TECHNICAL PAPERS

Absorption of Radioactive Calcium by the Peanut Fruit[1]

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Nutritional studies of the peanut plant, *Arachis hypogaea* L., indicate the necessity of an external supply of available calcium in the fruiting zone for normal fructification (*2, 3, 6*). The relation of the calcium supply to fruit development is the type of problem particularly suited to radioactive tracer study. The availability of calcium 45 facilitates the investigation of this fundamentally and economically important problem.

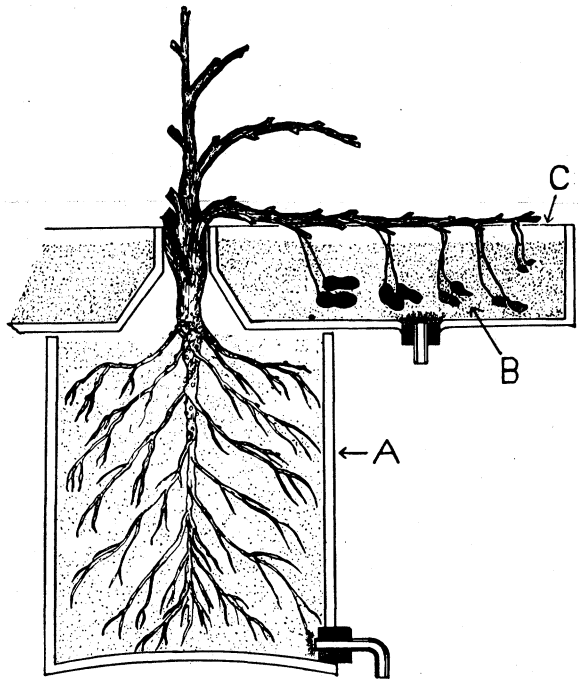

FIG. 1. Diagrammatic view of the peanut plant showing: A, rooting medium; B, fruiting medium; and C, wire mesh support to prevent branches and foliage from touching sand of the fruiting medium.

The runner-type peanut has a prostrate growth habit and bears its fruit from nodes along the trailing branches. Thus it is possible to separate completely the rooting medium from the fruiting medium of the plant. Peanut plants of the Dixie Runner variety were grown in sand culture with the root and fruit zones isolated from each other as shown in Fig. 1. The roots of 2 plants were in 4-gal glazed crocks and the sand of the fruiting zone was held in asphaltum-coated metal pans. A complete nutrient solution (*1*) was applied to the surface of both zones of the plants. When necessary, solution drainage from each zone of the plants was caught in 5-gal carboys. At 110 days plants were vegetatively vigorous and all stages of immature fruit development were present. At that time a single application of labeled calcium, as a solution of the chloride containing approximately 1.36 mg of calcium with an activity of 21 mc, was added to 1 l of nutrient solution and applied to the rooting or fruiting medium of each culture of 2 plants. Thereafter, drainage of any solution was returned to the proper receptacle. The fruiting zone treatment was discontinued after 9 days but the treatment of

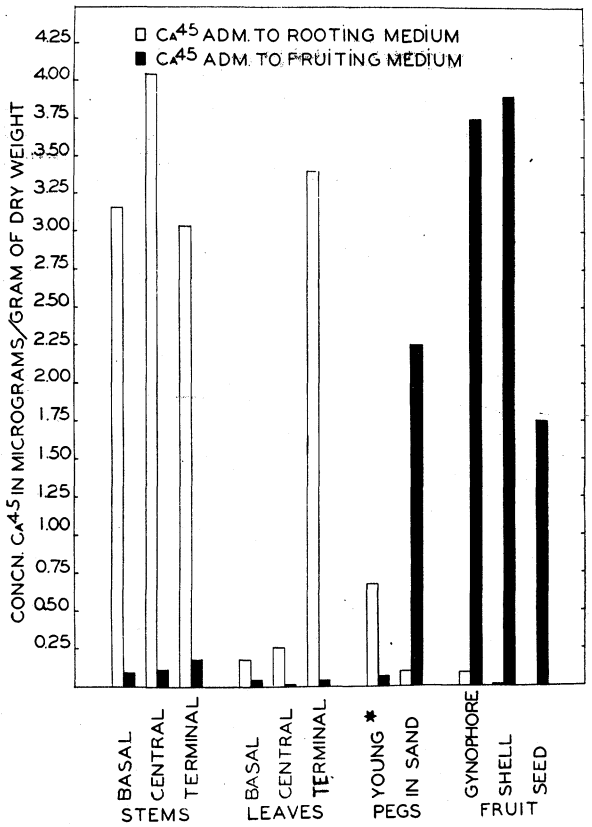

FIG. 2. Concentration of Ca^{45} in various portions of peanut plants 9 days after it was administered to the rooting or fruiting medium. The asterisk indicates young pegs (1" – 1½" long) which had not touched sand of fruiting medium.

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the root cultures was continued for 24 days. There were 4 replicates or a total of 8 plants to each treatment, and each plant, whether treated on the rooting or fruiting zone, was exposed to the same dosage of labeled calcium.

Leaves and sections of stems and fruiting organs of plants were sampled at periods of 3, 8, and 50 hr, and 9 and 24 days. Samples of leaves and stems were from lateral branches, since the peanut plant has a short upright central stem. Gynophores and fruits were thoroughly washed with a stream of distilled water when harvested. Samples were immediately weighed and subsequently dried at 70° C. The plant material was ashed and the calcium precipitated as the oxalate (*7*), which was collected on filter paper over a uniform area for measurement of total calcium by weight and radioactivity with a thin mica window Geiger counter (*5*). Self-absorption and decay corrections were made in the usual manner (*4*).

The pattern of labeled calcium distribution was similar for all plants of a given treatment. Fig. 2 illustrates the uptake of Ca^{45} in μg/gm of dry weight of portions of two representative plants after 9 days. Plants received the complete nutrient solution on the rooting and fruiting zones, and experimental conditions other than the zone of labeled calcium supply were the same in both cases.

Ca^{45} administered to the roots could be detected after 3 hr in all vegetative portions of the plant, being most pronounced in the stem, but was found only in the young peg (gynophore and ovary) of the different fruiting stages. The young peg consistently showed a more active absorption of calcium than the other classes of fruit; however, the capacity for calcium absorption decreased as the peg elongated and entered the fruiting medium. At 9 days the shell of fully developed green fruit contained a very small amount of labeled calcium, but never more than a trace could be detected in the seed. This relationship persisted throughout the 24 days.

The uptake of labeled calcium by the developing fruit was reversed when it was administered to the fruiting zone. The very active absorption of Ca^{45} by the gynophores and by shells and seeds of the fruit from the external supply in the fruiting medium very greatly exceeded the small amount of absorption by these organs when labeled Ca was supplied to the rooting zone of the plant. This emphasized the capacity for calcium absorption by the developing fruit from the external supply in the fruiting medium.

It is noteworthy that when labeled calcium was applied to the roots of the plant, the capacity for calcium absorption by the young peg decreased as it developed as shown by the decreased absorption of labeled calcium. Thus it appears that the calcium content of the young peg was diluted as it increased in size and that most of the Ca^{45} found in the fruit was absorbed in the early stages of peg development. This suggests that the capacity for calcium absorption by the gynophore and ovary is limited after a definite point during their development and that further fruit development is apparently dependent upon the external supply of calcium in the fruiting zone.

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The Influence of Delta and Gamma Benzene Hexachloride upon the Oxygen Uptake of Brain[1]

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During a study of the pharmacology of some stereoisomers of benzene hexachloride (BHC) in mammals, it was observed that whereas the gamma isomer is a potent convulsant agent, the delta isomer is a central nervous system depressant. Moreover, it was found that the two isomers are mutually antagonistic in their effects upon the central nervous system of the rabbit and dog (*5, 6*). In the same studies attempts were made to mitigate the effects of the gamma isomer by the administration of *i*-inositol, which was reported by others to prevent the growth-inhibiting action of the gamma isomer upon certain strains of saccharomyces (*4*). In no instance did *i*-inositol modify the course of convulsant action of γ-BHC. It was believed possible that this failure might be due to lack of penetration of *i*-inositol into susceptible brain cells. In view of these observations, and the often mentioned correlation (*1–3, 7–9*) between narcosis and brain oxygen uptake, the following study was initiated.

In exploratory studies rats received intraperitoneally sufficient drug to produce central stimulation (100 mg/kg of γ-BHC) or central depression (500 mgm/kgm of the delta isomer). The rats were decapitated after the onset of symptoms, and the QO_2 of brain slices was determined manometrically. By this method no difference could be observed between control and test brain slices. For the experiments reported herein, the following technique was employed: Normal rats were killed by decapitation, and the brains were removed and weighed. The entire brain

[1] In previous reports the authors used the word "Gammexane" as a synonym for the gamma isomer of benzene hexachloride. It has been brought to our attention that the name "Gammexane" is a trade mark designation of the Imperial Chemical Industries, Ltd. The term gamma benzene hexachloride has been approved by the Committee on Insecticide Nomenclature of the American Association of Economic Entomologists (*J. econ. Entomol.*, 1947, **40**, 280).

[2] The technical assistance of Anne M. Kunkel and Dorothy E. Stabile is gratefully acknowledged.