

DO AVOCADO ROOTS DEVELOP ROOT-HAIRS?

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In the great majority of vascular plants, the absorbing area of the roots is tremendously increased by the development of root-hairs immediately back of the area of elongation near the root tip. For many years it was believed that the roots of citrus trees do not develop root-hairs, but recent investigations have shown this belief to be erroneous, although root-hairs develop more abundantly under certain conditions than under others and may sometimes fail to develop at all.

No report could be found in the literature on the presence or absence of root-hairs in the avocado. Writers who had occasion to refer to avocado roots usually assumed that root-hairs were present, as in nearly all other trees, but no one actually reported any study or observation on the matter. For this reason the present study was undertaken. We have failed to find any root-hair development in the avocado, either under natural or under artificial environmental conditions for root growth.

It is well known that the abundance of root-hair development on plant roots decreases markedly as the medium in which they are growing becomes higher in water content. Many plants which develop root-hairs in soil fail to develop them when grown in water. On the other hand, saturated air seems to be a very favorable environment for development of root-hairs. Good aeration seems to be a requisite for good root-hair formation.

In the series of tests here reported, avocado roots were allowed to develop in five different environments: 1) water, 2) humid air, 3) sand, 4) peat moss, and 5) sand-peat mixture (equal parts). The humid air condition was provided by keeping the liquid level several inches below the seeds, so that the upper portion of the root system was in humid air, the lower portion in water.

Seeds were first germinated in a mixture of sand and peat, and when the taproot was about 5 inches long, each seedling was transferred to a 2-liter jar containing the medium. Seedlings grown in water and in moist air were supported by placing the seed on a piece of board on top of the jar, the roots going down through a hole slightly smaller than the seed diameter. Seedlings grown in sand, peat and a sand-peat mixture were transplanted to the medium with the seed resting on the surface. Glass museum jars were used for the fluid media, and glazed crocks with a drainage hole for the solid media.

A duplicate set of cultures was run in which a nutrient solution was supplied instead of tap water. This solution consisted of 6.47 g. superphosphate (20%) and 10.23 g. nitrate of potash dissolved in 400 cc. of water. Of this stock solution, 3 cc. was added every two weeks to the various cultures, except that only 1 1/2 cc. was supplied the moist-air jar because it contained only half the amount of water which was in the water jar. It was necessary to cover all the glass jars with black paper in order to prevent growth of

algae.

Examination of the roots was made at biweekly intervals for five months, removing small portions from the solid media and examining roots in the fluid media through the walls of the glass jars. No root-hairs were found in any case, using a binocular microscope magnifying 8 diameters. As a further test, a root tip was placed between glass slides under the pressure of rubber bands and allowed to grow in the peat medium thus for three weeks. It has been reported that pressure of this sort is one factor in inducing root-hair development, but none developed in this test, although the root tip continued to grow vigorously. Indeed, root growth was good under all the test conditions here employed.

Roots were also examined of trees growing in tubs in the greenhouse in a sandy loam soil, and of trees of large size growing out-of-doors in a Norfolk fine sand. Repeated examination failed to discover any root-hairs on these root tips.

The avocado forms in soil a much branched system of secondary roots, each rootlet having a white tip about 2 mm. long. A brown periderm covers the portions of the rootlet older than this white tip. It is evident that absorption of water and nutrients is dependent on the ramification of this root system so as to provide a maximum amount of these absorbing tips, since no root-hair system is developed to increase absorbing area in the usual way. Figure 1 shows a portion of the root system developed in peat where the porous nature of the medium gives ideal conditions for root-hair development. Several tips are clearly visible, magnified about 3 times, but nothing resembling root hairs.

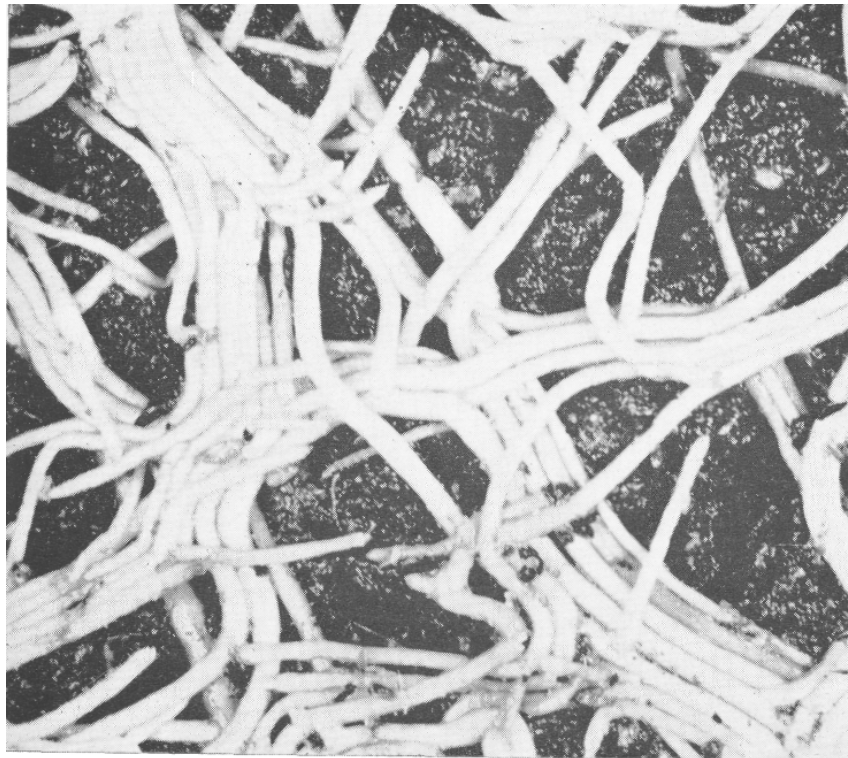


Fig. 1. Root Tips of Avocado Growing in Peat. (Magnification 3x.)