Germination control of stratified sugar maple seeds

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A method for the control of germination of stratified sugar maple seeds based on the water content of the seeds prior to stratification has been developed and is described.

Attempts to direct-seed dormant sugar maple (*Acer saccharum* Marsh.) seeds (fruits) in the fall have met with little success. Failure has been attributed mainly to bird and rodent pilferage (von Althen, unpublished data). The use of nondormant, stratified seeds sown in the spring, though overcoming the pilferage problem, also creates difficulties. Sugar maple seeds have morphologically mature but dormant embryos which usually require several weeks of stratification under cold, moist conditions (Anon. 1948). The temperature requirement for germination (5°C, or 41°F) is similar to the optimum temperature for stratification (Yawney 1968, Webb and Dumbroff 1969). Once dormancy is removed by stratification, seeds cannot be held without germinating regardless of the suitability of weather and seedbed conditions. At present, seeding dates must be anticipated several weeks in advance and if conditions are not suitable for seeding considerable loss of pretreated seed results.

Previous work on sugar maple (Webb and Dumbroff 1969) demonstrated that the processes of stratification and germination can be separated by controlling the moisture content of the embryo. Sufficient water accumulated in the space between the testa and pericarp during an initial 24-hr soaking period to allow for the breaking of dormancy but not for germination. Further addition of water to the stratified seeds, however, allowed germination to take place.

A series of experiments was initiated to examine this problem in more detail and to evaluate the potential of this method for application to direct seeding of sugar maple.

Whole seeds obtained from the Ontario Ministry of Natural Resources, Angus, Ontario in 1969 were soaked in aerated distilled water at 22°C (71.6°F) for 24, 48 and 72 hr and the water content of a sample of 20 sound seeds from each of the soaking treatments was determined gravimetrically (Fig. 1).

A further 540 sound seeds from each treatment were then placed in dry plastic bags after surface moisture was blotted away, and set to stratify at 5°C (41°F) in the dark. Previous handling may have resulted in the seeds being less than fully dormant, since some germination occurred after 21 days of stratification, an interval slightly less than half the length of the normal stratification period for this species. Seeds were removed from treatment after 21 days and the percentage germination which occurred during the stratification period was recorded (Fig. 2). Considerable germination took place in the 48- and 72-hr soaking treatments. However, only 8.1% of the seeds in the 24-hr treatment germinated during the stratification period.

Nongerminated seeds from the soaking treatments were divided into 10 groups of 10 seeds and set to germinate in Petri dishes at 5°C (41°F).

Fig. 1. Moisture contents of whole fruits soaked in distilled water for various periods of time.

Fig. 2. Effect of soaking time on germination in stratification.

In five groups (replicates) the seeds were placed in a humid atmosphere, but not in contact with liquid. This humid atmosphere was obtained by placing the seeds on the dry bottom half of the Petri dish, the top of which contained moist filter paper. In the other five replicates the seeds were placed on Whatman No. 3 filter paper moistened with 7 ml (approximately 0.25 oz) of distilled water. In the humid atmosphere only 10-30% of the seeds germinated, whereas seeds in contact with liquid germinated to 75-85% after 20 days (Table 1).

Seeds soaked in distilled water for 24 h showed little germination during stratification (Fig. 2), but readily germinated when additional moisture was provided. Seeds treated in the above manner have been stored for several weeks at 5°C (41°F) in

TABLE 1. Effects of soaking time on germination of stratified seeds.

Atmosphere	Soaking time (h)	Percent germination
Humid	24	20
	48	10
	72	30
Wet	24	77
	48	85
	72	75

the stratified state without appreciable germination. This method appears useful for the treatment of sugar maple seeds prior to direct seeding. Presumably, the ability to hold sugar maple seeds in a condition of incipient germination for indeterminate periods of time will give added flexibility to the forest manager's regeneration operations as seedling can now be delayed until weather and seedbed conditions are favorable. However, further work is required to test this method on large seed lots and to overcome the problems involved in maintaining large quantities of seeds at the precise moisture and environmental conditions required to control germination of stratified seeds.

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