THE TISSUE CULTURE TECHNIQUE AS A MEANS OF STUDYING CORRELATION

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For many years the tissue culture technique has been utilized as a means of studying the growth requirements of isolated parts of the plant body, especially those of roots (1, 2). In recent years its scope has been extended by many workers to study the role which vitamins and hormones, and related substances, may play in root growth. We have been interested more especially in adapting the technique to the observation of the effects which different organs of the plant exert upon one another during the growth of the plant. The technique involves growing excised parts of the plant body together in the same flask and also in separate flasks. This permits the observation of any effects which may be due to the cutting of the living tissue, and the separation of the excised parts from one another, which may be complete, as when they are isolated, or incomplete, as when they remain in the same flask and the diffusion of substances from one part to the other may still occur.

The plant most extensively studied has been lettuce, of the Grand Rapids tip-burn resistant variety. The seeds are sterilized and then germinated on water-soaked filter paper in previously autoclaved Petri dishes. When the seedlings are two days old, the parts are excised and transferred to the culture flasks. The medium is usually a modification of White's formula. The most widely studied group of cultures contained four series, (1) excised roots alone, (2) excised shoots alone, (3) excised roots and shoots in the same flask, and (4) the whole seedling. By the shoot is meant the entire young stem, including the cotyledons and part of the hypocotyl. Figure 1 is the histogram which results when

the total root growth on each of the parts of this series is compared. It shows clearly that while attached intact to the seedling, the root and its branches receive growth promoting materials from the shoot which are not available to it immediately from the medium, but that the root when present on the seedling greatly inhibits the growth of lateral and adventitious roots.

This same grouping of cultures has been used to study many growth-regulating substances, and when the root growths are diagrammed in the same way as are those in Figure 1, the fact is evident immediately that the different series of cultures differ widely in their response to the same substance. Thus, an over all increase or decrease in the magnitude of this type-figure does not take place, but rather a change in the shape occurs. The conclusion from this is obvious: that deductions which may be drawn from observations of the activity of any substance on excised roots alone must be seriously limited in their scope.

Other plants which we have cultured in this way are peas, canteloupe, and grass. The heterogeneity of response which peas show makes it difficult to use the technique to advantage. The importance of aeration in the development of some plants is shown by the canteloupe. The young stems, when cultured as described above for lettuce, elongate and the cotyledons grow to considerable size, but no differentiation takes place. The shoots and adventitious roots do not develop, but when a mat of glass wool is placed in the flask to support the young stem in the medium, growth is normal and very rapid. This suggests the results of White (3) with callus tissue. That the problem

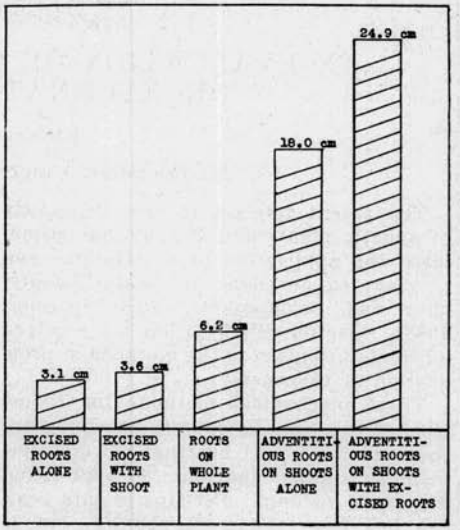

Fig 1.—Total root growth in correlation groups.

is at least partly one of aeration is further substantiated by the fact than when only a small portion of the stem is supported above the liquid surface, numerous adventitious roots make their appearance on that portion. On the other hand, young grass plants develop as well when submerged in the liquid medium as when on agar, and moreover, this growth compares favorably over periods of three or four weeks with that taking place in sand culture.

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