TABLE I
Vomiting and gastric peristalsis in frogs

Chemical	Concentration	Quantity injected or applied	Observations
Suprarenal extract	0·1%	0·5 ml	no response,
	0·3%	0·5 ml	slow peristalsis in stomach,
	0·5%	0·5 ml	peristalsis increased,
	1·0%	1·0 ml	peristalsis inhibited, no vomiting
Atropine	0·1%	0·5 ml	no response,
	0·3%	0·5 ml	slow relaxation of stomach muscles,
	0·5%	0·5 ml	relaxations advanced,
	1·0%	1·0 ml	relaxations advanced, no vomiting
Nicotine	0·1%	0·5 ml	immediate peristalsis,
	0·3%	0·5 ml	persitalsis advanced,
	1·0%	1·0 ml	peristalsis inhibited, no vomiting
Apomorphine	0·1%	0·5 ml	spontaneous reverse peristalsis in stomach and vomiting,
	0·3%	0·5 ml	peristalsis and vomiting,
	0·5%	0·5 ml	vomiting advanced,
	1·0%	1·5 ml	inhibitory effect on vomiting, muscles of the entire body paralysed in 15 minutes
Tartar emetic	0·1%	0·5 ml	slow reverse peristalsis and vomiting,
	0·3%	0·5 ml	vomiting advanced,
	0·5%	0·5 ml	vomiting advanced,
	1·0%	1·5 ml	all muscular activity paralysed in 12 minutes
Sodium hydrate	1 in 20,000 parts	0·1 ml	spontaneous contractions in the stomach, but no vomiting,
	do.	0·5 ml	all muscular activity paralysed

stimulants like sodium hydrate, nicotine and atropine. In frogs whose spinal cord alone was damaged, vomiting but not peristalsis, could be induced with the same chemicals. This was suggestive of the fact that reflexes could travel through the vagus nerve supplying the stomach while spinal nerves III, IV and V supplying the stomach were inactivated thus peristalsis was out of the question. Lastly, in frogs whose entire central nervous system was damaged no treatment of emetics or stimulants could induce either vomiting or peristalsis.

These experiments suggest a central control of vomiting somewhere in the medulla of the brain. Several workers[1,3,4,7] have demonstrated a vomiting centre and a chemoreceptor trigger zone in the medulla of the dog. A similar vomiting centre if not also a chemoreceptor trigger zone is suggested in the frogs used by this author.

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PROLINE ACCUMULATION UNDER ZINC DEFICIENCY IN MUSTARD

A STRIKING accumulation of the imino acid proline occurs in many plants in response to water deficit[1,2] and salinity stress[3,4]. In the present paper it has been reported that there is accumulation of proline by deficiency of a micronutrient,

Seeds of mustard (*Brassica juncea* L. var. T-59) were germinated in purified sand. After 10 days, uniform seedlings were selected and transplanted in ten litre glass troughs containing Hoagland's solution (half strength). Minor elements (except zinc) were added as suggested by Arnon[5]. There were three treatments (0, 0·01 and 0·05 ppm) of zinc. The chemicals used were of AR grade and purified by the method of precipitation and adsorption on phosphate and alkaline earth, autoclaving and thereafter extraction with dithizone[6]. Fifty seedlings were grown in each glass trough. Plants were supported in holes on a sun-mica lid with non-absorbent cotton wrapped around the stem. The aeration was done daily and the nutrient solution was replaced at weekly interval. Forty-five days after transplanting, plants were sampled, washed twice with double distilled water. The plants were separated into leaves, stem and root and dried in an oven at 60–70° C. Dry weight of leaves, stem and root per plant were recorded and the samples were analysed for zinc content by atomic absorption spectrophotometer. The proline content was analysed in leaves following the method of Bates, Waldren and Teare[7].

Plants grown in zinc deficient condition showed visual symptoms, about one month after transplanting. At 45 days, a marked decrease in dry weight of leaves, stem, root as well as tissue concentration and uptake of zinc was observed under zinc deficiency (Table I).

TABLE I

Growth and zinc content in mustard var. T–59 45 days after transplanting

Zinc levels (ppm)	Leaves	Stem	Root	Total
		Dry weight (g/plant)		
0	0·281	0·399	0·110	0·790
0·01	0·616	1·098	0·268	1·982
0·05	0·548	0·895	0·171	1·614
LSD at 5% P	0·080	0·303	0·028	0·322
		Tissue concentration of zinc (ug/g dry wt.)		
0	19·62	13·16	31·40	
0·01	28·08	21·42	55·71	
0·05	31·90	23·66	73·91	
LSD at 5% P	4·86	5·63	7·49	
		Total content of zinc (ug/plant)		
0	5·51	5·24	3·45	14·21
0·01	15·39	23·52	14·92	53·83
0·05	19·64	21·17	12·63	53·45
LSD at 5% P	2·81	5·96	1·44	6·38

The decrease in dry weight per plant was of the order of 60% and 51% as compared to plants grown in 0·01 and 0·05 ppm zinc levels respectively. Zinc level (0·01 ppm) in water culture appeared to be sufficient for growth of this mustard variety. The proline content in leaves increased under zinc deficiency (Table II). The accumulation of proline under zinc deficiency was about 4·7 and 8·0 times higher than that observed in plants grown in 0·01 and 0·05 ppm respectively.

TABLE II

Proline content in leaves of mustard var. T–59, 45 days after transplanting

Zinc levels (ppm)	μ moles/g fr. wt.
0	9·21
0·01	1·95
0·05	1·15
LSD at 5% P	1·20

Accumulation of proline during both water and salinity stress has been suggested to be a consequence of reduction in cell osmotic potential[4]. Mg^{2+} or Ca^{3+} ions could also cause greater proline accumulation than iso-osmotic solutions of the non-ionic osmoticum[8]. It has not been possible to explain from the present study, how zinc deficiency caused the accumulation of proline. However, the growth inhibition under zinc deficiency could possibly cause the accumulation of other ions available in the nutrient solution and thus effect the proline accumulation either by changing the osmotic potential of the cell or by specific ion effect.

The accumulation of proline, independent of any effect on osmotic potential, may also not be ruled out as has also been postulated under conditions of low temperature stress[9].

A simple criterion for assessing the susceptibility of genotypes to zinc stress would be desirable in studies on zinc nutrition of crops. Whether, proline accumulation is sensitive enough to provide such a tool would be a matter of further investigation.

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REVIEWS AND ANNOUNCEMENTS

Reverse Osmosis and Synthetic Membranes. Edited by S. Sourira Jan. (National Research Council, Canada, Ottawa, KIA OR9), 1977. Pp. 598. Price $ 45.00.

Reverse Osmosis research of hardly 17 years has opened new horizons to unravel the mysteries surrounded with natural phenomenon such as Osmosis. Upto 1960, the scientific community believed Reverse Osmosis technique as academic pursuit. With the announcement of Loeb-Sourirajan membrane, completely new enthusiasm was evident in the scientific community for Reverse Osmosis field and as a corrollary, tremendous amount of scientific and technological activity followed. The literature in the form of research papers, reports, bulletins, journals, etc., continued to flow since then. There are several documents available giving accounts of Reverse Osmosis research at various institutions world over. It is to the credit of the whole scientific community that Reverse Osmosis technique has turned out to be a dependable unit operation for separation, concentration and fractionation of inorganic or organic substances in aqueous or non-aqueous solutions in the liquid or gaseous state. Thus, it earned the credit of being the versatile field of separation technology in the chemical process engineering.

The book entitled *Reverse Osmosis and Synthetic Membranes* under review is rich in contents and is a milestone in the history of literature brought out so far by any single document on the subject of Reverse Osmosis. The editor and the main contributor Dr. S. Sourirajan, deserves all praise for his meticulously planning the book and presenting its contents in a systematic order. He has rightly said that the subject is evolving one, and since the literature is growing fast, in spite of its extensive coverage, the record imbibed in the book is by no means complete. But this shows his humbleness.

To measure and evaluate various approaches advanced for research in reverse osmosis technique where institutions and attitudes of scientists manifest in almost endless variety requires personal observation in depth and in greater detail. Exhaustive studies covered in the present book by Dr. Sourirajan are unique in nature and fulfil the requirements prescribed for understanding the science of reverse osmosis which has rightly been defined by the author as "A physico-chemical basis for Reverse Osmosis separation, material science of Reverse Osmosis membranes, and engineering science of Reverse Osmosis transport which together constitute the science of reverse osmosis". Besides his own contribution in the field of Reverse Osmosis, the valuable work done by his counterpart in other countries has been presented in the book with factual information. The selection of the material for the book has so ably been done that entire picture of RO research efforts is available to the reader.

Starting from Reverse Osmosis, a general separation technique, the book gives account of physico-chemical criteria for reverse osmosis separations, transport through reverse osmosis membranes, reverse osmosis process design, asymmetric cellulose acetate membranes, statistical design of experiments for optimizing the casting variables for cellulose acetate membranes, cellulose acetate and other cellulose ester membranes, grafted membranes for reverse osmosis, polyamide membranes, advances in development of sulphonated PPO and modified PPO membrane systems, PBI membranes, non-polysaccharide membranes, composite membranes, dynamic membranes, hollow fine fibre technology, spiral-wound reverse osmosis configuration, Westinghouse membrane techniques, British reverse osmosis techniques, and applications of reverse osmosis in the various fields such as food processing, pulp and paper industries, electroplating, treatment of domestic and municipal waters, gas permeation and