FROST DAMAGE

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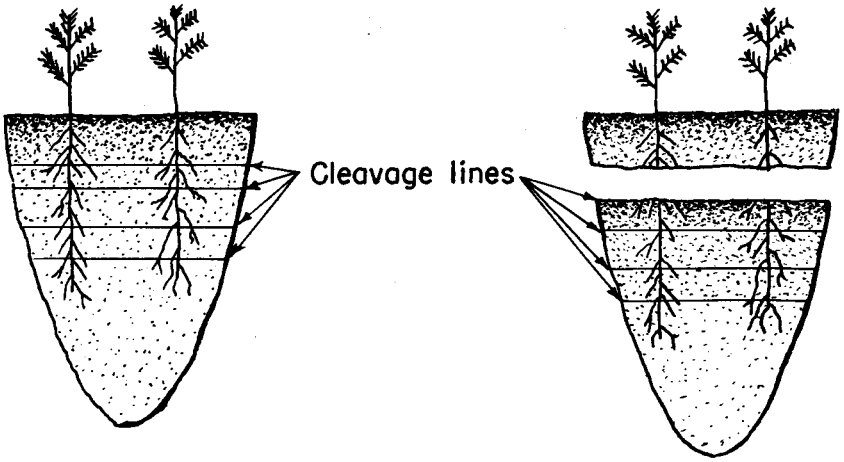
In midsummer of 1957 severe losses in beds of two year old balsam fir and white spruce were noted despite adequate irrigation. At first the loss was attributed to insects, because the roots were cut off at a depth of approximately 1 1/2 inches but no one could identify the insect by the damage, and no culprits could be found in the soil. So many trees were dying that the insect population would have had to be tremendous and operating at a constant depth. Mr. Charles Clement, U. S. F. S. Forest Tree Nursery Specialist, on his visit to the nursery, thought we should do some investigating by digging up samples of the soil. The soil is a light loamy sand.

Several samples were dug to the depth of the shovel and removed with care so as to disturb the soil as little as possible. Definite cleavage lines could be seen in the soil profile running horizontally, and at the depth of the most pronounced cleavage line, about 1 1/2 inches, the seedling roots had been snapped off (fig. 1). It was possible to separate the layers of soil along the cleavage lines.



This phenomenon can be explained as follows: A severe cold spell with insufficient snow or mulch freezes the soil to a depth dependent upon the degree and duration of the cold spell. Then, with snow absent, a warm spell occurs and the top inch or so of soil thaws. Sometimes the thaw is caused by a rain, but at any rate a layer of water collects on top of the unthawed soil. During a subsequent cold snap the layer of water and the thawed soil freeze, expand, and push the small seedlings up with them. Inasmuch as the lower roots are held fast, the expansion of upper layer stretches the small roots until they break. In beds where the trees were large enough to withstand the stretching without breaking, subsequent thawing of the soil produced trees with a corkscrew or pigtail stem. (Fig. 2)

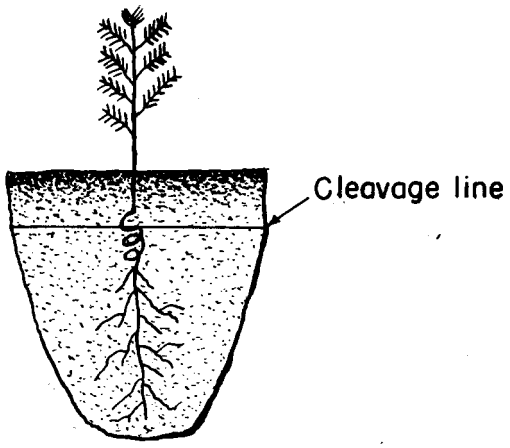


Figure 2

It might be noted that there were several definite cleavage layers indicating more than one period of frost thawing and freezing.

The frozen soil differed markedly from the soil at deeper levels that had not been frozen. Depth of frost penetration could be discerned with little trouble. The frozen soil was more compact and less friable, less crumbly than unfrozen soil. Its structure seemed to have broken down.

Here in New Hampshire we believe such occurrences to be a freak of nature, for there is usually sufficient snow on the ground but the winter of 1956-1957 was unusual in that it experienced a period of freezing and thawing with no snow on the ground. It is believed that such frost action can be prevented by using sufficient mulch. It is also felt that increasing the amount of organic matter in the soil should help control break down of soil structure and therefore reduce the damage.