AN IMPROVED SEEDLING ROOT-VOLUME MEASURING DEVICE

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A seedling root-volume measuring device has been exceedingly useful in our Forest Service research with sugar maple. The device, described by Austin,[2] consists of a large plastic cylinder fitted with a screwcap on one end and a small calibrated tube on the other. When the device is partially filled with water, seedling roots are inserted into the cylinder, and the volume of water displaced is then read from the calibrated tube.

However, we encountered several problems with the first volume-measuring device that we con

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Figure 1.—The slide-in cap fitted with an O-ring and tire valve provides a tight seal and eliminates air compression and displacement error encountered with the screw cap.

2 Austin, K. Two devices for speeding morphological assessment of nursery stock. Tree Planters' Notes 71, p. 29-31, 1965.

strutted. Regardless of the type of cap liner we used, the compression of the air trapped in the cylinder prevented a tight seal with a screwcap. Also, if the cap was not tightened to the same point each time, errors resulted from differences in displacement. Another problem-the greatest source of error encountered-was that some air bubbles remained trapped in the large cylinder when the device was inverted for reading. These bubbles tended to ding to the flat surface of the cylinder just below the reading column and vigorous shaking did not always completely eliminate them.

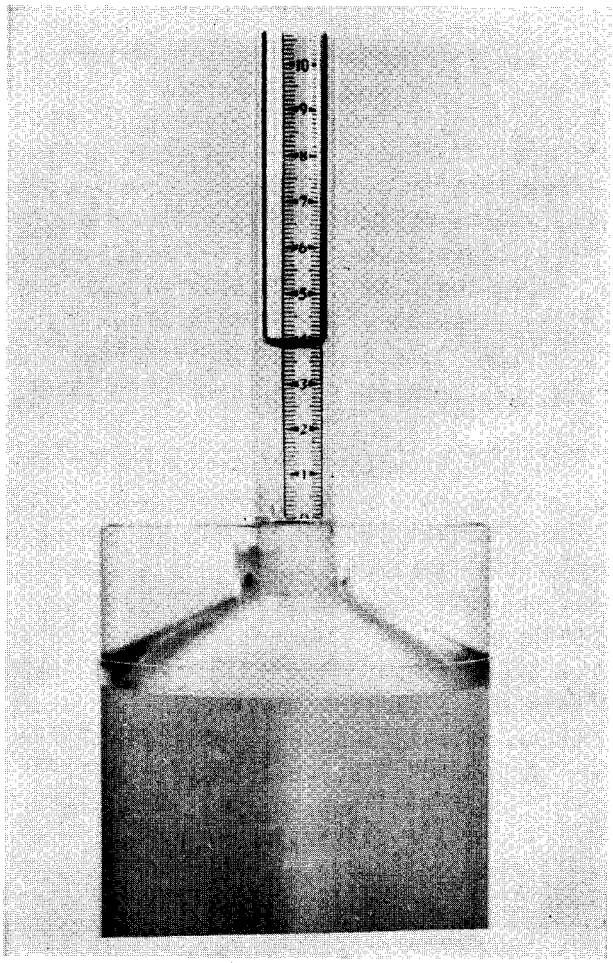

Figure 2.—The cone-shaped section below the small tube prevents air bubbles from being trapped in the large cylinder.

By modifying Austin's design slightly, we reduced the variation in readings to the acceptable limits of our experiments. The problems encountered with the screwcap were resolved by using a slide-in type of cap fitted with an 0-ring and a common tire valve (fig. 1). The 0-ring, held in place by a shallow groove, provided a highly effective seal. By depressing the valve stem as the cap was inserted, the compressed air in the cylinder was allowed to escape. Similarly, when the cap was removed, we again depressed the valve to allow air to enter the cylinder.

Efforts to eliminate air bubbles in the large cylinder by applying a silicone spray to the inner surface and by adding a wetting agent to the water were only partially successful. Therefore, we modified the joint between the large cylinder and the small tube to provide an unimpeded flow of air bubbles from one element to the other. This was done with a $11/_2$-inch thick piece of plexiglas that had been machined on the inside to the shape of a cone (fig. 2). We also noted that the continuous streaming of minute air bubbles that occurred each time the device was turned over could almost be eliminated by using a 10-percent alcohol-water mixture.

More precise measurements were also obtained by using a reference point in the small column instead of the large column.