UTILIZATION OF NATURAL BYPRODUCTS FOR THE CULTIVATION OF BLUE-GREEN ALGAE

THE work of Allen,[1] Gross[2] and Harvey[3] has proved the importance of trace elements as essential auxiliaries of the major nutrients, Ca, K, Mg, Na, Cl, S, P and N in the metabolism of planktonic organisms including diatoms. In their studies extracts of *Ulva* and *Fucus*, unsuspected as sources of trace elements, were actually found to induce the growth in cultures of diatoms in artificial sea-water. It has been shown elsewhere[4] that the maximum growth of blue-green algæ of salt water lagoons is dependent upon definite proportions of trace elements Mn, B, Cu, I, Fe, etc., besides those of the major nutrients mentiond above and that the soluble extracts from the sea-weeds are rich in these trace elements. The information is no doubt helpful, yet the addition of chemicals to increase the plankton would be costly and at present of little practical value in India. Cheap fertilizers and byproducts will have to be explored for this purpose. The present communication deals with the attempts made to utilize oilcakes, sea-weed composts and the wastes in the industries involving sea-weeds of high trace element content as possible sources as fertilizers for the production of fish food.

The artificial sea-water media were prepared according to the formula given by Lyman and Fleming.[5] The cold water-soluble portions of two oilcakes, *viz.*, gingelly oilcake and groundnut oilcake, were used in one series, that of

TABLE I

Trace element content of the substances used in cultures

(Expressed as mg. per kg. of dry material)

Material used	Mn		B		Cu		I		Mo		Fe	
	Total	W.S.	Total	W.S.	Total	W.S.	Total	W.S.	Total	W.S.	Total	W.S.
Oilcakes :												
Gingelly oil cake	74	..	nil	..	..	..	nil	..	..	..	32	..
Groundnut oilcake	16	..	nil	..	..	..	nil	..	..	..	25	..
Sea-weed composts :												
Hypnea + cow dung	105	28	5·8	1·2	trace	nil	18	trace	0·10	trace	102	14
Hypnea + fish waste + cow dung	84	26	4·2	0·9	trace	nil	28	trace	0·10	trace	84	12
Sargassum + cow dung	44	15	2·8	trace	2·1	nil	100	18	..	nil	60	8
Sea-weeds :												
G. lichenoides	550	160	12·8	2·0	10·0	3·0	119	20	0·24	0·08	70	12
C. dasyphylla	155	50	8·5	1·0	6·0	1·8	90	12	0·10	0·05	186	32
L. papillosa	240	100	4·4	0·4	3·8	1·2	trace	trace	0·05	trace	140	40
H. musciformis	195	95	7·5	1·0	nil	nil	trace	trace	0·09	trace	172	35

three sea-weed composts (*Hypnea* + cow dung; *Hypnea* + fish waste + cow dung and *Sargassum* + cow dung) in another and that of four species of sea-weeds, viz., *Gracilaria lichenoides*, *Chondria dasyphylla*, *Laurencia papillosa* and *Hypnea musciformis* in a third series.

The quantity of the various trace elements present in the water-soluble portions of the above was determined by analysing separately the extracts prepared from 5-10 g. of the samples. The total trace element content and the amounts in the water-soluble portions are tabulated in Table I.

To 10 ml. of the media in petri dishes were added 1, 2 and 3 ml. of the sterilized extracts separately. To these dishes equal quantities of an algal association (5 mg.) from a stock culture were inoculated. The composition of the algal association was as follows:

Phormidium tenue (Menegh.) Gom.—dominant.

Phormidium ambiguum Gom.—common.

Microcoleus chthonoplastes Thuret.—common.

Nitzschia vitrea Norman.—sub-dominant.

Nitzschia seriata—rare.

Gloeocapsa arenaria (Hass.) Rabh. (also its nannocyst stage)—few

Gymnodinium sp. (Dinoflagellate)—rare.

The growth obtained in the controls and in the treatment vessels after one month was estimated separately and the results are tabulated in Table II.

It may be seen from Table I that in the case of almost all the trace elements nearly 30 per cent. are present in a water-soluble form, and that all the algæ screened are sufficiently rich in trace elements except *L. papillosa*. Table II affords evidence of good growth of algæ in the treatment vessels, especially those treated with

TABLE II

*Weight of algæ obtained from different treatment vessels**

Source of trace elements	Control	1 ml. of extract		2 mls. of extract		3 mls. of extract	
	Wt. in g.	Wt. in g.	Chlorophyll	Wt. in g.	Chlorophyll	Wt. in g.	Chlorophyll
Hypnea + cow dung	nil	0·015	25	0·042	85	0·060	120
Hypnea + cow dung + fish waste	nil	0·015	30	0·040	85	0·052	105
Sargassum + cow-dung	nil	0·012	20	0·024	50	0·040	95
Gingelly oilcake	..	0·009	..	0·012	25	0·018	40
Groundnut oilcake	..	0·006	..	0·010	..	0·012	30
G lichen ides	0·008	0·023	40	0·045	95	0·076	185
C. dasyphylla	0·007	0·032	65	0·048	95	0·083	200
L. papillosa	nil	0·015	20	0·029	65	0·056	95
H. musciformis	0·008	0·020	40	0·040	90	0·073	150

* Average from three series of trials.

the extracts from *G. lichenoides*, *C. dasyphylla* and *H. musciformis*. There was similarity in the cultures in species composition. The extracts from the two oilcakes do not seem to favour the growth of the algæ to any appreciable extent. This may be because of the absence of several of the essential trace elements in them as may be seen from Table I.

My grateful thanks are due to Dr. N. K. Panikkar, for his keen interest in the work and to Dr. (Mrs.) F. Thivy for the identification of the algæ.

Central Marine Fisheries Res. Station,
Mandapam Camp, *October* 25, 1954.

V. KRISHNA PILLAI.

---

1. Allen, E. J., *J. Mar. Biol. Assn. U. K.*, 1914, **10,** 417.
2. Gross, F., *Ibid.*, 1937, **21,** 756.
3. Harvey, H. W., *Ibid.*, 1939, **23,** 499.
4. Krishna Pillai, V., *Ind. J. Fish.*, 1954, **1,** 130.
5. Lyman, J. and Fleming, R., *J. Mar. Res.*, 1940, **3,** 134.