

CORRESPONDENCE

Table 1. Composition and calorific value of some agro wastes

Agro waste	Moisture	Ash (%)	Carbon (%)	Sulphur (%)	Silica (%)	Calorific value (kcal/kg)
Pigeon pea	5	3	42	0.26	0–12	3196
Cotton straw	20	4	42	0.24	4.2	3107
Soyabean straw	15	14	39	0.27	0.76	1472
Wheat straw	9	16	44	0.21	4.27	4340
Rice husk	9	18	48	0.30	15.88	4309
Baggasse	50	15	47	0.05	0.45	2250

Table 2. Analysis of treated 'Consortia of microorganisms' compost at Bardoli Sugar Factory, Gujarat, India

Test	Untreated	Wonder Life treated
pH	8.7	6.9
Total nitrogen (%)	0.87	1.98
Total PO (%)	1.02	1.80
Potassium as K (%)	0.10	28
Sulphur as S (%)	0.26	0.68
Copper as Cu (ppm)	9.2	18.9
Zinc as Zn (ppm)	25.8	67.9
Iron as Fe (ppm)	632.8	2883.0
Manganese as Mn (ppm)	106.3	168.1
Molybdenum (ppm)	2.1	3.2
Moisture (%)	<35	45.5
Average particle size (in)	1.6–1.8	0.5–0.7
Smell	Pungent	No smell
Looks	Wheatish	Dark
Feel	Firm/rough	Loose
Microbial count	1.6×10^6	$>1.0 \times 10^9$
C : N ratio	14 : 1	28 : 1

white sugar production. Using the consortia of microorganisms to enhance the value of N, P, K and also micronutrients to increase the income of co-operatives

as well as that of the farmers, is possible. This was illustrated in a typical case of a sugar factory in Bardoli district, Gujarat as detailed in Table 2. Gaushalas (cattle

sheds) provide another big opportunity for value-added plant nutrient supply.

The most important consideration for organic farming will be its role in improved water use efficiency. It has been demonstrated in areas of Kutch, Gujarat⁵ and Ethiopia⁶ that good compost management in areas with water scarcity not only conserved moisture and increased water-use efficiency in agriculture, but also made remarkable improvement in the overall livelihood standard of local people.

These technologies are not glamorous but need intensive developmental efforts and high research priority and are extremely important for the developing world.

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Buckingham Canal saved people in Andhra Pradesh (India) from the tsunami of 26 December 2004

Information on tsunami heights relating to the mega thrust earthquake in Aceh Banda, Indonesia on 26 December 2004 has been compiled by Ramalingeswara Rao *et al.*¹ for the Indian coast. The M_w 9.3 earthquake at 6.28 h IST at the epicentre led to more than 1600 aftershocks in Sumatra and across the Andaman–Nicobar region, covering a secondary rupture 1300 km long. The maximum run-up of the tsunami was 5 m at Nagapattanam and the minimum was 2 m at Vizianagaram (Bogapuram) in the east coast of India. Buckingham Canal, about 310 km in length is situated, 1–2.5 km away all along the Bay of Bengal sea coast as

shown in Figure 1 *a*. The Buckingham Canal is also known as the National Waterway number 4 (NW-4). This vital link between Kakinada, Andhra Pradesh (AP) and Chennai was built by an order of the then Governor of Madras Presidency, the Duke of Buckingham, to have a navigable waterway, for transportation of commodities such as rice, salt and firewood. The canal constructed in 1878, was named after the Duke of Buckingham and had been in operation till 1964.

The canal was dug parallel, about 1–2.5 km away from the sea coast (Bay of Bengal), to get sea water through the pre-

existing creeks during high tide on full moon days, to maintain a constant water level in the canal. The width of the canal is 30 m and its depth is 10 m; its dimensions have got considerably changed in recent decades due to aquaculture debris, etc. at different locations of the canal in AP. The excess of floodwater from nearby rivers is released into the Buckingham Canal by opening the lockers (Figure 1 *b*) through the water channel on the western side of the canal near Siddavaram (Figure 2 *a*). A small segment of the canal is shown in Figure 2 *b*. Thousands of fishermen and their families are dwelling in areas between the Bucking-

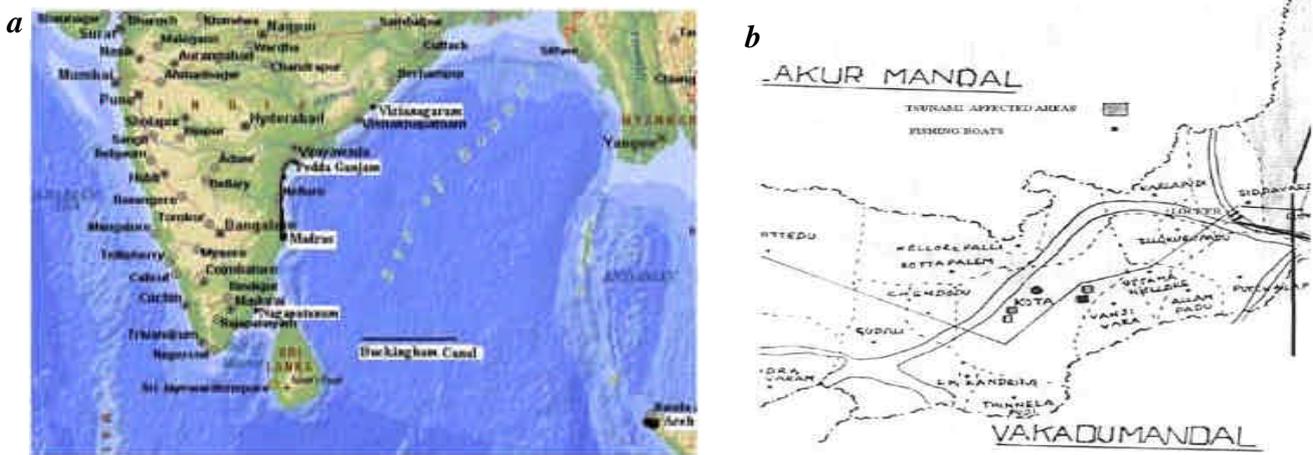


Figure 1. **a**, Buckingham Canal shown by a dark line in Andhra Pradesh and Tamil Nadu based on *The Hindu* report of 23 September 2002. The recent mega-thrust earthquake of 26 December 2004, at Banda Aceh, Sumatra Islands region is also shown. SR denotes the Swarnamukhi river flowing through Kota, Nellore district. **b**, A locker shown to release excess water from a river during floods via Buckingham Canal through creeks to the Bay of Bengal.

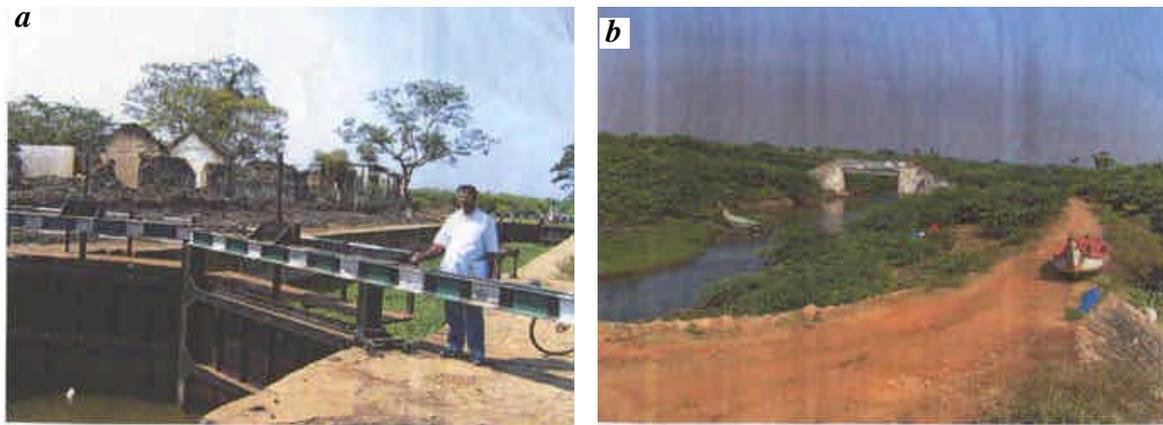


Figure 2. **a**, A small segment of Buckingham Canal in Kota Madal is shown as a thick line with locker, creek and fishing centres at shoreline. All villages are between Buckingham Canal and seashore line. **b**, During the tsunami, catamarans drifted nearly 1.5 km away from sea coast through creeks to Buckingham Canal.

ham Canal and the seashore. The recent tsunami did not engulf their houses or huts at elevated patches, because the tsunami waves drifted away towards the existing low-lying creeks at several places. Thus, it is observed that the Buckingham Canal acted as a buffer zone and regulated the tsunami waves on the coastal region over nearly 310 km from Pedda Ganjam to Chennai.

The canal from Chennai (Marakkanam) to Durga Raya Patnam near Nellore and then to Pedda Ganjam, all along the east coast was filled with tsunami water, which overflowed at a few places and receded back to sea within 10–15 min. This has helped save the lives of several fishermen, especially in coastal AP and parts of Chennai city and also helped in clearing of the aquaculture debris. In addition, the natural growth of vegetation on either side of the

canal, at several places consisting of thick bushes has had an effect in tsunami mitigation; for example, in Vakadu mandal at villages like Pudikuppam, Srinivasapuram and Tupilipalem, the damages were minimal.

Our field investigations suggest that the Buckingham Canal in AP, rocky wave-breakers in Tamil Nadu, casuarinas, mangroves and coconut plantations along the coast saved thousands of fishermen. The retreat of sea water was to a maximum of about 200–500 m before major run-up was observed at many places along the coast. The approaching tsunami sounded like two or three freight trains or the roar of a jet as reported by witnesses; in some places the tsunami advanced like a torrent of foaming water. At several places, new creeks developed, indicating the presence of palaeo-channels. The mechanism for development

of new creeks is yet to be studied in detail by considering coastal geomorphology and coastal inlets. The Buckingham Canal needs to be renovated for future tsunami hazard mitigation and for navigational purposes.

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