

Abstract

On the Structure, Ripening and Germination of the Fruit of the Birch. By Elias Mork.

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Any fresh information concerning the character and behaviour of any of our native tree species is bound to be of interest. The following is a translation of the author's summary of research work into the structure, ripening and germination of Birch seed, carried out by him in Norway recently as part of the work of the Norwegian Forest Research Station.

1. What we foresters call Birch seed is a nut-fruit (or achene) which has a thin pericarp which is, however, very impervious to water. This consists of three cell layers. These cells are impregnated with fatty substances. On the outside of the achene casing there is, moreover, a cuticle which makes it extremely difficult for water to penetrate into the seed.

2. Air-dry Birch seeds can remain floating on water for several months. If the temperature of the water is sufficiently high (about 30° C.) the seed germinates quite normally as it lies on the surface of the water. Under such conditions the best germination results are obtained.

3. The investigation into time of ripening and temperature of ripening has shown that Birch seed in the lowlands in the south of Norway requires at least 300 growth-units in order to become ripe. Time of ripening is reckoned from the date of flowering. (The term "growth-unit" refers to an index of growth conditions devised by the author, which is based on the height-increment of Norway Spruce and the mean temperature of the 6 warmest hours of the day).

4. The catkins do not begin to fall off before a warmth effect of about 400 growth units has been obtained.

5. Well ripened Birch seed retains its germinative capacity when stored much better than poorly ripened seed. It can retain its germinative capacity much longer under unfavourable germination conditions than unripened seed. As the seedlings which are produced from well-ripened seed are moreover stronger, the plant per cent. is also higher. It is thus important that one should not gather Birch seed too early in the autumn.

6. In an extra warm summer the seed of lowland Birch may be very well ripened in the course of 2 months, in a moderately warm summer at least $2\frac{1}{2}$ months are required and in a relatively cold summer at least $3\frac{1}{2}$ months before the seed ripens.

7. A varying temperature during germination helps to bring about a higher germination per cent. than a constant one. This applies to both well and poorly ripened lowland seed.

8. The highest germination per cent. with well-ripened lowland seed is got with a varying temperature with a maximum temperature of 30-35° C.

9. At a constant temperature of 40° C. there is no germination. On the other hand well-ripened seed germinates very satisfactorily at a temperature varied from 17 to 40° C. Un-ripened seed seems to be more sensitive to such high temperatures.

10. The germination minimum for well-ripened lowland seed lies at about 20° C., but it is a very small percentage of the seed which can germinate at that temperature. At 25° C. about half of the viable seed germinates.

11. The minimum temperature for germination seems to lie about 5° C. lower for poorly ripened lowland seed.

12. For Birch seed from alpine forests a constant germination temperature seems to be unfavourable for the whole range of temperatures dealt with.

13. The minimum temperature for germination is the same as for well-ripened lowland seed, since germination first begins at 20° C.

14. The optimum temperature seems to be a little higher than for well-ripened lowland seed, since one finds a definite optimum at 17-35° C.

15. The range of optimum is more restricted than for lowland seed since half of the viable seed germinate within a temperature range of 17 to 30° C.

16. If Birch seed which spends the winter outside in the soil covering made as great demands in respect of germination temperature as air-dried and stored seed then it would very seldom be possible to get natural regeneration of Birch in our alpine forests, because the soil temperature is not high enough for the germination of the seeds. According to Helms and Jorgensen (1925), however, the seeds of our Birch species after spending the winter in the soil undergo changes such that they can germinate at lower temperatures than air-dried and stored seeds.

17. The reason why the Birch in the alpine forests usually reproduces itself vegetatively cannot be due to the poor ripening conditions for seed because in alpine forests well-ripened seeds can be found even in years in which the summer temperature lies 0.5° C. below normal.

18. Seeding plots in the form of 40 meter-wide strips from which are removed all bushes, which intercept much of the sunlight and rain reaching the soil, combined with burning, is the surest method of securing natural regeneration of Birch in alpine forests. The soil is warmed up more readily under such treatment and the Birch plants can germinate and develop earlier in the spring while the

moisture in the soil is relatively high. Such strips must be fenced against stock.

19. As the fruit of the Birch is a nutlet in which the seed itself lies well protected in a pericarp through which water penetrates with difficulty, in the nursery it is thus most natural to sow the seed in the autumn. In that way the seed should experience the best conditions for making use of the spring moisture.

20. Good results can also be obtained after spring sowing. The seedbed in that case should be watered so well before the seed is sown that the soil is completely saturated with water.

21. It can be presumed as a result of laboratory investigations that the best results are obtained when one sows under glass (cold frames or boxes covered with glass). In that way high air humidity and high temperatures are obtained. Under such conditions no covering of the seeds themselves is necessary.

22. If the seed is covered with sand or ashes, the covering layer must not be more than one millimeter.

23. The germination percentage of Birch seed seems to vary to some extent with the season of the year in such a way that it becomes somewhat higher in the spring. Germination goes on moreover a little more quickly at that time of the year (*cf. Schmidt, 1929*). The great variations with the season of the year which have at times been obtained in investigations made by the State Seed Control must to a considerable extent be due to the fact that the germination temperature during autumn and winter has been somewhat too low.

24. In germination tests of Birch seed, therefore, one should have a somewhat higher temperature than that which seems to be best suited for our cereal and forage plants.

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