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A Study on the Composting of Sea-Weeds*

by

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Synopsis: A preliminary study on the composting of sea-weeds both under pit and heap systems with two treatments, namely, (i) washing the sea-weeds with fresh water, and (ii) sea-weeds not being washed in fresh water, was carried out at the Coconut Research Station, Pamban, to find out the manurial status of sea-weed compost and the results of the findings are discussed in this paper.

Introduction: Eversince Acharya (1939) evolved the "Bangalore method of composting", many notable advances have taken place in the field of composting. The Bangalore method of composting has been found suitable for converting farm-wastes, and other plant materials such as sugarcane trash, weeds, banana suckers and so on, with cow-dung emulsion as starter.

The importance of sea-weeds for manurial purposes has been recognised as early as 1890, and it formed a source of farm-manure in Rhode Island (Tseng, 1947). Sea-weeds are valuable as manure for agricultural crops, besides the importance of certain varieties as food, and raw-materials for the extraction of agar-agar. But very little attention has been paid to the utilisation of sea-weeds as manure in India. Chidambaram and Mukundan Unni (1947) have reported on the abundant occurrence of sea-weeds in the coast-line from Pt.Calimere to Capecomorin, a distance of about 250 miles in the Madras State. They have further reported that the quantity of sea-weeds washed ashore during the period July, 1944 to June, 1945 in the jurisdiction of the three fishing yards, Sethubavachatram, Idinthakarai and Ovari amounted to 120 tons. This shows that if sea-weeds are properly conserved and utilised, they would augment the manurial requirements of our crops to a considerable extent. In order to find out whether composting of sea-weeds enhances their manurial value, a preliminary trial was laid out in January, 1963, at the Coconut Nursery farm, Pamban, Ramanathapuram district, and the results of the trial are discussed in this paper.

Review of Literature: Salgado and Chinnarasa (1936) have reported the use of sea-weeds such as *Enhalus acoroides* Rich. (*Kadal thalai*-Tamil) as manure for coconuts in Pallai of Ceylon, and *Thalassia hemprichi* Aschers (Tamil-*Chatelai*) for paddy and coconut in Jaffna. Kandiah (1946) reported on the manurial value of sea-weeds, and indicated the possibility of composting most of them before applying to crops. He has further stated that the sodium chloride content of sea-weeds gets reduced on composting, and the active constituents of sea-weeds,

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especially nitrogen and potash, are conserved during composting without any loss. Scott (1946) has shown that sea-weeds growing just below water mark, are similar to farm yard manure in respect of nitrogen content, but are richer in potash and poorer in phosphorus. He has further stated that in a climate with low rainfall, the salt from the sea-water contained in sea-weeds might build up in the soil, and become dangerous to healthy plant growth. Chidambaram and Mukundan Unni (1947) have reported that the sea-weeds washed ashore in the Palk Bay and Gulf of Mannar are species of *Gracilaria, Sargassum* and *Turbinaria* and they conducted experiments at the Krusadai Island on composting them with fish offal and liver sediments, as starters. They tried two proportions of the above materials in the ratios of 15 : 3 : 4 and 20 : 4 : 3 in the rainy and hot seasons respectively. The compost prepared in the rainy season contained more of nitrogen but less of phosphorus and potash than that prepared in the hot season. Jepson (1949) has reported on the application of sea-weeds either in fresh state or after being rotted in heaps, to potatoes, pastures, tomatoes and root crops in Channel Islands.

Materials and Methods: There is abundant occurrence of sea-weeds, particularly, the species of *Gracilaria, Sargassum, Turbinaria, Padina* and *Acanthophora* in the shores of Palk Bay and Gulf of Mannar adjoining Pamban. In Palk Bay, the occurrence of sea-weeds is abundant during the North-East monsoon (November to March) and in the Gulf of Mannar during the South-West monsoon (April to October). The sea-weeds for the purpose of conducting the experiment were collected from the litoral regions of the sea. During the monsoonic rains, the sea-weeds were cut into bits, and washed ashore. They were collected and used in the experiment. The sea-weeds used in the experiment were an admixture of the above mentioned five algae. Two modes of composting, namely, pit and heap systems were tried. Under these, two treatments were tried:

1. Sea-weeds washed with fresh-water and
2. Sea-weeds without being washed in fresh water.

The pits were dug in sandy soil, each pit measuring 5' x 3' x 3'. The materials used in composting were raised above the ground level, in the case of pit system, to a height of 1½'. In the case of heaps, they were built to the dimensions of 5' x 3' x 4½'. The total quantity of sea-weeds used per pit and heap was 1,800 lb. and the total quantity of cow-dung used as starter per pit and heap was 25 lb. The cow-dung was made into a slurry with 8 gallons of water per pit and heap. In the case of treatment No. 1, the complete removal of salt from the sea-weeds was ensured by repeated washing in fresh water, and this was tested by tasting the sea-weeds. In the case of pit system, the sea-weeds were spread to a thickness of 9" at the bottom of the pit. Over this layer, cow-dung slurry was uniformly applied to a thickness of 3"; then alternate layers of sea-weeds and cow-dung followed till the mass in the pit raised above the ground level to a height of 1½'. The top of the pit was covered over with a layer of green leaves and wet sand. In the case of heap system, the heaps were built with sea-weeds and cow-dung slurry in a similar manner; but the heaps were not covered with

green leaves and wet-sand. Four holes were made at the top of each pit and heap for providing aeration. In the case of pit system, the decomposition was both aerobic and anaerobic. Compost samples were drawn at intervals of 60, 80 and 100 days from the date of sealing the pits and heaps for chemical analysis.

The compost samples drawn were treated with dilute acetic acid to prevent further decomposition, air-dried, powdered and passed through 1 mm. mesh sieve. The samples were analysed for total nitrogen, phosphoric acid, potash and organic carbon contents by A. O. A. C. methods.

Results and discussion: The results of analysis for total nitrogen, phosphoric acid, potash, lime, organic matter, acid insolubles, organic carbon and carbon/nitrogen ratio for the five species of sea-weeds employed in composting and also for the mixture of the above sea-weeds are presented in table I. In table II, the results of analysis for total nitrogen, phosphoric acid, potash, organic carbon and carbon/nitrogen ratios of the compost samples drawn from the experiment are furnished.

Statistical analysis of the data was carried out to find out whether there is any significant difference between the composts prepared under the pit and heap systems in the manurial status namely total nitrogen, phosphoric acid and potash contents and also to assess whether the duration of composting and the two treatments employed in the experiment have any significant bearing on the above active constituents of compost. The statistical analysis of the data is presented in table III.

The rapidity of decomposition of the raw materials used for composting is dependent upon their nature, Carbon/Nitrogen ratio, moisture content and the nitrogenous starter used for composting (Acharya *et al* 1945, and Rajagopala Iyengar *et al* 1955). Even if one of the above conditions for composting is neglected, the quality of compost will be affected to a great extent.

It will be seen from table I that all the sea-weeds, and the mixture of the same employed in composting have analysed more than 1% nitrogen and *Acanthophora* species analysed 2·2% nitrogen. All the sea-weeds have very low phosphoric acid content, but are rich in potash and lime, the lime content reaching even 15% in the case of *Padina* species. The organic matter content of the sea-weeds ranges from 55-81%.

From the statistical analysis of the data presented in table III it will be seen that compost prepared with sea-weeds which have been washed in fresh-water, has registered significantly higher content of nitrogen than that prepared with the untreated sea-weeds. But the washing of sea-weeds in fresh water does not exert any significant influence on the phosphoric acid and potash contents of compost. In respect of nitrogen content of compost, neither the mode of composting nor the duration of composting has any significant effect.

TABLE I.

Results of analysis of Sea-weeds used for composting (expressed on oven-dry basis)

S. No.	Name of sea-weeds	Moisture	Nitrogen	Phospho-ric acid	Potash	Lime	Insolub-les	Loss on ignition	Organic carbon	Carbon/ Nitrogen ratio
1.	*Turbinaria*	11.46	1.18	0.11	1.47	4.02	0.42	81.62	33.28	28.3:1
2.	*Saragassum*	11.52	1.41	0.22	1.52	7.14	0.44	76.72	28.01	19.9:1
3.	*Padina*	4.59	1.54	0.39	1.68	15.71	7.75	55.33	18.47	12.0:1
4.	*Acanthophora*	6.24	2.21	0.36	2.15	5.55	3.71	66.46	23.60	10.7:1
5.	*Gracilaria*	3.83	1.19	0.26	1.75	6.58	9.45	65.37	22.37	18.8:1
6.	Mixture of the above five sea-weeds	8.32	1 43	0.31	2.04	8.14	5.87	76.24	28.31	19.8:1

TABLE II.

Results of analysis of Sea-weed compost samples (expressed on oven-dry basis)

S. No.	Mode of composting	Treatments	Duration of composting														
			60 days					80 days					100 days				
			Nitrogen	Phosphoric acid	Potash	Organic carbon	C/N ratio	Nitrogen	Phosphoric acid	Potash	Organic carbon	C/N ratio	Nitrogen	Phosphoric acid	Potash	Organic carbon	C/N ratio
1.	Heap system	(a) Before washing with fresh water	0.45	0.22	1.76	6.84	15.2:1	0.44	0.17	2.07	5.32	12.1:1	0.43	0.18	1.59	4.86	11.3:1
		(b) After washing with fresh water	0.59	0.16	1.29	8.61	14.6:1	1.05	0.18	2.92	12.39	11.8:1	0.99	0.22	2.57	10.79	10.9:1
2.	Pit system	(a) Before washing with fresh water	0.35	0.29	1.30	5.53	15.8:1	0.33	0.23	1.52	4.13	12.5;1	0.27	0.15	0.84	3.19	11.8:1
		(b) After washing with fresh water	1.08	0.35	1.40	16.20	15.0:1	0.72	0.21	1.36	8.64	12.0:1	0.73	0.17	1.73	8.18	11.2:1

TABLE III.

Results of the statistical analysis – NITROGEN CONTENT

Analysis of variance:

Source	D. F.	S. S.	M. S.	F.
Periods	2	0.0431	0.0216	...
Systems	1	0.0002	0.0002	...
Washings	1	0.6487	0.6487	24.21*
Periods x Systems	2	0.0863	0.0432	
Periods x Washings	2	0.0022	0.0011	0.0268
Systems x Washings	1	0.0114	0.0114	
Periods x System x Washings	2	0.0876	0.0438	
Total	11	0.8795	...	

* Significant at P = 0.01 level

Summary of results:

Comparison of 'before' and 'after' washing

Washing	Mean N content	S. E. of mean	C. D. (P = 0·05)
Before	0.3517	...	...
	...	0.067	0.2235
After	0.8167	...	...

Conclusion: After, Before.

In respect of phosphoric acid content, the compost prepared in pits has registered higher phosphoric acid content than that prepared from heaps. This presumably accounts for the fact that there is no loss of phosphoric acid in pit system due to leaching. From the statistical analysis of the data obtained for the phosphoric acid contents of sea-weed compost, it is seen that the compost sample drawn at the end of the 60th day has registered higher phosphoric acid content than that drawn at the end of the 100th day; but the compost sample drawn at the end of the 80th day has been found to be on a par with that of the 60th day and the 100th day. Acharya (1949) reported that the materials used for composting require at least 3–5 months for complete decomposition, depending on the mode of composting and materials used in composting. The Carbon/Nitrogen ratio of the compost obtained at the end of the 80th day is round about 12:1 both under heap and pit systems. There is not much difference in the carbon/nitrogen ratios of the composts of 80th day and 100th day, unlike that of the 60th day. Acharya *et al* (1946) have reported that there is greater availability of "Available Nitrogen" in compost having a carbon/nitrogen ratio of less than 12:1. Therefore by removing the compost from both the heap and pit systems at the end of the 80th day and then applying to the field, much of mineralisation of

nitrogen in the compost manure can be made to take place in the field itself rather than in the compost heap. Therefore the duration of composting of sea-weeds has to be prolonged atleast upto the 80th day.

In respect of potash content of sea-weed compost, neither the treatments nor the mode and duration of composting have any significant effect on the compost produced.

Conclusion: The results showed that (1) the nitrogen content was significantly higher in the compost prepared with sea-weeds that were washed in fresh water, than that of the compost prepared with sea-weeds that were not washed; (2) the compost, prepared under pit system, registered higher phosphoric acid content than that prepared under heap system; and (3) in respect of potash content of compost, the treatments, the mode and duration of composting did not have any significant effect.

P_2O_5 CONTENT.

Analysis of variance:

Source	D. F.	S. S.	M. S.	F.
Periods	2	0.0183	0.0092	5.11*
Systems	1	0.0102	0.0102	5.67*
Washing	1	0.0001	0.0001	
Periods x Systems	2	0.0088	0.0044	
Periods x Washing	2	0.0004	0.0002	
Systems x Washing	1	0.0007	0.0007	0.0018
Periods x Systems x Washing	2	0.0030	0.0015	
Total	11	0.0415	...	

*Significant at P=0.05 level.

Summary of Results:

(i) *Comparison of periods*

Period	Mean P_2O_5 content	S. E. of mean	C. D. (P=0.05)
60 days	0.2550		
80 days	0.1975	0.0215	0.0719
100 days	0.1609		

Conclusion: 60, 80, 100

(ii) *Comparison of systems*

System	Mean P_2O_5 content	S. E. of mean	C. D. (P=0.05)
Heap	0.1750	0.0173	0.0579
Pit	0.2333		

Conclusion: Pit, Heap.

K_2O CONTENT.

Analysis of variance:

Source	D. F.	S. S.	M. S.	F.
Periods	2	1.0267	0.5134	2.31
Systems	1	0.5043	0.5043	2.27
Washing	1	0.3675	0.3675	1.66
Periods x Systems	2	0.6393	0.3197	
Periods x Washings	2	0.5778	0.2889	
Systems x Washings	1	0.0162	0.0162	0.2219
Periods x Systems x Washings	2	0.3201	0.1601	
Total	11	3.4519		

None significant.

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REFERENCES

Acharya, C. N. 1939 Comparison of different methods of composting waste materials. *Indian J. agric. Sci.*, **9** : 565–72.

———, C. Parthasarathy, and C. V. Sabnis 1946 Decomposition studies with different types of compost in the soils. *Ibid,*. **16** . 90–99.

———, C. V. Sabnis and F. G. T. Menezest 1945 Studies on compost–Influence of addition of soil on carbon and nitrogen economy. *Ibid.*, **15** : 214–19.

———, 1949 *Ind. cou. Agric. Res. Misc. Bull.* No. 60, 3rd edition.

Chidambaram, K. and Mukundan Unni 1947 Note on the value of sea-weeds as manure. *Madras agric. J.*, **34** : 39–47.

Jepson, S. 1949 Sea-weed as a fertilizer, *Farm week S. Africa*, **78** : 99.

Kandiah, S. 1946 Manurial value of some agricultural waste products, wood-ashes, sea-weeds and water-hyacinth. *Trop. Agriculturist*, **102** : 31–38.

Rajagopala Iyengar, T. K. M. Balakrishna Menon, D. M. Samuel and K. Sivasankaran Nair 1955 Compost from farm wastes. *Proc. Fifth Sci. Work Conf. A. C. & R. I., Coimbatore August*, 1955, 53–59.

Salgado, M. L. M., and E. Chinnarasa 1936 Note on the manurial value of two Ceylon Sea-weeds. *Trop. Agriculturist*. **87** : 385–87.

Scott, R. C. 1946 Manurial value of sea-weed. *J. Dep. Agric. S. Aust.* **59** : 10. 452.

Tseng, C. K. 1947 Sea-weed resources of North America and their utilisation, *Econ. Bot.*, **1** : 69–97.