in total protein content. Significant fall in the levels of gamma globulin, alpha beta globulin, and albumin type of proteins is observed on fatigue (Table II). This indicates that solubility of these proteins is more affected during fatigue as it might be particularly involved in buffering action.

TABLE II

Levels of globulins and alubumin type of proteins in muscle expressed as mg/gram wet weight. The values are means of ten individual observations

Muscle	Gamma globulin	Alpha and beta globulin	Albumin
Control	7·78 ±0·53	12·30 ±0·98	16·55 ±1·61
Fatigued	6·43 ±0·43	10·60 ±1·23	13·85 ±1·81
% Deviation	−17·3	−13·8	−16·4
*'t' test	0·01 S	0·05 S	0·05 S

* S = Significant.

Alternation in the levels of different types of proteins is not because of the rapid degradation or synthesis since such changes cannot be expected after a short period of extensive work. Changes in the intracellular environment of the muscle affects the ionization of sarcoplasmic proteins[11] and also the buffering capcity of proteins[12]. So it is suggested that variation in different protein fractions is only due to the alteration in ionization and soluble properties because of their involvement in buffering of acid and other metabolic byproducts produced during fatigue to protect the structural components of contractile machinery.

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GYNOPHORE NUTRITION IN GROUNDNUT

THE importance of Calcium in pod development is well known and direct absorption by developing fruits when calcium is applied in the peg region has been reported by Shibuya and Suzhuki[1], Bolhuis and Stubbs[2] and Seshadri[3]. But the presence of calcium at root region is not equally effective. The difference in ion uptake by pegs and roots deserves detailed study. An interesting observation by Pal and Laloraya[4] has indicated that root level sodium does not interfere with Calcium uptake. But calcium uptake by the developing pods is inhibited by sodium. The utility in terms of nutrient availability is obviously conditioned by the physico-chemical properties of the membranes of the root and the peg.

In the present investigations involving a provision of single and multiple deficiency conditions at the peg zone with complete nutrition at root zone, sand culture studies employing Arnon and Hoagland's[5] nutrient solution were made (K–390, Ca–120, Mg–48, NO_3N–224, NH_4–N–28, P–62 and S–64 ppm). TMV 2 bunch strain was used for the study. The gynophore regions were separated from the root zone by a plastic container. The technique adopted comprised insertion of the root of the young groundnut plant through a glass tube fitted to the plastic container. The root developed in the pot containing sand that was irrigated with complete nutrient solution. The junction of the glass tube at the base of the plastic container was sealed by wax. The plastic container was filled with washed sand irrigated with Arnon and Hoagland culture solution so modified as to provide single and multiple deficiencies (Table II). Chemical analysis of shell for nitrogen[6], phosphorus[7], potassium and sodium[8] and for calcium[9] and magnesium was made. Oil content of kernels (Soxhlet[10]) was determined.

Plants were harvested from five replicates. Yield of dry pods (g/plant) was determined and the data are presented (Table I).

TABLE I

Yield of dry pods (g/plant) as influenced by single and multiple deficiencies at peg zone

Treatment	Yield	Treatment	Yield	Treatment	Yield
(1) Complete	7·21	(6) — N — K	6·10	(11) — Ca — Mg	3·50
(2) — N	2·51	(7) — N — Ca	1·90	(12) — N — K — Ca	1·90
(3) — K	4·00	(8) — N — Mg	5·10	(13) — N — K — Mg	3·50
(4) — Ca	2·90	(9) — K — Ca	5·50	(14) — N — Ca — Mg	5·50
(5) — Mg	6·50	(10) — K — Mg	1·10	(15) — K — Ca — Mg	1·00
				(16) — N — K — Ca — Mg	2·00

C.D. (P = ·01) — 2·069.

TABLE II

Chemical composition of shell (mg/g) (Groundnut TMV 2) and oil content (per cent) of kernels as influenced by single and multiple nutrient deficiencies at peg zone

Nutritional Status	Nutrient element in shell (mg/g)					Oil content per cent
	N	P	K	Ca	Mg	
Complete ..	5·6	5·0	43·1	2·9	·48	49·8
Minus N ..	5·6	4·9	27·0	1·9	·38	32·7
Minus K ..	4·2	3·1	10·6	2·9	·29	41·0
Minus Ca ..	4·2	0·7	13·2	1·1	·29	41·0
Minus Mg ..	9·8	2·8	35·4	1·8	·19	44·3
Minus N and K ..	4·2	2·0	21·6	1·8	·09	33·3
Minus N and Ca ..	4·2	2·4	16·2	1·1	·19	38·5
Minus N and Mg ..	5·6	2·3	19·2	1·9	·18	42·2
Minus K and Ca ..	7·0	3·2	17·4	1·1	·38	44·5
Minus K and Mg ..	7·0	2·7	21·6	1·1	·19	46·5
Minus Ca and Mg ..	4·0	4·9	35·2	1·9	·29	38·0
Minus N K Ca ..	4·2	1·9	5·4	2·6	·19	33·6
Minus N K Mg ..	5·6	2·0	13·3	2·6	·09	38·6
Minus N Ca Mg ..	4·2	1·9	6·0	1·8	·19	32·5
Minus K Ca Mg ..	7·0	4·2	26·2	1·8	·38	42·2
Minus N K Ca Mg ..	4·2	6·0	10·2	1·4	·09	33·3

A deficiency of nitrogen reduces yield by 65·2% and an equal degree of severity is met with in calcium deficiency decreasing the yield by 59·8%. Multiple deficiencies show more depression by 73·6 and 84·7% due to –N–Ca and –K–Mg combinations respectively. Imposition of additional deficiencies over those of N and Ca has negligible yield depression but imposition of calcium deficiency over those of K and Mg effect further depression by 86·1%. This trend is interesting by way of

highlighting the limiting influence of calcium (Bledsoe *et al.*[11] and Gopalakrishnan and Nagarajan[12]). This situation influencing the nutritional status in peg zone is more significant compared to a similar status at the root zone.

Chemical composition of shell (Table II) shows no reduction in nitrogen content under nitrogen deficiency. Under other circumstances of multiple deficiencies, nitrogen content is increased. Magnesium deficiency increases N content of shell phosphorus content is acutely depressed due to calcium deficiency (5·0 *Vs* 0·7). Phosphorus content is very much lowered under any deficiency. A deficiency of N, Ca and Mg tends to affect K content very acutely (43·1 *Vs* 6·0) even as a combined deficiency of K and Ca or K and Mg affects Mg content (0·48 *Vs* 0·09).

Any nutrient deficiency impairs oil content. Magnesium deficiency in conjuction with N and Ca or K brings down oil content to 32·5 and 46·5% respectively compared to 49·8% in the control.

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EXUDATION OF PHOSPHORUS (^{32}P) FROM ROOTS OF COFFEE PLANTS

Exudation of foliar applied radioactive phosphorus (^{32}P) through roots of eight month old plants was more in robusta (*Coffea canephora* Pierre. cv. S. 274) than in arabica (*Coffea arabica* L. cv. S. 795)[1]. The effect of the plant age on the exudation of ^{32}P is described in this note.

Seedlings of the two coffee species were raised following the technique described previously[1]. The seedlings were then transferred to plastic pots (25 × 25 cm) and earthenware (lined with thick polythene sheet) crocks (30 × 38 cm) filled with weighed quantities of a mixture of jungle soil + farmyard manure + sand (6 : 2 : 1), and grown under pandal shade upto 25 and 50 months. For 25 month old plants, 1·25 g of labelled (^{32}P) superphosphate (supplied by BARC). dissolved in 50 ml water (adjusted to pH 6·5 with lime water) was sprayed on the foliage of each plant, the soil surface being covered with a thick polythene sheet. In the case of 50 month old plants, the leaves on only two secondary branches (with equal number of leaves) were sprayed with 1·25 g of labelled (^{32}P) superphosphate dissolved in 30 ml water, taking all the other precautions as before. In both the experiments, 48 hr. after feeding the radioisotope, the plants were depotted. A weighed quantity of the well mixed soil sample was died under infrared heat and the radioactivity monitored in a G.M. counter. The quantity of ^{32}P exuded through roots was calculated per plant. There were three replications for each coffee species.

With increase in the age of the plants from 25 to 50 months, the volume of the root system also increased and the exudation of P was also more in both the species (Table I). However, in both the age groups, roots of robusta plants exuded more radioactive phosphorus than arabica, in the 48 hr. period. The present data confirm the earlier findings[1,2,3].

Table I

Exudation of foliar applied phosphate (^{32}P) through roots (per plant) of two age groups of coffee plants

Coffee species	% of applied activity exuded		Quantity of ^{32}P exuded (mg of P)	
	25 months	50 months	25 months	50 months
Arabica	0·003	0·020	0·6	3·9
Robusta	0·005	0·041	1·1	8·3

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CHANGES IN OIL AND FATTY ACID COMPOSITION OF LINESS (*LINUM USITATISIMUM* L.) UNDER VARYING PHOTOPERIODS

In an earlier communication, it has been shown that change in photoperiod from 14 to 19 hours resulted in the increase in oil content and the degree of unsaturation in flax seed[1]. The experiment describes the effect of long photoperiods on oil and fatty acid composition in a flax variety morphologically different from the cultivated ones in India and grown particularly for fibre. The present note describes the effect of short and long photoperiods on oil and fatty acid composition in an Indian linseed cultivar.

Seeds (var. SH–1) were sown in pots with 20 replicates. Seedlings (7 day old) were shifted to three photoperiodic conditions *i.e.*, short photoperiod (8 hr. exposures to natural light), normal photoperiod (natural day) and long photoperiod (24 hr. light, consisting of natural light supplemented with 100 watt incandescent filament lamp during the night). Observations on emergence of flower bud and seed weight per plant were recorded. The oil in the seed was determined following cold percolation method[2]. The fatty acid composition was determined on duel column gas liquid chromatograph Shimadju Model GC 4 BPTF in methylated samples[3].

It is observed from Table I that long photoperiodic treatment hastened flower bud emergence whereas short photoperiod had the opposite effect. Seed weight per plant was reduced under both the photoperiodic treatments (short or long). The oil content was not affeced by long photoperiodic treatment; on the other hand it decreased considerably when plants were exposed to short photoperiod. Likewise the degree of unsaturation did not differ from the normal photoperiod under the long photoperiodic treatment. Under short photoperiodic treatment however, an increase in oleic acid and a decrease in the linolenic acid were observed.

TABLE I

Effect of photoperiod on flower bud emergence, seed weight, oil content and fatty acid composition in linseed (var. SH–1)

Treatment	Short photoperiod	Normal photoperiod	Long photoperiod	CD at 5%
Days to flower bud emergence	75·0	48·0	39·6	1·54
Seed weight per plant (g)	1·6	2·6	1·8	0·044
Oil content (g) percent dry weight	38·6 ±0·1	40·3 ±0·2	40·8 ±0·2	..
Fatty acid composition :				
Palmitic	6·6	6·6	5·8	..
Stearic	8·4	6·1	6·7	..
Oleic	38·0	30·7	30·0	..
Linolic	15·9	12·6	12·0	..
Linolenic	31·1	44·5	45·6	..

It has been suggested that oleic acid serves as the precursor of linolenic acid[4].

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