# Improving Siberian Larch Seed Germination Rates

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**Summary**

The flotation technique was used to segregate non-viable from viable Siberian larch (*Larix Sibirica* Ledeb.) seeds using water as the floating media. The non-viable seeds floated while the viable ones sank.

Without stratification, the average percent germination of the floating and sunken seeds were 4.2% and 71.0% respectively. Percent germination of the sunken seeds increased from 37.2% before segregation to approximately 70.0% after segregation.

Cold stratification for two weeks at 5°C before germination showed no significant difference in the average percent germination between the stratified and unstratified seeds.

# Improving Siberian Larch Seed Germination Rates

## Introduction:

Demonstration plantings at the Syncrude land reclamation sites have shown that Siberian larch (*Larix Sibirica* Ledeb.) is well adapted to the Fort McMurray climate. It thrives on medium to good quality soil and its growth rate exceeds one meter per year. Plans are currently under way to grow and plant a substantial amount of larch seedlings amongst a variety of indigenous species for the restoration of mined lands.

Siberian larch is native to northeastern Russia and western Siberia. Therefore, seeds have to be imported and they must pass all Federal and Provincial inspections before being allowed into Canada. These seeds go through intensive quarantine processes. The testing and handling procedures inevitably affect the overall seed viability.

Syncrude purchased some Siberian larch seeds from F.W. Schumacher Co. Inc. in Sandwich, Massachusetts. These seeds originated from eastern USSR and they would have been quarantined prior to entering the United States. The Vendor's record showed a 62% germination rate (Appendix I). When the seeds were shipped to Canada, they were subjected to further quarantine. The initial germination test at Syncrude showed a seed viability of only 37.2%. This rate must be improved substantially before the seeds can be used for starting a crop.

## Purpose:

To improve Siberian larch seed germination rates by segregating the viable from the non-viable seeds using the flotation technique.

## Method:

A handful of seeds were placed in a beaker. Water was added to about three quarter full. A spoon was used to slightly agitate the seeds to moisten the seed coat. The seeds were retained in the beaker and let stand on the counter for approximately three hours before discarding the water. The seeds were then wrapped in paper towel, placed in a plastic bag and stored at room temperature for a day.

The next day, the seeds were transferred to a large pail, filled to three quarter full of water and gently agitated with a spoon. Segregation of the seeds occurred. The floating seeds were scooped out first, followed by the sunken seeds after the water had been discarded. The segregated seeds were placed in separate containers.

A germination test of the floating and sunken seeds was conducted.

Occasionally, some seeds, though viable, do not germinate even when all the factors necessary for germination such as chemical/physical environment, water, oxygen, absence of inhibitory chemicals, temperature, light quality and quantity are provided. In such a case, there exists within the seed itself some block(s) that must be removed or overcome before the germination process can proceed. The seed is said to be dormant.

Dormancy, in most temperate species, can be released (when imbibed) by chilling the seeds for several weeks at temperatures ranging from 1 - 10°C. Chilling of seeds to break dormancy is a long-standing practice in horticulture and forestry and is generally referred to as stratification, because the seeds are sometimes arranged in layers (i.e. stratified) in moist substrata.

Although Siberian larch rarely requires pre-chilling for germination to occur, it was suspected, because the exact seed source was unknown, that seed dormancy was causing the low germination rates.

As such, the remaining seeds were wrapped in paper towel, placed in plastic bags, moistened and stratified at 5°C for two weeks. Additional germination tests were conducted on the stratified seeds.

In each of the tests, the floating seeds were replicated twice while the sunken seeds were replicated four times.

**Results:**

When water was initially poured over the seeds, the seed coat repelled all the water that it came in contact with. The seed coat was moistened only after persistent agitating and soaking. Wrapping the seeds in moist paper towel and keeping them in plastic bags over-night ensured optimum moisture imbibition. Thus,

the viable seeds became denser than water and sank, leaving the non-viable seeds floating.

The germination test results are presented in Tables 1 and 2.

The germination rates of the unstratified and stratified floating seeds were 4.2% and 7.3% respectively. Most of the non-viable seeds were either small, cracked or perforated by seed boring insects.

Germination rates of the unstratified and stratified sunken seeds were 71.0% and 68.0% respectively. These rates were up substantially from the initial 37.2% before seed segregation.

There were no significant differences between the germination rates of unstratified and cold stratified seeds.

Table 1. Average percent germination of unstratified Siberian larch seeds after separation by floatation technique.

| DATE | NUMBER OF SEEDS GERMINATED (UNSTRATIFIED) | | | | | |
|---|---|---|---|---|---|---|
| | $F_1$ | $F_2$ | $S_1$ | $S_2$ | $S_3$ | $S_4$ |
| March 12 | - | - | - | - | - | - |
| March 17 | 0 | 0 | 56 | 52 | 68 | 79 |
| March 18 | 3 | 2 | 30 | 35 | 40 | 42 |
| March 19 | 4 | 4 | 10 | 23 | 20 | 20 |
| March 20 | 3 | 2 | 9 | 16 | 6 | 15 |
| March 23 | 3 | 0 | 14 | 11 | 10 | 11 |
| # Germinated | 13 | 8 | 119 | 137 | 144 | 167 |
| # Not Germinated | 221 | 259 | 40 | 62 | 64 | 68 |
| Total Seed Sown | 234 | 267 | 159 | 199 | 208 | 235 |
| % Germination | 5.5 | 3.0 | 74.8 | 68.8 | 69.2 | 71.0 |
| Average % Germination | 4.2 | | 71.0 | | | |

F = Seeds that floated
S = Seeds that sank

Table 2. Average percent germination of stratified Siberian larch seeds after separation by floatation technique.

| DATE | NUMBER OF SEEDS GERMINATED (STRATIFIED FOR 2 WEEKS) | | | | | |
|---|---|---|---|---|---|---|
| | $F_1$ | $F_2$ | $S_1$ | $S_2$ | $S_3$ | $S_4$ |
| March 26 | - | - | - | - | - | - |
| March 31 | 13 | 6 | 134 | 103 | 125 | 93 |
| April 1 | 6 | 3 | 45 | 48 | 38 | 35 |
| April 2 | 4 | 1 | 23 | 24 | 15 | 17 |
| April 6 | 4 | 2 | 20 | 13 | 16 | 14 |
| April 7 | 0 | 0 | 1 | 1 | 0 | 0 |
| # Germinated | 27 | 12 | 223 | 189 | 194 | 159 |
| # Not Germinated | 247 | 243 | 111 | 87 | 84 | 79 |
| Total Seed Sown | 274 | 255 | 334 | 276 | 278 | 238 |
| % Germination | 9.8 | 4.7 | 66.7 | 68.5 | 69.8 | 66.8 |
| Average % Germination | 7.3 | | 68.0 | | | |

F = Seeds that floated
S = Seeds that sank

**Discussion:**

Viable and non-viable Siberian larch seeds can be segregated by the flotation technique. Hence, for a seed lot with low viability, this technique can be applied and a crop can be grown from the portion with the higher percentage of viable seeds.

The germination rates could probably be further improved by repeating the flotation process several times to ensure that most of the non-viable seeds were segregated and discarded.

It is recommended, when implementing the floating process, that only a small portion of seeds be used at a time. This will provide more room for seed mobility (improve the chances for the seeds to either float or sink) so that they are not trapped in a clump that might nullify the process.

# Appendix

Cable Address:
TREE SEEDS—SANDWICH
Tel.—508-888-0659
Telex—990237
FAX—508-833-0322

# F. W. SCHUMACHER CO., INC.

*Horticulturists* *Tree Seeds*

SANDWICH, MA 02563-1023, U.S.A.

March 17, 1992

Syncrude Canada Ltd.
P.O. Bog 4009, M.D. 0078
Fort McMurray Alberta
Canada T9H 3L1

Dear Sir:

Please find the information you have requested in your 1/29/92 letter.

Seed: Larix siberica
Source: Eastern USSR
Storage Temperature: 34°F
Specific treatments to seed: None
Seed Lot: 1990
Germination: 62% no pre-chill

We trust this will be beneficial to you.

Yours truly,

F.W. SCHUMACHER CO., INC.

Donald H. Allen
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**Conditions of Use**

Fung, M.Y.P., 1992. Improving Siberian larch seed germination rates. Syncrude Canada Ltd., Corporate Environment, Fort McMurray, Alberta. Report 92-4. 6 pp. plus appendix.