Experience has shown that the structures of the cell are remarkably well preserved. The finer details, such as mitochondria and cytoplasmic fibrillae, are not destroyed. Lignified tissues retain a soft, waxy texture and may be readily sectioned.

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AUTOMATIC FLOW-METER FOR DRIP SOLUTIONS IN PLANT NUTRITIONAL STUDIES

VARIOUS means have been utilized for providing a constant nutrient flow to plants growing in pot cultures. It has been realized that definite conclusions from such studies need to be based on several pots in each series. The drip-nutrient method, when used for several large series, necessitates a system which is simple in construction and requiring a minimum of time for refilling the nutrient reservoirs. Bearing these facts in mind, an apparatus embodying an apparently new principle of construction was devised where twelve eight-inch pot cultures were used in a single series. As a matter of fact, a larger number of pots may be used.

Fig. 1 illustrates the salient points of the system.

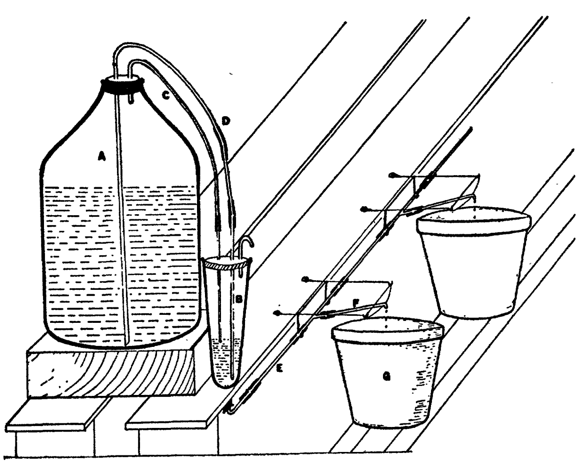

FIG. 1

The nutrient chamber (A) is a five-gallon bottle calibrated and wrapped in paper to exclude light. A narrow slit in the paper exposes the liter calibration marks. A siphon tube (D) of 12 mm bore is for delivery of the fluid into chamber B. The flow-meter (B) was constructed in order to provide a constant flow from chamber A regardless of the height of the liquid in it. Chamber B is a soil percolater of 300 cc capacity. It is provided with a 12 mm bore tube for connection with the siphon tube (D), a 4 mm bore tube for connection with the air line (C) and a small curved glass tube for the entrance of air. Experimentation showed that glass tubing of these sizes provide the most efficient operation. The air tube (C) may be of either glass or rubber tubing.

As a flow-meter, chamber B operates automatically to control the rate of flow from chamber A to the feed line (E). Explanation of the automatic action of the chamber is as follows: as the level of the liquid rises in chamber B, the flow ceases from A when the tip of the air tube (C) becomes submerged. The escape of the solution into the main feed line (E), also of 4 mm bore, permits air to enter chamber A through tube C and flow is resumed until again automatically stopped. The nutrient solution reaches the pots through capillary tube F. This tube is of 5 mm bore and is slightly bent at the tip, where it is suspended by a wire support.

The rate of drip into the pot (G) may be twice controlled, namely, by changing the elevation of the tip of tube F, and by raising or lowering the air tube (C) in the flow-meter (B). The latter controls the "head" of the fluid held in this chamber, thus directly regulating the pressure on the feed line (E). In this conjunction, as the nutrient requirements of the plants increase with growth, one may by simply raising the height of tube C in flow-meter B permit a faster drip into the cultures.

Two points of construction to be borne in mind are that the base of the flow-meter (B) should be at least four inches lower than that of chamber A, and all connections in the rubber stopper in A be airtight. A cork stopper may be used in chamber B.

This system in comparison with other drip-culture apparatus has the following advantages: no shifting of adjustments is encountered while refilling the nutrient supply chamber; it provides a uniform flow of the nutrient solution; it permits the use of double-deck benches, thus saving greenhouse space; it reduces the labor of maintenance to a minimum; it is easy to clean, and it is cheap in construction.

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