BRIEF PAPERS

GLASS POTOMETERS FOR STUDIES OF ABSORPTION AND EXUDATION BY EXCISED ROOTS

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(WITH ONE FIGURE)

Two types of potometers which have been found very useful in studies on roots are shown in figure 1. Type I is used for studies of exudation only, type II for absorption and exudation.

The dimensions of a potometer of either type are based upon such factors as: the diameter and length of the root selected for study; capacity of the vessel, A, which should be sufficient to provide an adequate oxygen supply when gases are not passed through the solution surrounding the root; and by the type of apparatus in which the potometer is placed.

Each potometer is filled or drained through the tube, N, by using a small pipette with a rubber bulb and a short piece of rubber tubing to fit over the external orifice of N. This pipette is used to stir the solution when desired. In type I, tube N is also used to pass gases or solutions continuously into the vessel and out through the side arm, P. The external orifices of N and P are closed with minute glass stoppers or by clamping rubber tubing passed over the projecting side arms.

A root with no lateral branches is threaded through the respective holes, R, S, and T of each potometer. In type I the hole, S, extends through the glass cover (which in some potometers is attached with vaseline to permit easy removal); in type II, S is the external aperture of the neck. The diameters of R and S correspond in general to the diameters of the selected roots; they are a fraction greater to permit threading without injury.

Threading a root through the aperture is conveniently done by holding the plant and excising the root at the upper level of R after threading. Excision is always made with a sharp razor blade through a drop of water surrounding the root at R. The excised root is held in place by the walls of the hole, T, bored through a small rod attached to the vessel wall.

The root is placed so that its cut surface is just below the top edge of the opening R. A small drop of water over the cut edge provides a meniscus as a reference point at the beginning of an experiment. Exudate flows from the cut surface into the “exudation” tube, E, attached to the bent glass rod, B, which is the potometer support. When desirable the opening R is covered with a minute piece of cover glass.

An “absorption” tube, D, attached to the neck of a potometer vessel of type II is the essential difference between the two potometer types. This is filled or drained by passing fluid through tube N.

Determination of the rates of absorption or exudation is based upon observation of the excursions of the terminal menisci in the “absorption” or
"exudation" tubes. The diameter of the bore of these tubes, as used in studies on young onion roots, is usually 1 mm. or less, and a horizontal microscope fitted with a filar micrometer eye piece is used to make readings. If growth occurs in excised roots it is necessary to make corrections for the excursions of the meniscus in the "absorption" tube D (type II).

Potometers of both types are used for studies of straight roots without laterals; potometers of type II are also used to study exudation of excised root systems. The glass cover is removed to permit ready insertion of the root system into the vessel A; it is replaced by fitting it over the cut end of the main root. The cut end is inserted into R from below; the exudation tube E of type I is not placed in as close proximity to S as in the illustration thus permitting easy insertion from below.

In the studies on onion roots, potometers are placed within individual doubled walled metal chambers, rectangular in shape, and are supported by fastening the bent arm of B in a clamp attached to a chamber wall. The cover of each chamber is firmly held in place against a thick gasket of soft rubber. Two glass windows in the front and back walls permit light to enter and provide for observations. Two holes in opposite side walls of each chamber, face each other and are in line with the long axis of the exudation tubes and arm extensions of each potometer. These holes provide access into the closed chamber without removing the cover. Pipettes are
conveniently passed through them to fill or drain the vessels and tubes. The holes are closed with rubber stoppers. These openings in the side walls also provide for making connections to the external orifices of N and P (type I) for continuous flow of gases or solutions.

The lower portion of each chamber is flooded with water to a level just below the arm of tube N. This serves as a water bath and provides a humid atmosphere in the upper portion of the enclosed space.

Further temperature control is attained by circulating water through the space between the walls of each chamber.

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