

IMPROVING BLACK SPRUCE SEED COLLECTION

by

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INTRODUCTION

A study of seed production and dispersal in black spruce on peatlands is a part of the research being conducted on regeneration problems in such areas. The seed production study is still in its early stages, but a proposal emanating from it seems worth presenting at this time. The proposal is that black spruce seed collections should be made from cones up to five years of age. Seed viability has not dropped greatly in that period, and there are still sufficient seed remaining in the cones to make it worth while handling them.

This report discusses the proposal, describes the methods being used, and includes some information presented previously by other investigators.

METHODS

The work is being done near Cochrane, Ontario, on the Kennedy Township black spruce research area described in an earlier report (Vincent, 1965). In general it is a reasonably typical clay belt low-land area with peat depth varying from one-half foot to over three feet. The black spruce stands are overmature.

Seed production is being studied by cutting and stripping five

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to normal (window plus fluorescent) office light for 5 to 10 minutes when germination was checked. It was thought the cupboard would provide better conditions for the germination tests, but available data do not confirm this.

At the end of the germination tests, each seed which had failed to germinate was cut open under a dissecting microscope to determine its condition. This formed the basis for computations of total numbers of apparently sound seed.

Germination percentages, seeds per cone, and so on were calculated. Summaries are presented in the following section.

RESULTS

Tables 1 and 2 show summaries of data from the current study. The ten trees sampled range from intermediate to dominant in terms of the original crown canopy but, since the stands are overmature and opening up, all the crowns have been reasonably exposed to light during the past five years.

Numbers of cones per tree vary considerably, and there is also much variation in the proportions of cones which are five years or less from time of origin (Table 1). This is influenced in part at least by the variability in annual cone production. Years of even date seem to have larger numbers of cones, with 1964 having been a particularly good seed year (Table 2).

Table 1. Sample tree descriptions

Tree No.	Tree age	D.B.H. (inches)	Height (feet)	Crown length (feet)	Total cones	Per cent cones less than six years old
1	91	6.0	46	35	815	86
2	130	9.5	60	47	3,819	66
3	153+	11.4	70	43	5,825	82
4	203	10.0	60	45	3,377	41
5	165	12.7	71	56	6,740	63
6	95	6.9	53	35	6,038	47
7	116	9.3	58	37	12,374	33
8	112	6.8	50	30	450	63
9	172	8.4	54	39	6,180	45
10	137	8.4	52	25	2,090	47
Avg.	137	9.1	57	39	4,771	63

Table 2. Data on cones and extracted seed germination, 1965 collection

Year cone formed	No. cones	Total seed	Seed per cone	Per cent sound seed	Sound seed per cone	Germination per cent <u>All 'Sound'</u> seed!seed!	Total seed germinated
1965	675	16,313	24.2	31.7	7.7	24.2 76.3	3,949
1964	5,140	102,606	20.0	28.7	5.7	13.6 47.5	14,009
1963	1,002	16,184	16.1	25.9	4.2	12.7 49.1	2,059
1962	3,262	26,583	8.1	26.4	2.1	11.6 43.9	3,078
1961	865	5,781	6.7	18.0	1.2	10.5 58.6	609
Total per tree	10,944	167,467	15.3	28.0	4.3	14.1 50.5	23,704
Avg.	2,189	33,493	15.3	-	-	- -	4,741

The numbers of extracted seed per cone are no more than half the numbers actually contained in the cones. That this is not peculiar to this investigation is verified by information from the work of Millar (1936) and from the data on black spruce seed in "The Woody Plant Seed Manual" (Anon., 1948). From the latter it may be calculated that seed production varies from 7.2 to 7.8 seeds per cone, while Millar shows that seeds per cone vary from 55 to 69 depending on cone size, with 35 still in 3-year-old cones. This indicates that improvements in the extraction process are desirable.

The proportions of sound seed extracted are low, and decrease slightly with cone aging. The percentage germinated varies from 44 to 76 per cent. This is within the limits shown in Anon. (1948) and well above the results shown by Chai and Hansen (1952), but slightly below the results given by LeBarron (1948). It is believed that, given better facilities than those available to the investigator, the average germination percentages would have been considerably higher. Actual germination among seed lots varied from zero to 100 per cent, with several of the lots from cones three years or older having germination up to 95 per cent. In any one age class from one tree there was often considerable variation between the first and second extractions. There was no particular pattern to this as either the first or second extraction might have the better result.

The calculation of total seed germinated (Table 2) indicates

that about 10 trees should provide one pound of viable seed. More efficient extraction and germination procedures should reduce this number.

DISCUSSION

The chief advantage of collecting seed in cones up to five years old is that it makes collections independent of the time of year, and of good or poor seed years, and introduces the possibilities of mechanization. A tractor and wagon or sled can be sent into the cutover and the upper three or four feet of the black spruce top can be lopped and tossed onto the wagon for removal. Cones can quickly be removed at a central point. This is a distinct advantage as anyone who has spent hours picking a bushel or two of black spruce cones (at 7,000 to 16,000 cones per bushel) can vouch. Another advantage is that a relatively small acreage need be worked over, thus the seed can be collected from the better sites and stands where there are likely to be more seed (Millar, 1936; LeBarron, 1948).

There will be a greater bulk of cones to handle, but this should be offset by the fact that cones can be collected when convenient, perhaps during slack periods for continuing staff, and the increased mechanization possible at an earlier stage in seed processing than is now usual.

REFERENCES

- ANON. 1948. Woody-plant seed manual. U.S.D.A. Misc. Pub. No. 654.
- CHAI, T.S. and H.L. HANSEN. 1952. Characteristics of black spruce (*Picea mariana*) seed from cones of different ages. Minn. For. Notes No. 2.
- LABARRON, R.K. 1948. Silvicultural management of black spruce in Minnesota. U.S.D.A., Cir. 791.
- MILLAR, J.B. 1936. The silvical characteristics of black spruce in the Clay Belt of northern Ontario. Univ. Toronto, M.Sc. Thesis.
- VINCENT, A.B. 1965. Establishment of an area for studying regeneration problems in black spruce. Can. Dept. Forestry, Mimeo 65-0-7.

floating seed were sound.

Through a series of mishaps, germination tests of the seed collected in 1964 are valueless, although data on numbers of seed per cone, and so on, provide some useful information.

Separate germination tests were made of the seed from the two extractions of the seed collected in 1965. Lots of 100 seed, or less if fewer were available, were selected at random from the seed which sank in methanol. These were soaked for 36 hours in a solution of five drops of concentrated sulphuric acid to one pint of distilled water¹ to break dormancy. They were then placed in covered Petri dishes on absorbent pads which had been soaked in water brought to pH 5 with sulphuric acid. The pads were kept moist with this water, and with water containing Captan if mold was appearing. Germination was checked three times weekly for five weeks. A seed was taken as germinated when the radicle had appeared.

The two sets of extractions were tested under somewhat different conditions. The first set, after being placed in the Petri dishes were set on shelves on an office wall. The shelves were draped with black broadcloth to exclude much of the light. Room temperature was usually at 72°F, with occasional fluctuations not lower than 64° nor above 75°F. The second set were tested in a small, windowless cupboard which was darker than the shelves. It remained at 80°F most of the time, with infrequent fluctuations between 75 and 82°F. The seed from both sets were exposed

¹/ As suggested by J. W. Fraser, Petawawa Forest Experiment Station.