0	-	0
	1961	95	3.1	5.8	9.4	18.0	0	-	3
Picea	1962	94	3.2	5.9	1.6	5.0	1	2.9	42
sitchensis	1963	61	3.2	5.6	2.5	9.0	33	3.4	13
x glauca	1964	61	4.1	7.1	9.8	26.5	0	-	6
F-21	1960	51	2.2	4.2	7.1	18.5	0	-	1
	1961	51	2.9	5.8	9.8	20.2	0	-	1
Picea	1962	51	3.1	6.0	1.6	6.0	0	-	23
sitchensis	1963	34	3.1	6.6	2.8	21.0	17	3.4	3
x glauca	1964	34	3.6	8.7	6.8	25.3	0	-	3
F-S	1960	78	2.7	4.8	9.2	18.3	0	-	1
	1961	77	3.6	6.8	11.9	25.0	1	2.5	0
Picea	1962	77	3.8	7.0	2.7	6.0	0	-	19
sitchensis	1963	67	4.1	7.2	3.3	12.5	10	3.3	10
	1964	67	4.6	7.9	7.2	20.0	0	-	5

Table 3

Relative rating of different plot trees based on 1964 growth.

Plot number	Species	Origin	Average tree height	Maximum tree height	Average leader growth	Maximum leader growth	Total rating
F-9	P. glauca	Vankleek Hill, Ont.	7	6	5	6	24
F-15	P. abies	Istebena, Poland	4	3	6	4	17
F-16	P. abies	Schwartzwald, Germany	6	7	7	6	26
F-18	P. glauca	Jutland, Denmark	2	4	1	1	8
F-19	P. sitchensis x glauca	Jutland, Denmark	8	8	8	8	32
F-20	P. sitchensis x glauca	Lundsgard, Denmark	2	5	2	2	11
F-21	P. sitchensis x glauca	Jutland, Denmark	4	1	4	3	12
F-S	P. sitchensis	B.C.	1	2	3	5	11