



Winter drying and spring frost damage

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Cover photo: In red pine plantations, winter drying often appears on exposed needles over the snow level.
(Photo : J. Morissette)



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INTRODUCTION

Much tree damage, especially to trees situated at the northern limit of their area of distribution, results from unfavorable weather conditions which periodically occur in Quebec. Ice and snow cause breakage of trunks and branches, and excessive cold, sudden temperature changes, and dryness repeatedly retard the growth of vegetation.

Winter drying and spring frost damage are frequently encountered phenomena that warrant a detailed description because their symptoms are difficult to identify. Winter drying causes the plant's most tender tissues to die following periods of warm weather in winter. It is most prevalent in the south of the province and the St. Lawrence valley; in northern Quebec and elevated locations, temperatures are low enough so that drying of plant tissues is less pronounced. In mountainous areas, damage can be concentrated at a given altitude or in locations exposed to warm winds.

When the active growth season has started, spring frosts can cause buds to freeze and thus contribute to retardation of tree growth. Both phenomena rarely lead to mortality unless adverse conditions are repeated over a number of consecutive years. However, their resistance to pathogens apt to cause cankers, blight, and sapwood rot is reduced after repeated exposure to frost.

VULNERABLE SPECIES

Since they keep their foliage all winter, conifers are more vulnerable to winter drying. As a rule, temperate-zone conifers are more sensitive to winter drying than those from boreal zones. In Quebec, analysis of figures for past years indicates that relative sensitivity is as follows (in decreasing order): red and Scots pine; white, Norway, and red spruce; jack and eastern

white pine; and cedar and balsam fir. Hemlock seems to be more resistant.

All species can be affected by bud freezing when late spring frosts occur because buds are formed in the fall. In Quebec, among deciduous species, ashes, basswoods, and poplars (in decreasing order) are more sensitive than maples, birches, and beeches. Among coniferous species, balsam fir and white and Norway spruce are severely damaged more often than are larches, pines, and black spruce (Figure 1).

For all species affected by either winter drying or spring frost damage, young seedlings are the most vulnerable because their undeveloped root systems do not as easily overcome water imbalances in the tissues.



Figure 1.
Bud freezing on balsam fir.
(Photo : C. Monnier)

CAUSES

In winter, a period of warm weather followed by days of extreme cold often causes a water imbalance which leads to winter drying. If this happens at the beginning of the winter (December), this may be even more harmful since at that time of year the tree has not yet reached its highest level of resistance to cold. During the warmer winter periods, if the relative humidity is low, the needles give off water to the ambient air. Since this evaporation cannot be offset by the root system in the still-frozen ground, the needles dry out, turn red, and fall. Solar radiation during winter, combined with lower temperatures, also generates photo-oxidation at the needle cell level.

Bud freezing can occur early in the spring, late in the fall, or even in winter when

the temperature drops suddenly. Quick changes in temperature are more damaging than extreme cold. A few days of premature warmth in the spring causes the tree to start growing too early, and the growing buds are highly vulnerable to frosts that follow since their acclimatization to frost is reduced. In deciduous species, the bud splits, especially if it does not have a waxy coating. Some leaf cells are damaged and development is stopped. In coniferous species, the bud splits, dies, and dries out. In the fall, some trees continue to grow actively after others have stopped, particularly if they were generously fertilized with nitrogen too late in the summer. These trees are vulnerable to early fall frosts. The same symptoms as occur in spring damage may be present, but they are generally less severe.

SYMPTOMS

The overall result of these unfavorable weather conditions is dead shoots or branches in deciduous trees and reddened or browning needles and dead shoots in coniferous trees.

The symptoms of winter drying appear only on the exposed portions of trees and are noticeable only in springtime. Suddenly, the very dry, brittle foliage turns bright red. Later, the dried out needles turn brown and fall, and on the trees that manage to survive, new foliage appears, sometimes in tufts at the ends of new shoots or from adventive buds. This burning of the needles can be partial or total, depending on the severity of the damage. If partial damage occurs, more damage is seen on parts of the foliage exposed to sun or on the sites most exposed to sun. The parts of the foliage covered by snow are generally not subject to winter drying damage (Cover photo).

Spring frosts lead to coloration of the new tender foliage in deciduous species. If the foliage is already open, severe frost causes withering followed by the browning and death of leaves and small branches. Lighter frost can cause holing of the leaves (Figure 2). The edges of the holes stay green and show no

marks such as those made by insects; neither do they turn brown as they would in the case of spots caused by pathogens. In the coniferous species, needles turn brown, branch tips bend and may die.

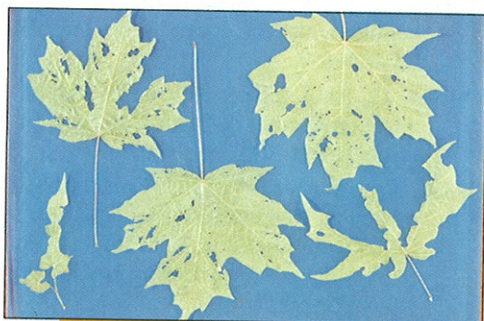


Figure 2.

On hardwoods, late spring frost results in holes of various sizes on leaves as an expression of more or less severe damage.

(Photo : A. Lavallée)

PREVENTION

Damage caused by winter drying or bud freezing cannot be completely avoided. However, trees planted in aerated, well-drained, fertile soil are more resistant to unfavorable weather conditions. Soils with low water retention capability should be enriched and their texture improved before seedlings are transplanted. In plantations, preference should be given to the best acclimatized species of local origin whenever possible. Selection of late-budding species

reduces the risk of damage on sites exposed to spring frosts. Give roots a chance to take hold, either by planting early in the fall or by waiting until the next spring. Afterwards, proper growth must be maintained.

Ornamental trees should not be planted in locations exposed to strong winds. Severe trimming of branches at the end of the summer also delays acclimatization to cold. If they are planted in dry soil, or if June and August have been dry months, care should be taken to ensure that they receive adequate moisture in the fall before the ground freezes. We recommend providing small ornamental trees with

shade and shelter from the wind in the fall by placing snow fencing, jute, or some other suitable material around them to prevent burning, photo-oxidation, and drying of foliage during the winter. It is a good idea to place leaves, sphagnum peat moss, or straw at the bases of young conifers to prevent deep freezing of the soil and the roots, especially where snow cover is slight. If damage ap-

pears, we recommend pruning of dead branches and an application of organic or chemical fertilizer (14-5-6 at 40g/m²) in mid-June to improve plant vigor. Dead shoots should be pruned lower on the branch where the tissue is still green, above a living bud, to accelerate scarring and prevent penetration of pathogenic fungi.

REFERENCES

- Aussenac, G.** 1970. Gelées tardives et jeunes peuplements forestiers. *Rev. For. Fr.* 22:463-469.
- Oquist, G.** 1983. Effect of low temperature on photosynthesis. *Plant Cell, and Environ.* 6:281-300.
- Sakai, A.; Larcher, W.** 1987. Frost survival of plants. Responses and adaptation to freezing stress. *Ecological studies*. Vol. 62, Springer-Verlag, Berlin, Heidelberg, New York. 321 p.
- Sinclair, W.A.; Lyon, H.H.; Johnson, W.T.** 1987. Diseases of trees and shrubs. Cornell Univ. Press, Ithaca and London. 574 p.
- Skelly, J.M.** 1968. Winter drying. Forest tree diseases of Virginia, MR-FTB-3, VA. Polytech. Inst. Ext. Div. Control Serv. 130.

