

USE OF DIFFERENT MEDIA FOR THE GERMINATION

OF

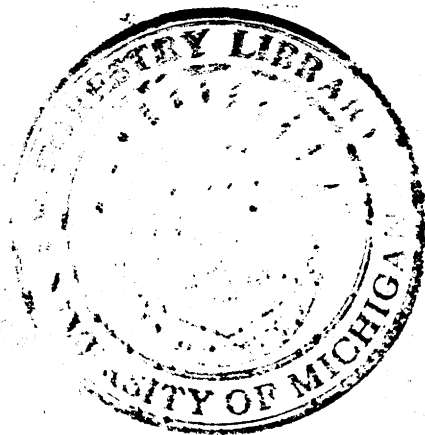
TSUGA CANADENSIS AND ABIES BALSAMEA SEEDS

by

Leslie Darvel Lloyd

1930

Lloyd



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USE OF DIFFERENT MEDIA FOR THE GERMINATION
OF
TSUGA CANADENSIS AND ABIES BALSAMEA
SEEDS

INTRODUCTION.

T.S. Hansen, P.A. Herbert, and others, have shown through their experiments on the germination of seed, that the use of different media have produced widely different results in the number of seeds germinating and in their survival. None of these tests, however, have been tried on either *Tsuga canadensis* or *Abies balsamea*.

OBJECT OF EXPERIMENT.

The object of this experiment was to test the germination of *Tsuga canadensis* and *Abies balsamea* on a number of different media and to get a lead for further study, and if possible, to find the best method of germinating these seeds in the nursery.

PROCEDURE.

Two lots of one thousand seeds of *Abies b* and 500 seeds of *Tsuga c* were counted out and checked for difference in weight on a sensitive beam-balance. The difference in number of seeds, by this simple check, was only 1% by weight in the case of the 1,000 seeds and approximately 3% in the case of 500 seeds.¹ As this was accurate

1. U.G. Kapper in his article briefed in the Biological abstracts for September-November, 1928, Number 18487, carried on a series of experiments pertaining to the weighing and counting of seed and is quoted as follows: "For practical purposes 500 seeds should be used in germination tests, but in researches 800 seeds should be used. Weight may be determined within 1% by the use of 1,000 seeds. Purity may be determined to an accuracy of 2% for seed that is 90-97% pure and within 1% for seed more than 97% pure."

enough for the purpose of this experiment the remainder of the seeds were weighed instead of ^{being} counted. The usual method of quartering and quartering of the seeds was used to obtain an accurate sample of the lot.

Twelve flats (1' x 1') were used for both species. In all cases care was taken to see that the media^{um} used for Tsuga c and Abies b was the same because the both trees show similar growth and habitats characteristics and it was thought the seeds might show similar results in this experiment. These flats are briefly described.

Flat No.	Description
Abies Tsuga	
1 & 13	Sand - fine quartz sand not sterilized. Seed covered with a thin layer of fine quartz sand.
2 & 14	Rotten Wood - taken from the inside of a white (?) oak tree which had just been felled and found to have heart rot. Seed covered with a thin layer of fine rotten wood.
3 & 15	Top soil - a dark gray sandy loam soil from Eber White Woods, Ann Arbor, Mich.
4 & 16	Muck - a heavy dark muck soil from Eber White Woods, Ann Arbor, Mich.
5 & 17	Sphagnum moss - ordinary sphagnum with only a very slight amount of organic matter. Seed sown on top of moss - not covered.
6 & 18	Acid phosphate - 4.5 grams of acid phosphate in a solution of 12 oz. of water sprayed over the flat. The soil in the flat is sand of the same sample as used in flats 1, 7, 8, 9, 10, 11, 12, 13, 19, 20, 21, 22, 23 and 24. The seeds were broadcast sown over the surface, covered with a thin layer of fine sand, and then the acid phosphate solution sprayed gently over the surface.
7 & 19	Acid phosphate - 9.0 grams of acid phosphate in a solution of 12 oz. of water sprayed over the prepared flat in the same manner as 6 and 18.
8 & 20	Ammonia sulphate - 1.8 grams of ammonia sulphate in a solution of 12 oz. of water sprayed over the prepared flat in the same manner as 6 and 18.

Flat No. Abies Tsuga	Description
9 & 21	Ammonia sulphate - 4.5 grams of ammonia sulphate in a solution of 12 oz. of water sprayed over the prepared flat in the same manner as 6 and 18.
10 & 22	Potassium sulphate - 4.5 grams of potassium sulphate in a solution of 12 oz. of water sprayed over the prepared flat in the same manner as 6 and 18.
11 & 23	Potassium sulphate - 9.0 grams of potassium sulphate in a solution of 12 oz. of water sprayed over the prepared flat in the same manner as 6 and 18.
	Lime - 9.0 grams of lime in a solution of 25 oz. of water sprayed over the prepared flat in the same manner as 6 and 18.

The two lots of seed were purchased from the Brown Companies seed extracting plant at Berlin, N.H. and the following data was sent along with them.

1. Species: American Hemlock - *Tsuga canadensis*
Region of Origin: N. New England
Altitude: 200-1057 feet
Year of collection: not given
Purity (by weight): 98%
Germinative energy: not given
Cutting test: 60%
Shipped: 12/6/29
2. Species: Balsam fir - *Abies balsamea*
Region of origin: NE New Hampshire and NW Maine.
Altitude: 643-1260
Year of collection: 1929
Purity (by weight): 73%
Germinative energy: not given
Cutting test: 28%
Shipped: 12/6/29

Both lots of seed were kept in cold storage until used.

All the flats were placed in a large water-tight tray and were kept moist by adding water to the tray from time to time. At no time did the seeds have a chance to dry out.

Near the end of the test, pH test were run to determine the acidity. These tests were made on every flat with a La Motte Kenny test set.

Count was kept by placing a tooth-pick behind each seed that germinated so that the final survival could be determined.

RESULTS

NUMBER OF SEEDS GERMINATING AND SURVIVING¹

TABLE NO. I

No's.	Flats	Abies balsamea 1000 seeds planted		Tsuga canadensis 500 seeds planted	
		Total Germination ²	Survival ²	Total Germination ²	Survival ²
1&13	Sand (check)	1	0	28	26
2&14	Rotten Wood	5	3	9	8
3&15	Top Soil	8	3	47	40
4&16	Muck	2	0	6	3
5&17	Sphagnum Moss	70	42	123	120
6&18	Acid Phosphate 4.5 gms.	38	6	29	23
7&19	Acid Phosphate 9.0 gms.	5	0	42	29
8&20	Ammonia Sulphate 1.8 gms.	8	2	28	17
9&21	Ammonia Sulphate 4.5 gms.	2	0	10	9
10&22	Potassium Sulphate 4.5 gms.	3	1	17	14
11&23	Potassium Sulphate 9.0 gms.	0	0	28	11
12&24	Lime 9.0 gms.	0	0	2	2

1. Survival was taken at the end of the test; June 9, 1930.

2. See also graphs I and II with the plotted results.

pH TESTS FOR ACIDITY

TABLE NO. II

Flats		Abies balsamea	Tsuga canadensis	Average
No's.	Description	pH	pH	pH
1&13	Sand (check)	8.4	8.3	8.3
2&14	Rotten Wood	4.4	4.8	4.6
3&15	Top Soil	6.4	6.4	6.4
4&16	Muck	6.6	6.6	6.6
5&17	Sphagnum Moss	6.6	7.0	6.8
6&18	Acid Phosphate 4.5 grams	7.2	7.2	7.2
7&19	Acid Phosphate 9.0 grams	6.6	6.6	6.6
8&20	Ammonia Sul- phate 1.8 gms.	7.2	7.2	7.2
9&21	Ammonia Sul- phate 4.5 gms.	4.6	4.6	4.6
10&22	Potassium Sul- phate 4.5 gms.	7.2	7.2	7.2
11&23	Potassium Sul- phate 9.0 gms.	6.8	6.8	6.8
12&24	Lime 9.0 gms.	8.6*	8.6*	8.6*

TABLE NO IV.

Frequency table showing the number of *Abies balsamea* seeds which germinated under the different conditions of acidity.¹

PH	Number of seeds which germinated	Number of Flats
4.4	5	1
4.6	2	1
4.8		
5.0		
5.2		
5.4		
5.6		
5.8		
6.0		
6.2		
6.4	8	1
6.6	77	3
6.8	0	0
7.0	0	0
7.2	49	3
7.4		
7.6		
7.8		
8.0		
8.2		
8.4	1	1
8.6		
8.8		
	TOTAL	12

1. See also graph IV with the plotted results.

TABLE NO. V.

Frequency table showing the number of *Tsuga canadensis* seeds which germinated under the different conditions of acidity.¹

pH	Number of seeds which germinated	Number Flats
4.4		
4.6	10	1
4.8	9	1
5.0		
5.2		
5.4		
5.6		
5.8		
6.0		
6.2		
6.4	47	1
6.6	47	2
6.8	28	1
7.0	123	1
7.2	74	3
7.4		
7.6		
7.8		
8.0		
8.2	28	1
8.4		
8.6	2	1
8.8+		12

1. See also Graph V with the plotted results.

CONCLUSIONS.

1. The flats showing the best germination were the sphagnum moss with a pH of 6.6 for *Abies b*, and 7.0 for *Tsuga c*. From observations it seems quite likely that optimum moisture conditions, good aeration, and the right conditions of acidity were responsible for this high germination.

2. ~~Too~~ acid conditions, as in the case of the ammonia sulphate (4.5 grams), and rotten wood and too alkaline conditions, as in the case of lime, and the two sand flats, gave the minimum of germination.

3. Acid phosphate (4.5 grams, pH 7.2) gave the second best results for *Abies b* and third best (9.0 grams, pH 6.6) for *Tsuga c*.

4. Top soil, as might be found in the nursery, while giving good results for *Tsuga c* and fair results for *Abies b*, in both cases fell far short of the sphagnum moss flats, was exceeded by the acid phosphate (4.5 grams) for *Abies b*, and very nearly approached by the acid phosphate (9.0 grams) for *Tsuga c*.

5. The results clearly show that greatly increased germination is possible in the nursery if the optimum physical and chemical conditions are met for each species. What these conditions are can only be found out through more exhaustive research.

6. From the two histograms (Graphs IV and V) it can be seen that acidity conditions around neutral to slightly acid (pH of 7.2 to 6.4) were the best for both *Abies b* and *Tsuga c*.

7. It is not possible to draw any conclusions as to rate of germination in the different ~~media~~ media, as can be seen by inspecting Table III or Graph III.

BIBLIOGRAPHY

- Kapper, V.G. - Biological Abstracts for September-November, 1928,
Number 18487.
- Brown, Edgar - The interpretation of germination tests. Proc. Assoc.
Official Seed Analysts of N. America, 1926, pp. 28-29.
- Bates, C.G. - Better seeds, better trees.
Jr. of Forestry, 1927, pp. 130-144.
- Herbert, P.A. - A laboratory study of black spruce. Jr. for 1927,
pp. 437-442.
- Bates, C.G. - The technique of seed testing. Proc. Soc. Am. for
Vol. VIII, pp. 134 and 127-138, 1913.
- Boyce, J.S. - Some methods in the germination tests of coniferous
seeds. For Club Annual, U. of Neb. Vol. VII, p. 75, 1925.
- Fashiro, Shiro - New method of determining the vitality of seeds.
Int. Congress of Applied Chem. Vol. XXVI, p. 163, 1912.
- Hansen, T.S. - Use of fertilizers in a coniferous nursery. Jr. For,
Nov. 1923, p. 732.

JR. OF FORESTRY REFERENCES

1901-1926 Inc.

	Date	Page
Fertilizers in forest production	1911	626
Fertilizers:		
Effects of	1905	52
In U.S. practice	1918	227
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BROWN COMPANY
SEED-EXTRACTING PLANT
Berlin, N. H. - U.S.A.

Seed Origin Record

Species Balsam fir Abies balsamea
(Common Name) (Scientific)

Region of origin: NE Newtump + N.H. Vme.

Latitude: 643-1260

Year of collection: 1929

Purity (by weight): 73 %

Germinative energy, Tests are not completed % in _____ days

_____ ungerminated sound seed Date 19

cutting test shows 28%
sent to Mich Date 12/6/1929

Forest Conservation Dept.
Ann Arbor

own _____
ate Mich By CSO

1 lb.

7623-6C

No. 9.

BROWN COMPANY
SEED-EXTRACTING PLANT
Berlin, N. H. - U.S.A.

Seed Origin Record

Species American hemlock *Tsuga canadensis*
(Common Name) (Scientific)

Region of origin: N. New England.

Altitude: 200-1057 ft.

Year of collection:

Purity (by weight): 98 %

Germinative energy, Test not completed. % in _____ days

Shows cutting test of 60%
_____ ungerminated sound seed Date _____ 19_____

Plant to Univ. of Mich. Forest + Lams. Dept. Date 12/6 1929

Town Ann Arbor, Mich.

Date _____ By CP.

NORTHERN NEW ENGLAND 1929 SEED CROP

Please order by Lot Number

SPECIES	Approx. Mean Summer Temp.	Approx. Alt.	Purity %	Germinative Energy			Date of Test	Price per Lb.	Price per Oz.	Seed Lot No.
				%	In No. Da.	+% Sound Seed				
Abies balsamea (Balsam fir)	56°-60°F	643-1260	82.6	22	90	6.5	2/3/30	\$4.50	\$.35	23
	62°-64°F	12-100	77.5	12	45	7	1/8/30	4.00	.35	24
Picea glauca (White spruce)	60°-62°F	250-1260	90.5	60	25	14	2/8/30	7.00	.50	25
	62°-64°F	472-1165	87.5	42	30	16	2/8/30	7.00	.50	27
Picea mariana (Black spruce)	59°-60°F	866-1260	75.7	85	30	1.5	2/1/30	9.00	.70	30
Picea rubra (Red spruce)	58°-60°F	812-1260	83.7	86.5	30	6	1/9/30	7.50	.50	41
	60°-62°F	643-720	82.4	79	30	8	2/28/30	7.50	.50	42
	62°-64°F	75-219	84.5	80	15	7	2/26/30	7.50	.50	43
	62°-64°F	75-1175	83.5	86	30	4	3/1/30	7.50	.50	44
Pinus resinosa (Red pine)	58°-60°F	643-1057	89.3	81.5	20	3	1/4/30	14.00	1.00	31
	62°-64°F	632-1000	94.9	89.5	20	8	1/26/30	14.00	1.00	32
Pinus rigida (Pitch pine)	62°-64°F	Less 100		Tests	Incomplete			8.00	.50	39
	62°-64°F	1020-1260		"	"			8.00	.50	40
Pinus sylvestris (Scotch pine)	From Central Sweden		97	93	30	4	2/2/30	4.00	.30	51
Pinus strobus (White pine)	58°-60°F	643-1260	89	38	95	—	2/28/30	4.00	.35	28
	62°-64°F	75-291	93.3	43	45	—	2/23/30	4.00	.35	29
Acer saccharum (Rock maple)	60°-62°F	1002		Tests	Incomplete			2.00	.15	47
Carpinus caroliniana (Amc. Hornbeam)	60°-62°F	1002		"	"			2.00	.15	49
Fraxinus americana (White ash)	60°-62°F	1002		"	"			2.00	.15	46
Quercus rubra (Redoak)	60°-62°F	812		"	"			1.00	.10	45

NOTE: 1. Prices are F. O. B., Berlin, N. H., U. S. A.
 2. All orders are subject to seed supply or loss from unforeseen causes.
 3. Claims for loss or damage in transit must be made direct to delivery company.
 4. We do not guarantee in any way the productiveness of our seed.
 5. Prices are subject to change without notice.
 * Not certified as to origin.

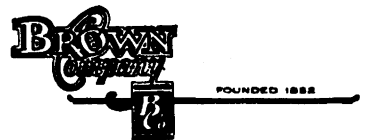
This Seed is Certified as to ORIGIN.

1930

PRICE LIST

1929 Seed Crop with origin
data — climatic data,
Purity and Germination tests

*



SEED EXTRACTING PLANT

BERLIN, N. H.

U. S. A.

This seed is not from the latest seed crop, but is certified as to origin, and has been well stored — see germination tests

Please order by Lot Number

SPECIES	Approx. Mean Summer Temp.	Approx. Altitude in feet	Purity %	Germinative Energy			Date of Test	Price per Lb.	Price per Oz.	Lot No.
				%	In No. Da.	+ % Sound Seed				
<i>Picea rubra</i> (Red spruce)	58°-60°F	1000-1500	90	66	30	9	2/26/30	\$6.00	\$.45	2
<i>Picea glauca</i> (White spruce)	63°-64°F	1000	83.6	60	30	12	2/26/30	6.00	.45	7
<i>Pinus strobus</i> (White Pine)	64°F	630	89.8	54	Tests	Incomplete		4.00	.30	1
	63°F	250	80.7	43	“	“		4.00	.30	5
	61°F	1000	77.3	46	“	“		4.00	.30	6
<i>Pinus sylvestris</i> (Scotch pine)	66°F	50	95.9	86	30	5	2/26/30	3.50	.25	15
	63°F	250	74.2	43	30	3.5	2/26/30	4.50	.30	10
<i>Thuja occidentalis</i> (N. White cedar)	62°F	900	76.2	24.5	30	2	2/26/30	4.50	.30	11-12
	60°F	1000	73.9	36.5	30	1.5	2/26/30	4.50	.30	13

* This seed is not certified as to origin, but was purchased from reliable dealers.

* <i>Pinus resinosa</i> (Red pine)	Dealers	—	85	86	20	5	2/16/30	10.00	.70	19
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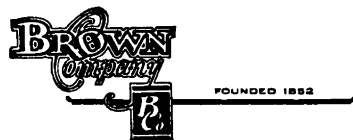
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 3. Claim for loss or damage in transit must be made direct to delivery company.
 4. We do not guarantee in any way the productiveness of our seed.
 5. Prices are subject to change without notice.

Know the Origin of Your Seed

1930

PRICE LIST

(1928 Crop)



SEED EXTRACTING PLANT

BERLIN, N. H.

U. S. A.

Tested Seed Pays

BROWN
Company

FOUNDED 1852



Portland, Maine

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PLEASE ADDRESS
BROWN COMPANY
FORESTRY DIVISION
BERLIN, N. H.

April 2, 1930

Mr. L. D. Lloyd
509 East Liberty St.
Ann Arbor, Mich.

Dear Mr. Lloyd:

There is considerable interest evidenced in regard to Tested and Certified Tree Seed. As pioneers in this industry we feel that the motive is correct and that the planter will benefit greatly by knowing in advance just what he is putting into the ground.

When you consider the many years required before trees develop from seed to maturity it seems only good business to plant seed that is clean, fertile and adapted to your climate and purpose.

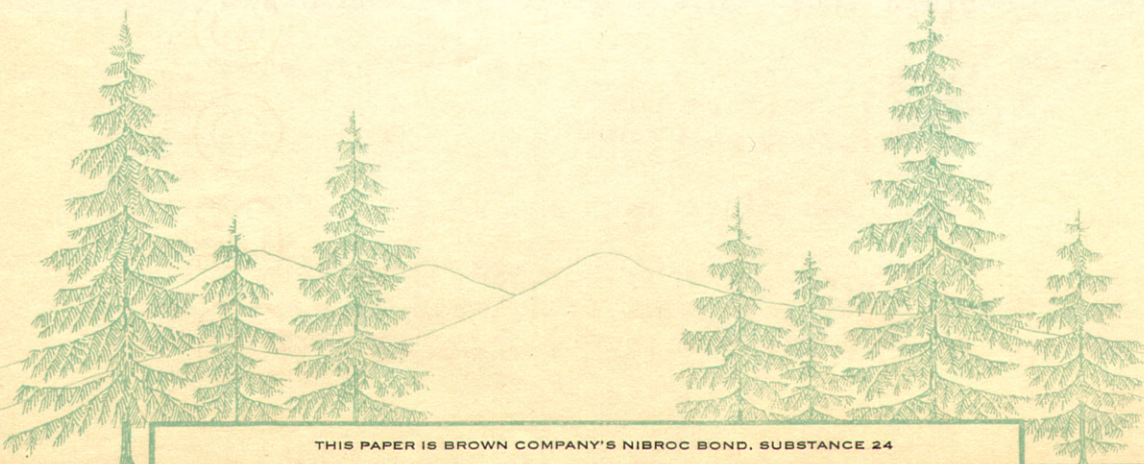
When you use seed of this kind, your yield will be greater. You are practically assured of success--and in advance.

Yours very truly,

Ray Gardner

BROWN COMPANY
Forestry Dept.

RG:G.





THE UNIVERSITY OF MICHIGAN

TO RENEW PHONE 764-1494

4

DATE DUE

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