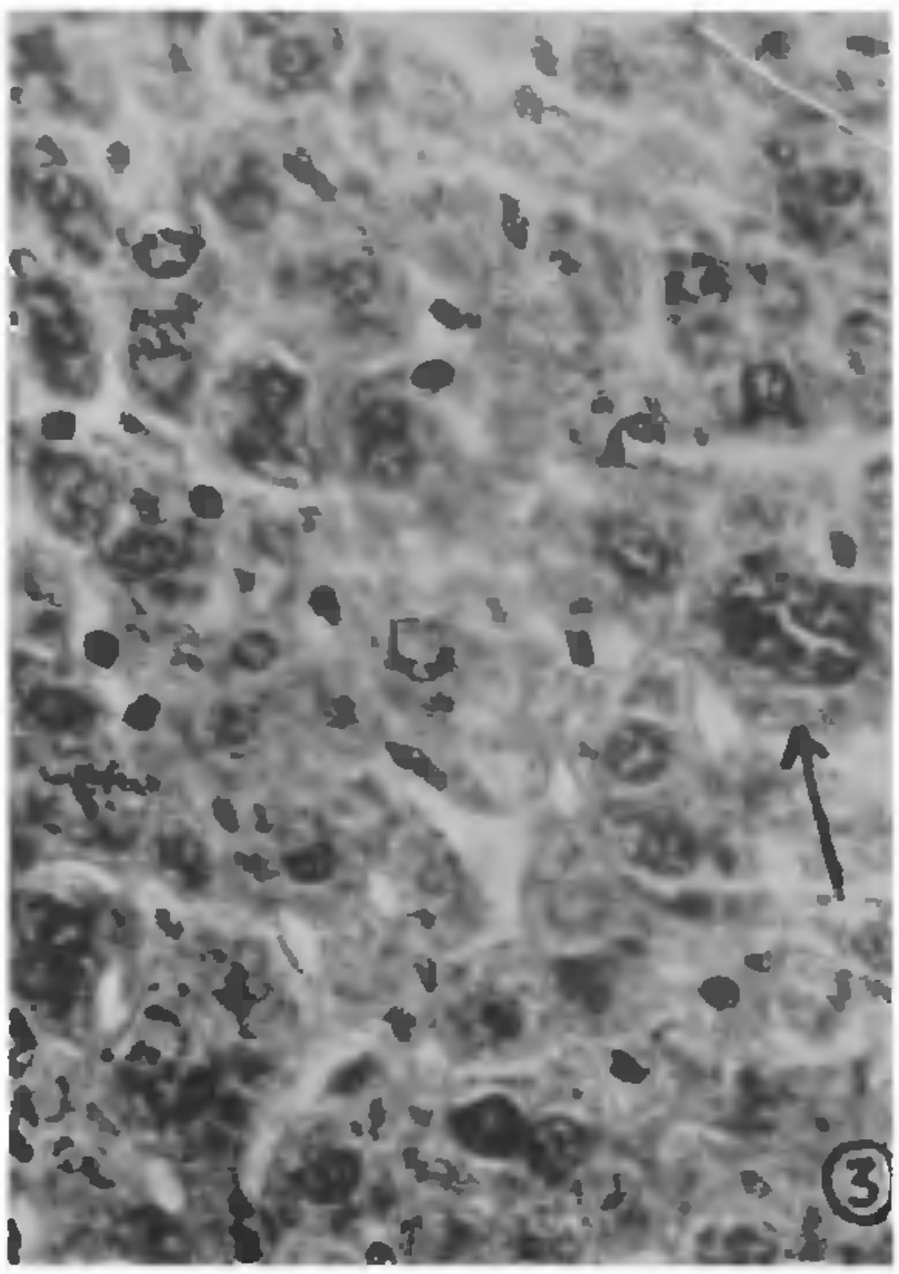

FIG. 3. Liver 14 days after exposure to 900 R of gamma rays showing a mononucleated giant hepatocyte (arrow) × 400.

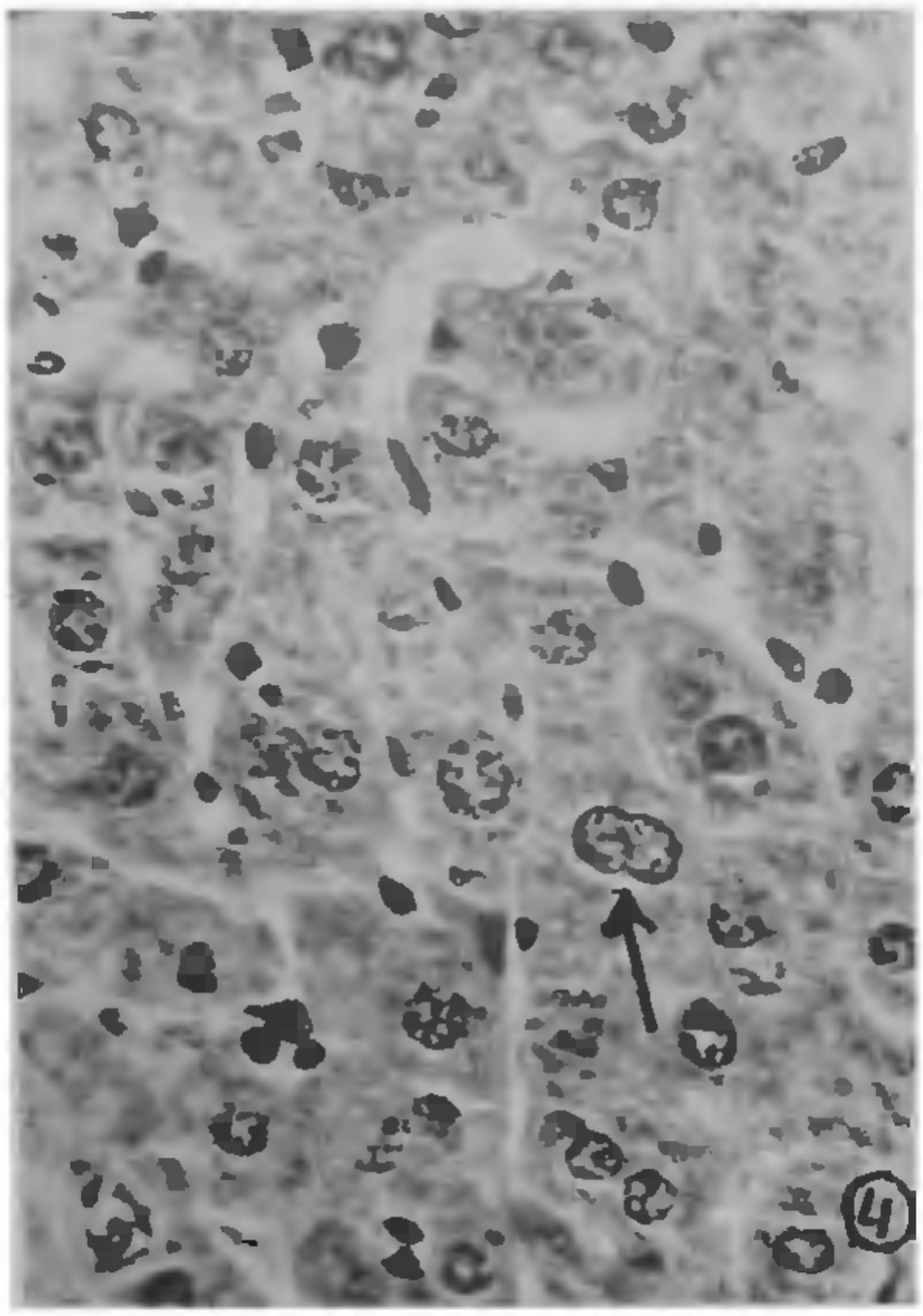

FIG. 4. Liver 14 days after exposure to 900 R of gamma rays showing the fusion of nuclei in a binucleated cell (arrow) × 400.

phenomenon[4] and it seems to be a step before degeneration and cell death[6].

One of us (MLG) is thankful to UGC for providing Teacher-Fellowship under the Faculty Improvement Programme.

August 16, 1980.

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$^{14}CO_2$ INCORPORATION STUDIES IN PEANUT (*ARACHIS HYPOGAEA* L.) UNDER PHOSPHORUS DEFICIENCY

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PLANTS usually form characteristic symptoms in response to the lack of essential elements. Phosphorus with nitrogen and potassium is classified as a macronutrient. A good supply of phosphorus has been associated with increased root growth. Deficiency of phosphorus causes stunted plant growth and delayed maturity[1]. Phosphorus is indeed the ubiquitous and essential element in the energy transfer processes such as photosynthesis which is so vital to life and growth[2]. Peanut, an important oil yielding crop showed decreased growth and altered metabolism under phosphorus deficiency[3]. In the present study an attempt is made to find out the effect of phosphorus deficiency on $^{14}CO_2$ uptake in peanut.

Uniform seeds of peanut (*Arachis hypogaea* L. Var. TMV–2) were surface sterilized in 0·1% $HgCl_2$ solution, washed repeatedly in distilled water and sown in porcelain pots containing acid washed sand. The cotyledonary leaves were excised gently on 10th day after sowing and thinning was done to 3 plants per pot. The pots were divided into two sets and the

TABLE I

$^{11}CO_2$ incorporation in peanut leaves under phosphorus deficiency. Radioactivity measured as c.p.m. × 10^{-2}/g fresh leaf
(Mean of three replications)

Age in days	Feeding time (min)	Alcohol soluble fraction								Alcohol insoluble fraction							
		Control				P-Deficient				Control				P-Deficient			
		TI	AAF	OAF	SuF	TI	AAF	OAF	SuF	TI	AAF	OAF	SuF	TI	AAF	OAF	SuF
20*	10	490·3	147·1	137·3	205·9	373·2	155·0	140·2	78·0	386·2	186·7	64·9	134·6	206·2	62·0	103·6	40·6
	20	636·4	190·9	241·8	203·7	438·1	170·9	162·2	105·0	596·8	236·8	134·8	225·2	491·9	206·0	149·7	136·2
30**	10	530·8	153·9	132·7	244·2	424·9	123·9	173·8	127·2	492·7	103·8	126·2	262·7	456·4	176·9	177·5	102·0
	20	719·0	172·4	158·0	388·6	465·2	134·9	162·8	167·5	673·6	163·9	99·0	410·7	516·6	117·3	182·6	216·7

* — 10 days after treatment; ** — 20 days after treatment; c.p.m. — counts per minute; TI — Total incorporation; AAF — amino acid fraction; OAF — Organic acid fraction; SuF — Sugar fraction.

first set received the nutrient solution of Hoagland and Arnon[4] which served as control. Phosphorus deficiency was created by replacing KH_2PO_4 with $KHSO_4$ in the second set. All the plants received the respective nutrient solutions once in 3 days.

$^{14}CO_2$ feeding technique as described by Berry *et al.*[5] was adapted with 10 and 20 min as feeding time. The incoporation studies were carried out in 20 day (10 days after treatment) and 30 day (20 days after treatment) old plants. The first compound leaf from the base was cut under water and used for feeding. After the selected periods of feeding the leaves were killed by plunging in boiling 80% ethanol, extracted and centrifuged. The supernatant was taken out and the residue was re-extracted with ethanol and centrifuged. The two alcohol soluble fractions were pooled and the alcohol insoluble residue was hydrolysed with 6N HCl. After hydrolysis, the acid was evaporated and the resulting residue was taken in 80% ethanol constituting the alcohol insoluble fraction. Both alcohol soluble and insoluble fractions were evaporated to a known volume and an aliquot was examined for radio activity using end window GM counter. Preparation of water soluble fraction and fractionation of alcohol soluble and insoluble fractions into amino acids, organic acids and sugar fractions were done according to Atkins and Canvin[6]. Total $^{14}CO_2$ incorporated into each of these fractions was determined as mentioned earlier. Triplicate samples were maintained for each experiment.

The results of the present study indicated a decreased $^{14}CO_2$ incorporation into alcohol soluble and insoluble fractions under P-deficient conditions. Incorporation rates were high 20 min after feeding both in the 20 day and 30 day old plants (Table I). A decrease of 23·88 and 31·16% incorporation over controls after 10 min and 20 min feeding time in 20 day old plants; and 19·95 and 35·30% decrease into alcohol soluble fraction in 30 day old plants was observed under P-deficiency. ^{14}C incorporation into alcohol insoluble fraction showed less decrease except in 20 day old plants after 10 min feeding; 53·39, 17·58% in 20 day old plants and 7·37 and 23·31% decrease in 30 day old plants was observed at 10 and 20 min feeding time respectively, under phosphorus deficiency.

Fractionation of alcohol soluble and insoluble fractions indicated higher rates of incorporation into amino acids and organic acids under phosphorus deficiency. However amino acids of alcohol insoluble fraction showed lowered incorporation in 20 day old P-deficient plants *initially, i.e., 10 min after feeding.* But ^{14}C incorporation into sugar fraction was found to decrease significantly both in 20 and 30 day old P-deficient plants (Table I).

Phosphorus is one of the essential elements that plays a *pivotol role in plant metabolism.* Deficiency of P in nutrient medium results in stunted growth of peanut plants and lowers the uptake of potassium[3]. The decreased potassium in turn reduces stomatal opening, which ultimately results in poor uptake of $^{14}CO_2$. The lowered K^+ under P-deficiency as observed in our previous studies[3] may even be responsible for the reduced photosynthesis and increased respiration, thereby lowering the amounts of carbohydrates. Our previous studies[3] also indicated low amounts of sugars in peanut leaves under P-deficiency. Thus the lowered *incorporation into alcohol insoluble fraction indicates* lowered synthesis of starch under P-deficiency. High rates of incorporation into amino acids under P-deficiency is explained in terms of their lowered utilization in protein synthesis. High rates of incorporation into organic acids and poor rates of incorporation into sugars indicate that the conversion of organic acids to carbohydrates may be slowed down under P-deficiency.

Phosphorus compounds have been shown to be essential for photosynthesis, the interconversion of carbohydrates and related compounds, fat metabolism and a host of other life processes. The reduced rates of $^{14}CO_2$ uptake in peanut leaves as observed in the present study indicates that the poor growth of plants might be due to lesser availability of carbohydrates for the vital growth processes.

GGR is grateful to CSIR (New Delhi) for providing financial assistance.

September 2, 1980.

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PRESS MUD AS ADDITIVE TO INCREASE BIOGAS PRODUCTION FROM CATTLE WASTE

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ANAEROBIC digestion depends on several different microbial activities functioning concurrently and at