Table 4: Organ weight per unit live weight (g x 10^{-2}) of rats on different levels of cocoa husk

Organ	Level of Husk (%)				
	0	10	20	30	40
Liver	4.82	4.70	5.05	4.52	4.82
Kidney	0.82	0.88	0.88	0.91	1.03
Heart	0.45	0.42	0.45	0.45	0.42

Summary

Thirty weanling laboratory rats were used in a three-week trial to determine the optimum level of cocoa pod husk (CPH) inclusion in the diet. The CPH was included at 5 levels, viz 0, 10, 20, 30 and 40 percent in the diet.

The most optimum level of inclusion in terms of growth rate and feed efficiency was the 20 percent CPH inclusion. There were no observed toxicity effects due to CPH feeding.

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Salt effect on *in vivo* activity of nitrate reductase in peanut (*Arachis hypogaea* L.) seedlings.

Resumen. Se estudió la actividad de la reductasa de nitratos bajo la influencia del cloruro y el sulfato de sodio. Ambas sales promovieron la actividad de la enzima *in vivo* tanto en los cotiledones como en los ejes embrionarios. El efecto del cloruro fue más pronunciado que el del sulfato.

Inhibition of the activity of nitrate reductase (NADH: Nitrate reductase, EC 1.6.6.1) by water, heat and salt stress (3, 6, 7, 8) and the factors for such decrease were described earlier (2, 8, 12). Sankhla and Huber (10), however, reported a promotion in the *in vivo* activity of nitrate reductase in cotyledons and leaves of 4-day-old *Phaseolus* seedlings treated with salt and ABA. However, the mechanism of action of such stimulation has not been elucidated. Differences in the *in vivo* and *in vitro* activities of the enzyme under the influence of salt (50-150 mM) in *Salicornia* has been reported by Austenfeld (1). Earlier studies indicated that the

stimulation of nitrate reductase activity was not due to an osmotic effect, but could be attributed to high ion concentrations. This may lead to an increased release of nitrite to the reaction media which could result in a stimulation of the nitrate reductase activity (12). High concentrations of monovalent cations are said to exert specific effects on cell membrane permeability which may lead to an increased release of nitrite from the cells. The present study was intended to find out the effect of two salts of sodium with different anionic species at equi-valent concentrations (70 meq/l) on the *in vivo* activity of nitrate reductase.

Material and methods

Healthy and uniform sized seeds of peanut (*Arachis hypogaea* L.) var TMV2 were surface sterilized for 3 min with 0.1% $HgCl_2$, washed thrice with distilled water and were allowed to germinate in 28° ± 2°C in 6" petridishes filled with acid washed quartz sand. Distilled water served the control and for treatments 70 meq/l of NaCl and 70 meq/l of Na_2SO_4 were added to the sand. Cotyledons and embryonic axes were separated on days 2, 4, 6 and 8 of germination. The *in vivo* activity of the enzyme was measured after infiltration and incubation in 0.1 mM KNO_3 for 1 h, following the procedure of Klepper *et al.* (5).

Results and discussion

Higher activity of nitrate reductase was noticed under the influence of the two salts. The stimulation was more in the embryonic axes than in the cotyledons. With progress in age there was a decrease in the enzyme activity, both in the control and the treated seedlings. Although both salts stimulated the nitrate reductase activity chloride showed 2 to 3 fold higher stimulation (% over control) than sulphate; this was more pronounced on the 4th day, both in cotyledons and embryonic axes. Earlier studies indicated higher activity of nitrate reductase under the influence of high concentration of monovalent cations (4, 10). In the present study the pronounced effect of chloride over sulphate on the stimulation of enzyme, when supplied as their sodium salts at equivalent concentration (70 meq/l), may indicate a differential effect of these anions on cell membrane permeability. Presence of sulphate in the medium may be inhibiting the production of nitrite which can be attributed to the plasmolysis of cells or to a direct effect of salt on on the enzyme. Earlier studies (9) have also shown the influence of inorganic salts on the permeability of cell membranes. The results support the earlier views (4) of inhibition in the stimulation of nitrate reductase in alfalfa leaf discs when they were supplied with sulphate salts of potassium and sodium, while the chloride salts of the two cations were found to stimulate the nitrite production.

Table 1. Effect of chloride and sulphate salts of sodium (70 meq/l) on *in vivo* activity of nitrate reductase (μmole/NO_2^-/g.fr.wt./h) in peanut seedlings (means of 3 replications).

	Age in days			
	2	4	6	8
Cotyledons				
Control	0.192	0.162	0.100	0.100
NaCl	0.496	0.862	0.652	0.240
	(258)	(532)	(652)	(240)
Na_2SO_4	0.368	0.214	0.316	0.960
	(191)	(132)	(316)	(96)
Embryonic axes				
Control	0.960	0.110	0.144	0.102
NaCl	0.909	0.894	0.716	0.366
	(947)	(812)	(497)	(689)
Na_2SO_4	0.728	0.404	0.354	0.120
	(758)	(367)	(246)	(216)

Figures in parantheses denote the values in % over the control.

Summary

Activity of nitrate reductase in peanut seedlings was studied under the influence of chloride and sulphate salts on sodium. Both salts promoted the *in vivo* activity of the ensyme as well in cotyledons as in embryonic axes. The effect of chloride was more pronounced than sulphate.

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