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Radiation Laboratory
University of California
Berkeley, California

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The uptake of carbon dioxide by plant roots preparations has been demonstrated by various workers (1,2,3,4). In addition to confirming the fact of fixation, I have investigated the effect of a number of factors involved and the compounds in which the absorbed carbon appears, using carbon-14.

Excised barley roots, from seedlings one week old grown in tap water, were exposed to $C^{14}O_2$ while supported in phosphate buffer at pH 5.6 in a closed vessel, the radiocarbon being administered as $NaHC^{14}O_3$. Following the period of exposure, the buffer was decanted off, the roots were rinsed rapidly with distilled water and boiling 80 percent ethanol added. The material was ground thoroughly in a mortar and pestle and quantitative transfer of liquid and solid matter made into a graduated cylinder. Aliquots of 100 λ each of centrifuged extract were plated and counted using a thin-window Geiger tube, whence the radioactivity of the total volume of extract was

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derived. Concentration of the clear extract to a volume of 1 to 2 ml. by vacuum distillation followed, from aliquots of which two-dimensional chromatograms on Whatman No. 1 filter paper were prepared, using phenol-water and butanol-propionic acid-water as solvents. Radioautographs were produced by exposure of Eastman "No Screen" X-ray film to the chromatograms.

The following results were obtained:

1. Under virtually anaerobic conditions, the uptake of C^{14} was reduced to a very low value, depending upon the efficiency of oxygen displacement.
2. When, after excision, the root material was held in aerated Hoagland solution for 24 hours before exposure to C^{14} in phosphate buffer, only approximately one fifth the activity was incorporated as when tap or distilled water was substituted for the nutrient solution.
3. In experiments involving various exposure times, $C^{14}O_2$ uptake rapidly declined after 10 min., only a slow rate of fixation occurring between 30 min. and 60 min. (the longest period studied).
4. The principal, non-volatile, 80% ethanol-soluble compounds found to be radioactive were malic, citric (or isocitric) aspartic and glutamic acids, asparagine, glutamine, serine and tyrosine, with traces (in some experiments) of α -ketoglutaric acid, alanine and several as yet undetermined compounds. A typical radioautograph is reproduced. (Figure 1)

Radioactivity has also been found to be present in insoluble products, which are being investigated.

References

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Fig. 1. Radioautograph showing radioactive, 80 percent ethanol-soluble products of 60 min. fixation of $C^{14}O_2$ by excised barley roots. The chromatogram from which this radioautograph was prepared was run horizontally in phenol-water and vertically in butanol-propionic acid water.