

1973

Frost Crack in Norway Maple, *Acer platanoides*

D. W. French

University of Minnesota, St. Paul

J. S. Fuhs

University of Minnesota, St. Paul

Follow this and additional works at: <https://digitalcommons.morris.umn.edu/jmas>



Part of the [Plant Sciences Commons](#)

Recommended Citation

French, D. W., & Fuhs, J. S. (1973). Frost Crack in Norway Maple, *Acer platanoides*. *Journal of the Minnesota Academy of Science*, Vol. 39 No. 1, 3-4.

Retrieved from <https://digitalcommons.morris.umn.edu/jmas/vol39/iss1/3>

This Article is brought to you for free and open access by the Journals at University of Minnesota Morris Digital Well. It has been accepted for inclusion in Journal of the Minnesota Academy of Science by an authorized editor of University of Minnesota Morris Digital Well. For more information, please contact skulann@morris.umn.edu.

Frost crack in Norway maple, *Acer platanoides*

D. W. French* and J. S. Fuhs**

ABSTRACT — Frost cracks developed on from 0 — 29 per cent of the Norway maples in one nursery near St. Paul, Minnesota, in late November, 1970. The trees affected averaged 0.9 — 1.3 inches in diameter and, of the eight varieties in the nursery, Jade Glen was the most susceptible and Emerald Queen the most resistant. More of the trees on a northeast facing slope were affected than those on a flat knoll. After 2 years the majority of the cracks were closed, except in the Crimson King variety, in which case 86 per cent were still open. Wood rotting fungi, especially *Schizophyllum commune*, were recovered from 100 per cent of the trees.

During the fall of 1970 in a nursery near St. Paul, Minnesota, an unusually large number of Norway maples, *Acer platanoides* L., sustained frost cracks. These frost cracks were first observed on November 24, 1970, (Figure 1 and 2). To determine incidence and occurrence in relation to various aspects of site, four blocks of trees were surveyed by the authors. One block was on a slope facing northwest to west-northwest; the second block was on a flat knoll bordered by a road on the east and an open field on the north; the third block was located on a slope facing southwest to west; and the fourth block was on a south-facing slope. Each of the four blocks contained either four or five varieties of Norway maple, but not necessarily all the same varieties. One block had been planted in 1968, two in 1969, and one in 1970. The maples planted in 1968 averaged 1.3 inches in diameter, and those planted in 1969 averaged 0.9 inch in diameter at 4.5 feet above ground. At the time of planting the root stocks were 3 years old with a 1-year-old scion, except for the non-grafted trees. The soils are a Carrington loam or silt loam, and the nursery is almost free of weeds.

Random selection for survey

One randomly selected row of 35 to 509 trees of each variety was surveyed in each of the four blocks. The facing of the frost crack, its height above ground, and whether or not the crack extended completely through the stem were recorded as well as the diameter of the tree.

Weather data from the Minneapolis-St. Paul International Airport (13 miles west of the nursery) were compiled on a day by day basis for October through December, 1970, including cardinal temperatures, weather type, precipitation (water equivalent) and average wind speed with direction.

Incidence and distribution of cracks

The incidence of trees with frost cracks ranged from 0 to 29.2 per cent (Table 1). The maximum incidence, averaging 19.5 per cent for five varieties, occurred in block 1 on the northwest facing slope, in trees planted in 1969. The average incidence of frost crack in the older trees, in block 3, was 5.7 per cent, and no frost cracks were detected in the younger trees in block 4. More frost cracks occurred in block 1 on the northwest facing slope than in block 2 on the flat knoll, 19.5 per cent as compared with 11.6 per cent. Among the three varieties common to blocks 1 and 2, the average incidence was 20.2 per cent for the trees on the northwest facing slope

and 9.9 per cent for those on the flat knoll. The Emerald Queen variety tended to be resistant, with frost cracks present on 2.7 — 7.0 per cent of the trees. The greatest range in incidence between sites was noted on the non-grafted trees, from 7.1 — 29.2 per cent. Jade Glen was susceptible, with frost cracks on 15.7 — 28.8 per cent of the trees. Jade Glen had more multiple cracks than any of the other varieties, and of the ten cracks which went completely through the tree six were in the Jade Glen variety.

The lower end of the frost cracks was generally from 7-14 inches above the ground. There was no predominant facing of the cracks, although in the Jade Glen variety on the southwest slope most of them faced south to west.

During the last 9 days of October, temperatures averaged 50 F and precipitation 1.56 inches. In November, temperatures were in the 30's; precipitation increased and by November 19, totaled 3.45 inches for those 19 days. On November 14 and 15 the temperatures ranged from a high of 33 F and 36 F to a low of 19 F and 17 F, respectively, and on November 22, 23 and 24 the maximum temperatures were 36, 15, and 28 F and the minimums 5, 5 and 3 F, respectively. The average wind speed for November 22-24 was 18.5 mph with a maximum average velocity of 37 mph. The wind on November 22 and 23 was from the northwest and then from the south on the 24th. On November 25, the temperature ranged from a low of 27 F to a high of 42 F. The ground was not frozen in November.

The varieties varied in their rates of recovery. Two years after the original injury, the average length of the wounds in the Crimson King variety was 1.8 times longer than when originally measured, while for four other varieties (Schwedler, Jade Glen, Non-grafted, and Emerald Queen) the length increased 1.2 to 1.4 times the original. After 2 years, 86 per cent of the frost cracks in the Crimson King variety were still open and 14 per cent had just closed. In contrast, from 67 to 100 per cent of the frost cracks in the other varieties had closed.

When pieces of wood bordering 12 frost cracks from randomly selected trees were plated on agar in December 1970, shortly after the damage had occurred, wood rotting fungi were recovered from 22 of the 24 samples (taken from upper and lower end of each frost crack). Wood rotting fungi were recovered from all 12 trees. *Schizophyllum commune* Fr. was the primary species. Six months later, the following spring, wood rotting fungi were recovered from less than 12% of the pieces cultured.

Time and conditions of frost cracking

It is apparent that the conditions were favorable for frost cracking in the vicinity of St. Paul, Minnesota, during the

*D. W. FRENCH is Professor of Plant Pathology at the University of Minnesota St. Paul campus and Associate Director of the Lake Itasca Biological stations.

**J. S. FUHS is a research assistant at the University of Minnesota St. Paul campus working on forestry development problems.



FIG. 1. A frost crack on a tree shortly after it had occurred in Nov., 1970.

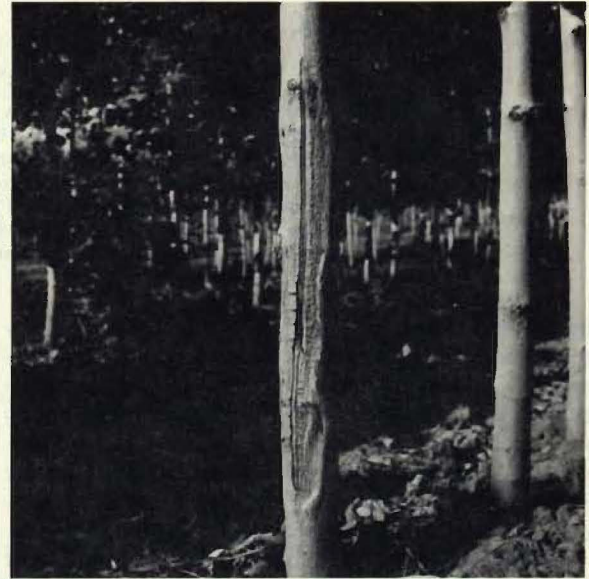


FIG. 2. A frost crack 22 months after it had occurred.

period November 22-24, 1970, when almost 30 per cent of some varieties of Norway maple were damaged. On this occasion a northwest facing slope was more favorable for frost cracking than a site on a flat knoll. Trees that had been

TABLE 1. Average percentages of trees with frost cracks and total trees surveyed in each of four blocks of trees representing various exposures.

| | Block number, exposure, and year trees were planted | | | |
|---------------|---|-------------------------------|---------------------------------------|--------------------------------|
| | Block 1 ^a Northwest slope 1969 | Block 2 Flat Knoll 1969 | Block 3 Southwest slope 1968 | Block 4 South slope 1970 |
| | % Total ^b | % Total | % Total | % Total |
| Nongrafted | 29.2 417 | 7.1 255 | - | 0 80 |
| Emerald Queen | 2.7 295 | 7.0 291 | 0 256 | 0 127 |
| Jade Glen | 28.8 257 | 15.7 256 | 17.0 206 | 0 98 |
| Schwedlers | 15.6 590 | - | 0 35 | 0 115 |
| Columnar | 21.4 205 | - | 6.7 75 | - |
| Cleveland | - | - | 4.8 42 | - |
| Royal Red | - | - | - | 0 73 |
| Crimson King | - | 16.4 104 | - | - |
| Average | 19.5 | 11.6 | 5.7 | 0 |

^a Blocks 1 and 2 contained trees planted in 1969, the third block, trees planted in 1968, and the fourth block trees planted in 1970.

^b Total number of trees surveyed — this is the number of trees of that variety in the row which was randomly selected. Hyphens indicate that variety was not present in the block.

planted in 1969 and were 3 years old were more susceptible to frost crack than trees 2 or 4 years old. The average diameter, of 0.9 inch, for the 3-year-old trees is the size that was most vulnerable to frost cracking.

As far as could be determined the frost cracks occurred during a period when the temperature reached lows of 3-5 F following relatively mild weather. The amount of frost cracking might have been increased as a result of wind velocities which reached a maximum average of 37 mph.

The incidence of frost crack varied with variety. Apparently Jade Glen was the most susceptible, and Emerald Queen the most resistant. Exact comparisons were not possible because all varieties were not present in each block. In spite of the incomplete samples however, it may be assumed that the nongrafted Norway maples were susceptible, as were the Columnar, Schwedler, and Crimson King varieties.

No conclusions could be drawn as to the facing of the cracks, although in the Jade Glen variety on a southwest slope the majority of cracks faced south to west. The most susceptible portion of the stem seems to be near the base, less than 2 ft. above the ground.

After 2 years the majority of the frost cracks had closed in all the varieties except Crimson King, in which 86 per cent were still open. Wood rotting fungi, especially *S. commune*, were recovered from all 12 trees sampled. Although fewer wood rotting were recovered 6 months after the initial isolations we assume that they were still present.