the aid of a magnifying glass. They are so delicate that they are easily destroyed by bruising or by slight exposure to the sun or wind. In the ordinary practice of framplanting, the greater part of the root-hairs are broken off and destroyed, but if the soil conditions are favorable they are rapidly reproduced.

## THE FUNCTIONS OF ROOTS.

One of the self-evident functions of roots is to anchor or support the tree in the ground.  $\sum$  this end the development of the roots of a tree correspond very closely with that of the top above ground. If the top is low and spreading, the roots will be shallow and spreading. If the top is high, exposing it to strong winds, the roots naturally grow deeper to anchor it more firmly in the soil.

Another function of the roots is to dissolve inorganic elements in the soil, making them available as plant food. This solvent power of the roots is due to the acid juice contained in the root-hairs, which acts chemically upon the mineral plant food in the soil, gradually dissolving it so that it may enter into the growth of the tree.

In addition to rendering plant food available, the roots absorb soil moisture containing this plant food in solution. The absorption of soil moisture takes place mostly in the root-hairs and small rootlets; the older roots, covered with a hard thick bark absorb very little, if any at all.

From this brief study of the nature and

functions of roots, it will be seen that while the older and larger roots may be most important in anchoring the tree in the soil, yet the newer and smaller roots and root-hairs, which are usually most remote from the trunk, are most attractive in nourishing the tree.

## PRACTICAL CONCLUSIONS.

In this connection a few practical points may be emphasized, which should be remembered in the management of trees singly or in orchards :

1. In transplanting young trees, the better the root system is preserved uninjured, and the more favorable the soil conditions for growth, the more readily the root-hairs are reproduced, and the roots establish themselves in their new position.

2. In watering newly planted, or even established trees, if the water is to be of any use, it must be applied so that it will reach the smallest roots.

3. Whenever a fertilizer of any kind is applied for the benefit of the tree, it should not be banked around the tree trunk as is often done, but should be spread evenly over the ground out as far as the roots extend. The rain water passing through the soil will gradually wash it down to where the root-hairs can get at it.

4. As water is the vehicle by which all plant food is taken in by the roots, it is important that the soil be so managed as to conserve soil moisture sufficient to supply the needs of the tree.

O. A. C., Guelph. PROF. A. H. HUTT.

A FINE RECORD.—Mr. W. A. McKinnon, Chief of the Fruit Division, Department of Agriculture, reports as follows :

"The 'Marina,' on her last trip, carried a lot of Bartlett and other pears, and they were reported landed in good condition. The thermograph record shows that the fruit was carried at an average temperature of 39 degrees, with a variation of not more than two degrees during eleven days' run. Mr. Robt. Logan, Chief Engineer of the 'Marina," deserves the gratitude of the fruit trade for this performance, which also reflects great credit on the Donaldson Line."